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1                   **HANFORD FACILITY DANGEROUS WASTE PERMIT APPLICATION,**  
2                   **GENERAL INFORMATION PORTION**

3                   **FOREWORD**

4     The Hanford Facility, located in southeastern Washington State, is owned by the U.S. Government and  
5     operated by the U.S. Department of Energy (DOE), Richland Operations Office (DOE-RL) and the Office  
6     of River Protection (DOE-ORP). Dangerous waste and mixed waste are generated and managed on the  
7     Hanford Facility. Waste components are regulated in accordance with the *Resource Conservation and*  
8     *Recovery Act (RCRA) of 1976*, the *Hazardous and Solid Waste Amendments of 1984*, and/or the *State of*  
9     *Washington Hazardous Waste Management Act of 1976* (as administered through the Washington State  
10    Department of Ecology *Dangerous Waste Regulations*, Washington Administrative Code 173-303); or the  
11    *Atomic Energy Act of 1954*.

12    The original 1989 *Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement)*  
13    established the permitting framework for the Hanford Facility (Ecology et al. 1996). The original  
14    document addressed the Hanford Facility as a single RCRA facility (U.S. Environmental Protection  
15    Agency/State Identification Number WA7890008967), which consisted of approximately 70, treatment,  
16    storage, and/or disposal (TSD) units. The Hanford Federal Facility Agreement and Consent Order also  
17    established a stepwise permitting process that provided for the issuance of an initial Hanford Facility  
18    RCRA Permit (Permit) for less than the entire Hanford Facility. Any TSD units not included in the initial  
19    Permit are incorporated through a Permit modification. TSD units not yet incorporated into the Permit  
20    were to continue to operate under interim status. Subsequent amendments of the Tri-Party Agreement  
21    have retained the RCRA permitting framework established by the original 1989 document. The initial  
22    Permit became effective in September 1994. The Permit is issued to seven Permittees: the DOE-RL and  
23    the DOE-ORP as the owner/operator, and to five of its contractors, as co-operators. For purposes of the  
24    Permit, the DOE contractors are identified as 'co-operators' and sign in that capacity (refer to Permit  
25    Condition I.A.2). Any identification of these contractors as an 'operator' elsewhere in the application is  
26    not meant to conflict with the contractors' designation as co-operators but rather is based on the  
27    contractors' contractual status with the DOE-RL and the DOE-ORP.

28    The Permit is considered a single Permit organized into a General Information Portion (this document,  
29    DOE/RL-91-28) and unit-specific documentation. The scope of the unit-specific documentation is  
30    limited to individual 'final status operating' TSD units for which Part B Permit documentation has been or  
31    is anticipated to be submitted. Documentation for TSD units 'undergoing closure', or for units that are, or  
32    are anticipated to be, 'disposed through other options', will continue to be submitted by the Permittees  
33    in accordance with the provisions of the *(Tri-Party Agreement)*. The scope of the General Information  
34    Portion includes information that could be used to describe 'final status operating' TSD units, units  
35    'undergoing closure', or units being 'disposed through other options'. Documentation contained in the  
36    General Information Portion is broader in nature generally applies to multiple TSD units included in the  
37    unit-specific documentation. Where appropriate, the unit-specific documentation makes cross-reference  
38    to the General Information Portion, rather than duplicating text. The regulators could use the General  
39    Information Portion as a source for both unit-specific and General Permit Conditions. However, only  
40    portions of the General Information Portion (DOE/RL-91-28) are enforceable, as noted in the Permit, List  
41    of Attachments, *[O]nly those portions of the Attachments specified in Parts I through VI are enforceable*  
42    *Conditions of this Permit and subject to the Permit modification requirements of Condition I.C.3.* The  
43    intent of the General Information Portion is: (1) to provide an overview of the Hanford Facility; and  
44    (2) to assist in streamlining efforts associated with TSD unit-specific documentation, and the Permit  
45    modification process. The checklist provided indicates where information is contained in the General  
46    Information Portion and the unit-specific documentation of the Permit.

1 The Permit modification process is used to incorporate TSD units into the Permit as permitting  
2 documentation for these units is finalized. TSD units will remain in interim status until incorporated into  
3 the Permit or dispositioned through other options.

4 'Dangerous Waste', as used in the title of the *Hanford Facility Dangerous Waste Permit Application*,  
5 refers to waste subject to Washington Administrative Code 173-303 requirements and to requirements of  
6 the *Hazardous and Solid Waste Amendments*, including those for which the state of Washington has not  
7 yet been granted authority by the U.S. Environmental Protection Agency. Throughout this document,  
8 'mixed waste' refers to waste containing both dangerous and radioactive components. The radioactive  
9 component of mixed waste is interpreted by the DOE to be regulated under the *Atomic Energy Act*; the  
10 nonradioactive dangerous component of mixed waste is interpreted to be regulated under the *Resource*  
11 *Conservation and Recovery Act* and Washington Administrative Code 173-303. Please note that source,  
12 special nuclear and byproduct materials, as defined in the *Atomic Energy Act of 1954* (AEA), are  
13 regulated at DOE facilities exclusively by DOE acting pursuant to its AEA authority. There materials are  
14 not subject to regulation by the State of Washington. All information contained herein and related to, or  
15 describing AEA-regulated materials and processes in any manner may not be used to create conditions or  
16 other restrictions set forth in any permit, license, order, or any other enforceable instrument. DOE asserts  
17 that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special  
18 nuclear and byproduct materials at DOE-owned nuclear facilities. Information contained herein on  
19 radionuclides is provided for process description purposes only.

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1	<b>Chapter 1.0</b>	<b>Part A</b>
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2 **1.0 PART A [A]**  
3  
4 This chapter addresses Section A of the Washington State Department of Ecology's (Ecology) *Dangerous*  
5 *Waste Permit Application Requirements* (permit application guidance) (Ecology 1996). This permit  
6 application guidance calls for a discussion of the Part A forms for the Hanford Facility.  
7  
8 The Hanford Facility is a single *Resource Conservation and Recovery Act (RCRA) of 1976* facility, and  
9 as such has been issued a single identification number by the U.S. Environmental Protection Agency  
10 (EPA) and Ecology (EPA/State Identification Number WA7890008967).  
11  
12 The Hanford Facility Part A (DOE/RL-88-21) contains the Part A's for the Hanford Facility. The  
13 Hanford Facility Part A consolidates into a single document the current revisions of all Part A forms.  
14 Thus, the contents of this document have not been reproduced for inclusion in this chapter of  
15 DOE/RL-91-28, General Information Portion.  
16  
17 The Hanford Facility Part A is designed to facilitate the insertion of new or revised material and is  
18 updated periodically. Revisions to the Hanford Facility Part A, for interim status TSD units are carried  
19 out in accordance with the requirements of the *Dangerous Waste Regulations, Washington*  
Administrative Code (WAC) 173-303-805(7). Revisions to the Hanford Facility Part A, for TSD units  
incorporated into Parts III, V, or VI are carried out in accordance with Hanford Facility RCRA Permit  
(Permit) Condition I.C.3. The Hanford Facility Part A, for clean-closed TSD units is revised to include  
the word "CLOSED" across the front of the form and the date the closure certification was accepted by  
Ecology.

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1                   **2.0 FACILITY DESCRIPTION AND GENERAL PROVISIONS [B AND E]**

2 This chapter describes the Hanford Site and Hanford Facility and addresses general provisions and  
3 information. Topics discussed include the following:

- 4 • General description
- 5 • Topography
- 6 • Location information
- 7 • Seismic consideration
- 8 • Traffic information
- 9 • Waste management units.

10 Provisions included in Standard Conditions (Part I) and General Conditions (Part II) of the Hanford  
11 Facility RCRA Permit (Permit) are addressed.

12 The information contained in this document need not be duplicated in the unit-specific documentation,  
13 but will be cross-referenced as appropriate

14                   **2.1 GENERAL DESCRIPTION [B-1]**

15 The Hanford Facility is owned by the U.S. Government and operated by the U.S. Department of Energy  
16 (DOE), through the Richland Operations Office (DOE-RL) and the Office of River Protection  
17 (DOE-ORP). Dangerous waste and mixed waste managed on the Hanford Facility. Waste components  
18 are regulated in accordance with the RCRA, the *Hazardous and Solid Waste Amendments (HSWA) of*  
19 *1984*, and/or the *State of Washington Hazardous Waste Management Act of 1976* (as administered  
20 through Ecology's *Dangerous Waste Regulations, WAC 173-303*); or the *Atomic Energy Act of 1954*.

21 The original 1989 Tri-Party Agreement established the permitting framework for the Hanford Facility.  
22 The original document addressed the Hanford Facility as a single RCRA facility (EPA/State Identification  
23 Number WA7890008967), which consisted of approximately 70 TSD units. Since that time, TSD units  
24 have been clean closed or closed pursuant to the Tri-Party Agreement, §6.3.3, reducing the number of  
25 TSD units to approximately 50. Approximately 33 percent of these units are, or are anticipated to be,  
26 'final status operating'; approximately 50 percent are 'undergoing closure'; and the balance are anticipated  
27 to be, 'disposed through other options' under the Tri-Party Agreement.

28 The Permit became effective in September 1994. The Permit is issued to seven Permittees: DOE-RL and  
29 DOE-ORP, as the owner/operator, and to five of its contractors, as co-operators

30 For purposes of corrective action, the Permittees mean only the U.S. Department of Energy. Except for  
31 corrective action, the DOE contractors are identified as 'co-operators' and sign in that capacity (refer to  
32 Permit Condition I.A.2). Any identification of these contractors as an 'operator' elsewhere in this  
33 document is not meant to conflict with the contractors' designation as co-operators but rather is based on  
34 the contractors' contractual status with the DOE-RL and DOE-ORP.

35 Hanford Facility operating TSD units operate in accordance with interim status until incorporated in the  
36 Permit Based on the Tri-Party Agreement and Permit Condition I.A.1. Reference to the Permit in the  
37 remainder of this document refers to the most recent revision, unless otherwise specified.

38 The Permit documentation submitted by the Permittees includes a General Information Portion  
39 (DOE/RL-91-28), certain Permit Attachments, and unit-specific documentation. The scope of the  
40 unit-specific documentation includes individual, 'final status operating' TSD units for which Permit  
41 documentation has been, or is anticipated to be, submitted (refer to DOE/RL-91-28, Chapter 1.0).  
42 Documentation for TSD units 'undergoing closure', or for units that are, or are anticipated to be,  
43 'disposed through other options', will continue to be submitted by the Permittees in accordance with

1 the provisions of the Tri-Party Agreement. However, the scope of the General Information Portion  
2 includes information that could be used to discuss 'final status operating' units, units 'undergoing closure',  
3 or units being 'disposed through other options'. Alternatives for addressing Hanford Facility TSD  
4 units are identified as follows:

- 5 • 'Final status operating' TSD unit (Part B Permit documentation referred to for both TSD units in  
6 Part III and TSD units in the process of being incorporated into Part III of the Permit)
- 7 • TSD unit 'undergoing closure'
  - 8 – Clean closure (closure plan documentation)
  - 9 – Background closure (closure plan documentation)
  - 10 – Modified closure (closure/postclosure plan and postclosure Permit documentation)
  - 11 – Closure as a land disposal unit (closure/postclosure plan and postclosure Permit documentation)
  - 12 – Integrated Closure in conjunction with an operable unit (in accordance with Tri-Party Agreement,  
13 §5.5 and §6.1).
- 14 • TSD unit 'disposed through other options'
  - 15 – Procedural closure (in accordance with Tri-Party Agreement, §6.3.3 or in response to withdrawal  
16 requests submitted in fulfillment of Tri-Party Agreement Milestone M-20-45)
  - 17 – Facility decommissioning process (in accordance with Tri-Party Agreement, §8.0)
  - 18 – TSD unit subject to the closure work plan/closure plan process in accordance with Tri-Party  
19 Agreement, §8.0.

## 20 **2.1.1 Facility Description [B-1a]**

21 This section includes a general description and/or discussion of the following:

- 22 • Hanford Site
- 23 • Hanford Facility
- 24 • Hanford Facility permitting
- 25 • Hanford Site Missions
- 26 • Description of dangerous waste management operations and processes
- 27 • Other processes regulated under WAC 173-303.

### 28 **2.1.1.1 Hanford Site**

29 The Hanford Site covers approximately 1,450 square kilometers of semiarid land that is owned by the  
30 U.S. Government and managed by the DOE-RL and DOE-ORP. The city of Richland adjoins the  
31 southeastern most portion of the Hanford Site boundary and is the nearest population center.

32 In early 1943, the U.S. Army Corps of Engineers selected the Hanford Site as the location for plutonium  
33 production for national defense. For over 20 years, activities were primarily dedicated to the continuation  
34 of plutonium production and managing the waste generated. In later years, activities became increasingly  
35 diverse, involving research and development for advanced reactors and renewable energy technologies.  
36 The end of the Cold War brought the shutdown of most of the Hanford Site's plutonium production and  
37 management facilities. Current missions are to safely clean up and manage the legacy waste on the  
38 Hanford Site, and to develop and deploy science and technology.

39 The Hanford Site is divided into numerically designated areas. These areas served as the location for  
40 reactor, chemical separation, and related activities for the production and purification of special nuclear  
41 materials and other nuclear activities. The reactors are located along the Columbia River in the  
42 100 Areas. The reactor fuel reprocessing units are in the 200 Areas, which are on a plateau approximately  
43 11 kilometers from the Columbia River. The 300 Area, located adjacent to and north of Richland,  
44 contains the reactor fuel manufacturing plants, and the research and development laboratories. The

1 400 Area, 8 kilometers northwest of the 300 Area, contains the Fast Flux Test Facility designed for  
2 testing liquid metal reactor systems. The 600 Area covers all locations not specifically given an area  
3 designation. In addition to these Hanford Facility locations, DOE manages two main locations off the  
4 Hanford Facility. The first location, to and north of Richland, is the Richland Industrial Center (formerly  
5 the 1100 Area), which contains offices associated with administration, maintenance, transportation, and  
6 materials procurement and distribution. The second location is the 700 Area, which is in downtown  
7 Richland, which contains offices.

8 Where general information for the Hanford Site is discussed in this document, such information also  
9 applies to the Hanford Facility, unless otherwise designated.

#### 10 **2.1.1.2 Hanford Facility**

11 The boundary of the Hanford Facility includes the contiguous portion of the Hanford Site that contains  
12 dangerous waste TSD units owned by the U.S. Government and operated by the DOE-RL and DOE-ORP.  
13 This portion of the Hanford Site is shown in Figure 2.1. A legal description for this portion of the  
14 Hanford Site is provided in DOE/RL-91-28, Appendix 2C. The legal description excludes lands north  
15 and east of the Columbia River, river islands, lands under the exclusive jurisdiction or control by the  
16 Bonneville Power Administration, lands leased to Energy Northwest, and lands owned by or leased to  
17 Washington State).

18 Exclusion of the noted lands is based on the following rationale. The lands north and east of the  
19 Columbia River contain no TSD units. These lands are under consideration for non-U.S. DOE use and  
20 for ownership transfer (DOE/EIS-0222). In addition, the DOE-RL has no control over Bonneville Power  
21 Administration lands or lands that are owned by or leased to Washington State (e.g., US Ecology site).  
22 The U.S. Department of Energy lands leased to Energy Northwest are to be covered by a separate  
23 dangerous waste permit if necessary and, therefore, are not included in the Permit. The legal description  
24 of the Hanford Facility is based on this rationale and is consistent with the facility definition provided to  
25 Ecology in 1994, with one exception.

26 Depending on context, the term 'facility', as used in this Permit documentation, also could refer to  
27 building nomenclature. In this context, the term 'facility' either remains un-capitalized or as part of the  
28 title for various TSD units.

#### 29 **2.1.1.3 Hanford Facility Permitting**

30 This section describes the permitting approach for the Hanford Facility. This approach accommodates  
31 requirements established by applicable regulations and authorities, the Tri-Party Agreement, the Permit,  
32 and permitting documentation. As noted in the Introduction and Definition Sections of the Permit, the  
33 Permit is intended to be consistent with the terms and conditions of the Tri-Party Agreement.  
34 Coordination with the Tri-Party Agreement is addressed in Permit Condition I.A.3.

##### 35 **2.1.1.3.1 Applicable Regulations and Authorities**

36 The requirements of RCRA and the *State of Washington Hazardous Waste Management Act* (as  
37 administered through WAC 173-303) pertain to all Hanford Facility units that were used to treat, store,  
38 and/or dispose of hazardous waste on or after November 19, 1980; State-only dangerous waste on or after  
39 March 12, 1982; mixed waste on or after August 19, 1987; and units at which such waste will be treated,  
40 stored, and/or disposed in the future, except as provided by WAC 173-303-200 and WAC 173-303-802.

41 'Dangerous waste' means hazardous, dangerous, or extremely hazardous waste as defined by RCRA  
42 and/or WAC 173-303 (refer to Appendix 2B of this document). 'Mixed waste' means waste that contains  
43 both dangerous and radioactive components (Appendix 2B). The radioactive component of mixed waste  
44 is interpreted by the U.S. Department of Energy to be regulated under the *Atomic Energy Act*; the

1 nonradioactive dangerous component of mixed waste is interpreted to be regulated under RCRA and  
2 WAC 173-303. Please note that source, special nuclear and by-product materials, as defined in the  
3 Atomic Energy Act of 1954 (AEA), are regulated at DOE facilities exclusively by DOE acting pursuant  
4 to its AEA authority. These materials are not subject to regulation by the State of Washington. All  
5 information contained herein and related to, or describing AEA-regulated materials and processes in any  
6 manner may not be used to create conditions or other restrictions set forth in any permit, license, order, or  
7 any other enforceable instrument. DOE asserts that pursuant to the AEA, it has sole and exclusive  
8 responsibility and authority to regulate source, special nuclear and by-product materials at DOE-owned  
9 nuclear facilities. Information contained herein on radionuclides is provided for process description  
10 purposes only.

11 'Final status operating' TSD units include, but are not limited to, tank systems, surface impoundments,  
12 container storage areas, containment buildings, landfills, and miscellaneous units that were, are, or are  
13 anticipated to be, involved in dangerous and/or mixed waste activities. The scope of the unit-specific  
14 documentation is limited to individual 'final status operating' TSD units, which Part B Permit  
15 documentation has been, or is anticipated to be, submitted. However, the scope of the General  
16 Information Portion includes information that could be used to discuss 'final status operating' units, units  
17 'undergoing closure', or units being 'disposed through other options'. Unit-specific documentation for  
18 TSD units 'undergoing closure', or for units that are, or are anticipated to be, 'disposed through other  
19 options', will continue to be submitted by the Permittees in accordance with the provisions of the  
20 Tri-Party Agreement.

21 In accordance with the stepwise RCRA permitting process defined for the Hanford Facility in the  
22 Tri-Party Agreement and Permit Condition I.A.1, those TSD units that are not yet incorporated into the  
23 Permit will continue to operate under interim status. Interim status capacity expansion of the Hanford  
24 Facility is in accordance with the provisions of WAC 173-303-281, as applicable, and  
25 WAC 173-303-805(7). Construction under final status for new TSD units is also occurring at the  
26 Hanford Facility.

27 Dangerous waste and the dangerous waste component of mixed waste on the Hanford Facility are subject  
28 to land disposal restrictions (LDR) (40 CFR 268 and WAC 173-303-140). Ecology has received  
29 authorization from the EPA to administer certain LDR provisions of RCRA pursuant to §3006 and those  
30 provisions operate in lieu of federal requirements. For other LDR requirements implementation refer to  
31 Tri-Party Agreement Action Plan, §6.1.

### 32 **2.1.1.3.2 Hanford Federal Facility Agreement and Consent Order**

33 The Tri-Party Agreement, as initially established in 1989 and subsequently amended, is a legal document  
34 covering Hanford Site environmental compliance and restoration and remediation activities. Reference to  
35 the Tri-Party Agreement in this document refers to the most recent amendment of the document, unless  
36 specified otherwise. The Tri-Party Agreement is divided into two parts, the Agreement and Consent  
37 Order and the Action Plan.

38 Purposes of the Tri-Party Agreement as related to RCRA permitting include the following:

- 39 • To provide a framework for permitting TSD units and to promote an orderly, effective investigation  
40 and cleanup of contamination on the Hanford Site
- 41 • To ensure compliance with the RCRA and the *State of Washington Hazardous Waste Management*  
42 *Act* for TSD units, including requirements covering permitting, compliance, closure, and postclosure  
43 care

- 1 • To establish a procedural framework and schedule for developing, prioritizing, implementing, and  
2 monitoring appropriate response actions on the Hanford Site in accordance with the CERCLA, the  
3 National Contingency Plan, the Superfund guidance and policy, RCRA, and RCRA guidance and  
4 policy
- 5 • To identify TSD units that require permits; to establish schedules to achieve compliance with interim  
6 and final status requirements and to complete Permit documentation for such units in accordance with  
7 the Tri-Party Agreement Action Plan; to identify TSD units that will undergo closure; to close such  
8 units in accordance with applicable laws and regulations; to require postclosure care where necessary;  
9 and to coordinate closure with any inter-connected remedial action on the Hanford Site
- 10 • To minimize the duplication of analysis and documentation.

11 The Tri-Party Agreement Action Plan, an enforceable part of the Tri-Party Agreement, establishes  
12 methods, procedures, and plans for (1) compliance, permitting, and closure under the RCRA and the *State*  
13 *of Washington Hazardous Waste Management Act* and (2) cleanup of the Hanford Site under CERCLA  
14 and RCRA corrective action provisions. The Tri-Party Agreement Action Plan also specifies which  
15 regulatory agency (i.e., either Ecology or EPA) has lead regulatory agency responsibility.

16 Tri-Party Agreement Action Plan, Appendix B, contains a listing of Hanford Facility TSD units. In  
17 accordance with Tri-Party Agreement Action Plan, §5.3, any additional TSD units that are identified are  
18 to be added to Tri-Party Agreement Action Plan, Appendix B. Tri-Party Agreement Action Plan, §2.4,  
19 and Appendix D include the identification of major milestones established to achieve compliance with  
20 RCRA and WAC 173-303 TSD requirements. Such milestones (M) include those for submittal of Part B,  
21 closure plan, closure/postclosure plan, and withdrawal request documentation (e.g., M-20-00, M-45-06,  
22 M-24-00), and RCRA past-practice site investigations and remedial actions (e.g., M-13, M-15, M-16).

23 Tri-Party Agreement Action Plan, §6.2, the permitting process for individual TSD units that comprise the  
24 Hanford Facility is described. Figure 2.3, was adapted from Tri-Party Agreement Action Plan, §6.2,  
25 which depicts the process for dangerous waste permitting documentation for 'final status operating'  
26 TSD units by the Permittees. This process applies to existing TSD units, units subject to interim status  
27 capacity expansion, and new units (i.e., units that do not have interim status and must have a permit  
28 before construction). The process for TSD units 'undergoing closure' is addressed in §2.5. Figure 2.3,  
29 was adapted from Tri-Party Agreement Action Plan, §6.3, which depicts a flowchart for processing  
30 closure plan documentation.

31 The review of each submittal to the regulator is to be conducted in accordance with a process supported  
32 by the development of working drafts, project manager meetings, and workshops. In accordance with  
33 Tri-Party Agreement Action Plan, §4.1, project manager meetings are held to discuss progress, address  
34 issues, and review plans pertaining to a specific TSD unit. These meetings are held monthly, unless the  
35 project managers for the parties (DOE-RL, Ecology, and/or the EPA) agree that a meeting is not  
36 appropriate. Workshops also are held between the Permittees and the regulators, on an as-needed basis,  
37 to address and resolve comments associated with the working drafts.

38 At the end of the review and comment response process, final documentation is readied for a 'final status  
39 operating' TSD unit and serves as the basis for incorporation of that unit into part III of the Permit. For  
40 example, after the unit-specific documentation is submitted by the Permittees, a final Permit decision will  
41 be made by Ecology pursuant to WAC 173-303-840. Ecology will draft unit-specific Permit Conditions  
42 for this TSD unit to be incorporated into Part III of the Permit during an agency initiated Permit  
43 modification (refer to §2.1.1.3.3). A process flowchart for modification of the Permit is included as  
44 Figure 2.4.

1 A similar documentation finalization process is in place for TSD units 'undergoing closure' (Figure 2.3),  
2 and is discussed in more detail in §2.5. A closure/postclosure plan, or postclosure Permit documentation  
3 is to be developed for most of these TSD units in accordance with Tri-Party Agreement Action Plan, §2.4,  
4 §5.3, §6.3, §8.0, and Appendix D

5 Procedural closure is used for those units that were classified as being TSD units, but actually were never  
6 used to treat, store, or dispose of hazardous waste on or after November 19, 1980; State-only dangerous  
7 waste on or after March 12, 1982; and mixed waste on or after August 19, 1987, except as provided by  
8 WAC 173-303-200 or WAC 173-303-802. Procedural closure is discussed in more detail in §2.5.1.3.

### 9 **2.1.1.3.3 Hanford Facility Permit**

10 The Permit is divided as follows:

11 Part I: Standard Conditions. Part I contains Permit Conditions that are similar to those appearing in other  
12 dangerous waste permits issued by Ecology.

13 Part II: General Facility Conditions. Part II combines typical dangerous waste Permit Conditions with  
14 those conditions intended to address issues specific to the Hanford Facility. Where appropriate, the  
15 General Facility Permit Conditions apply to all final status dangerous waste management activities on the  
16 Hanford Facility. Certain General Facility Permit Conditions address dangerous waste management  
17 activities associated with areas between TSD units identified in Permit Attachment 3, Permit  
18 Applicability matrix, Category D (e.g., training, contingency planning).

19 Part III: Unit-Specific Permit Conditions for Final Status Operations. Part III contains those Permit  
20 requirements that apply to each individual TSD unit operating under final status. Permit Conditions for  
21 each TSD unit are found in a Permit chapter dedicated to that TSD unit. These unit-specific Permit  
22 chapters contain references to Standard and General Facility Permit Conditions (Parts I and II), as well as  
23 additional requirements that are intended to ensure that each TSD unit is operated in an efficient and  
24 environmentally protective manner. The Permittees submit the unit-specific documentation that serves as  
25 the basis for Part III chapters of the Permit.

26 Part IV: Corrective Actions for Past-Practices Activities. Part IV of the Permit contains those  
27 requirements that apply to corrective action of solid waste management units (SWMUs) on the Hanford  
28 Facility, and for conducting investigations and remediations at such SWMUs. Further discussion of  
29 SWMUs is contained in §2.5. In addition, Permit Condition II.Y contains conditions on corrective action.  
30 Permit Conditions for solid waste management units are found in a Permit chapter dedicated to solid  
31 waste management unit(s) or an operable unit.

32 Part V: Unit-Specific Permit Conditions for TSD Units Undergoing Closure. Part V contains those  
33 requirements that apply to specific TSD units undergoing closure. Requirements for each TSD unit  
34 undergoing closure are found in a Permit chapter dedicated to that TSD unit or multiple TSD units. These  
35 unit-specific Permit chapters could contain references to Standard Permit Conditions (Part I) and General  
36 Facility Permit Conditions (Part II), and additional requirements that are intended to ensure that each TSD  
37 unit is closed in an efficient and environmentally protective manner. Further discussion of the permitting  
38 process for TSD units 'undergoing closure' is contained in §2.5.

39 Part VI: Unit-Specific Permit Conditions for Units in Postclosure. Part VI contains requirements that  
40 apply to those specific TSD units that have completed closure requirements (refer to DOE/RL-91-28,  
41 §11.1.1) and need to meet postclosure standards. As set out in Tri-Party Agreement Action Plan, §5.3,  
42 certain TSD units will be permitted for postclosure care pursuant to WAC 173-303. Requirements for  
43 each TSD unit or a combination of TSD units undergoing postclosure care are found in a Permit chapter,  
44 within Part VI, dedicated to that unit(s). These unit-specific Permit chapters could contain references to

1 Standard Permit Conditions (Part I) and General Permit Conditions (Part II), as well as the unit-specific  
2 Permit Conditions.

3 The Permit Conditions are applied to the Hanford Facility as defined by Attachment 3, Permit  
4 Applicability Matrix referenced in Permit Condition I.A.1.b.

5 The Permit is organized to allow a stepwise permitting process as defined in the Tri-Party Agreement. As  
6 TSD unit-specific documentation, is finalized by the Permittees, and approved by Ecology, additional  
7 unit-specific Permit Conditions are incorporated into the Permit through the Permit modification process.

8 After unit-specific actions contained in Parts III through VI have been completed and accepted by  
9 Ecology, the Permittees will submit a Class 1 Permit modification requesting that the Permit chapter and  
10 any associated attachments be retired. Once retired, the unit-specific documentation will be found in the  
11 Administrative Record.

12 The permit modification process is outlined in Figure 2.4. A Permit modification does not affect the  
13 10-year term of the Permit (Permit Condition I.C.1), unless the Permit is revoked and reissued under  
14 WAC 173-303-830(3), or terminated under WAC 173-303-830(5), or continued in accordance with  
15 WAC 173-303-806(7). In accordance with the stepwise permitting process, only those portions of the  
16 Permit newly proposed for incorporation would be open to public comment. Revocation and reissuance  
17 means the existing Permit is revoked and an entirely new Permit is issued, to include all TSD units  
18 permitted as of that date. In this case, all Permit Conditions to be reissued would be open to public  
19 comment and a new term would be specified for the reissued Permit.

#### 20 **2.1.1.3.4 Hanford Facility Permit**

21 The Permit documentation submitted by the Permittees includes a General Information Portion  
22 (DOE/RL-91-28), certain Permit Attachments, and unit-specific documentation. The scope of the  
23 unit-specific documentation includes individual, 'final status operating' TSD units for which Permit  
24 documentation has been, or is anticipated to be, submitted (refer to Chapter 1.0). Documentation for  
25 TSD units 'undergoing closure', or for units that are, or are anticipated to be, 'disposed through other  
26 options', will continue to be submitted by the Permittees in accordance with the provisions of the  
27 Tri-Party Agreement. However, the scope of the General Information Portion includes information that  
28 could be used to discuss 'final status operating' units, units 'undergoing closure', or units being  
29 'disposed through other options'.

30 Both the General Information Portion and Part III unit-specific documentation of the Permit address the  
31 contents of the documentation requirements prepared by Ecology (Ecology 1996). Both the General  
32 Information Portion and the TSD units in Part III are organized as follows:

- 33 • Foreword
- 34 • Contents
- 35 • Chapter 1.0: Part A [A]
- 36 • Chapter 2.0: Facility Description and General Provisions [B and E]
- 37 • Chapter 3.0: Waste Analysis [C]
- 38 • Chapter 4.0: Process Information [D-1 through D-8]
- 39 • Chapter 5.0: Groundwater Monitoring [D-10]
- 40 • Chapter 6.0: Procedures to Prevent Hazards [F]
- 41 • Chapter 7.0: Contingency Plan [G]
- 42 • Chapter 8.0: Personnel Training [H]
- 43 • Chapter 9.0: Exposure Information Report
- 44 • Chapter 10.0: Waste Minimization [D-9]
- 45 • Chapter 11.0: Closure and Financial Assurance [I]
- 46 • Chapter 12.0: Reporting and Recordkeeping

- 1 • Chapter 13.0: Other Federal and State Laws [J]
- 2 • Chapter 14.0: Part B Certification [K]
- 3 • Chapter 15.0: References
- 4 • Appendices as necessary to support individual chapters.

5 Documentation contained in the General Information Portion is broader in nature and generally applies to  
6 multiple TSD units included in the unit-specific documentation. Where appropriate, the unit-specific  
7 documentation makes cross-reference to the General Information Portion, rather than duplicating text.  
8 The regulators could use the General Information Portion as a source for both unit-specific and General  
9 Permit Conditions. However, only portions of the General Information Portion (DOE/RL-91-28) are  
10 enforceable, as noted in the Permit, List of Attachments, *[O]nly those portions of the Attachments*  
11 *specified in Parts I through VI are enforceable Conditions of this Permit and subject to the Permit*  
12 *modification requirements of Condition I.C.3.* The intent of the General Information Portion is: (1) to  
13 provide an overview of the Hanford Facility; and (2) to assist in streamlining efforts associated with TSD  
14 unit-specific documentation, and the Permit modification process.

#### 15 **2.1.1.4 Description of Dangerous Waste Management Operations and Processes**

16 A brief description of dangerous waste management operations and processes for Hanford Facility TSD  
17 units is contained in §2.5 (for units 'undergoing closure' or being 'disposed through other options')  
18 and in DOE/RL-91-28, §4.1 (for 'final status operating' units). Additional detail for 'operating' TSD units  
19 is contained in the unit-specific documentation.

#### 20 **2.1.1.5 Other Processes Regulated Under the Dangerous Waste Regulations**

21 Other Hanford Site processes or activities regulated under Ecology's *Dangerous Waste Regulations*  
22 include recycling (e.g., WAC 173-303-017, -120, -500), generator activities [e.g., WAC 173-303-170),  
23 treatment-by-generator (WAC 173-303-170(3)(b)], transport (e.g., WAC 173-303-240), permits by rule  
24 (e.g., WAC 173-303-802), and research, development, and demonstration (RD&D) permits  
25 (WAC 173-303-809). The activities in this section are not included within the scope of this  
26 documentation or of the Permit, except where specific language has been included in the Permit.

#### 27 **2.1.2 Construction Schedule [B-1b]**

28 This section addresses the scheduling of construction of new TSD units, or the remodeling of existing  
29 units, and the timing of associated permitting activities. Discussions in this section are general, and are  
30 based primarily on information contained in WAC 173-303-335, the Tri-Party Agreement, and in  
31 U.S. DOE Orders addressing design and construction processes.

32 Existing provisions of the Tri-Party Agreement serve as a means for the timely dissemination to the  
33 regulators of construction and associated permitting information that can be used for scheduling purposes.  
34 Articles XL and XLVIII of the Tri-Party Agreement outline provisions for DOE to provide cost, schedule,  
35 and scope planning and reporting information to Ecology and the EPA. Such information identifies  
36 construction activities and schedules related to existing or planned TSD units. In some cases, as outlined  
37 in Tri-Party Agreement Action Plan, §2.0, §11.0, and Appendix D, construction commitments are  
38 associated with Tri-Party Agreement milestones and are tracked as part of milestone activities. Project  
39 manager meetings also are used to discuss planned construction, permitting activities, and required  
40 timeframes.

41 Several U.S. DOE Orders establish requirements for the planning and scheduling of construction  
42 activities. Requirements to be addressed depend on several factors, including the cost and function of a  
43 proposed project. Figure 2.5 provides a generic project schedule keyed to the project process outlined in  
44 U.S. DOE Orders. This schedule also illustrates general timeframes for associated permitting  
45 documentation. Figure 2.5 illustrates that detailed design information, sufficient to fulfill Part B

1 documentation needs, might not be available until 1 to 2 years before the start of construction. In general,  
2 the final status permitting process for a TSD unit of moderate complexity takes at least 3 years. Thus, if a  
3 final status permit is required before the initiation of construction, construction delays could be incurred.  
4 If such construction is associated with TSD units that are not yet incorporated into the Permit, delays  
5 could be avoided by proceeding with construction under interim status or interim status capacity  
6 expansion (WAC 173-303-281, -805; refer to §2.1.1.3.1). The granting of interim status capacity  
7 expansion will be considered on a case-by-case basis, in accordance with WAC 173-303-281, as  
8 applicable, and WAC 173-303-805(7). Otherwise, the TSD units will be incorporated into the Permit  
9 with available information and construction will occur under final status requirements.

10 The generic project schedule shown in Figure 2.5 might not be applicable to TSD units on the Hanford  
11 Facility subject to privatization.

## 12 **2.2 TOPOGRAPHIC MAP [B-2]**

13 This section addresses general topographic map requirements for the Hanford Facility and additional  
14 requirements for land disposal facilities.

### 15 **2.2.1 General Requirements [B-2a]**

16 Topographic map requirements in WAC 173-303 are as follows:

- 17 • Part A Permit Application [WAC 173-303-803(3)(1)]
- 18 • General Topographic map [WAC 173-303-806(4)(a)(xviii)]
- 19 • Regulated Unit Groundwater [WAC 173-303-806(4)(a)(xx)(C) and (4)(a)(xx)(D)(I)]
- 20 • Solid Waste Management Units [WAC 173-303-806(4)(a)(xxiii)(A)(I)]
- 21 • Known releases [WAC 173-303-806(4)(a)(xxiv)(A)(I)]

22 Due to the complexity of the Hanford Facility, topographic map requirements are met through the  
23 combination of the Hanford Facility topographic map (§2.2.1.1), 'final status operating' TSD unit  
24 topographic maps (§2.2.1.2, and §2.2.2), TSD unit illustrations and figures (§2.2.1.2 and §2.2.2), and  
25 other information used in conjunction with the topographic maps (§2.2.1.3 through §2.2.1.7). Because of  
26 the size of the Hanford Facility, DOE/RL-91-28, Appendix 2A uses a scale of 1-inch equals 1,000 feet  
27 (1cm equals 120 meters).

#### 28 **2.2.1.1 Hanford Facility**

29 Drawings in DOE/RL-91-28, Appendix 2A provide a general overview of the Hanford Site and  
30 surrounding area. The drawing illustrates the following:

- 31 • Boundary of the Hanford Site (for area shown)
- 32 • Contours sufficient to show surface water flow
- 33 • Fire control services
- 34 • Intake and discharge structures
- 35 • Access roads, internal roads, railroads, perimeter gates, and barricades
- 36 • The location of all surface water bodies
- 37 • The location of all industrial related activity

38 Injection well locations are found outside of Permit documentation. In compliance with WAC 173-218,  
39 the location of all injection wells on the Hanford Site has been registered with Ecology. The location of  
40 more than 200 active Class V underground injection wells have been identified and incorporated in the  
41 State of Washington UIC database. There are currently over 400 Class V underground injection wells  
42 (active and inactive) registered with Ecology.

1 **2.2.1.2 Treatment, Storage, and Disposal Units**

2 Specific location maps or figures for Hanford Facility TSD units have been incorporated into Parts III  
3 through VI of the Permit. As a result, the following information has been incorporated into the Permit in  
4 one or more maps or figures for each of these units:

- 5 • Map scale and date (where appropriate, Part III units only)
- 6 • Map orientation
- 7 • Location of the unit
- 8 • Access road location (where appropriate, Part III units only)
- 9 • Access control (where appropriate, Part III units only)
- 10 • Loading and unloading areas (Part III units only)
- 11 • Buildings and the location of all operational facilities within the TSD boundaries (Part III units only)
- 12 • Other Structures (e.g., sewers, loading and unloading areas) within the TSD boundaries (Part III units  
13 only).
- 14 • Groundwater information for regulated units (Refer to §2.2.2).

15 Injection well locations are found outside of Permit documentation in accordance with §2.2.1.1.

16 **2.2.1.3 Prevailing Wind Directions**

17 Prevailing wind directions across the Hanford Site are presented in Figure 2.6. Prevailing wind directions  
18 in the 200 East and 200 West Areas (located approximately in the center of the Hanford Site) are from the  
19 northwest in all months of the year. Secondary maxima occur for southwesterly winds.

20 Monthly average wind speeds are lowest during the winter months, averaging 9.7 to 11.3 kilometers per  
21 hour and highest during the summer, averaging 14.5 to 16.1 kilometers per hour. Wind speeds that are  
22 well above average usually are associated with southwesterly winds. However, the summertime drainage  
23 winds generally are northwesterly and frequently reach 50 kilometers per hour. Information on the  
24 likelihood and frequency of strong winds and tornados in the region has been summarized in a final  
25 environmental impact statement (DOE/EIS-0113).

26 **2.2.1.4 Floodplain Area**

27 Three sources of potential flooding of the Hanford Facility are considered: (1) the Columbia River,  
28 (2) the Yakima River, and (3) storm-induced run-off in ephemeral streams draining the Hanford Facility.  
29 No perennial streams occur in the central part of the Hanford Facility. However, Cold Creek is an  
30 intermittent or ephemeral stream that exists along Highway 240 during periods of extreme precipitation.

31 The Federal Emergency Management Agency has not prepared floodplain maps for the Columbia River  
32 through the Hanford Site. The flow of the Columbia River is largely controlled by several upstream dams  
33 that are designed to reduce major flood flows. Based on a U.S. Army Corps of Engineers study of the  
34 flooding potential of the Columbia River that considered historic data and water storage capacity of the  
35 dams on the Columbia River (COE 1969), the U.S. DOE (RLO-76-4) has estimated the probable  
36 maximum flood (Figure 2.7). The estimated probable maximum flood would have a larger floodplain  
37 than either the 100- or the 500-year floods.

38 The 100-year floodplain for the Yakima River, as determined by the Federal Emergency Management  
39 Agency (FEMA 1980), is shown in Figure 2.8.

40 The only other potential source of flooding of the Hanford Facility is run-off from a large precipitation  
41 event in the Cold Creek watershed. This event could result in flooding of the ephemeral Cold Creek.  
42 PNNL (PNL-4219) has given an estimate of the probable maximum flood using conservative values of  
43 precipitation, infiltration, surface roughness, and topographic features. The 100-year flood is less than the

1 probable maximum flood as shown in Figures 2.7 and 2.8.

2 The location of individual 'operating' TSD units with respect to the identified floodplains is addressed in  
3 the unit-specific portion.

#### 4 **2.2.1.5 Surrounding Land Use**

5 A figure showing the surrounding land use is provided as Figure 2.10. In support of surrounding land  
6 use, no public water supplies including public drinking water wells were found to be located within 1/4  
7 mile of the Hanford Facility Boundary shown in Figure 2.1. The land surrounding the Hanford Facility is  
8 designated agricultural with the exception of the land adjacent to the Hammer Facility, which is  
9 designated industrial. Other than public drinking water wells, injection wells, and regulated unit  
10 groundwater monitoring wells, wells and springs within a ¼ mile of the Hanford Facility boundary will  
11 be evaluated on a case-by-case basis for individual TSD units.

#### 12 **2.2.1.6 Solid Waste Management Units and Known Releases**

13 Information on Solid Waste Management Units and Known Spills is provided in DOE/RL-91-28,  
14 Appendix 2D.

#### 15 **2.2.1.7 Other Buildings and Structures**

16 In addition to the location of buildings and structures on the unit-specific topography maps identified in  
17 Part III of the Permit, the location of other prominent buildings and structures is provided in the series of  
18 area maps found in DOE/RL-91-28, Appendix 2A.

#### 19 **2.2.2 Additional Requirements for Land Disposal Facilities [B-2b]**

20 In addition to the unit-specific information discussed in §2.2.1.2, for regulated units, the following  
21 information will be incorporated into the 'final status operating' unit-specific topographic map,  
22 illustrations, or other suitable maps or figures (contingent upon scale)

- 23 • A delineation of the waste management area if the waste management area is different from the TSD  
24 unit(s) boundary
- 25 • Proposed point of compliance for groundwater monitoring networks
- 26 • Proposed groundwater monitoring well locations.
- 27 • Unit-specific contaminant plumes and extent of the plume. Regional contaminant plumes are  
28 generally mapped in Hanford's annual Groundwater Monitoring reports (e.g., PNNL-14187), but  
29 unit-specific contaminant plumes are provided in the unit-specific groundwater documentation for the  
30 regulated unit.
- 31 • In addition, the following required information for regulated units is provided in DOE/RL-91-28,  
32 Chapter 5.0. Locations of the uppermost aquifer and the discussion on aquifers hydraulically  
33 interconnected beneath the unit (including flow direction and rate)
- 34 • An overview of the groundwater contamination from dangerous constituents.

#### 35 **2.3 SEISMIC CONSIDERATION [B-3]**

36 The Hanford Facility is located in Zone 2B as identified in the *Uniform Building Code* (ICBO 1991). For  
37 a proposed TSD unit or an expansion of an existing unit, a demonstration that the unit is designed to  
38 withstand the maximum horizontal acceleration of the "design earthquake" for Zone 2B will be made in  
39 the unit-specific portion.

1 No active faults, or evidence of a fault that has had displacement during Holocene times, have been found  
2 on the Hanford Facility (DOE/RE-0164). The youngest faults recognized on the Hanford Facility occur  
3 on Gable Mountain, approximately 1.6 kilometers north of the 200 East Area, and 7.2 kilometers  
4 northeast of the 200 West Area. These faults are of Quaternary age and are considered 'capable' by the  
5 U.S. Nuclear Regulatory Commission (NUREG-0892).

## 6 **2.4 TRAFFIC INFORMATION [B-4]**

7 The regional public highway network traversing the Hanford Site (Washington State Highways 24 and  
8 240), nonrestricted access roadways (Route 10, and portions of Route 4S located south of the Wye  
9 Barricade), and restricted access roadways are shown in Figure 2.9.

10 Roadways east of the Yakima Barricade and north of the Wye Barricade, and within the 300 and  
11 400 Areas, are restricted to authorized personnel only. Other U.S. DOE roadways are subject to such  
12 restrictions or closure as the U.S. DOE might require.

### 13 **2.4.1 Hanford Site Roadways**

14 Figure 2.9 shows the major roads throughout the Hanford Site. These roads are classified as either  
15 primary or secondary routes. The primary routes include Routes 4S, 10, 2S, 3, 6, and 11A, as well as  
16 various avenues within each area. The primary routes are constructed of bituminous asphalt (usually  
17 5-centimeters thick, but the thickness of the asphalt layer will vary with each road) with an underlying  
18 aggregate base in accordance with U.S. Department of Transportation requirements. The secondary  
19 routes are constructed of layers of an oil and rock mixture with an underlying aggregate base. The  
20 aggregate base consists of various types and sizes of rock found onsite. The present load-bearing  
21 capacities of these roads are unknown; however, loads as large as 9.8 kilograms per square centimeter  
22 have been transported without observable damage to road surfaces. All roads originally were constructed  
23 to meet the requirements for the American Association of State Highway and Transportation Officials  
24 HS-20-44 load rating (AASHTO 1983). An HS-20-44 loading represents a two-axle tractor (front  
25 axle loading of 3,630 kilograms and rear axle loading of 14,500 kilograms) plus a single-axle trailer with  
26 a 14,500-kilogram axle loading.

### 27 **2.4.2 Traffic Control Signs, Signals, and Procedures**

28 Standard traffic control signs are used throughout the Hanford Site (e.g., octagonal stop signs, triangular  
29 yield signs). Speed limits are posted throughout the Hanford Site, and the maximum-posted speed is  
30 88 kilometers per hour on major thoroughfares. Inside the various areas, posted speeds are reduced to a  
31 maximum of 56 kilometers per hour and held to speeds as low as 24 kilometers per hour.

## 32 **2.5 WASTE MANAGEMENT UNITS**

33 The Tri-Party Agreement classifies and outlines the approach for addressing over 2,000 waste  
34 management units on the Hanford Site. The classification of Hanford Site waste management units is  
35 illustrated in Figure 2.11 and includes the following:

- 36 • Solid waste management units
  - 37 – 'Final status operating' TSD units
  - 38 – TSD units 'undergoing closure'
    - 39 ▪ Non-land disposal TSD units
    - 40 ▪ Land disposal TSD units
  - 41 – Past-practice units
    - 42 ▪ RCRA past-practice
    - 43 ▪ CERCLA past-practice
  - 44 – Other Solid Waste Management Units (SWMUs)

- 1 • Other waste management units
- 2     – Facilities subject to decommissioning
- 3     – Miscellaneous waste management units.

4 The remainder of this section briefly addresses these classes of waste management units, with the  
5 exception of 'final status operating' TSD units. 'Final status operating' TSD units are addressed in  
6 DOE/RL-91-28, §4.1.

### 7 **2.5.1 Solid Waste Management Units [E]**

8 A SWMU is any discernable location at a facility, as defined for the purposes of corrective action, where  
9 solid wastes have been placed at any time, irrespective of whether the location was intended for the  
10 management of solid or dangerous waste. Such locations include any area at a facility that has routinely  
11 and systematically released solid wastes, including spills. Such units include regulated units as defined  
12 by chapter 173-303 WAC. The requirements to address corrective action have been incorporated into the  
13 Permit. The Hanford Site contains over 1,100 SWMUs. The remainder of this section, as well as  
14 DOE/RL-91-28, Appendix 2D, provides an overview of Hanford Site SWMUs, with the exception of  
15 'final status operating' TSD units.

16 The Tri-Party Agreement Action Plan defines a TSD as:

17 *A RCRA term referring to the treatment, storage, or [and/or] disposal of hazardous waste. Under RCRA,*  
18 *TSD activity can occur only at units which received or stored hazardous waste after November 19, 1980,*  
19 *the effective date of the RCRA regulations (refer to §2.1.1.3.1).*

20 Furthermore, the Tri-Party Agreement Action Plan defines a TSD unit as:

21 *"a unit used for treatment, storage, or [and/or] disposal of hazardous waste and is required to be*  
22 *permitted and/or closed pursuant to RCRA requirements as determined in this Action Plan."*

23 Figure 2.3 depicts a flowchart for processing closure documentation. In accordance with Tri-Party  
24 Agreement Action Plan, §5.3, all TSD units that undergo closure, irrespective of permit status, will be  
25 closed in accordance with WAC 173-303-610. Permit Conditions for TSD units undergoing closure are  
26 contained in Parts V of the Permit. Refer to DOE/RL-91-28, Chapter 11.0 for a discussion of closure  
27 options at the Hanford Facility. Where applicable, postclosure Permit documentation will contain a  
28 description of modified closure institutional controls, a description of the landfill final cover, cover  
29 maintenance and inspection, groundwater monitoring, and corrective actions if required, that could occur  
30 during the postclosure period.

31 Where applicable, postclosure Permit documentation will contain a description of modified closure  
32 institutional controls, a description of the landfill final cover, cover maintenance and inspection,  
33 groundwater monitoring, and corrective actions if required, that could occur during the postclosure  
34 period.

#### 35 **2.5.1.1 Past-Practice Units**

36 Tri-Party Agreement Action Plan, §3.3, defines a 'past-practice unit' as a waste management unit where  
37 waste or substances (intentionally or unintentionally) have been disposed and that is not subject to  
38 regulation as a TSD unit. Because of the relatively large number of past-practice units on the Hanford  
39 Site, a process has been established for organizing these units into groups called 'operable units'. The  
40 concept of operable units is to group the numerous units (primarily by type, geographic area, and/or by  
41 process) into manageable components for investigation and remedial action and to prioritize the cleanup  
42 work to be done on the Hanford Site. Each of the operable units is to be subject to an investigation in the  
43 form of either a CERCLA or a RCRA past-practice process as described in Tri-Party Agreement Action  
44 Plan, §7.3 and §7.4, respectively.

1 As noted in Article III, Article IV, Article XXIV, and Article XXXII of the Tri-Party Agreement, and  
2 Tri-Party Agreement Action Plan, §3.3, §5.5, and §6.1, some TSD units 'undergoing closure', primarily  
3 land disposal units, will be investigated and managed in conjunction with past-practice units; these units  
4 have been assigned to appropriate operable units. Those TSD units not assigned to an operable unit are  
5 typically treatment or storage units that are likely to be 'clean closed' rather than closed as a land disposal  
6 unit (refer to DOE/RL-91-28, §2.5.1.1 and DOE/RL-91-28, Chapter 11.0). The Tri-Party Agreement  
7 encourages to the maximum extent possible that RCRA and CERCLA cleanup strategies be integrated.  
8 To this end, land disposal TSD units, e.g., ponds, cribs, trenches, retention basins, that are to be closed  
9 were identified as potential waste sites, in Tri-Party Agreement Action Plan, Appendix C, and assigned to  
10 operable unit for investigation and eventual remediation. The associated closure actions could be  
11 performed in conjunction with the remedial actions planned for the remaining waste sites in the operable  
12 unit.

13 This process to achieve integration of TSD unit closures and waste site remedial actions has been  
14 documented in DOE/RL-98-28, *200 Areas Remedial Investigation/Feasibility Study Implementation*  
15 *Plan—Environmental Restoration Program*. Closure information required for the TSD unit will be  
16 incorporated into the CERCLA response action documentation. A table can be provided showing the  
17 location of closure documentation or can be included as a separate attachment to a feasibility study or an  
18 engineering study/cost analysis.

19 Once the public review and comment period has been completed for the CERCLA documentation, then  
20 the closure information will be used to prepare a Part V Permit chapter and associated unit-specific Permit  
21 Attachment with the closure plan information. Since public review and comment has already been  
22 completed, the new Part V Permit chapter and appendix will be added to the Permit via a Class I  
23 modification.

24 Coordination of the remediation of past-practice operable units with TSD closures will enable RCRA  
25 TSD units located within past-practice operable units to have the same cleanup standards. This  
26 coordination will minimize the possibility of having different cleanup standards for coincident or adjacent  
27 parcels of land.

28 Permit Condition II.K, Soil and Groundwater Performance Standards also support the coordination  
29 approach spelled out in the Tri-Party Agreement Action Plan. Permit Condition II.K.7, specifies that,  
30 when agreed to by Ecology, integration of other statutorily or regulatory mandated cleanups could be  
31 accommodated by the Permit. Results from other cleanup investigation activities could be used whenever  
32 possible to supplement and/or replace TSD unit closure investigation activities. All, or appropriate parts  
33 of, multipurpose cleanup and closure documents could be incorporated into the Permit through the Permit  
34 modification process. Cleanup and closures conducted under any statutory authority with oversight by  
35 either Ecology or EPA, which meets the equivalent of the technical requirements of Permit  
36 Condition II.K, could be considered as satisfying the requirements of the Permit. Further discussion of  
37 Permit Condition II.K is contained in DOE/RL-91-28, Chapters 5.0 and 11.0.

#### 38 **2.5.1.2 Other Solid Waste Management Units**

39 In accordance with the Permit, any SWMUs located on DOE-RL and DOE-ORP managed property are,  
40 or will be, included in the Tri-Party Agreement and assigned to operable units. The processes and  
41 procedures to be followed, and the schedules of compliance for investigation and subsequent remediation,  
42 will be contained in the Tri-Party Agreement. An example of a type of 'other SWMU' is inactive  
43 miscellaneous underground storage tanks.

44 The SWMUs not located on DOE-RL and DOE-ORP managed property will undergo investigations and  
45 remediations, as necessary, in accordance with the requirements and schedules identified in the Permit.  
46 Additional information on Hanford Site SWMUs is contained in DOE/RL-91-28, Appendix 2D.

1 **2.5.2 Other Waste Management Units**

2 Of the approximately 1,600 Hanford Site waste management units, approximately 470 are classified as  
3 'other waste management units', rather than SWMUs (DOE/RL-88-30). These 'other waste management  
4 units' are comprised mainly of one-time spills to the environment, sanitary waste disposal facilities  
5 (i.e., septic tanks), and facilities managed or addressed by the Fluor Hanford or environmental restoration  
6 projects.

7 **2.5.2.1 Facilities Subject to Decommissioning**

8 This section addresses waste management units that could be handled under Tri-Party Agreement Action  
9 Plan, §8.0, Facility Decommissioning Process, or under the Permit. Tri-Party Agreement Action  
10 Plan, §8.0 defines an additional process for the identification and decommissioning of key Hanford  
11 facilities (e.g., PUREX Plant, Plutonium Finishing Plant, B Plant Complex, and Fast Flux Test Facility).  
12 Facilities that are fully dispositioned under the TSD unit closure process, or dispositioned in conjunction  
13 with an operable unit cleanup, are not addressed under Tri-Party Agreement Action Plan, §8.0. The TSD  
14 units subject to Tri-Party Agreement Action Plan, §8.0 have physical closure actions that need to be done  
15 in conjunction with the physical disposition actions in the facility (e.g., removal of structural  
16 components).

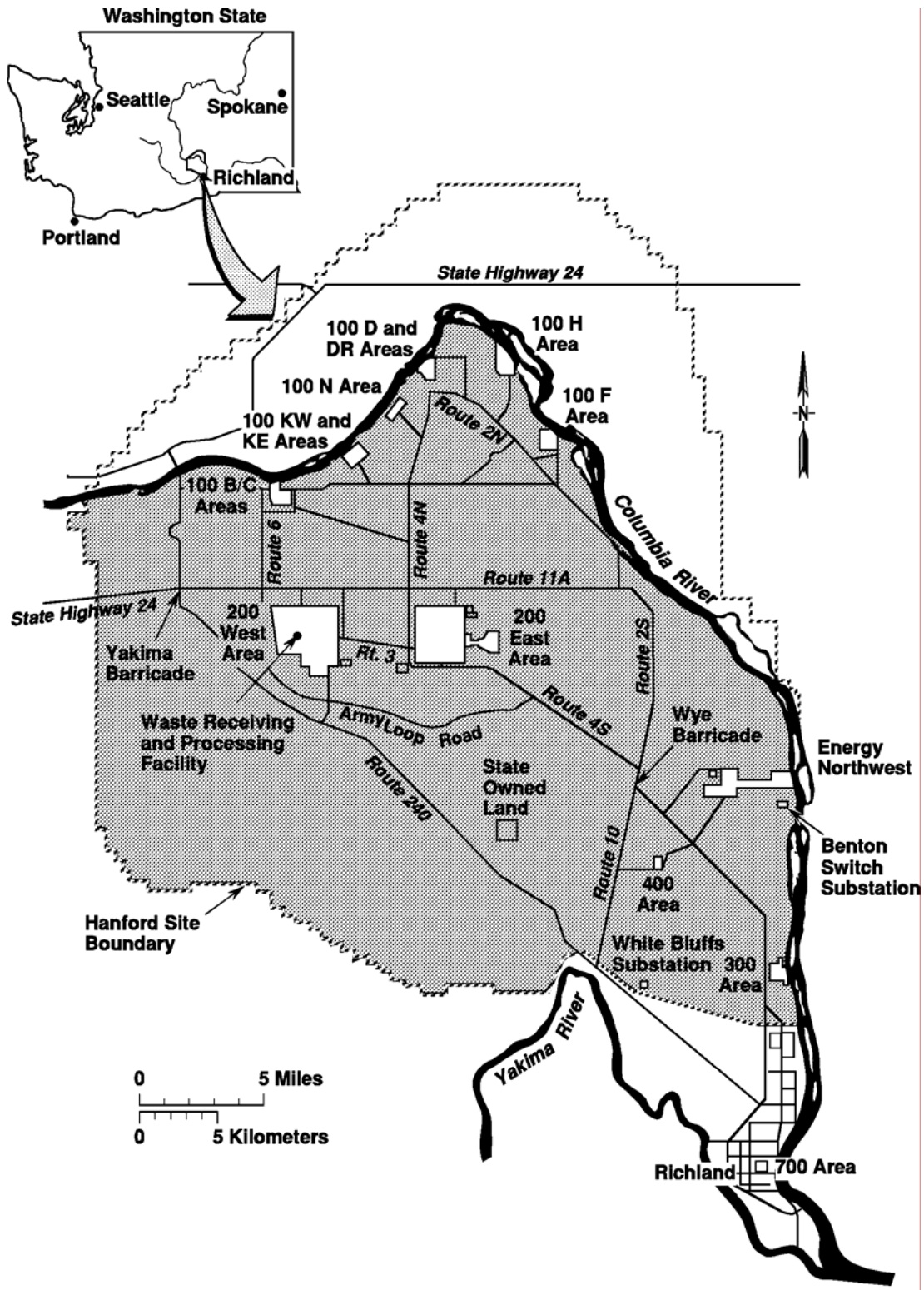
17 Tri-Party Agreement Action Plan, §8.0, enables DOE-RL, DOE-ORP, and the regulators to enter into  
18 negotiations for transition or disposition of key facilities within three months of a shutdown notice or  
19 decision to proceed with disposition, respectively. Provisions of this section enable the conduct of  
20 regulated and nonregulated work in an orderly sequence to ensure coordination with other cleanup  
21 actions. Within the Tri-Party Agreement Action Plan, §8.0, the processes, and key planning documents  
22 associated with the decommissioning phases of transition, surveillance and maintenance, and disposition  
23 are defined.

24 The nature of the decommissioning process has led DOE-RL, DOE-ORP, and the regulators to evaluate  
25 the timing of RCRA closure at key facilities. The phased decommissioning process, combined with other  
26 requirements, often makes completion of RCRA closure activities during the transition or surveillance  
27 and maintenance phases impracticable. In cases where timely completion of TSD unit closure is  
28 practicable, a complete closure plan will be prepared for implementation during the transition phase. In  
29 cases where physical conditions and/or unknowns prevent timely completion of closure, a preclosure  
30 work plan will be prepared for implementation during the transition phase. The preclosure work plan can  
31 detail actions to be completed during the transition phase to facilitate full RCRA closure in the future.

32 **2.5.2.2 Miscellaneous Waste Management Units**

33 Examples of miscellaneous waste management units are one-time spills to the environment and sanitary  
34 waste disposal facilities (i.e., septic tanks). The term 'miscellaneous waste management unit' used in this  
35 context is different from that defined in WAC 173-303-040 for a 'miscellaneous TSD unit'.

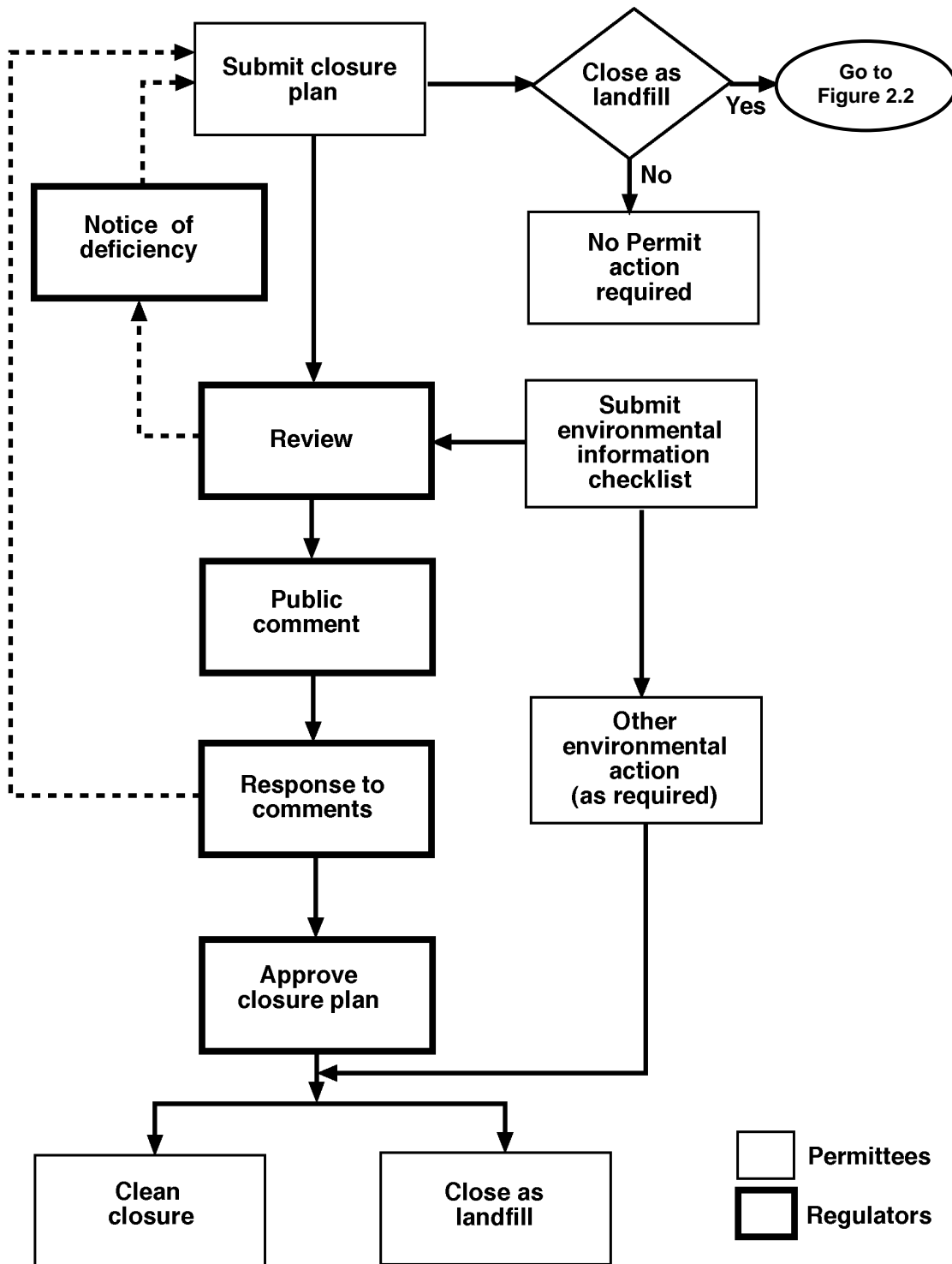
Figure 2.1. Hanford Facility Boundary  
(DOE/RL-91-28, Appendix 2C, Legal Description)



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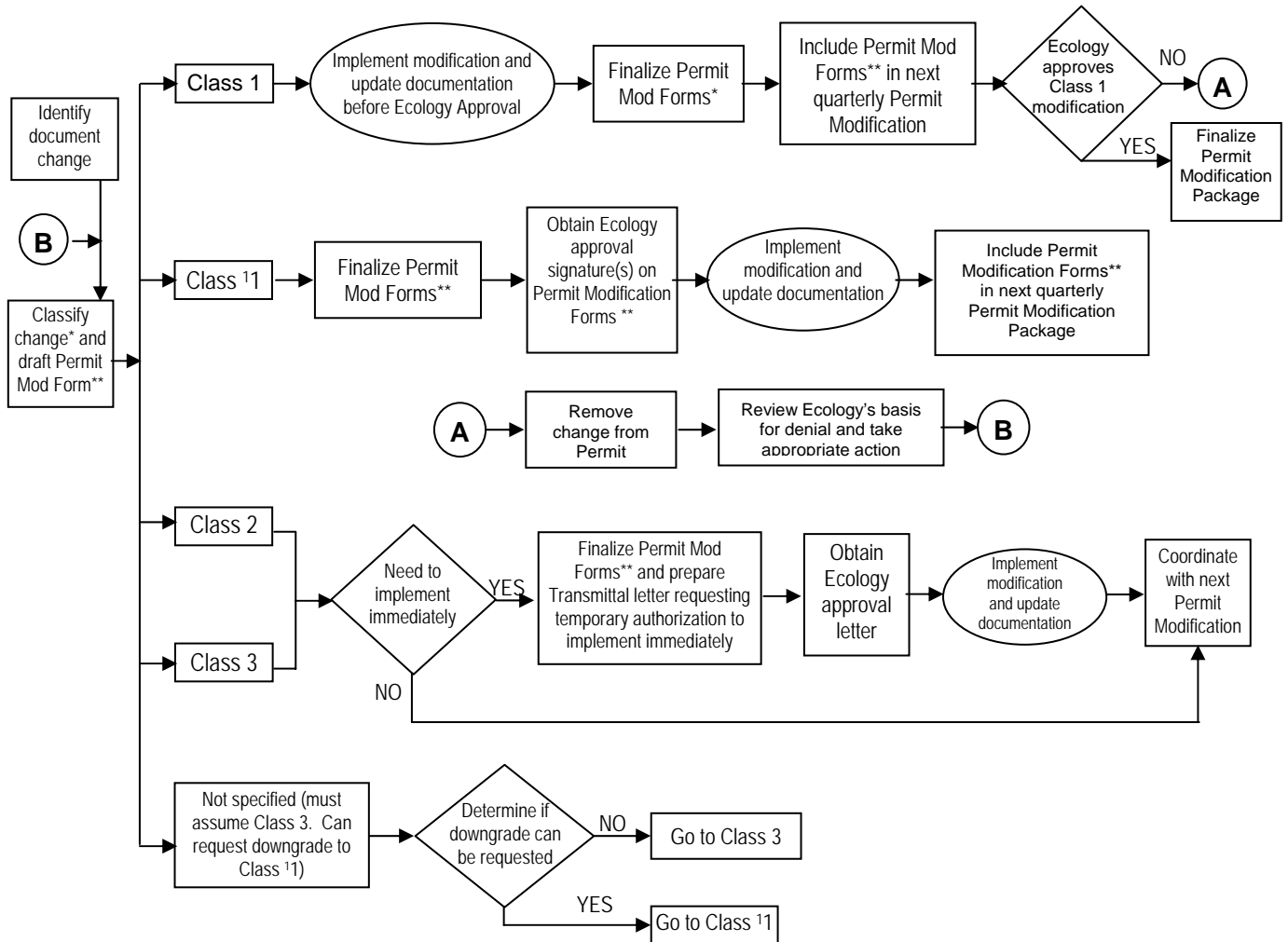


Figure 2.3. Closure Process Flowchart  
(Adapted from Tri-Party Agreement)



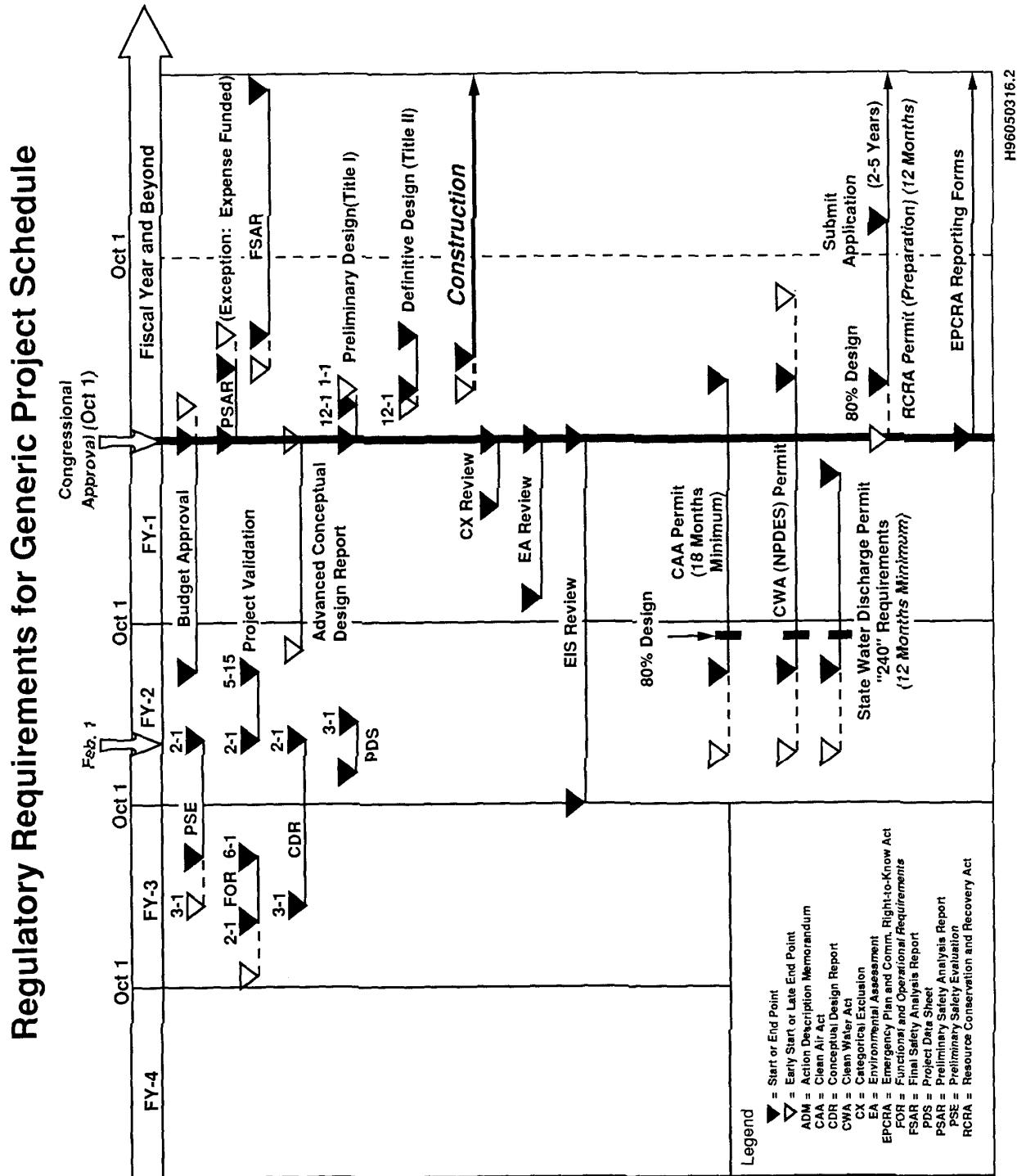
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Figure 2.4. Permit Modification Process  
 [WAC 173-303-830(4) and Appendix I]



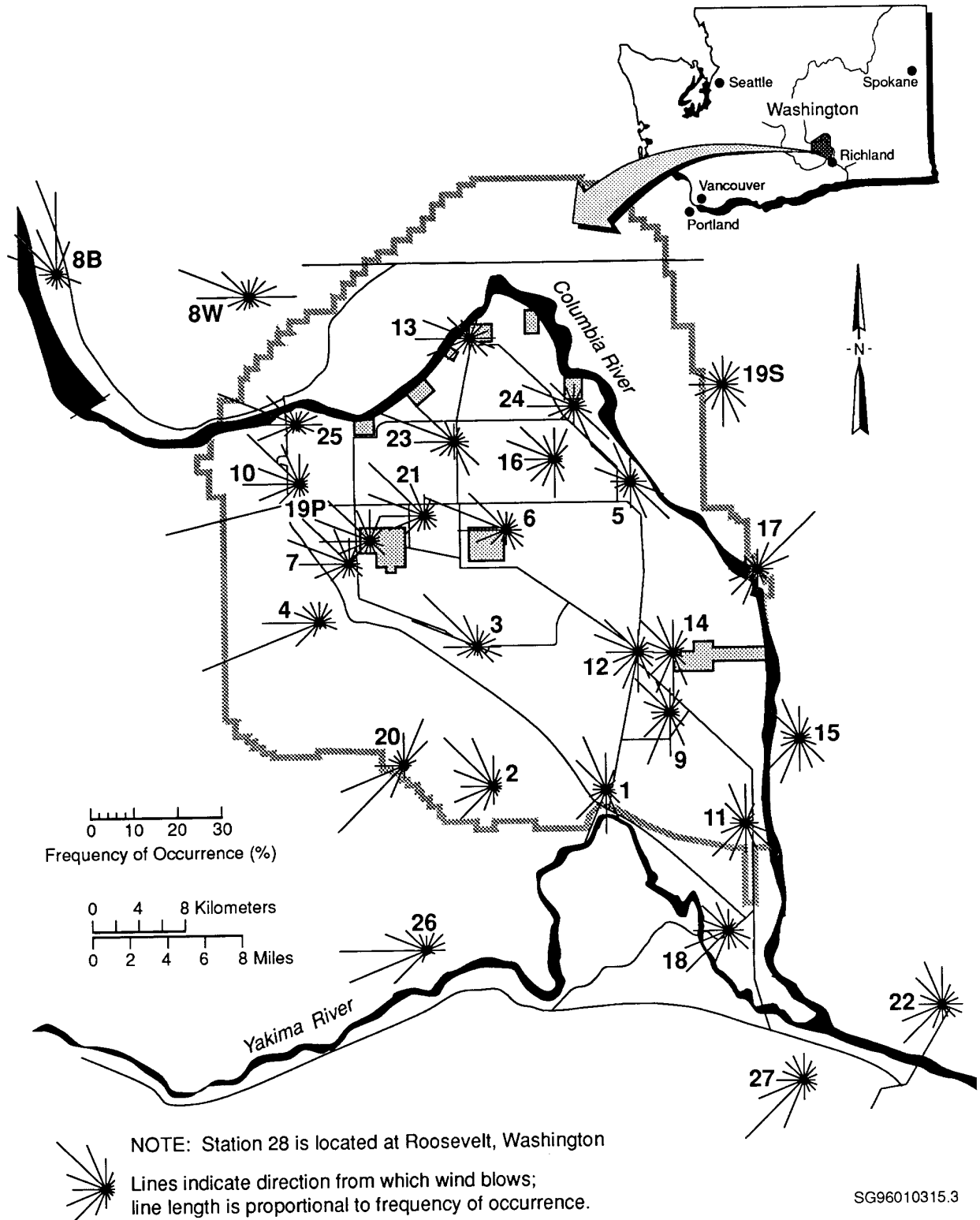
- \* = Approach Ecology for concurrence on questionable classifications
- \*\* = Permit Modification Notification Form

Figure 2.5. Generic Project Schedule.



H96050316.2

Figure 2.6. Prevailing Wind Direction for the Hanford Site  
(Adapted from PNNL-14242).



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Figure 2.7. Columbia River Floodplain  
(Probable maximum flood, adapted from DOE/EIS-0222)

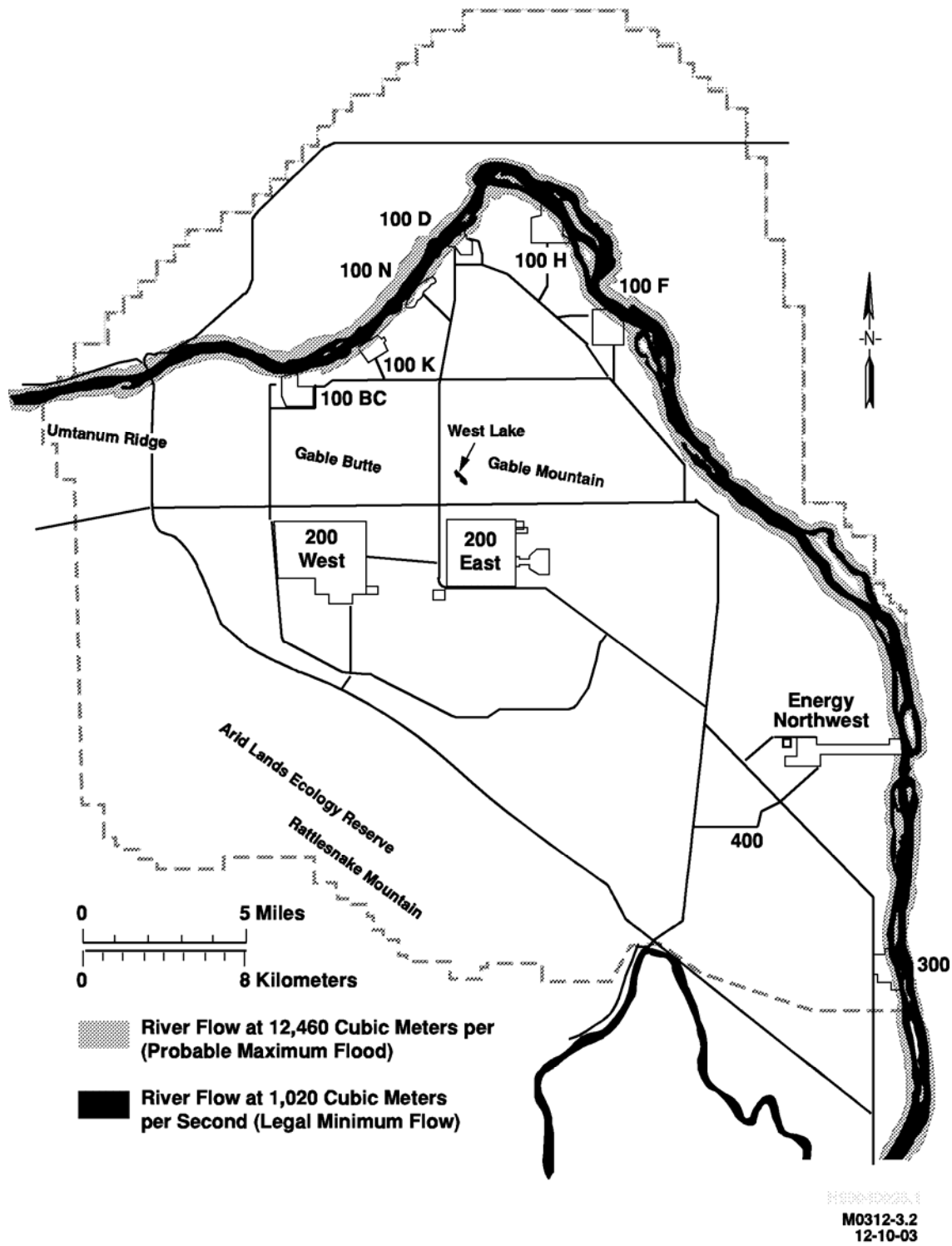


Figure 2.8. 100-Year Floodplain of the Columbia River and Yakima River and the Cold Creek Probable Maximum Flood  
(Adapted from DOE/EIS-0222).

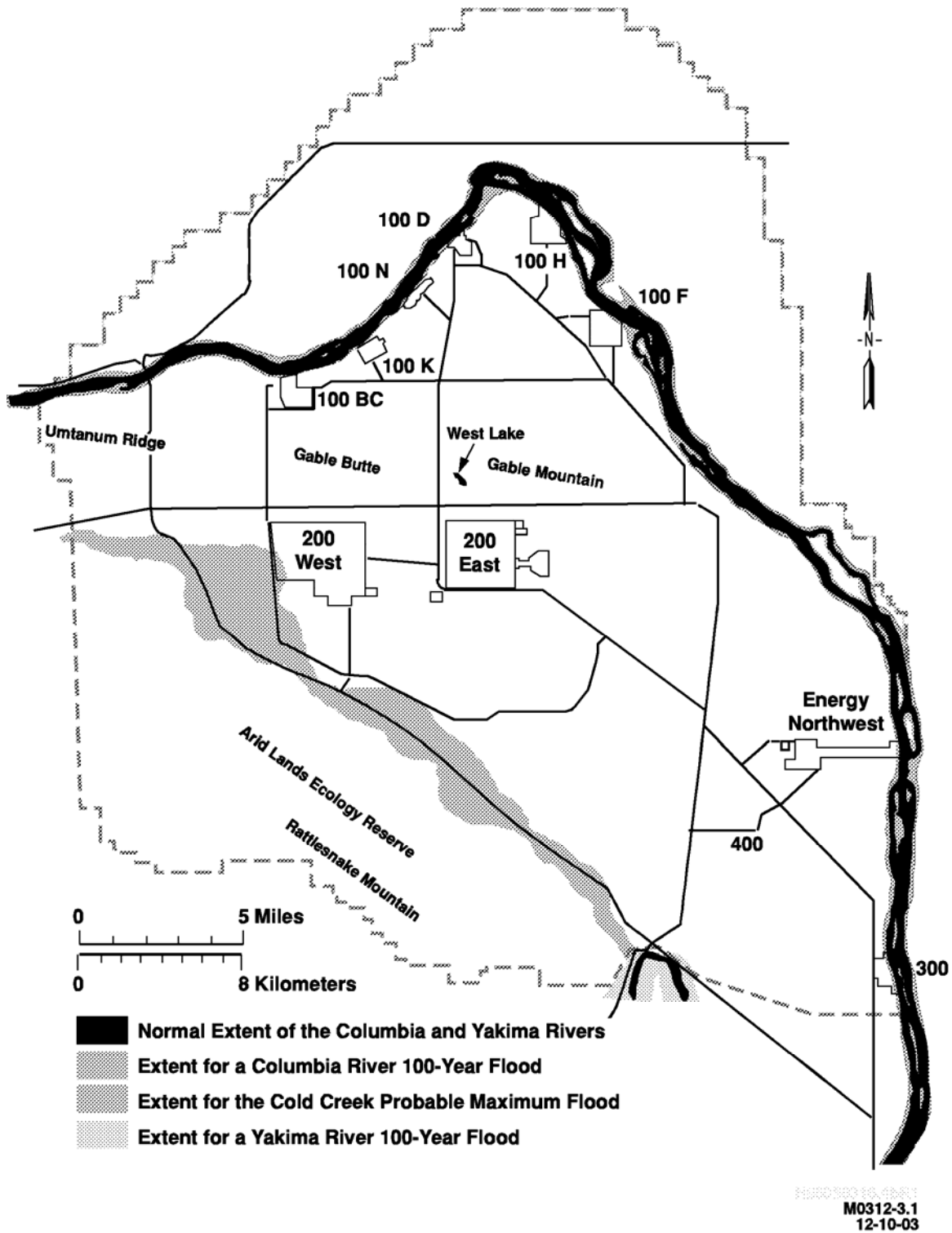
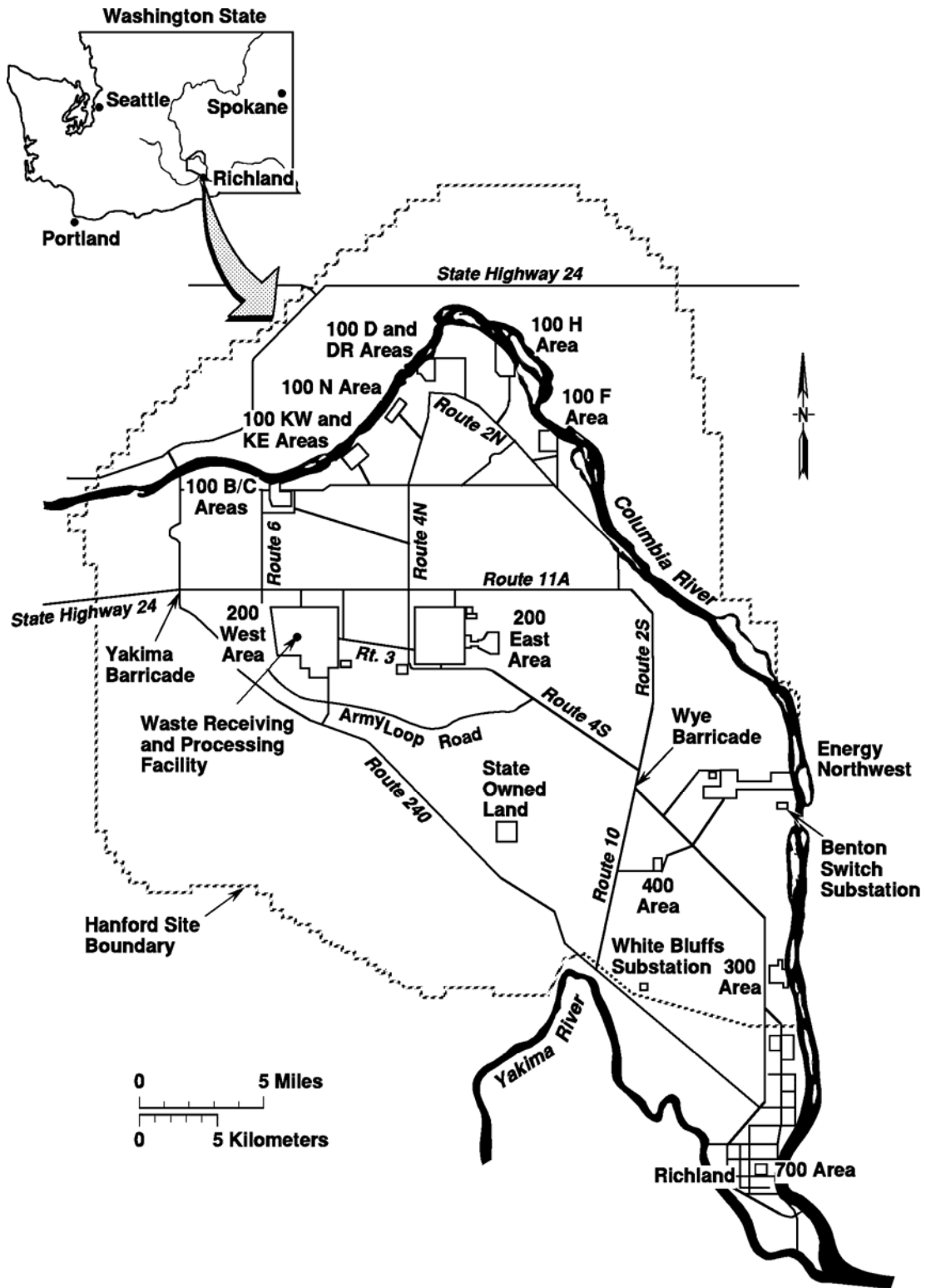
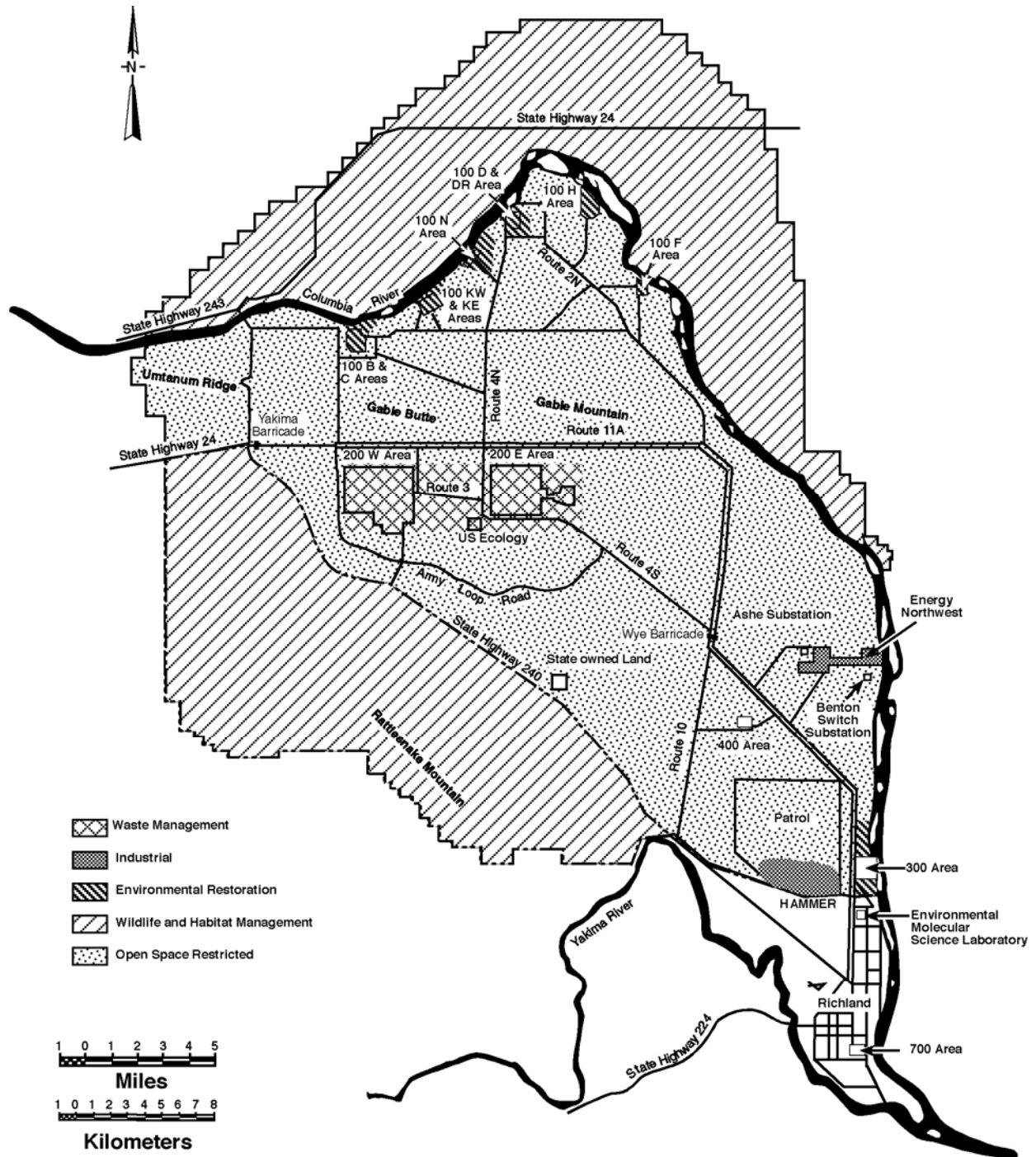


Figure 2.9. Hanford Site Roadways  
(Adapted from DOE/EIS-0222).



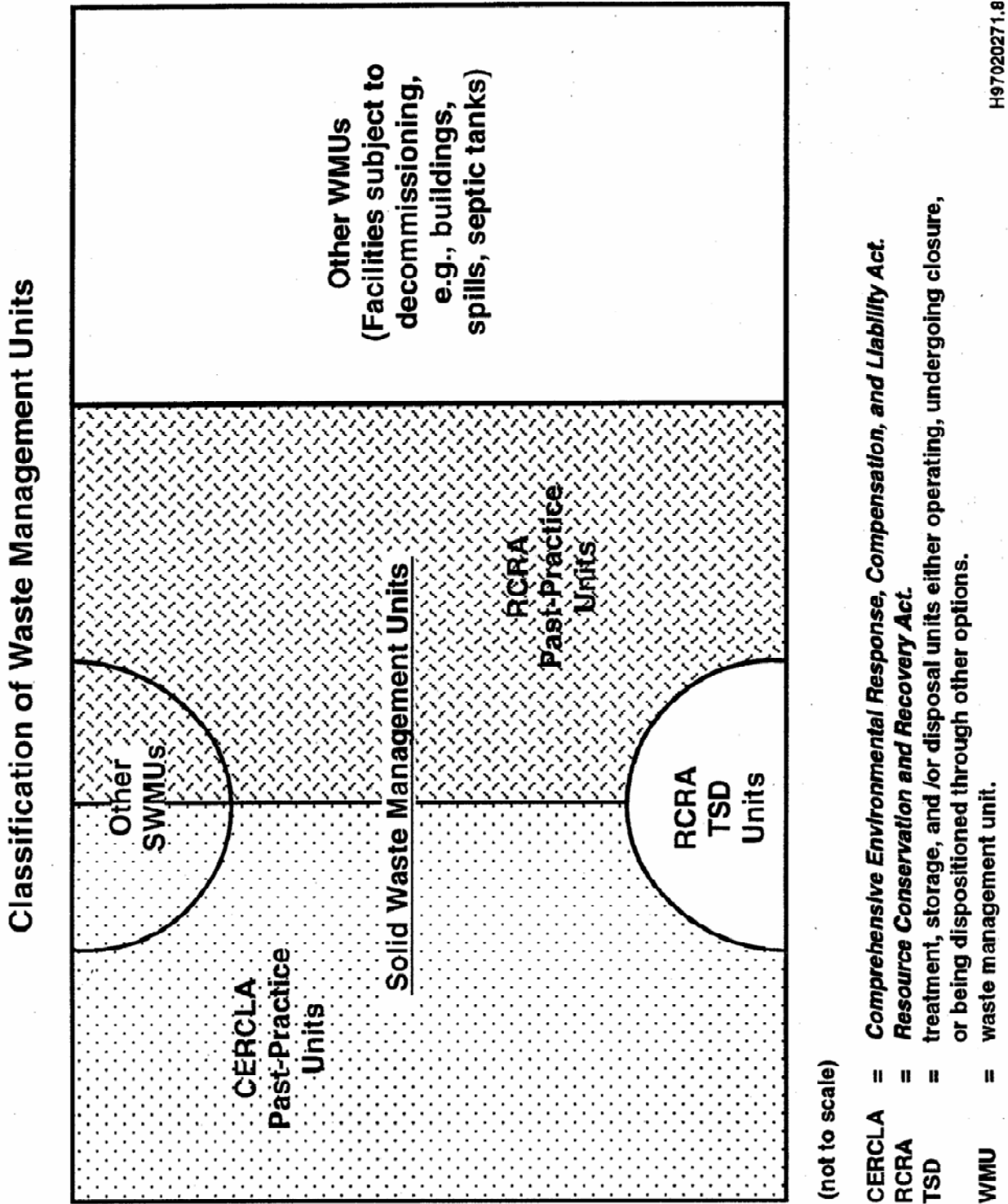
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Figure 2.10. Surrounding Land Use



H97020271.3aR1

Figure 2.11. Waste Management Units.



1 **Chapter 3.0** **Waste Analysis**

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1 **3.0 WASTE ANALYSIS [C]**

2 This chapter provides general information, specified in Section C of Ecology's permit application guidance  
3 (Ecology1996), on the analysis and handling of waste treated, stored, and/or disposed on the Hanford  
4 Facility. Topics discussed include the following:

- 5 • Chemical, biological, and physical analyses
- 6 • Waste analysis plan
- 7 • Manifest system
- 8 • Tracking system
- 9 • Other waste analysis documentation.

10 Provisions contained in Hanford Facility RCRA Permit (Permit) Conditions I.E (Duties and  
11 Requirements), II.A (Facility Contingency Plan), II.D (Waste Analysis), II.E (Quality Assurance/Quality  
12 Control), II.N (Receipt of Dangerous Wastes Generated Offsite), II.P (Manifest System), and II.Q (On-Site  
13 Transportation) are also discussed.

14 Detailed information on the characteristics of the waste treated, stored, and/or disposed at individual 'final  
15 status operating' TSD units is contained in the unit-specific documentation. Detailed information on waste  
16 treated, stored, and/or disposed at individual TSD units 'undergoing closure' or being 'disposed  
17 through other options' has been, or is anticipated to be, submitted in accordance with the provisions of the  
18 Tri-Party Agreement.

19 **3.1 CHEMICAL, BIOLOGICAL, AND PHYSICAL ANALYSIS [C-1]**

20 The Hanford Facility treats, stores, and/or disposes of dangerous and/or mixed waste designated as:  
21 (1) characteristic dangerous waste (ignitable, corrosive, toxic, reactive); (2) State-only dangerous waste per  
22 WAC 173-303; and (3) listed (e.g., due to the presence of spent solvents and discarded pure chemical  
23 products). The waste form ranges from liquid to hard crystalline material (e.g., salt cake stored in the DST  
24 System), as well as contaminated equipment, paper, rags, etc. Waste characteristics and process  
25 information for each TSD unit is contained in the Hanford Facility Operating Record, Unit-Specific File as  
26 identified in DOE/RL-91-28, Chapter 12.0.

27 Specific information on the type (i.e., dangerous waste numbers) and volume of waste that could be  
28 managed by each TSD unit is contained in the Hanford Facility Part A. Hanford Facility Part A Permit  
29 documentation is based primarily on process information with additional information provided by waste  
30 sampling and analysis programs.

31 **3.1.1 Land Disposal Restrictions**

32 Dangerous waste and the dangerous waste component of mixed waste on the Hanford Facility are subject  
33 to LDR requirements contained in 40 CFR 268, WAC 173-303-140, and Permit Condition II.S. Under the  
34 regulations, waste is prohibited from land disposal unless the waste meets treatment standards specified in  
35 40 CFR 268, Subpart D, or meets requirements for other alternatives (e.g., a treatability variance). In  
36 addition, certain hazardous debris that have been contaminated with a listed hazardous waste may be  
37 excluded if managed pursuant to 40 CFR 261.3(f) and WAC 173-303-070(2)(c). Other environmental  
38 media, such as soils contaminated with listed waste, may be excluded from regulation if a determination is  
39 made by Ecology that the soil no longer contains a hazardous waste (i.e., contained-in determination).  
40 State-only LDR standards will be met as applicable for dangerous waste disposed within the State of  
41 Washington.

42 The specified technologies for treatment of LDR waste are identified in the regulations for some waste in  
43 lieu of meeting a specific concentration requirement. While treatment capability generally exists for the

1 dangerous waste subject to LDR, treatment currently is not available for most of the mixed waste subject to  
2 LDR that requires storage on the Hanford Facility. Provisions in the Tri-Party Agreement and in the  
3 *Federal Facility Compliance Act of 1992* allow for storage of land disposal restricted waste until treatment  
4 and disposal capability is available. A brief summary of LDR provisions is described in the Tri-Party  
5 Agreement Action Plan, §6.1.

6 Should it become necessary to seek an exemption from a disposal prohibition pursuant to 40 CFR 268.6;  
7 an extension to the effective date of any land disposal restriction pursuant to 40 CFR 268.5; a variance  
8 from a treatment standard pursuant to 40 CFR 268.44; an equivalent technology pursuant to  
9 40 CFR 268.42(c); and/or an exemption pursuant to WAC 173-303-140(6), the records documenting the  
10 quantities and date each waste was placed under such exemption, extension, or variance will be maintained  
11 as required by WAC 173-303-380(1)(i).

12 The 'final status operating' TSD units will follow the provisions of their waste analysis plans (refer to §3.2)  
13 to determine which, if any, LDR apply to their waste. Waste analysis plan provisions for 'final status  
14 operating' TSD units are found in the unit-specific documentation.

### 15 **3.1.2 Air Emissions**

16 Air emissions from the Hanford Facility are required to be addressed under the dangerous waste  
17 regulations (WAC 173-303-690, -691, and -692) and as incorporated by reference, RCRA (40 CFR 264  
18 Subpart AA, BB, and CC). Information pertaining to these requirements is included in  
19 DOE/RL-91-28, §4.10.

### 20 **3.1.3 Waste in Piles [C-1a]**

21 Waste piles and containment buildings are associated with TSD units 'undergoing closure' and with units  
22 being 'disposed through other options'.

### 23 **3.1.4 Landfilled Wastes [C-1b]**

24 Currently only one 'final status operating' TSD unit, the LLBG, is classified as a landfill. Information for  
25 this unit, currently operating under interim status, is found in the Hanford Facility Part A  
26 (DOE/RL-88-20).

### 27 **3.1.5 Wastes Incinerated and Wastes Used in Performance Tests [C-1c]**

28 No incinerator units currently are found on the Hanford Facility. If incinerator units are established in the  
29 future, and if waste is used in performance tests, information for each unit will be entered into the HF Part  
30 A and into the unit-specific documentation.

## 31 **3.2 WASTE ANALYSIS PLAN [C-2]**

32 This section contains a discussion of waste analysis plans and related quality assurance information. The  
33 'final status operating' TSD units incorporated into Part III of the Permit will address waste analysis and  
34 quality assurance in accordance with Permit Conditions II.D and II.E, respectively, and/or in accordance  
35 with any unit-specific Permit Conditions.

36 The WAC 173-303-300 requires a facility owner or operator to confirm the knowledge about a dangerous  
37 waste before this waste is treated, stored, and/or disposed. The purpose for such knowledge is to ensure  
38 that this dangerous waste is managed properly. Waste analysis plans contained in the unit-specific  
39 documentation address the requirements of WAC 173-303-300(5). For TSD units that receive waste from  
40 offsite sources, the waste analysis plan includes measures for confirming that each dangerous waste

1 received matches the identity of the waste specified on the accompanying manifest or shipping paper in  
2 accordance with WAC 173-303-300(5)(g) and the requirements in -300(6).

3 Development and/or revision of TSD unit-specific waste analysis plans generally are carried out using  
4 guidance provided by the EPA (EPA/PB94-963-603). The data quality objective (DQO) process  
5 developed by the EPA is a key tool in determining the type, quantity, and quality of data needed to support  
6 waste analysis, as described in the Tri-Party Agreement Action Plan, §6.5. For Hanford Facility TSD  
7 units, data quality objectives (DQOs) are developed jointly between unit-specific representatives and the  
8 regulators in DQO workshops or during the notice of deficiency workshops. The DQOs identify data  
9 needed for proper waste handling and treatment along with any data needed to ensure protection of the  
10 environment. After identification of the data needed, the appropriate parameters, sampling and analytical  
11 methods, and quality assurance levels are selected. The unit-specific representatives and the regulators will  
12 determine how DQO process results are documented for a TSD unit on a case-by-case basis. Sampling,  
13 and analytical methods will generally be conducted in accordance with procedures referenced in  
14 WAC 173-303-110. However, alternate sampling and analytical methods could be utilized in some cases.  
15 Alternative methods identification includes sources such as *Joint NRC/EPA Guidance on Testing*  
16 *Requirements for Mixed Radioactive and Hazardous Waste* (62 FR 62079); unit-specific Permit  
17 Conditions for waste analysis plans and sampling and analysis plans; and exemptions granted in  
18 accordance with WAC 173-303-110(5).

19 As noted in Permit Condition II.E.5, the DQO process can be used to determine the level of quality  
20 assurance and quality control for the collection, preservation, transportation, and analysis of each sample  
21 that is required for the implementation of the Permit. The DQOs are approved by Ecology, in writing, or  
22 through incorporation of the TSD unit waste analysis plans into Part III of the Permit.

23 Additional information on the quality assurance and quality control for individual TSD units can be found  
24 in the unit-specific documentation. The information is integrated, as appropriate, with the quality  
25 assurance and control program discussed in Article XXXI of the Tri-Party Agreement, §6.5 and §7.8 (for  
26 corrective action) of the Tri-Party Agreement Action Plan. The Tri-Party Agreement reiterates the  
27 commitment to the DQO process as a means of specifying the appropriate levels of quality assurance and  
28 quality control.

29 Specific waste analysis requirements for each 'final status operating' TSD unit are governed by a waste  
30 analysis plan. In accordance with WAC 173-303-806(4)(a)(iii), these waste analysis plans are incorporated  
31 in the unit-specific documentation.

32 Permit Conditions II.F and II.K address groundwater monitoring and closure standards, respectively.  
33 Quality assurance and quality control of groundwater monitoring activities are described in  
34 DOE/RL-91-28, Chapter 5.0, for each 'final status operating' TSD unit in the unit-specific documentation.

### 35 **3.3 MANIFEST SYSTEM [C-3]**

36 The Hanford Facility manages dangerous and/or mixed waste from both onsite and offsite sources.  
37 Management of waste received from, or sent to, offsite sources are addressed in this section; managing of  
38 waste from onsite sources is addressed in §3.4.

39 Offsite shipments of dangerous and/or mixed waste to and from the Hanford Facility are subject to the  
40 manifest system requirements specified in WAC 173-303-370 and -180, respectively. The TSD units  
41 incorporated into Part III, Part V, or Part VI of the Permit will address manifest system requirements in  
42 accordance with Permit Conditions I.E.17, I.E.18, II.N, and II.P and/or in accordance with any  
43 unit-specific Permit Conditions.

1 Additional manifest system information specific to individual 'final status operating' TSD units can be  
2 found in the unit-specific documentation. Manifest system records for 'final status operating' TSD units  
3 incorporated into Part III of the Permit are maintained on file and can be located by accessing the 'Records  
4 Contacts' identified in DOE/RL-91-28, §12.1.

### 5 **3.3.1 Procedures for Receiving Shipments [C-3a]**

6 The Hanford Facility receives dangerous and mixed waste from offsite (including foreign) sources. Such  
7 waste is subject to the manifest system requirements specified in WAC 173-303-370 and to the reporting  
8 requirements specified in WAC 173-303-390(1) and WAC 173-303-390(2). The 'final status operating'  
9 TSD units incorporated into Part III of the Permit will receive offsite waste in accordance with Permit  
10 Condition II.N and/or in accordance with any unit-specific Permit Conditions.

11 Notification for foreign waste receipt is made in accordance with WAC 173-303-290. Notification of  
12 subsequent shipments of the same waste from the same foreign source in the same calendar year is not  
13 required.

### 14 **3.3.2 Response to Significant Discrepancies [C-3b]**

15 Appendix 2B contains a definition of 'Significant Discrepancy' taken from the Permit. The 'final status  
16 operating' TSD units incorporated into Part III of the Permit will respond to significant discrepancies in  
17 accordance with WAC 173-303-370(4) and WAC 173-303-390(1), Permit Conditions I.E.17 and I.E.18,  
18 and/or in accordance with any unit-specific Permit Conditions.

### 19 **3.3.3 Provisions for Non-acceptance of Shipment [C-3c]**

20 This section addresses non-acceptance of undamaged shipments and activation of the contingency plan for  
21 damaged shipments.

#### 22 **3.3.3.1 Non-acceptance of Undamaged Shipment [C-3c(1)]**

23 Provisions for non-acceptance of shipments are contained in WAC 173-303-370(5). The 'final status  
24 operating' TSD units incorporated into Part III of the Permit will address these provisions in accordance  
25 with WAC 173-303-370(5) and WAC 173-303-390(1), Permit Conditions I.E.17, I.E. 18, and II.P.1 and/or  
26 in accordance with any unit-specific Permit Conditions. Additional discussion of waste acceptance criteria  
27 for 'final status operating' TSD units is contained in the unit-specific documentation.

#### 28 **3.3.3.2 Activation of Contingency Plan for Damaged Shipment [C-3c(2)]**

29 Permit Attachment 4, contains the *Hanford Emergency Management Plan* (DOE/RL-94-02). As specified  
30 in Permit Condition II.A and Permit Attachment 3, the *Hanford Emergency Management Plan* applies to  
31 'final status operating' TSD units incorporated into Part III of the Permit, TSD units undergoing closure or  
32 post closure in Part V, and Part VI of the Permit, and areas of the Hanford Facility between TSD unit  
33 boundaries to the extent of hazardous substance releases that threaten human health or the environment.  
34 As stated in the *Hanford Emergency Management Plan* (DOE/RL-94-02), the applicability of the Permit to  
35 areas of the Hanford Facility between TSD units, concerning hazardous substance releases are limited to  
36 transportation events occurring on the Hanford Facility.

37 TSD units incorporated into Part III of the Permit will address damaged shipment response in accordance  
38 with the contingency plan documentation developed for each TSD unit.

### 1    **3.4   TRACKING SYSTEM [C-4]**

2    The Hanford Facility has one EPA/State identification number and is considered a single RCRA facility.  
3    The boundaries of the Hanford Facility are shown in DOE/RL-91-28, Chapter 2.0, Figure 2.1; roadways on  
4    the Hanford Facility are shown in DOE/RL-91-28, Chapter 2.0, Figure 2.9. With the exception of  
5    conditions specified in Permit Condition II.P.2, transportation along these roadways is considered onsite.  
6    Permit Condition II.P.2, defines transportation of dangerous waste along State Highways 240, 24, and 243,  
7    and Route 4 South (Stevens Drive) to be offsite shipments requiring manifesting, unless such routes are  
8    closed to general public access at the time of the shipment (DOE/RL-91-28, Chapter 2.0, Figure 2.9).

9    Onsite transfers of dangerous or mixed waste are not subject to the manifesting requirements specified in  
10   WAC 173-303-370 and -180. However, all onsite waste transfers are conducted in a manner to ensure  
11   protection of human health and the environment. Waste tracking forms for the transfer of waste onsite are  
12   used. These waste tracking forms effectively track waste inventories from generation through treatment,  
13   storage, and/or disposal.

14   The TSD units incorporated into Part III of the Permit will address onsite transportation in accordance with  
15   Permit Conditions II.Q and/or in accordance with any unit-specific Permit Conditions. Permit Condition  
16   II.Q specifies that documentation must accompany any onsite dangerous waste that is transported to or  
17   from any TSD unit subject to the Permit through or within the 600 Area unless the roadway is closed to  
18   general public access at the time of shipment. Waste transported by rail or by pipeline is exempt from  
19   Permit Condition II.Q. Onsite waste tracking records for TSD units incorporated into Part III of the Permit  
20   are maintained on file and can be located by accessing the 'Records Contacts' identified in  
21   DOE/RL-91-28, §12.1. In accordance with WAC 173-303-180(6), if Ecology approves an alternate paper  
22   tracking system serving the purpose of a manifest, the requirements of WAC 173-303-180, Manifest, and  
23   WAC 173-303-190(2), labeling, do not apply to the movement of on-site transfers when such transfers  
24   occur on a public or private right-of-way within or along the border of contiguous property under the  
25   control of the same person (e.g., DOE). As such, the alternate paper tracking system utilized at the  
26   Hanford Facility is the manifest system minus the provisions associated with off-site shipments. These  
27   provisions are the designated facility requirements and the processes associated with receiving and  
28   accepting waste.

### 29   **3.5   OTHER WASTE ANALYSIS DOCUMENTATION**

30   Part of the activities associated with closure implementation for a TSD unit is to perform a DQO process  
31   (refer to DOE/RL-91-28, §3.2 and §11.1.2). This process assists in determining the data needs for closure.  
32   The unit-specific representatives and the regulators will determine how DQO process results are  
33   documented for a TSD unit on a case-by-case basis. Sampling and analysis activities pertaining to closure  
34   are carried out in accordance with the SAP. Once the sampling activities are completed, and the analytical  
35   data is assessed, a closure recommendation is made. Permit Condition II.D.1 addresses the need for a SAP  
36   for TSD units included in Part V.

#### 37   **3.5.1   Sampling and Analysis Plan**

38   A SAP is prepared to document the strategy developed to support closure of a TSD unit. The SAP  
39   describes the type of media that will be sampled, i.e., soil, concrete, gravel, or asphalt. The sample  
40   locations, number of samples per location, and the constituents that will be analyzed for also are discussed.  
41   In addition, the procedures that will be used to take the samples and prepare the samples for  
42   transfer/shipment to the laboratory are identified. The types of analytical methods that will be used by the  
43   laboratory are listed. Various tables and figures are included in the plan that support discussions on where  
44   samples will be taken, what constituents will be analyzed, and the number of samples.

1 **3.5.2 Data Evaluation Report**

2 A data evaluation report is prepared once the data have been analyzed and the results have been assessed.  
3 This report discusses the sampling activities undertaken and the analytical results from the media sampled  
4 to support the closure of a TSD unit. The sample collection methods, field quality assurance, and control  
5 methods are reviewed. Any field deviations from the SAP that occurred are documented in the report.  
6 The previously agreed upon closure performance standards or cleanup levels are identified. Results of the  
7 data assessment for each sample analyte are discussed. The analytical data are evaluated and organized  
8 into categories, for example: organics, metals, and/or anions. Finally, a conclusion section is prepared that  
9 states the results of comparing the analytical data with the closure performance standards or cleanup levels.  
10 This comparison serves as the basis for a decision on whether or not clean closure can be achieved.  
11 Various tables also are included that contain information on the analytical results for each sample, data  
12 validation qualifiers for each sample, and a comparison of the data for each sample to the associated  
13 closure performance standards or cleanup levels.

1 **Chapter 4.0** **Process Information**

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## 4.0 PROCESS INFORMATION [D]

2 This chapter provides general process information on the management of dangerous waste and mixed  
3 waste for Hanford Facility TSD units, and addresses the provisions identified in Section D of Ecology's  
4 permit application guidance (Ecology 1996). Also addressed are provisions contained in Hanford Facility  
5 RCRA Permit (Permit) Conditions II.L, II.R, II.U, and II.V.

6 The processes used to control design and operational information, and the method for transmitting design  
7 and operational changes to the regulators is described below. In addition, a discussion of certification is  
8 included, as it pertains to supporting certain RCRA and dangerous waste permitting activities.

### 9 4.1 OVERVIEW

10 The Hanford Facility treats, stores, and/or disposes of dangerous and mixed waste generated on the  
11 Hanford Facility. Mixed waste generated offsite also is managed within certain TSD units. The Hanford  
12 Facility 'final status operating' TSD units are located in the 200 and 300 Areas. The physical location of  
13 these areas can be found in the figures provided in DOE/RL-91-28, Appendix 2A. Detailed process  
14 information for 'final status operating' TSD units is presented in the unit-specific documentation. These  
15 documents contain information on specific dangerous waste numbers or codes, process design capacities,  
16 and estimated annual quantities of waste handled.

#### 17 4.1.1 100 Areas

18 The 100 Areas contain no 'final status operating' TSD units.

#### 19 4.1.2 200 Areas

20 The 200 East and 200 West Areas encompass the chemical separations plants that were used for the  
21 reprocessing of nuclear materials. These reprocessing plants generated various dangerous and mixed  
22 wastes that were discharged to the soil column or stored in underground storage tanks (referred to as tank  
23 farms). The original mission for the plants in the 200 Areas was in support of nuclear weapons  
24 development and production related to national defense. The end of the Cold War prompted the shutdown  
25 of chemical separations activities supporting this original mission. Current activities in the 200 Areas are  
26 focused on clean up of chemical separations facilities and the associated waste. This includes continued  
27 storage of tank waste pending treatment, facility closure, liquid effluent treatment, and construction of new  
28 waste treatment capacity.

29 Most of the 'final status operating' TSD units are located in the 200 East and/or 200 West Areas (refer to  
30 DOE/RL-91-28, Figure 2.1, Figure 2.9 and Appendix 2A).

#### 31 4.1.3 300 Area

32 The 300 Area historically was used for the fabrication of the 100 Areas reactor fuels and for the main  
33 RD&D activities. Fuel fabrication activities ceased when N Reactor was placed in standby and shutdown.  
34 Current activities include RD&D supporting the waste management and environmental restoration and  
35 remediation mission, including the development of new technologies for the treatment and disposal of the  
36 waste accumulated throughout the life of the Hanford Site. There are two 'final status operating' TSD units  
37 in the 300 Area.

#### 38 4.1.4 400 Area

39 The 400 Area contains no 'final status operating' TSD units.

1 **4.1.5 600 Area**

2 The 600 Area includes everything within the Hanford Facility boundary that is not within any other  
3 specific area (DOE/RL-91-28, Figure 2.2). The 600 Area contains no 'final status operating' TSD units.

4 **4.2 CONTAINERS [D-1]**

5 The Hanford Facility 'final status operating' TSD units with container handling capabilities [refer to  
6 Hanford Facility Part A (DOE/RL-88-21)] include the following:

- 7 • 200 Area Effluent Treatment Facility (ETF)
- 8 • Central Waste Complex (CWC)
- 9 • Waste Receiving and Processing (WRAP) Facility
- 10 • T Plant Complex
- 11 • 222-S Laboratory Complex
- 12 • 325 Hazardous Waste Treatment Units (HWTUs)
- 13 • 305-B Storage Facility
- 14 • Low-Level Burial Grounds (LLBG)
- 15 • Waste Treatment and Immobilization Plant.

16 The T Plant Complex and the Waste Treatment and Immobilization Plant also include a containment  
17 building. TSD units, which have not been incorporated into Part III of the Permit, are operating pursuant  
18 to the interim status requirements.

19 **4.3 TANK SYSTEMS [D-2]**

20 The Hanford Facility 'final status operating' TSD units with tank systems [refer to Hanford Facility Part A  
21 (DOE/RL-88-21)] include the following:

- 22 • DST System/204-AR Waste Unloading Station
- 23 • 242-A Evaporator (including other treatment)
- 24 • 200 Area ETF
- 25 • T Plant Complex
- 26 • 222-S Laboratory Complex
- 27 • 325 HWTUs
- 28 • Waste Treatment and Immobilization Plant

29 TSD units, which have not been incorporated into Part III of the Permit, are operating pursuant to the  
30 interim status requirements.

31 **4.4 WASTE PILES [D-3]**

32 No Hanford Facility 'final status operating' TSD units currently are classified as waste piles.

33 **4.5 SURFACE IMPOUNDMENTS [D-4]**

34 The LERF is the only Hanford Facility 'final status operating' TSD unit classified as a surface  
35 impoundment [refer to Hanford Facility Part A (DOE/RL-88-21)].

36 **4.6 INCINERATORS [D-5]**

37 No Hanford Facility 'final status operating' TSD units currently are classified as incinerators.

1 **4.7 LANDFILLS [D-6]**

2 The LLBG is the only Hanford Facility 'final status operating' TSD unit classified as a landfill [Hanford  
3 Facility Part A (DOE/RL-88-21)]. Since the LLBG has not yet been incorporated into Part III of the  
4 Permit, the LLBG is operating pursuant to the interim status requirements.

5 **4.8 LAND TREATMENT [D-7]**

6 No Hanford Facility 'final status operating' TSD units currently are classified as land treatment units.

7 **4.9 MISCELLANEOUS UNITS**

8 The PUREX Storage Tunnels, the Waste Treatment and Immobilization Plant, and WESF are the only  
9 Hanford Facility 'final status operating' TSD units classified as miscellaneous units [refer to Hanford  
10 Facility Part A (DOE/RL-88-21)]. The unit-specific documentation for WESF has not been submitted to  
11 Ecology. WESF is operating pursuant to the interim status requirements.

12 **4.10 AIR EMISSIONS CONTROL [D-8]**

13 Air emissions released from certain or applicable Hanford Facility TSD units are regulated under the  
14 dangerous waste regulations (WAC 173-303-690 and -691) and RCRA (40 CFR 264 Subpart AA, BB, and  
15 CC). The following sections discuss air emissions on the Hanford Facility.

16 **4.10.1 Process Vents [D8-8a]**

17 Hanford Facility process vents associated with specific separation processes identified in  
18 WAC 173-303-690(1)(b), which are used to manage hazardous waste with organic concentrations of at  
19 least 10 parts per million by weight, are regulated under WAC 173-303-690. Threshold limits that require  
20 emission controls apply to the summation of all applicable emission sources for the entire Hanford Facility.

21 To determine whether the threshold limits are exceeded, thereby requiring emission controls, the  
22 applicable processes were identified first for each TSD unit. Of the Hanford Facility TSD units, only the  
23 242-A Evaporator and 200 Area ETF currently operate processes that contribute to the Hanford Facility  
24 organic emissions release rate.

25 Estimates for a 1995, 242-A Evaporator Campaign 95-1 yielded a maximum emission rate of  
26 0.316 kilogram per hour and a 212-kilogram total release. Plans are to operate an average of two  
27 campaigns per year with organic emissions similar to Campaign 95-1. Performance tests for volatile  
28 organic compound emissions at the 200 Area ETF were completed in January of 1996. These tests yielded  
29 an average emission rate of 0.35 gram per minute measured at stream number G6 of the ventilation offgas  
30 system. When combined, the 242-A Evaporator and 200 Area ETF emission rates total 0.337 kilogram per  
31 hour. This combined release rate is well below the threshold of 1.4 kilograms per hour or 2,800 kilograms  
32 per year.

33 In summary, the process vents on the Hanford Facility currently do not exceed the threshold limits  
34 triggering process controls under the regulations. However, the amount of organic emissions could change  
35 as waste streams are changed, or TSD units are brought online or are deactivated. The organic air  
36 emissions summation will be re-evaluated periodically as conditions warrant. Further details regarding  
37 process vents are discussed in unit-specific documentation.

38 **4.10.2 Equipment Leaks [D-8b]**

39 The organic air emissions released from Hanford Facility equipment leaks are regulated under dangerous  
40 waste regulations WAC 173-303-691. These regulations apply to equipment that manages hazardous

1 waste with organic concentrations of at least 10 percent by weight. Individual TSD units managing waste  
2 with organic concentrations of at least 10 percent by weight include special precautions and equipment to  
3 mitigate air emissions from leakage. Further details specific to individual TSD units can be found in the  
4 unit-specific documentation.

#### 5 **4.10.3 Tanks, Containers, and Surface Impoundments [D-8c]**

6 Certain organic air emissions released from Hanford Facility hazardous waste tanks, containers, and  
7 surface impoundments are regulated under WAC 173-303-692 (based on 40 CFR 264, Subpart CC).  
8 These regulations apply to tanks, containers, and surface impoundments used to manage certain  
9 organic-containing hazardous waste. Mixed waste has been deferred from the regulations. Therefore, only  
10 individual TSD units on the Hanford Facility that manage hazardous waste (not mixed waste) will address  
11 this requirement. Further details specific to individual TSD units can be found in the unit-specific  
12 documentation.

#### 13 **4.11 WASTE MINIMIZATION [D-9]**

14 Waste minimization information is presented in DOE/RL-91-28, Chapter 10.0.

#### 15 **4.12 GROUNDWATER MONITORING FOR LAND-BASED UNITS [D-10]**

16 Groundwater monitoring for land-based units is presented in DOE/RL-91-28, Chapter 5.0.

#### 17 **4.13 DESIGN AND OPERATIONAL INFORMATION**

18 This section presents a discussion of the processes used to control design and operational information, and  
19 the method for transmitting design and operational changes to the regulators in accordance with the Permit.  
20 In addition, a discussion of independent PE certification is included, as it pertains to supporting certain  
21 RCRA and dangerous waste permitting activities for design and operation of the TSD units.

##### 22 **4.13.1 Transmittal of Design Information to Regulatory Agencies**

23 Design of TSD units on the Hanford Facility is controlled in accordance with an established engineering  
24 control system. This system serves as the basis for meeting Permit design information requirements.  
25 Standard engineering practices ensure that uniform methods are in place to control tasks such as design  
26 review, configuration control, change control, specification preparation, and review and approval  
27 requirements. These practices are used on all engineering, development, and project work on the Hanford  
28 Facility that result in a documented design or deliverable hardware end item.

29 Developments of, and changes to, design specifications and drawings related to TSD units on the Hanford  
30 Facility are carried out in accordance with the engineering practices of the contractor responsible for the  
31 activity. Although there is some variation among contractors, no work affecting design (excluding  
32 emergency response activities that will be conducted in accordance with contingency plans) is allowed to  
33 be performed at a TSD unit until an approved design drawing or appropriate engineering design directive  
34 has been issued. This process ensures that components and materials selected meet system requirements  
35 while providing a means for configuration control.

36 Permit Condition II.L, establishes general requirements for design and operation of 'final status operating'  
37 TSD units incorporated into Part III of the Permit, particularly those related to 'critical systems'. Critical  
38 systems are defined, as applicable, for each 'final status operating' TSD unit within the unit-specific  
39 documentation (refer to Glossary for definition of 'critical systems').

40 Permit Condition II.L.1, addresses the need for proper design, construction, maintenance, and operational  
41 controls to minimize the possibility of a fire, explosion, or any unplanned sudden or non-sudden release of

1 hazardous substances that could threaten human health or the environment. Design standards, generally  
2 address these requirements, and are factored into Hanford Facility design and construction activities.

3 Permit Condition II.L.2, establishes general requirements for design changes, nonconformance, and  
4 as-built drawings. Permit Condition II.L.2.b requires that during construction of a project subject to the  
5 Permit, changes to the approved design, plans, and specifications be documented with an engineering  
6 change notice. Permit Condition II.L.2.b further requires:

7 • All engineering change notices be maintained in the Hanford Facility Operating Record, Unit-Specific  
8 File (refer to DOE/RL-91-28, §12.1.34) and be available to Ecology upon request or during the course  
9 of an inspection

10 • Copies of engineering change notices affecting any critical system be provided to Ecology within  
11 5 working days of initiating the engineering change notice

12 • Ecology to review an engineering change notice modifying a critical system and inform the Permittees  
13 within 2 working days in writing whether the proposed engineering change notice, when issued, will  
14 require a Class 1, 2, or 3 Permit modification. If after 2 working days, if Ecology has not responded, it  
15 will be deemed as acceptance of the engineering change notice by Ecology.

16 Permit Condition II.L.2.c, requires that during construction of a project subject to the Permit, any work  
17 completed that does not meet or exceed the standards of the approved design, plans and specifications be  
18 documented with a nonconformance report. Permit Condition II.L.2.c further requires:

19 • All nonconformance reports be maintained in the Hanford Facility Operating Record, Unit-Specific  
20 File (refer to DOE/RL-91-28, §12.1.34) and be available to Ecology upon request or during the course  
21 of an inspection

22 • Copies of nonconformance reports affecting any critical system be provided to Ecology within  
23 5 working days after identification of the nonconformance

24 • Ecology to review a nonconformance report affecting a critical system and inform the Permittees  
25 within 2 working days in writing whether a Permit modification is required of any nonconformance  
26 and whether prior approval is required from Ecology before work proceeds that affects the  
27 nonconforming item.<sup>125</sup>

28 • If after 2 working days Ecology has not responded, it will be deemed as acceptance and no Permit  
29 modification is required.

30 Permit Condition II.L.2.d, requires that upon completion of a construction project subject to the Permit,  
31 as-built drawings be prepared, unless otherwise stated in unit-specific Permit Conditions. These as-built  
32 drawings are to incorporate the design and construction modifications resulting from all project  
33 engineering change notices and nonconformance reports as well as modifications made pursuant to  
34 WAC 173-303-830. Completed as-built drawings are to be placed within the Hanford Facility Operating  
35 Record, Unit-Specific File (refer to DOE/RL-91-28, §12.1.35) within 12 months of completing  
36 construction, or within an alternate period specified in Part III of the Permit.

37 On an ongoing basis, a tabulation of design changes [for those TSD units incorporated into Part III of the  
38 Permit] can be located by accessing the 'Records Contact' identified in DOE/RL-91-28, §12.1.

#### 39 **4.13.2 Replacement or Upgrading With Functionally Equivalent Components**

40 All maintenance on the Hanford Facility is controlled and performed in accordance with an established  
41 work control system. The work control system ensures that the proper documentation is prepared for the

1 activity, and provides a means to track work from initiation to completion. The work control system also  
2 addresses replacement or upgrading with functionally equivalent materials. This system serves as the basis  
3 for meeting Permit equivalent component requirements.

4 Permit Condition II.R, establishes general requirements for the substitution of an equivalent or superior  
5 product for any equipment or materials specified in the Permit. Part III, Chapter 10, for the Waste  
6 Treatment and Immobilization Plant also provides for 'Administrative Information' to be considered  
7 equivalent. Use of these products or information is not considered a Permit modification. However, a  
8 substitution will not be considered equivalent unless it is at least as effective as the original equipment or  
9 materials in protecting human health and the environment.

10 Permit Condition II.R, also requires substitution documentation to be placed in the Hanford Facility  
11 Operating Record, Unit-Specific File within 7 days after the change is put into effect. The substitution  
12 documentation is to be accompanied by a narrative explanation, and the date the substitution became  
13 effective. The location of substitution documentation for TSD units incorporated into Part III of the Permit  
14 can be determined by accessing the 'Records Contact' identified in DOE/RL-91-28, §12.1.

#### 15 **4.13.3 Professional Engineer Certification**

16 Certifications in accordance with WAC 173-303-810(13)(a) by an independent qualified registered  
17 professional engineer/registered professional engineer are required to support certain RCRA and dangerous  
18 waste permitting activities on the Hanford Facility (e.g., tank integrity assessments, closures, etc.). These  
19 certifications will be performed in accordance with WAC 173-303, as documented in  
20 DOE/RL-91-28, Table 12.1, unless superceded by unit-specific documentation. Multiple certifications by  
21 the same individual will not nullify the individual's independent status. Certification requirements for units  
22 undergoing closure are discussed in DOE/RL-91-28, Chapter 11.0.

#### 23 **4.13.4 Mapping and Marking of Underground Pipelines**

24 Conditions II.U and II.V of the Permit specify requirements for the mapping and marking of underground  
25 pipelines, respectively. These conditions apply to dangerous waste underground pipelines, including  
26 active, inactive, and abandoned pipelines that contain or contained dangerous waste subject to the  
27 provisions of WAC 173-303. The Permittees maintain maps and markings in accordance with these Permit  
28 Conditions.

1 **Chapter 5.0** **Groundwater Monitoring for Land-Based Units**

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## 5.0 GROUNDWATER MONITORING FOR LAND-BASED UNITS [D-10]

This chapter describes the groundwater monitoring activities for land-based TSD units (dangerous waste surface impoundment, land treatment, or landfill units) by addressing the provisions identified in Section D-10 of Ecology's permit application guidance (Ecology 1987 and 1996). Furthermore, the chapter discusses groundwater monitoring provisions contained in Condition II.F. of the HF RCRA Permit (DW Portion). The general groundwater monitoring information contained in this chapter (e.g., Section 5.3, "Aquifer Identification") need not be duplicated in the Unit-Specific Portion of the *Hanford Facility Dangerous Waste Permit Application*, but can be cross-referenced as appropriate. Pertinent information also can be cross-referenced in preclosure work plan, closure work plan, closure plan, closure/postclosure plan, or postclosure permit application documentation (refer to Chapter 2.0, Section 2.5).

Currently, Hanford Facility RCRA groundwater monitoring activities are structured to provide groundwater monitoring information for individual land-based TSD units. This approach was outlined in the original Tri-Party Agreement and largely has been retained throughout subsequent amendments of the Tri-Party Agreement and throughout interactions with the regulators. This chapter primarily addresses this TSD unit-specific groundwater monitoring approach. However, a need to more fully integrate Hanford Site groundwater monitoring activities has become increasingly evident. Such integration also would support the *Cost and Management Efficiency Initiative* (Ecology et al. 1994). A collaborative effort to develop a groundwater monitoring strategy based on the data quality objective process (EPA540-R-93-0071 and EPA/600/R-96-055) currently is underway. This process is being used to justify why data are being collected, how the data are expected to be used to make decisions, and how much data are needed to meet criteria specified by the stakeholders. The results of this effort will be incorporated through the provision of a revised *Hanford Site Ground Water Protection Management Plan* (DOE/RL-89-12).

A summary of RCRA groundwater monitoring activities on the Hanford Facility is contained in the *Hanford Site Groundwater Monitoring for Fiscal Year 1997* (PNNL-11793). This report summarizes monitoring information for two land-based 'operating' TSD units, LERF and LLBG (refer to Chapter 4.0, Sections 4.1.2.4 and 4.1.2.8, respectively). A more detailed description of the groundwater programs for these units is contained in the Unit-Specific Portion of this permit application [i.e., DOE/RL-97-03 (LERF) and DOE/RL-88-20 (LLBG)]. The aforementioned *Hanford Site Groundwater Monitoring Report* also summarizes monitoring information for land-based TSD units 'undergoing closure' (refer to Chapter 2.0, Section 2.5). For certain of these TSD units, more detailed information is contained in closure plan/postclosure plan documentation. The content of this chapter focuses on groundwater monitoring for 'operating' TSD units. However, this information also is relevant to TSD units 'undergoing closure'.

Unit-specific groundwater monitoring programs are designed to comply with applicable regulations and agreements for TSD units operating under both interim status (WAC 173-303-400 and WAC 173-303-805) and final status (WAC 173-303-645 and WAC 173-303-806). The following is a generalized discussion of the RCRA groundwater monitoring requirements for a TSD unit. This discussion provides background information relevant to subsequent, more specific groundwater monitoring discussions. In these discussions, the term 'RCRA' refers to both federal and state groundwater monitoring regulations as appropriate.

The RCRA groundwater monitoring programs are implemented under two types of groundwater monitoring regulations: interim status and final status. A land-based TSD unit operating under interim status must have implemented a monitoring program capable of determining the impact of the TSD unit on groundwater quality in the uppermost aquifer beneath the TSD unit. The interim status program can take the form of either detection monitoring or assessment monitoring. An interim status corrective action order, however, may be issued (by the regulators) when the facility releases hazardous waste to the

1 environment. 'Detection-level' monitoring also is referred to as 'indicator evaluation' monitoring in the  
2 regulations for interim status facilities; 'detection-level' is used throughout this chapter to refer to this type  
3 of monitoring for both interim status and final status TSD units. At a minimum, an interim status detection  
4 monitoring system must include one upgradient and three downgradient groundwater monitoring wells. A  
5 generalized configuration for such a system is shown in Figure 5-1. The LLBG and LERF currently are  
6 monitored under interim status regulations. Final status groundwater requirements for the LERF, which  
7 has been incorporated into the HF RCRA Permit (DW Portion), will take effect when Ecology approves  
8 the final status groundwater monitoring plan. Final status groundwater requirements for the LLBG will  
9 take effect when this TSD unit is incorporated into the HF RCRA Permit (DW Portion). A groundwater  
10 monitoring plan for LLBG that meets final status requirements may be implemented before this time if  
11 approved by Ecology.

12 Before the installation of a detection monitoring system, a groundwater monitoring plan must be developed  
13 and followed. This plan details well locations, procedures, requirements for vadose zone and aquifer  
14 characterization, and well installation; sample collection, preservation, and transportation; and sample  
15 analysis. Chain-of-custody control must be developed and followed. Additionally, relevant components of  
16 the DQO process are to be incorporated in a site-specific 120 groundwater monitoring plan and a quality  
17 assurance project plan (QAPjP). Methods to be used to interpret groundwater monitoring data also are  
18 specified.

19 Under interim status, groundwater monitoring data obtained from the detection monitoring system are used  
20 to establish background groundwater quality through quarterly sampling and analysis of several water  
21 quality parameters (as specified in 40 CFR 265.92) for 1 year. After the first year, sampling and analysis  
22 must be conducted at least annually for the parameters related to groundwater quality, and semiannually for  
23 the indicator parameters related to groundwater contamination (i.e., pH, specific conductance, total organic  
24 carbon, and total organic halogen).

25 If a confirmed statistically significant evidence of contamination (i.e., as revealed in indicator parameters)  
26 in the groundwater exists, the regulatory agency is notified and a groundwater quality assessment  
27 monitoring plan developed. The objective of assessment monitoring is to determine if dangerous waste or  
28 dangerous waste constituents from the regulated unit have entered the groundwater and, if so, the  
29 concentration, rate, and extent of migration of the constituents in the groundwater. This determination is  
30 achieved through quarterly sampling and could require the installation of additional wells and/or additional  
31 sampling of existing wells. Monitoring must continue during the active life of the facility, and for disposal  
32 facilities during the postclosure care period unless the regulated unit is to be clean closed.

33 For final status TSD units, there could be a three-stage groundwater monitoring program that involves  
34 detection, compliance, and corrective action, as warranted (EPA-230/02-89-042). A final status detection  
35 monitoring system must include both background (generally upgradient) and compliance (generally  
36 downgradient) wells (Figure 5-1). Wells installed to support interim status could be used as final status  
37 monitoring wells. A groundwater monitoring plan is developed to address each final status monitoring  
38 stage, using the DQO process. Also specified in each plan are methods to be used to conduct and interpret  
39 groundwater monitoring data. The choice of an appropriate statistical method depends on the monitoring  
40 stage and the nature of the data. A flow chart that guides the selection of the appropriate method to be  
41 used for data interpretation is presented in Figure 5-2.

42 The final status detection monitoring program is designed to determine whether a RCRA-regulated unit  
43 has adversely affected the groundwater quality in the uppermost aquifer beneath the site. This is  
44 accomplished by testing for statistically significant changes in concentrations of constituents of interest in a  
45 downgradient monitoring well relative to baseline levels. These baseline levels could be obtained from  
46 upgradient (or background) wells, and are referred to as interwell (or between-well) comparisons.  
47 Alternatively, if baseline values are obtained from historical measurements from that same well, the  
48 comparisons are referred to as intrawell (or within-well) comparisons. If a statistically significant increase

1 (or pH decrease) over baseline condition occurs in a downgradient compliance well, a compliance  
2 monitoring program might be initiated. A compliance monitoring program must be initiated after the  
3 owner and/or operator cannot successfully demonstrate that a source other than the regulated TSD unit has  
4 caused the contamination or that the increase resulted from an error in sampling, analysis, or evaluation.

5 In a compliance monitoring program, the monitoring objective is to determine whether groundwater  
6 protection standards have been exceeded. This is accomplished by comparing the concentration of a  
7 constituent of concern to groundwater protection standards, such as an alternate concentration limit,  
8 maximum concentration limit, background, health-based standards, or any other standards that constitute  
9 applicable, relevant, and appropriate requirements. Monitoring must continue at the TSD unit, if a  
10 detection monitoring is conducted, through the postclosure care period.

11 A third stage, a corrective action program, is initiated if a groundwater protection standard is exceeded at  
12 the point of compliance. Exceeded is defined as statistically significant evidence of increased  
13 contamination. Corrective action could consist of additional vadose zone and aquifer characterization and  
14 the removal or treatment in place of the dangerous constituents.

15 The remainder of this chapter includes a more specific discussion of the implementation of Hanford  
16 Facility groundwater monitoring activities.

## 17 **5.1 EXEMPTION FROM GROUNDWATER PROTECTION REQUIREMENTS [D-10a]**

18 An exemption from the groundwater monitoring requirements as allowed under  
19 WAC 173-303-645(1)(b)(i), (ii), and (iv) is not requested at this time.

## 20 **5.2 INTERIM STATUS PERIOD GROUNDWATER MONITORING DATA [D-10b]**

21 In 1986, interim status groundwater monitoring for four Hanford Facility TSD units was implemented  
22 through a *Consent Agreement and Compliance Order* (Ecology DE-86-133). Three of these TSD units are  
23 undergoing closure and are currently in interim status or in final status. The fourth TSD unit, the LLBG, is  
24 an 'operating' unit. As specified in the Tri-Party Agreement, permit application documentation for the  
25 LLBG was submitted in 1989 (DOE/RL-88-20); in accordance with the Class 3 Permit Modification  
26 Schedule (refer to Chapter 2.0, Section 2.1.1.3.3), the status of this TSD unit is anticipated to change from  
27 interim to final in 1999. Final status is sought for at least one other 'operating' TSD unit requiring a  
28 groundwater monitoring system, the LERF (DOE/RL-97-03). The initial permit application  
29 documentation for the LERF was submitted in June 1991; in accordance with the Class 3 Permit  
30 Modification Schedule (refer to Chapter 2.0, Section 2.1.1.3.3), the status of this TSD unit change from  
31 interim to final in 1998. With the exception of the 183-H Solar Evaporation Basins and the 300 Area  
32 Process Trenches (refer to Chapter 2.0, Section 2.5.1.1.2), other land-based TSD units 'undergoing closure'  
33 (refer to Chapter 1.0, Table 1-1 and Chapter 2.0, Section 2.5) are not scheduled to be entered into the HF  
34 RCRA Permit (DW Portion) until 1998 later.

35 The interim status groundwater monitoring program implemented for a TSD unit is summarized in the  
36 following sections. The information presented includes a (1) summary of the existing hydrogeologic data,  
37 (2) description of the general well design, (3) discussion of the groundwater monitoring system design,  
38 (4) summary of the interim status groundwater sampling and analysis plan for monitoring wells, and  
39 (5) preliminary description of the statistical procedures used to assess water quality results. In addition, a  
40 summary is presented on the techniques and methods used to characterize the uppermost aquifer beneath  
41 the Hanford Site in support of the monitoring well system design.

## 1 **5.2.1 Interim Status Groundwater Monitoring Approach**

2 A specific investigative approach is taken to support the design of each TSD unit groundwater monitoring  
3 system in the interim status period. This approach consists of the following two elements.

- 4 • Establish an initial groundwater monitoring well system from which stratigraphic, hydrogeologic, and  
5 background water quality information can be obtained for the uppermost aquifer. Data from this initial  
6 system are used to determine the need for additional monitoring wells.
- 7 • Provide hydrogeologic properties of the uppermost aquifer system beneath the TSD unit using data  
8 collected from the monitoring well system and from previously collected or published data.

9 Groundwater monitoring plans are developed for each TSD unit to address these elements. These  
10 groundwater monitoring plans contain specific details regarding characterization needs and details  
11 regarding the monitoring system design. The groundwater monitoring plans also contain a sampling and  
12 analysis plan.

13 Groundwater monitoring plans were developed for the two 'operating' TSD units: LLBG  
14 (WHC-SD-EN-AP-015) and LERF (WHC-SD-AP-024). Two assessment monitoring plans also have been  
15 prepared for the LLBG (WHC-SD-EN-AP-021 and -022). In each case, the assessment monitoring  
16 indicated that the detection was a 'false positive', and the LLBG resumed detection monitoring. Interim  
17 status groundwater monitoring plans also have been developed for land-based TSD units 'undergoing  
18 closure' (refer to Chapter 1.0, Table 1-1 and Chapter 2.0, Section 2.5).

19 As part of groundwater monitoring system installation, subsurface sediment samples are collected during  
20 drilling at each well location. Grab samples, as a minimum, are described and classified in the field  
21 (Appendix 2B) and are considered adequate for general geologic and some physical/chemical analysis.  
22 Selected samples, collected by various techniques, are submitted to a laboratory for analyses to determine  
23 various physical and chemical properties.

24 Data collected from installation of the monitoring system and from previously collected or published data  
25 are summarized in a characterization report. Characterization reports have been completed for both  
26 land-based 'operating' TSD units for which final status is sought and are summarized in the respective Part  
27 B permit application documentation [i.e., DOE/RL-88-20 (LLBG) and DOE/RL-97-03 (LERF)].  
28 Groundwater monitoring information for land-based TSD units 'undergoing closure' is summarized in  
29 'borehole completion data packages' (Appendix 2B), Hanford Site groundwater monitoring annual reports,  
30 and in quarterly reports.

31 Groundwater is collected and analyzed from monitoring wells under the interim status programs. During  
32 the first year of monitoring, samples are collected quarterly to establish background water quality for each  
33 well. Statistical evaluations of subsequent data are compared with these background concentrations to  
34 provide an indication of whether dangerous constituents from the TSD unit are significantly affecting the  
35 groundwater quality.

36 The annual groundwater monitoring report provides an interpretation of the data obtained through the  
37 sampling and analysis programs for the interim status groundwater projects, including such information for  
38 the LLBG, LERF, and other RCRA units. Groundwater monitoring results have been, and will continue to  
39 be, reported in the annual groundwater monitoring report released by March 1 of each calendar year.

## 40 **5.2.2 Investigative Methods**

41 The techniques and methods used to assess the hydrogeologic properties of the uppermost aquifer beneath  
42 the Hanford Site are summarized in this section.

### 43 **5.2.2.1 Existing Hanford Site Hydrogeologic Information**

44 Hydrogeologic information has been collected since activities began on the Hanford Site in the mid-1940s.  
45 Much of the information on subsurface geology is derived from the analyses and interpretations of

1 boreholes and wells completed in and around the Hanford Site. These data are available in formal  
2 borehole data packages and in the well file library (refer to Chapter 12.0, Section 12.1.26). Some of the  
3 historical data have been entered into the Hanford Environmental Information System (HEIS). Data used  
4 in the Unit-Specific Portion are documented in groundwater monitoring plans, reports, and in unit-specific  
5 Part B permit application documentation.

6 There are numerous reports that provide interpretations of raw data. Much of what is known about the  
7 geology, hydrology, climatology, and meteorology of the Hanford Site has been compiled in the  
8 Consultation Draft Site Characterization Plan (DOE/RW-0164, volumes 1, 2, and 3). Hanford Site studies  
9 include a summary of groundwater quality (WHC-EP-0260) and a compilation of water table elevation  
10 maps (WHC-EP-0394).

#### 11 **5.2.2.2 General Well Design**

12 As required by WAC 173-303-400(3)(a) and 40 CFR 265.91, the interim status groundwater monitoring  
13 system includes the completion of monitoring wells to obtain representative groundwater samples from the  
14 uppermost aquifer beneath each of the land-based TSD units. Wells are designed to meet the requirements  
15 of WAC 173-160.

16 In some circumstances, wells that existed before implementing the RCRA groundwater monitoring  
17 requirements are used as part of the monitoring network. Authorization and criteria for using groundwater  
18 wells that existed before the lists of the RCRA parameters were established are provided in a letter from  
19 Ecology and the EPA dated July 16, 1990 (EPA and Ecology 1990). No pre-RCRA wells currently are  
20 used for RCRA monitoring at the LLBG or the LERF.

21 Details on the individual well completion methods are provided in the TSD unit-specific groundwater  
22 monitoring plans. Specifications for well designs (e.g., WHC-S-014) and procedures for performing the  
23 well installations are contained in contractor procedure manuals.

#### 24 **5.2.2.3 Well Locations**

25 The locations of the interim status monitoring wells for the individual TSD units are documented in the  
26 TSD unit-specific groundwater monitoring plans, unit-specific borehole data packages, and in the  
27 Unit-Specific Portion of this permit application.

#### 28 **5.2.2.4 Downgradient and Upgradient Interim Status Wells**

29 At least one monitoring well is installed hydraulically upgradient from each TSD unit. Their number,  
30 location(s), and depth(s) must be sufficient to yield groundwater samples that are representative of the  
31 background groundwater quality in the uppermost aquifer beneath the TSD unit and not impacted by the  
32 TSD unit.

33 There must be at least three groundwater monitoring wells located hydraulically downgradient of the TSD  
34 boundary (e.g., point of compliance) (Figure 5-1). Their number, locations, and depths of the wells are  
35 designed for the detection of any statistically significant amount of dangerous waste or dangerous waste  
36 constituents that might migrate from the TSD unit to the uppermost aquifer.

37 The upgradient and downgradient well locations for each TSD unit are selected on the basis of water table  
38 elevations and any other applicable information available at the time of well installation. The well  
39 locations for TSD units are found in the interim status groundwater monitoring plans and in the  
40 Unit-Specific Portion of this permit application. Specific well location coordinates and elevations are  
41 found in the Hanford Well Information System (HWIS) database.

#### 42 **5.2.2.5 General Hydrogeologic Investigative Techniques**

43 Characterization of the hydrogeologic properties of land-based TSD units may be based on information  
44 gained from borehole sediment samples, geophysical logging, aquifer testing, water level measurements,

1 and other pertinent sources of information (EPA 1986b). The unit-specific permit application  
2 documentation contains details regarding sample collection intervals and tests performed.

3 Limited hydraulic properties have been obtained from field determinations as well as permeameter testing  
4 in the laboratory. Aquifer testing (constant-discharge production and recovery phases) was performed  
5 primarily before 1989. Increased restrictions on purgewater disposal resulted in the use of alternative  
6 testing methods from 1989 until recently. Slug testing was the primary method used to obtain field  
7 information on the aquifer properties until 1998. A combined suite of hydraulic tests has been used to  
8 determine hydrologic properties. Slug tests, borehole tracer-dilution tests, tracer pump-back tests, and  
9 constant-rate pumping tests are used in selected new wells. Descriptions of the test methods used to obtain  
10 hydraulic property information are provided in unit-specific permit application documentation, assessment  
11 monitoring plans and reports, and other investigation plans and reports. Contaminant plume and trend  
12 information is also used to assist in determining groundwater flow and contaminant movement.

### 13 **5.2.3 Interim Status Data**

14 Groundwater monitoring activities performed during the interim status period are summarized in this  
15 section.

#### 16 **5.2.3.1 Sampling and Analysis Plan**

17 Sampling and analysis plans are found in the unit-specific groundwater monitoring plans. The aspects of  
18 the groundwater sampling and analysis plans that have been used, and currently are being used for the  
19 interim status program monitoring wells, are described in this section. Representative groundwater  
20 samples from the uppermost aquifer beneath the Hanford Facility are obtained and analyzed for the  
21 purpose of detecting potential contaminant releases from TSD units. All interim status sampling activities  
22 on the Hanford Facility currently are performed in accordance with EPA SW-846 protocol or an equivalent  
23 EPA-approved method (EPA/230/02-89-042).

24 The following sections describe the general methods used in the acquisition of groundwater samples.

##### 25 **5.2.3.1.1 Static Water-Level Measurements**

26 The static water level is measured, recorded, and remeasured until reproducible results are obtained before  
27 purging or sampling monitoring wells. Procedures for water level measurements are found in  
28 subcontractor procedure manuals.

##### 29 **5.2.3.1.2 Well Purging**

30 Monitoring wells are purged before sample collection to obtain groundwater samples that are  
31 representative of groundwater. Most monitoring wells are purged until a minimum of three casing  
32 volumes of water have been removed from the wells; the wells may be sampled after field parameters  
33 stabilize (Section 5.2.3.1.4). Methods of minimizing or eliminating purge volumes before sampling  
34 currently are being evaluated.

##### 35 **5.2.3.1.3 Sample Withdrawal**

36 After the monitoring well has been purged, the pumping rate is reduced and samples are withdrawn.  
37 Multiple groundwater samples are obtained for laboratory analyses during the sampling event. Samples  
38 typically are collected and bottled in the following order:

- 39 • Bottles with septum caps (volatiles)
- 40 • Unfiltered samples (major-ions, cyanide, semivolatiles, metals)
- 41 • Filtered samples (metals).

##### 42 **5.2.3.1.4 Field Analyses**

43 Temperature, pH, turbidity, and specific conductance are measured and recorded during well purging and  
44 sample withdrawal. Groundwater samples for laboratory analysis are generally not collected until each of  
45 these parameters has stabilized.

1 **5.2.3.1.5 Chain of Custody**

2 Chain-of-custody procedures are followed in collecting interim status data to ensure the compositional  
3 integrity of groundwater samples from the time of collection through laboratory analysis and data  
4 reporting.

5 **5.2.3.1.6 Quality Assurance and Quality Control Procedures**

6 Quality assurance and quality control procedures are applied to both field and laboratory data to ensure the  
7 reliability and validity of the data. The Tri-Party Agreement (Article XXXI, Paragraph 105, and Sections  
8 6.5 and 7.8 of the Tri-Party Agreement Action Plan) also specifies quality assurance and quality control  
9 requirements that are to be implemented.

10 **5.2.3.2 Analytical Data**

11 Analytical data on the interim status groundwater program are presented in the following sections.

12 **5.2.3.2.1 Groundwater Elevations**

13 Groundwater elevation data have been obtained since RCRA groundwater monitoring began. Water levels  
14 also are available for existing wells prior to the RCRA groundwater monitoring program. Water level data  
15 are compiled into the HEIS database. Hanford sitewide groundwater maps are produced at least annually.

16 **5.2.3.2.2 Results of Water Quality Analyses**

17 Quarterly samples are collected for the first year to establish background water quality. Constituents  
18 analyzed for are specified by 40 CFR 265.92 (b)(1)(2)(3). Specific analytical parameters are specified in  
19 unit-specific permit application documentation. After the first year, the wells are sampled for  
20 40 CFR 265.92 (b)(2) groundwater quality parameters at least annually and are sampled for  
21 40 CFR 265.92 (b)(3) indicator parameters and site-specific parameters semiannually. The TSD units in  
22 assessment-level monitoring require sampling quarterly or an agreed upon sampling frequency. The  
23 constituents analyzed for are detailed in the groundwater monitoring plans and in the unit-specific permit  
24 application documentation.

25 All groundwater quality data from the monitoring well network are entered into the Hanford  
26 Environmental Information System (HEIS) database-for permanent storage and are available electronically.  
27 Data from the HEIS database may be downloaded to smaller databases for data validation, data reduction,  
28 and trend analysis. Results are summarized in Quarterly reports and in the annual groundwater monitoring  
29 report.

30 **5.2.3.2.3 Statistical Results**

31 Statistical analyses of the sampling results for indicator parameters (including pH, specific conductance,  
32 total organic carbon, and total organic halogens) are discussed in unit-specific permit application  
33 documentation. Detailed statistical analysis methods have been documented (WHC-SA-1124-FP). Results  
34 of statistical analyses are presented in groundwater monitoring annual reports (e.g., DOE/RL-91-03,  
35 PNNL-13116).

36 **5.3 AQUIFER IDENTIFICATION [D-10c]**

37 The characteristics of the uppermost aquifer beneath the Hanford Site and regional hydrogeologic factors  
38 influencing this aquifer are summarized in the following section. This summary begins with a brief  
39 description of the regional physiographic and geomorphic setting of the Hanford Site. The climate and  
40 meteorology of the region also are summarized to address aquifer recharge potential from precipitation.  
41 An overview of the regional geologic framework follows, as this framework provides a major influence on  
42 aquifer characteristics. A description of the physical characteristics of the uppermost aquifer and a  
43 summary of contaminant travel time determinations comprise the remainder of this section. Hydrogeologic

1 terms used in this discussion are defined in the glossary contained in Appendix 2B. A brief parenthetical  
2 explanation follows the initial use of these terms within the text.

3 The hydrogeologic information discussed for the Hanford Site also applies to the Hanford Facility, unless  
4 otherwise designated.

### 5 **5.3.1 Physiographic and Geomorphic Setting**

6 This section addresses the physiographic and geomorphic setting of the Hanford Site, or a description of  
7 the nature and origin of landforms. The Hanford Site is situated within the Pasco Basin of south-central  
8 Washington (Figure 5-3). The Pasco Basin is bounded on the north by the Saddle Mountains, on the west  
9 by Umtanum Ridge, Yakima Ridge, and the Rattlesnake Hills, and on the south by Rattlesnake Mountain,  
10 all anticlinal folds of the Yakima Fold Belt (a physiographic subdivision of the Columbia Plateau  
11 characterized by anticlinal upwarps and synclinal downwarps of the underlying bedrock). The Pasco Basin  
12 is bounded on the east by the Palouse slope, a monocline (broad fold) that inclines to the east (Figure 5-3).

13 Surface topography seen at the Hanford Site is the result of: (1) anticlinal ridges, (2) Pleistocene  
14 cataclysmic flooding (flooding resulting from glacial activity occurring north of the Hanford Site 13,000 to  
15 10,000 years ago), (3) Holocene eolian activity (relatively recent wind activity), and (4) land sliding. Since  
16 the end of the Pleistocene, winds have locally reworked the flood sediments, depositing dune sands in the  
17 lower elevations and loess (windblown silt) around the margins of the Pasco Basin. Sand dunes have  
18 largely stabilized except where these dunes have been reactivated because of the disturbance of anchoring  
19 vegetation (WHC-SD-ER-TI-0003).

### 20 **5.3.2 Climate and Meteorology**

21 The Hanford Site is located in a semiarid desert area. The climate in the vicinity of the Hanford Site is  
22 largely influenced by the rain-shadow effect of the Cascade Range located in western Washington. This  
23 effect results in cold air drainage across the region that largely controls the wind regime of the Hanford  
24 Site.

25 Climatological data have been collected at the Hanford Meteorological Station, located between the  
26 200 Areas, since 1945 (PNL-6415). Temperature and precipitation data also are available from nearby  
27 locations for the period 1912 through 1943. A summary of these data through 1980 has been published  
28 (PNNL-11139). Data from the Hanford Meteorological Station are representative of the general climatic  
29 conditions for the region and describe the specific climate of the 200 Areas Plateau.

#### 30 **5.3.2.1 Wind**

31 Prevailing wind directions on the 200 Areas Plateau are from the northwest in all months of the year (refer  
32 to Chapter 2.0, Figure 2-8). Secondary maxima occur for southwesterly winds.

33 Monthly average wind speeds are lowest during the winter months, averaging 10 to 11 kilometers per hour,  
34 and highest during the summer, averaging 15 to 16 kilometers per hour. Wind speeds that are well above  
35 average usually are associated with southwesterly winds. However, the summertime drainage winds  
36 generally are northwesterly and frequently reach 50 kilometers per hour. Estimates of wind extremes have  
37 been summarized by Stone et al. (PNL-4622). Information on the likelihood and frequency of strong  
38 winds and tornadoes in the region have been summarized in a final environmental impact statement  
39 (DOE/EIS-0113), the Hanford Meteorological Station climatological summary (PNL-4622), and by the  
40 National Severe Storms Forecast Center.

### 1 **5.3.2.2 Temperature and Humidity**

2 Ranges of daily temperatures vary from normal maxima of 1.6°C in early January to 35°C in late July. The  
3 record maximum temperature is 46°C, and the record minimum temperature is -32.7°C.

4 The annual average relative humidity at the Hanford Meteorological Station is 54 percent. It is highest  
5 during the winter months, averaging approximately 75 percent, and lowest during the summer months,  
6 averaging approximately 35 percent.

### 7 **5.3.2.3 Precipitation**

8 Precipitation measurements have been made at the Hanford Meteorological Station since 1945. Average  
9 annual precipitation at the Hanford Meteorological Station is 16 centimeters per year. Most of the  
10 precipitation occurs during the winter, with nearly half of the annual amount occurring in the months of  
11 November through February. Days with greater than 1.3 centimeter precipitation occur less than 1 percent  
12 of the year. Rainfall intensities of 0.5 inch (1.3 centimeter) per hour persisting for 1 hour are expected  
13 once every 10 years. Rainfall intensities of 2.54 centimeter per hour for 1 hour are expected only once  
14 every 500 years. Winter monthly average snowfall ranges from 0.76 centimeter in March to  
15 13.5 centimeter in January. The record snowfall of 59.4 centimeters occurred in January 1950. Snowfall  
16 accounts for approximately 38 percent of all precipitation during the months of December through  
17 February.

### 18 **5.3.3 Regional Geology**

19 The regional geology provides the framework for understanding the stratigraphic (rock layers) and  
20 structural (rock deformation) controls on the aquifers beneath the Hanford Site. An overview of the  
21 regional geology and a description of the primary stratigraphic units that comprise these aquifers are  
22 provided in this section.

23 The Hanford Site lies in the Pasco Basin near the eastern limit of the Yakima Fold Belt. The Pasco Basin  
24 is divided by the Gable Mountain anticline into the Wahluke syncline to the north and the Cold Creek  
25 syncline to the south. The Pasco Basin is underlain by Miocene-aged (approximately 17 to 8.5 million  
26 years before present) volcanic (molten rock) flows of the Columbia River Basalt Group and late Miocene-  
27 to Pleistocene-aged sediments (approximately 10.5 million to 12,000 years before present) that overlie the  
28 basalts. The basalts and sediments thicken into the Pasco Basin and generally reach maximum thicknesses  
29 in the Cold Creek syncline in the vicinity of the 200 Areas. Hanford Site structure and stratigraphy are  
30 illustrated in Figures 5-3 and 5-4, respectively, and described in WHC-SD-ER-TI-0003. A brief review of  
31 this information follows.

32 The Columbia River Basalt Group is greater than 3,658-meters thick beneath the Pasco Basin. The  
33 sequence of volcanic flows within the Pasco Basin can be divided into the Grande Ronde, Wanapum, and  
34 Saddle Mountains formations (major rock divisions) (listed from oldest to youngest). The youngest  
35 formation of the Group, the Saddle Mountain Basalt, is characterized by a sequence of volcanic flows and  
36 intercalated sedimentary units called interbeds.

37 Late Miocene to Quaternary sediments overly the basalts. Most of this sedimentary sequence can be  
38 divided into two main units: the Ringold Formation of late Miocene to middle-Pliocene age (approximately  
39 10.5 million to 3 million years before present) and the Hanford formation of Pleistocene to Recent age  
40 (approximately 1 million to 12,000 years before present).

41 The Ringold Formation was formed by fluvial-lacustrine (stream-lake) processes. This formation  
42 comprises the basal part of the sedimentary sequence above the basalt. The Ringold Formation is up to  
43 185-meters thick at the Hanford Site in the deepest part of the Cold Creek syncline south of the 200 West

1 Area, and up to 170-meters thick in the western Wahluke syncline. The Ringold Formation pinches out  
2 against Gable Mountain, Yakima Ridge, Saddle Mountains, and Rattlesnake Mountain anticlines. The  
3 Ringold Formation is largely absent in the northern and northeastern parts of the 200 East Area and  
4 adjacent areas to the north in the vicinity of West Lake, located south of Gable Mountain. The Ringold  
5 Formation is composed of unindurated to semi-indurated (loose to semi-hardened) clay, silt, fine to  
6 coarse-grained sand, or granule to cobble gravel that can be divided into five facies (lateral subdivisions of  
7 a rock type) (WHC-SD-EN-EE-004). The five facies include: (1) fluvial gravel (generally with a fine to  
8 medium sand matrix); (2) fluvial sand; (3) overbank deposits (sediments deposited beyond the natural  
9 levee of a stream or river during a flooding event) and paleosols (ancient soils) composed of silty sand to  
10 clay; (4) lacustrine sandy silts to clays; and (5) basaltic alluvium or fanglomerate deposited at the foot of  
11 ridges (anticlines).

12 The distribution of facies associations within the Ringold Formation forms the basis for three stratigraphic  
13 subdivisions (WHC-SD-EN-EE-004). The first of these subdivisions forms the lower half of the formation  
14 and is characterized by intervals dominated by fluvial gravel and sand (facies 1 and 2) that interfinger with  
15 intervals containing fine-grained deposits (facies 3 and 4). Interstratified deposits typical of the fluvial  
16 sand (facies 2) and overbank-paleosol facies (facies 3) associations dominate the second subdivision. The  
17 third and uppermost subdivision is dominated by the lacustrine facies association (facies 4). Facies 5 are  
18 mainly found in the vicinity of the anticlinal ridges to the west and north of the Hanford Site.

19 Other less extensive stratigraphic units within the Pasco Basin overlie the Ringold Formation and underlie  
20 the Hanford formation. These units include a laterally discontinuous Plio-Pleistocene unit and  
21 pre-Missoula gravels. The pre-Missoula gravels are approximately equivalent in age to the  
22 Plio-Pleistocene unit.

23 The Hanford formation was formed by glaciofluvial processes. During Pleistocene glaciation, eastern  
24 Washington was subjected to a number of cataclysmic floods that resulted from the breakup of ice dams  
25 impounding glacial lakes in Idaho, Montana, and northeastern Washington. The Hanford formation  
26 generally can be divided into two main facies: coarse-grained or gravelly deposits and fine-grained or  
27 sandy and silt deposits. The Hanford formation also is commonly divided into two informal members: the  
28 Pasco gravels and the Touchet beds (DOE/RW-0164). The Pasco gravels generally correspond to the  
29 gravelly facies, and the Touchet beds correspond to the sandy to silty facies. The Hanford formation is  
30 thickest in the Cold Creek bar in the vicinity of the 200 West and 200 East Areas where the formation is up  
31 to 64 meters thick. Hanford formation deposits are absent on ridges approximately 360 meters above sea  
32 level.

33 Holocene surficial deposits consist of silt, sand, and gravel that form a thin (less than 4.9-meter) veneer  
34 across much of the Pasco Basin. These sediments were deposited by a mix of eolian and alluvial processes  
35 during the past 10,000 years.

36 Details of the geology for 'operating' TSD units for which final status is sought are provided in  
37 groundwater monitoring plans included in the unit-specific portion.

#### 38 **5.3.4 Regional and Hanford Site Hydrology**

39 The regional and Hanford Site surface and groundwater hydrology are discussed in the following sections.  
40 Primary surface-water features associated with the Hanford Site and region are the Columbia River and its  
41 major tributaries, the Yakima, Snake, and Walla Walla Rivers. With regard to groundwater hydrology, the  
42 uppermost aquifer is primarily in the Ringold Formation and the vadose zone (unsaturated zone above the  
43 water table) is primarily in the Hanford formation. The Hanford formation comprises the upper 9 to 91  
44 meters of the vadose zone throughout most of the Hanford Site, but extends below the regional water table  
45 in parts of the 200 East Area and eastward towards the Columbia River.

1 **5.3.4.1 Surface Hydrology**

2 Surface drainage enters the Pasco Basin from several other surrounding basins. Within the Pasco Basin,  
3 the Columbia River is joined by major tributaries including the Yakima, Snake, and Walla Walla Rivers.  
4 Two intermittent streams traverse through the Hanford Site: Cold Creek and Dry Creek (refer to  
5 Chapter 2.0, Section 2.2.1.4). Water drains through these creeks during the wetter winter and spring  
6 months. No perennial streams originate within the Pasco Basin.

7 Total estimated precipitation over the Pasco Basin averages 16 centimeters per year (Section 5.3.2.3).  
8 Mean annual run-off from the Pasco Basin is estimated to be less than  $3.1 \times 10^7$  cubic meters per year, or  
9 approximately 3 percent of the total precipitation. Recharge from infiltration of precipitation is highly  
10 variable on the Hanford Site both spatially and from year to year. The rate of natural recharge depends  
11 primarily on soil texture, vegetation, and climate, and ranges from near zero, where fine-grained soils and  
12 deep-rooted vegetation are present, to  $>10$  cm/yr (4 in/yr) in areas where soils are coarse textured and bare  
13 of vegetation (Gee et al. 1992; PNNL-10285).

14 Within the vicinity of the Hanford Site, primary surface-water features are the Columbia and Yakima  
15 Rivers. West Lake, about 4 hectares in size and less than 0.9-meter deep, is the only natural lake within  
16 the Hanford Site. Waste water ponds, cribs, and ditches associated with waste management activities also  
17 are present on the Hanford Site.

18 **5.3.4.2 Groundwater**

19 Confined and semiconfined aquifer systems occur beneath the Hanford Site in the basalt flow tops, flow  
20 bottom zones, and sedimentary interbeds (DOE/RW-0164, volume 2, pp. 3.6-1). These deeper aquifers are  
21 intercalated with aquitards consisting of basalt flow interiors. Vertical flow across the aquitards within the  
22 basalt aquifer system is inferred from water level or potentiometric surface data, but the leakage is not  
23 quantified and direct measurements are not available (DOE/RW-0164, volume 2, pp. 3.6-17). The  
24 multiaquifer system within the Pasco Basin has been conceptualized as consisting of four primary  
25 hydrogeologic units: (1) Hanford and Ringold formation sediments, (2) Saddle Mountain Basalt,  
26 (3) Wanapum Basalt, and (4) Grande Ronde Basalt. The discussion in the following sections focuses on  
27 the uppermost aquifer systems within the Ringold and Hanford formations and within the Saddle  
28 Mountains Basalt, the aquifer comprised of the Rattlesnake Ridge interbed.

29 **5.3.5 Uppermost Aquifer**

30 The unconfined to semiconfined aquifer associated with the sedimentary units stratigraphically above the  
31 basalts is the uppermost regionally extensive aquifer beneath the Hanford Site. The water table ranges in  
32 depth from 0 meter at West Lake and the Columbia and Yakima Rivers, to greater than 106.7 meters near  
33 the center of the Hanford Site. Groundwater within this aquifer system is contained within the  
34 glaciofluvial sands and gravels of the Hanford formation and the fluvial-lacustrine sediments of the  
35 Ringold Formation. The position of the water table beneath the western portion of the Hanford Site is  
36 generally within the coarse-grained gravel units of the Ringold Formation (WHC-SD-EN-EE-004). In the  
37 northern and eastern portions of the Hanford Site, the water table is generally within the Hanford  
38 formation. Hydraulic conductivities for the Hanford formation (610 to 3,048 meters per day) are much  
39 greater than those of the coarse-grained gravel units of the Ringold Formation (186 to 930 meters per day)  
40 (RHO-RE-SR-87-24, WHC-SD-EN-EE-004). Stratigraphic divisions of these units and their hydrologic  
41 properties are discussed in detail in the geology and hydrology of the Hanford Site  
42 (WHC-SD-ER-TI-0003).

43 This aquifer system is approximately 152-meters thick near the center of the Pasco Basin. Laterally, the  
44 aquifer system is bounded by anticlinal basalt ridges that extend above the water table. A generalized

1 east-west geologic cross-section showing the position of the water table and major stratigraphic units  
2 beneath the Hanford Site is presented in Figure 5-5.

3 The base of the uppermost aquifer generally is regarded as the basalt surface. On a local scale where the  
4 Ringold Formation is present, the silts and clays of the Formation's lower mud unit and the Formation's  
5 fine-grained units (WHC-SD-EN-EE-004) form a confining layer. Thus, in the strict sense, the  
6 groundwater is unconfined above this layer and semiconfined below this layer.

7 Significant water level changes have occurred on the Hanford Site. Water levels in the uppermost aquifer  
8 have risen because of artificial recharge mechanisms. Waste water ponds on the Hanford Site have  
9 artificially recharged the uppermost aquifer below the 200 East and 200 West Areas. Recharge from the  
10 200 Areas waste water disposal units is estimated to be approximately 10 times the natural recharge on the  
11 Hanford Site (RHO-ST-42). The increase in water table elevations was most rapid from 1950 to 1960 and  
12 apparently stabilized between 1970 and 1980, when only small increases in water table elevations  
13 occurred. Waste water discharges from the 200 Areas have been reduced since 1984 and the water levels  
14 have declined significantly. Other artificial recharge mechanisms include excessive application of imported  
15 irrigation water or impoundment of streams.

16 The general direction of groundwater flow is primarily from natural recharge areas west of the Hanford  
17 Site to discharge areas toward the Columbia River. The general west-to-east flow pattern is interrupted  
18 locally by the groundwater mounds in the 200 Areas. From the 200 Areas, there is also a component of  
19 groundwater flow to the north, between Gable Mountain and Gable Butte. Figure 5-6 illustrates the water  
20 table conditions beneath the Hanford Site.

21 Details of the hydrology for 'operating' TSD units for which final status is sought are provided in the  
22 unit-specific groundwater monitoring plans and permit application documentation.

### 23 **5.3.6 Uppermost Confined Aquifer**

24 The Rattlesnake Ridge aquifer is the uppermost fully-confined aquifer system that occurs beneath the  
25 Hanford Site. As discussed previously, Ringold Formation sediments are semiconfined in some areas.  
26 The Rattlesnake Ridge aquifer consists of the flow bottom of the Elephant Mountain Basalt member, the  
27 flow top of the Pomona basalt, and the Rattlesnake Ridge interbed. The thickness of the Rattlesnake Ridge  
28 interbed, which is the principal transmissive zone within the aquifer, ranges from 15 to 25 meters beneath  
29 the 200 Areas and generally thickens toward the west (RHO-ST-42, RHO-RE-ST-12P). Erosional  
30 windows (gaps in the rock) in the Elephant Mountain basalt confining layer exist locally. This could allow  
31 hydraulic communication between the Rattlesnake Ridge aquifer and the overlying unconfined aquifer  
32 (RHO-RE-ST-12P). More recent information on the hydrogeology, flow dynamics, and hydrochemistry of  
33 the uppermost confined aquifer system is available in PNL-10158 and 10817.

34 Natural recharge to the Rattlesnake Ridge aquifer occurs in the higher elevations surrounding the Pasco  
35 Basin to the west, north, and northeast. The flow of groundwater generally is toward the northeast beneath  
36 the 200 West Area and possibly east to north beneath the 200 East Area. The aquifer is heterogeneous in  
37 composition because the aquifer consists of a basalt flow top and flow bottom, a clayey basalt  
38 conglomerate, an epiclastic fluvial-floodplain unit, an air-fall tuff, and a volcanoclastic unit derived from  
39 fluvial reworking of the tuff and detrital sediments (RHO-RE-ST-12P). This heterogeneity produces  
40 variability of groundwater flow through the aquifer (RHO-RE-ST-12P).

### 41 **5.3.7 Contaminant Travel Times**

42 The travel time of a contaminant from the Hanford Site to the Columbia River is the sum of the time  
43 required for the contaminant to travel through the vadose zone to reach the water table and the time

1 required for the contaminant to travel in the groundwater to the Columbia River. Travel time  
2 determinations can be based on small- or large-scale field measurements of transport rates or on  
3 calculations supported by laboratory scale measurements of the transport parameters. Further discussion of  
4 contaminant travel time is contained in Chapter 9.0.

5 The parameters that affect the travel time in the unconfined aquifer are the following:

- 6 • Distance
- 7 • Permeability (or hydraulic conductivity)
- 8 • Porosity
- 9 • Hydraulic gradient
- 10 • Dispersivity
- 11 • Retardation
- 12 • Heterogeneity (geologic structure).

13 In addition to these parameters, the vadose zone travel times are further affected by the relative  
14 permeability, the moisture content, and the recharge rate. Because of the variability of the sediments, the  
15 calculation of travel times based on laboratory derived parameters is considered less accurate than the large  
16 scale field measurements. The following sections summarize the work that has been done in determining  
17 travel times in the vadose zone and unconfined aquifer.

#### 18 **5.3.7.1 Vadose Zone**

19 The travel time through the vadose zone depends on the moisture content, which in turn depends on the  
20 recharge rate. In the cases of artificial recharge where near saturated conditions have been maintained  
21 down to the water table (e.g., 216-B-3 Expansion Ponds), the flow velocity is nearly equal to the saturated  
22 hydraulic conductivity of the soil column. This implies a travel time on the order of days. For other cases  
23 where the natural recharge is the driving force, the travel time varies considerably depending on the  
24 assumed recharge. Several calculations have been done (DOE/EIS-0013) for natural recharge in the  
25 200 East Area ranging from 0.5 centimeter per year to 5.0 centimeters per year. These values were chosen  
26 to reflect current and possibly future wetter conditions. The computational results indicated travel times on  
27 the order of 900 years to 100 years, respectively, for conservative contaminants. An estimate of travel time  
28 as a function of recharge in a 60-meter deep vadose zone has been provided by Gee (Gee et al. 1992).

#### 29 **5.3.7.2 Saturated Zone**

30 More than 20 estimates of travel times from the 200 East and 200 West Areas to the Columbia River have  
31 been made by investigators using a number of different methodologies and assumptions. A review of the  
32 various travel time estimates has been made over the past 40 years (PNL-6328). These estimates can be  
33 classified as being based on one of the following methods: (1) extrapolation of local groundwater velocity  
34 measurements, (2) mathematical methods, and (3) monitoring the movement of contaminant plumes.

35 The rate and direction of groundwater flow in the vicinity of the 100 Areas are greatly influenced by the  
36 level of the Columbia River. This can severely alter the groundwater gradient and even cause flow to be  
37 reversed up to 305 meters inland during periods of high water. A similar effect occurs in the 300 Area  
38 (WHC-SD-ER-TI-0003).

### 39 **5.4 CONTAMINANT PLUME DESCRIPTION [D-10d]**

40 Ecology regulations [WAC 173-303-806(4)(a)(xx)(D)] require "A description of any plume of  
41 contamination that has entered the groundwater from a regulated unit at the time that the application was  
42 submitted..." This section contains a description of contaminant plumes identified in the aquifers beneath

1 the Hanford Site. Information provided in this section is relevant to SWMU discussions contained in  
2 Chapter 2.0, Section 2.5 and Appendix 2D.

3 Groundwater contamination currently is monitored under a comprehensive groundwater monitoring and  
4 long-term surveillance program. The results of the monitoring program along with isopleth maps are  
5 prepared and published annually (e.g., PNNL-13116). Contaminant plumes are primarily delineated using  
6 isopleth maps (i.e., maps with lines connecting points of equal concentration or values).

#### 7 **5.4.1 Radionuclide Contamination**

8 Isopleth maps are prepared to track the movement of radiological contaminant plumes (e.g., tritium, gross  
9 beta) in the unconfined groundwater flow system beneath the Hanford Site. A study of these plumes can  
10 be used to provide an early indication of the rate and direction of contaminant movement. An example of  
11 an isopleth map delineating a contamination plume is shown in Figure 5-7 (PNNL-13116). This figure  
12 depicts the distribution of average tritium concentrations in the unconfined aquifer in 1996. Tritium and  
13 iodine-129 are the most widespread radionuclides in the unconfined aquifer (PNNL-13116). More  
14 detailed information on distribution and levels of radionuclide contamination can also be found in  
15 numerous other site-specific reports. A detailed bibliography of groundwater related reports is provided in  
16 PNNL 13116.

#### 17 **5.4.2 Nonradioactive Contamination**

18 The most common nonradioactive inorganic contaminants that have been observed in groundwater are  
19 nitrate, cyanide, fluoride, and hexavalent chromium. Among the nonradioactive organic contaminants  
20 routinely observed in the groundwater samples are carbon tetrachloride, trichloroethylene,  
21 cis-1,2-dichloroethene, and chloroform (PNNL-11793).

22 Nitrate, like tritium, can be used to define the extent of contamination because nitrate is present in many  
23 waste streams at the Hanford Site and is mobile in the groundwater (PNNL-11793). Isopleth maps are  
24 prepared to show levels of nitrate concentrations in the groundwater. The configuration of the nitrate  
25 plumes can be found in PNNL (1997, Figure S.2). Additional information on nonradioactive  
26 contamination is found in groundwater status reports (e.g., PNNL-11793).

27 It should be noted that the present extent of detectable contamination is primarily the result of past liquid  
28 waste discharges to the ground.

#### 29 **5.5 DETECTION MONITORING PROGRAM [D-10e]**

30 The final status detection monitoring program is designed to detect the impact of the land-based TSD unit  
31 on groundwater quality in the uppermost unconfined aquifer beneath the unit. The final status detection  
32 monitoring plan contains details regarding the following:

- 33 • Design of the monitoring well network (number and locations of monitoring wells, well construction)
- 34 • Frequency of groundwater monitoring
- 35 • Type and behavior of chemical parameters that will be used to indicate the presence of groundwater  
36 contamination
- 37 • Sampling, analysis, and statistical procedures that will be used
- 38 • Methods by which regular determinations of the groundwater flow rate and direction will be  
39 determined.

40 A description of unit-specific monitoring networks is found in the Unit-Specific Portion of this permit  
41 application. Final status requirements are applicable to land-based TSD units on incorporation into the  
42 HF RCRA Permit (DW Portion).

1 The following sections provide the necessary data and information to support the implementation of a final  
2 status detection monitoring program at land-based TSD units.

### 3 **5.5.1 Indicator Parameters, Waste Constituents, Reaction Products to be Monitored [D-10e(1)]**

4 The monitoring parameters are selected on the basis of suitability to groundwater monitoring at land-based  
5 TSD units, and do not necessarily apply to the entire Hanford Facility. The following criteria are  
6 considered in the selection of monitoring parameters for each land-based TSD unit:

- 7 • Process knowledge and/or use of the TSD unit
- 8 • Present in significant quantity in the waste that has been disposed
- 9 • Relative mobility and low retardation with respect to groundwater flow, and the stability and  
10 persistence in the environment
- 11 • Lack of significant natural presence of the parameters in the groundwater
- 12 • Ease of detection and minimal sampling and analytical interferences (detectability)
- 13 • Usefulness as indicators of other potential contaminants
- 14 • Lack of data interpretation problems caused by common laboratory and field contaminants.

#### 15 **5.5.1.1 Dangerous Waste Characterization [D-10e(1)(a)]**

16 A list of the dangerous waste numbers that could be disposed in each land-based TSD unit is included in  
17 the HF Part A and in unit-specific permit application, preclosure work plan, closure work plan, closure  
18 plan, and closure/postclosure plan documentation. These sources include, to the degree possible,  
19 compositions, quantities, and dates of waste disposal, and have, or will, form the basis for the selection of  
20 the unit-specific monitoring parameters and constituents.

#### 21 **5.5.1.2 Behavior of Constituents [D-10e(1)(b)]**

22 The mobility, stability, and persistence of waste constituents and their reaction products that have been  
23 disposed at a TSD unit are of prime importance in determining the proper unit-specific monitoring  
24 parameters and constituents. Constituents that generally are mobile and persistent through the unsaturated  
25 zone and into the saturated zone are useful indicators of chemical migration from a waste disposal site.

26 Parameters such as distribution or sorption coefficients for inorganic (e.g., Freeze and Cherry 1979,  
27 pp. 402-408) and organic constituents (Lyman et al. 1982) and chemical solubilities are used in these  
28 evaluations. Other important properties that are considered for organic constituents are vapor pressure and  
29 the Henry's Law constant (used to evaluate to what degree compounds will be partitioned into the aqueous  
30 phase and to what degree this phase is likely to migrate as a vapor).

#### 31 **5.5.1.3 Detectability [D-10e(1)(c)]**

32 The detectabilities (the presence or absence) of the groundwater sampling parameters for each land-based  
33 TSD unit are to be given in terms of the method detection limit for each of the constituents listed. The  
34 practical quantification limits (PQLs) are used to determine if concentration is quantifiable. The PQLs  
35 represent the lowest concentrations of analytes in groundwater that can be reliably determined within  
36 specified limits of precision and accuracy by the standard analytical methods under routine laboratory  
37 operating conditions. Specific requirements are addressed in the unit-specific groundwater monitoring  
38 plans.

### 39 **5.5.2 Groundwater Monitoring Program [D-10(e)(2)]**

40 This section describes a comprehensive program to be used during the final status detection monitoring  
41 program. The final status detection monitoring system is designed to detect the migration of releases of  
42 dangerous waste or dangerous waste constituents within the uppermost unconfined aquifer at compliance  
43 points immediately downgradient from potential leak sources. The groundwater will be monitored as  
44 required during the active life of the regulated unit (including the closure/postclosure care period).

1 Groundwater monitoring requirements are contained in Condition II.F. of the HF RCRA Permit  
2 (DW Portion).

### 3 **5.5.2.1 Description of Wells [D-10e(2)(a)]**

4 The basis for locating the monitoring wells around individual land-based TSD units, and the well locations  
5 selected to achieve the desired coverage with the minimum number of wells, are discussed in the following  
6 sections.

#### 7 **5.5.2.1.1 Background**

8 Groundwater monitoring wells that are required to be installed will be in compliance with the general  
9 groundwater monitoring requirements of WAC 173-303-645(8). These wells will yield groundwater  
10 samples from the uppermost unconfined aquifer that are representative of the quality of background water  
11 immediately upgradient of the unit and the quality of water passing beneath the unit. A determination of  
12 background quality may include sampling of wells that are not hydraulically upgradient of the waste  
13 management area.

#### 14 **5.5.2.1.2 Design Approach for Monitoring Wells**

15 Tentative locations for monitoring wells are identified along the downgradient sides (point of compliance)  
16 of the TSD unit. Initial well locations are determined based on consideration of the interpreted direction of  
17 groundwater flow crossing the unit.

18 The groundwater monitoring system must be capable of yielding groundwater samples for analysis and  
19 must consist of the following:

- 20 • Monitoring wells installed hydraulically upgradient from the limit of the TSD unit. The number,  
21 location, and depths of the wells must be sufficient to yield groundwater samples that are  
22 (1) representative of groundwater quality in the uppermost aquifer near the unit and (2) not affected by  
23 leakage from the unit
- 24 • Monitoring wells installed hydraulically downgradient at the boundary of the TSD unit. The number,  
25 location, and depth of the wells must allow for the detection of dangerous waste or dangerous waste  
26 constituents that migrate from the TSD unit to the uppermost aquifer
- 27 • All monitoring wells must be cased in a manner that maintains the integrity of the monitoring well  
28 borehole. This casing must allow collection of representative groundwater samples and prevent  
29 contamination of the samples or the aquifer.

30 Existing wells might be used as part of the monitoring network provided the wells are: (1) in compliance  
31 with WAC 173-160; or (2) meeting criteria as 'equivalent' to a RCRA standard well; or (3) meeting  
32 specific DQOs for each monitoring well [Attachment 7 of the HF RCRA Permit (DW portion)]. The  
33 reasoning for selection of the location of the individual wells is, or will be, included in unit-specific permit  
34 application documentation. Well remediation and abandonment will be accomplished in accordance with  
35 WAC 173-160 and the requirements of Condition II.F.2. of the HF RCRA Permit (DW Portion).

#### 36 **5.5.2.1.3 Well Maintenance and Remediation**

37 Monitoring well maintenance, remediation, and abandonment will be performed in accordance with  
38 Attachment 6 of the HF RCRA Permit (DW Portion), WAC 173-160, the Tri-Party Agreement, and the HF  
39 RCRA Permit (DW Portion). Condition II.F.2. of the HF RCRA Permit (DW Portion) specifically  
40 addresses requirements for well remediation and abandonment, involving the following:

- 41 • Development of a well inspection plan involving inspection of wells at least once every 5 years;  
42 placement of inspection documentation in the Hanford Facility Operating Record (refer to  
43 Chapter 12.0, Section 12.1.26)

- 1 • Evaluation of wells in accordance with Sections 4.2 through 4.8.3 of Attachment 6 of the HF RCRA  
2 Permit (DW Portion) and Attachment 7 of the HF RCRA Permit (DW Portion)
- 3 • Provision of written notice to Ecology at least 72 hours before the Permittees remediate (excluding  
4 maintenance activities) or abandon any well subject to the HF RCRA Permit
- 5 • Construction of wells pursuant to the HF RCRA Permit in compliance with WAC 173-160.

#### 6 **5.5.2.1.4 Monitoring Well Locations and Design**

7 To comply with groundwater monitoring requirements, monitoring wells (i.e., point of compliance) at  
8 land-based TSD units are located at intervals along "the hydraulically downgradient limit of the waste  
9 management area..." [WAC 173-303-645(6)(a)]. The waste management area is defined as "the limit  
10 projected in the horizontal plane of the area on which waste will be placed during the active life of the  
11 regulated unit" [WAC 173-303-645(6)(b)]. If the facility contains more than one regulated unit, the waste  
12 management area is described by an imaginary line circumscribing the several regulated units. These  
13 regulations, therefore, require that monitoring wells be placed as close as reasonably possible to the edge of  
14 the regulated unit (i.e., unit boundary). Installation of monitoring wells will be based on the following  
15 criteria:

- 16 • Satisfy the regulatory requirements for a groundwater monitoring system that consists of a sufficient  
17 number of wells installed at appropriate locations and depths to yield groundwater samples that:
  - 18 (1) represent the composition of background groundwater that has not been impacted by a TSD unit.
  - 19 (2) represent the composition of groundwater passing the point of compliance.
- 20 • Location of monitoring wells should ensure a high level of confidence that dangerous waste or  
21 dangerous constituents migrating from a regulated unit would be reliably detected.
- 22 • Wells should be placed in locations that will afford the collection of hydrogeologic information.

#### 23 **5.5.2.2 Equipment Decontamination [D-10e(2)(b)]**

24 All field equipment decontamination and sampling activities will comply with aspects of a health and  
25 safety plan and procedures manuals. The procedures are intended to prevent cross-contamination between  
26 boreholes during drilling activities. Field equipment decontamination activities will be reported in field  
27 documentation.

#### 28 **5.5.3 Background Values [D-10e(3)]**

29 Background values are defined as the concentrations of chemical, physical, biological, or radiological  
30 constituents, or other characteristics in or of groundwater at a particular point in time and upgradient of a  
31 unit, that have not been affected by that unit. Background groundwater quality for detection monitoring  
32 can be based on sampling of wells that are not upgradient from the unit if (1) hydrogeologic conditions do  
33 not allow the owner or operator to determine what wells are upgradient or (2) sampling at other wells will  
34 provide a better indication of background groundwater composition that is as or more representative than  
35 that obtained from samples from upgradient wells [WAC 173-303-645(8)(a)(i) and (b) and  
36 40 CFR 264.97(a)(1)]. In this case, baseline values will be determined using historical measurements from  
37 each well.

38 Background or baseline values will be determined for final status detection-level groundwater monitoring  
39 parameters. These include general contamination indicator parameters such as specific conductance, pH,  
40 total organic carbon, total organic halogen, or heavy metals and site-specific parameters (waste constituents  
41 or reaction products) that will provide a reliable indication of the presence of dangerous constituents in  
42 groundwater. The site-specific parameters (described in unit-specific permit application documentation)  
43 will be selected based on (1) the types, quantities, and concentrations of waste constituents present; (2) the  
44 mobility, stability, and persistence of the waste constituents; (3) the detectability of the parameters; and (4)  
45 existing data.

1 Background or baseline values are used to determine whether a RCRA-regulated unit has adversely  
2 affected the groundwater quality in the uppermost aquifer beneath the site. This is accomplished by testing  
3 for statistically significant changes in concentrations of constituents of interest in a downgradient  
4 monitoring well relative to baseline levels. These baseline levels could be obtained from upgradient (or  
5 background) wells, and are referred to as interwell (or between-well) comparisons. Alternatively, if  
6 baseline values are obtained from historical measurements from that same well, the comparisons are  
7 referred to as intrawell (or within-well) comparisons. Requirements for sampling frequency are discussed  
8 in Section 5.5.4.5.1. Statistical analyses are presented in Section 5.5.4.7.

9 Background data (used for inter-well comparisons) subsequently will be reviewed for seasonal variations,  
10 trends, and significant differences among the wells. The background statistics and/or statistical  
11 methodology might be modified, if required, to address temporal or spatial variation. Background data  
12 also will be reevaluated if changes in groundwater flow direction results in changes in definition of  
13 upgradient wells. Additionally, baseline data (used for intra-well comparisons) will be updated  
14 periodically (every one to two years) and must be modified for non-detects, seasonal variations, or trend.

#### 15 **5.5.4 Sampling, Analysis, and Statistical Procedures [D-10e(4)]**

16 This section provides information on the groundwater sampling, analysis, and statistical evaluation  
17 procedures that are proposed for use with the monitoring well system. The choice of an appropriate  
18 statistical test depends on the type of monitoring (i.e., detection or compliance) and the nature of the data  
19 (e.g., the proportion of values in the data set that are below detection limit, and whether spatial variability  
20 exists) (Figure 5-2). Statistical procedures under final detection or compliance monitoring program status  
21 are discussed in Section 5.5.4.7 and Section 5.6.7.4, respectively. As the postclosure monitoring program  
22 will be implemented at least 30 years in the future, actual protocols and procedures likely will be  
23 equivalent to those cited in this section.

#### 24 **5.5.4.1 Sample Collection [D-10e(4)(a)]**

25 The groundwater monitoring system proposed for use on the Hanford Facility is designed to provide  
26 representative groundwater quality data from the uppermost aquifer beneath each land-based TSD unit.  
27 Procedures to be followed during the collection of groundwater samples from the network have been  
28 developed and will be available to all onsite personnel and to the regulators. These procedures will be  
29 consistent with those listed in EPA SW-846.

#### 30 **5.5.4.1.1 Static Water Level Measurements**

31 Before purging or sampling the monitoring well, the static water elevation will be measured, recorded, and  
32 remeasured until reproducible results are obtained. The measurements will be taken as depth-to-water  
33 from the top of the well casing and the values will be subtracted from the surveyed elevation of the casing  
34 to obtain the elevation of the water table. Graduated steel measuring tapes or other approved devices will  
35 be used for the measurements.

#### 36 **5.5.4.1.2 Well Purging**

37 Monitoring wells will be purged using a dedicated pump before samples are collected. This action will be  
38 taken to obtain groundwater samples that are representative of the formation water, rather than of the  
39 stagnant water from the well casing. Groundwater that has occupied the well casing for a long duration  
40 often is oxidized and might not be indicative of true formation water.

41 As a guideline, high-yielding monitoring wells will be purged until a minimum of three casing volumes  
42 have been removed. However, a well will not be considered ready for sample collection until concurrent  
43 measurements of pH, specific conductivity, and water temperature have stabilized to at least plus or minus  
44 10 percent over two well volumes pumped (EPA 600/2-85-104). Wells with excessively long purge times  
45 could be considered adequately purged when the parameters listed previously have stabilized. Purging of

1 low-yielding monitoring wells (i.e., those that are pumped dry) will consist of removing all standing water.  
2 Methods of minimizing or eliminating purge volumes before sampling currently are being evaluated. If  
3 the results are favorable, alternate purging and sample-collection techniques will be documented and  
4 reflected in revised groundwater monitoring plans.

5 The pumping rate at each well will be chosen to minimize turbidity and aquifer stress. Generally, the rate  
6 of pumping during sampling will be kept below the rate used during well development  
7 (EPA 600/2-85-104).

8 Water levels, pumping rates, and values of sampling parameters (i.e., pH, specific conductance, and  
9 temperature) will be recorded in field logbooks and transferred to a sample groundwater field record form.

10 Requirements for purgewater management are specified in Condition II.F.1. of the HF RCRA Permit (DW  
11 Portion). This condition specifies that purgewater be handled in accordance with requirements of  
12 Attachment 5 of the HF RCRA Permit (DW Portion).

### 13 **5.5.4.1.3 Field Analysis**

14 During well purging and sample withdrawal, field determinations of temperature, turbidity, pH, and  
15 specific conductance will be measured and recorded. The stabilization of these parameters will be an  
16 indication that well water has been purged and formation water is being sampled. Other methods of  
17 determining the presence of formation water (e.g., measuring the concentration of specific ionic species  
18 during the well purging process) might be proposed at a future time.

### 19 **5.5.4.1.4 Sample Withdrawal**

20 After the monitoring well has been purged, water samples will be withdrawn from the well using a  
21 dedicated pump. The sample withdrawal rate will be kept to approximately 1 liter per minute as  
22 recommended for groundwater sampling when volatile organic compounds are involved  
23 (EPA 600/2-85-104).

24 Samples will be collected and containerized in the order of volatilization sensitivity of the parameters to be  
25 analyzed. Samples to be analyzed for volatile organic compounds or other organics will not be filtered.

### 26 **5.5.4.2 Sample Preservation and Shipment [D-10e(4)(b)]**

27 Sample container and preservation methods that will be used during the groundwater monitoring program  
28 are in accordance with EPA SW-846. Measurements of pH and specific conductance will be taken in the  
29 field on unpreserved samples and documented on field records.

30 Precleaned and prelabeled sample containers will be supplied for each monitoring well and will include the  
31 appropriate preservatives. To ensure zero head space, the containers for samples analyzed for volatile  
32 organic compounds will be filled to slightly more than full before being capped. Samples typically are  
33 collected in the following order:

- 34 • Bottles with septum caps (volatiles)
- 35 • Unfiltered samples (major-ions, cyanide, semivolatiles)
- 36 • Filtered samples (metals).

37 Immediately after collection, the sample containers will be placed in sealed, insulated coolers packed with  
38 ice to cool the ambient temperature to approximately 4°C. The samples will be transported to the  
39 laboratory for arrival within sufficient time to meet holding time requirements. Field parameter record  
40 forms and approved sample analysis request forms will be attached to the sealed containers.

1 **5.5.4.3 Analytical Procedures [D-10e(4)(c)]**

2 The laboratory(ies) approved for the groundwater monitoring program will use standard laboratory  
3 procedures as listed in EPA SW-846 or an alternate equivalent. Alternate procedures, when used, will  
4 meet the guidelines of EPA SW-846, Chapter 1.0.

5 Quality control samples, e.g., field duplicates, blanks, and spiked samples, will be collected and analyzed  
6 to assess the performance of the sampling program and the analytical laboratories.

7 **5.5.4.4 Chain of Custody [D-10e(4)(d)]**

8 Chain-of-custody procedures will be followed to ensure the integrity of groundwater samples and to trace  
9 the possession and handling of the individual samples from the time of collection through laboratory  
10 analyses and data reporting.

11 Additional quality assurance and quality control methods include sample labels, sample seals, field  
12 logbooks, sample analysis request sheets, and laboratory notebooks.

13 **5.5.4.5 Additional Requirements for Compliance Point Monitoring [D-10e(4)(d)]**

14 The following sections discuss additional requirements for compliance point (downgradient) monitoring.

15 **5.5.4.5.1 Sample Frequency [D-10e(4)(e)(i)]**

16 In compliance with regulations, all wells (compliance and background) will be sampled at least  
17 semiannually during detection monitoring [WAC 173-303-645(9)(d) and 40 CFR 264.98(d)] and during  
18 the active and postclosure period of each land-based TSD unit. The default sampling requirement of  
19 taking a sequence of four samples from each well during each sampling interval will be followed, if it is  
20 appropriate for the proposed statistical evaluation method (e.g., analysis of variance procedures). In this  
21 case, these four samples will be taken at an interval that ensures, to the greatest extent technically feasible,  
22 that an independent sample is obtained. This requirement could be accomplished by reference to the  
23 uppermost aquifer's effective porosity, hydraulic conductivity, and hydraulic gradient, and the fate and  
24 transport characteristics of the potential contaminants. An alternate sampling procedure approved by  
25 Ecology will be used, if the owner/operator finds it to be protective of human health and the environment  
26 [EPA/230/02-89-042, page 2-8, WAC 173-303-656(8)(g)(ii) and 40 CFR 264.97(g)(2)]. Specific  
27 sampling requirements (frequency and/or interval) will be presented in unit-specific permit application  
28 documentation.

29 **5.5.4.5.2 Compliance Point Groundwater Quality Values [D-10e(4)(e)(ii)]**

30 The groundwater quality data obtained from the compliance point monitoring wells will be documented in  
31 a form that expresses each groundwater sampling parameter, the analytical value of the concentration in  
32 groundwater from the most recent sampling event, the analytical detection limit, and the background (for  
33 inter-well comparisons) or baseline (for intra-well comparisons) concentration limit for each parameter.  
34 Summary statistics, if needed, will be provided.

35 **5.5.4.6 Annual Determination [D-10e(4)(f)]**

36 Groundwater flow rates and flow direction within the uppermost aquifer will be determined annually for  
37 those land-based TSD units being monitored. Average horizontal flow rates and directions could be  
38 determined in several ways, e.g.: (1) movement of groundwater plumes over time; (2) in situ measurement  
39 devices (e.g., downhole flow meter); or (3) calculated from the groundwater gradient and aquifer properties  
40 using the Darcian flow theory:

41  $v_h = K_h i_h / n_e$

42 where

43  $v_h$  = the horizontal groundwater velocity

- 1  $K_h$  = the horizontal hydraulic conductivity  
2  $i_h$  = the horizontal hydraulic gradient  
3  $n_e$  = the effective porosity.

4 The value of  $K_h$  will be determined from hydraulic property investigations performed on monitoring wells.  
5 The average value of  $i_h$  at the location of each monitoring well will be calculated from the water table  
6 elevations. Effective porosities range between 10 percent and 30 percent (RHO-ST-42, p. 3-12). These  
7 data will enable the groundwater flow velocity to be determined in the vicinity of each monitoring well.

#### 8 **5.5.4.7 Statistical Determination for Detection Monitoring Program [D-10e(4)(g)]**

9 The concentrations of constituents of concern in compliance point wells will be compared with background  
10 (inter-well comparisons) or with baseline (intra-well comparisons) values semiannually to determine  
11 whether there is statistically significant evidence of contamination. Statistical methods appropriate for a  
12 final status detection monitoring program will include analysis of variance, tolerance intervals, predication  
13 intervals, control charts, test of proportions, or other statistical methods approved by Ecology  
14 [WAC 173-303-645(8)(h)]. The type of monitoring, the nature of the data, the proportions of nondetects,  
15 and temporal variation are important factors to consider when selecting appropriate statistical methods.  
16 The statistical evaluation procedures chosen will be based on the EPA guidance document, *Statistical*  
17 *Analysis of Ground-Water Monitoring Data at RCRA Facilities - Interim Final Guidance* and its  
18 addendum (EPA/530-SW-89-026 and EPA 1992) and Provisional Standard Guide for Developing  
19 Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs developed by  
20 American Society for Testing and Materials (ASTM PS64-96). Specifics will be addressed in unit-specific  
21 permit application documentation.

22 The background (or baseline values) and the statistical approach will be evaluated and updated  
23 periodically. If changes in groundwater-flow directions result in changes in definition of upgradient  
24 well(s) or changes in site conditions, background (or baseline) values will be reestablished. If statistical  
25 evaluation methods are no longer effective to achieve the objective because of changing site conditions, a  
26 new statistical approach will be proposed in the unit-specific groundwater monitoring plan.

#### 27 **5.5.4.8 Reporting**

28 The results of the statistical evaluation will be reported to Ecology in RCRA quarterly letters and annual  
29 groundwater monitoring reports. The statistical results could include a list of groundwater parameters  
30 analyzed, detection limits and background or baseline values for each parameter, and the quantified  
31 laboratory results. For a particular TSD unit, if statistically significant evidence of contamination is  
32 obtained and the owner/operator decide not to make a false-positive claim, the following steps will be  
33 taken.

- 34 • Ecology will be notified in writing within 7 days of the finding with a report indicating which indicator  
35 parameters and or constituents have shown a statistically significant increase over the background or  
36 baseline values.
- 37 • A determination will be made as to whether dangerous constituents are present, and if so, in what  
38 concentration;
- 39 • The owner/operator may resample within one month and repeat the analysis for those compounds  
40 detected in the above;
- 41 • The dangerous constituents detected either in the initial analysis or in the second confirmation analysis  
42 will form the basis for compliance monitoring.
- 43 • Within 90 days or time agreed to in writing by Ecology, a plan will be submitted to Ecology to  
44 establish a compliance monitoring program meeting the requirements of WAC 173-303-645(10) or 40  
45 CFR 264.99.

1 In case of a false-positive claim, the following will be taken:

- 2 • Notify Ecology in writing within 7 days of the finding (i.e., exceedance) and indicate that a  
3 false-positive claim will be made;
- 4 • Submit a report to Ecology within 90 days or time agreed to in writing by Ecology. This report should  
5 demonstrate that a source other than the regulated unit caused the contamination or that the  
6 contamination resulted from an error in sampling, analysis, or evaluation or natural variation in  
7 groundwater chemistry;
- 8 • Submit an application for a permit modification, if necessary, to make any appropriate changes to the  
9 detection-monitoring program within 90 days or time agreed to in writing by Ecology;
- 10 • Continue to monitor in accordance with the detection-monitoring program;
- 11 • Submit an application for a permit modification, if the detection monitoring program no longer  
12 satisfies the requirements [of WAC 173-303-645(9)], to make any appropriate changes to the program  
13 within 90 days or time agreed to in writing by Ecology.

14 Groundwater monitoring records will be retained in the Hanford Facility Operating Record as discussed in  
15 Chapter 12.0, Section 12.1.26.

## 16 **5.6 COMPLIANCE MONITORING PROGRAM [D-10f]**

17 A compliance monitoring program will be established for a land-based TSD unit if groundwater sampling  
18 during detection-level monitoring reveals statistically significant evidence of contamination (confirmed by  
19 verification sampling) at the point of compliance. In a compliance monitoring program, the monitoring  
20 objective is to determine whether groundwater protection standards have been exceeded. This is  
21 accomplished by comparing the concentration of a constituent of concern to groundwater protection  
22 standards such as maximum concentration limit and alternate concentration limit; background; or  
23 applicable, relevant, and appropriate requirements.

### 24 **5.6.1 Waste Description [D-10f(1)]**

25 Waste that could be managed by TSD units is included in the HF Part A. If required, additional  
26 information will be provided on (1) the results of any direct sampling of the waste, (2) a list of expected  
27 waste constituents, and (3) an estimate of the composition and physical properties of any immiscible fluids  
28 that could be expected to have been derived from the waste.

### 29 **5.6.2 Characterization of Contaminated Groundwater [D-10f(2)]**

30 If a compliance-level monitoring program at a given TSD unit is considered necessary, a complete  
31 characterization of groundwater will be provided in which an increase in dangerous chemicals above  
32 appropriate reference levels is indicated. In general, the characterization of groundwater could include  
33 (1) concentrations of each constituent detected in 40 CFR 264, Appendix IX, (2) concentrations of major  
34 anions and cations, and/or (3) concentrations of any other appropriate constituents [e.g., Table I of  
35 WAC 173-303-645(5)]. However, specific requirements will be proposed in unit-specific permit  
36 application documentation. Disposal of purgewater is determined by analytical results of the groundwater.  
37 If the analytical results exceed the criteria established in Attachment 5 of the HF RCRA Permit  
38 (DW Portion), the purgewater is contained. All other purgewater is returned to the ground or as specified  
39 in Attachment 5 of the HF RCRA Permit (DW Portion) and complies with Permit Condition II.F.

### 40 **5.6.3 Dangerous Constituents to be Monitored [D-10f(3)]**

41 If compliance monitoring is required, the DQO process will be used to guide the selection of constituents  
42 of concern, sampling and analysis, statistical methods, etc. If other groundwater constituents indicative of

1 migrating waste products are identified, the list of groundwater parameters will be revised to include such  
2 constituents.

#### 3 **5.6.4 Concentration Limits [D-10f(4)]**

4 With enactment of compliance-level monitoring, maximum concentration limits will be identified for  
5 applicable groundwater monitoring parameters listed in Table 1 of WAC 173-303-645, and other  
6 appropriate constituents for the specific TSD unit. Alternate concentration limits will be proposed after  
7 considering the observed concentrations of chemical constituents in the groundwater that might have been  
8 derived from the regulated unit in question. The Hanford Site groundwater background (DOE/RL-96-61),  
9 and other standards that are applicable, relevant, and appropriate requirements, will be considered when  
10 proposing an alternate concentration limit. Concentration limits will be proposed in unit-specific permit  
11 application documentation.

12 If, during compliance-level monitoring, the reference concentration limits for a given groundwater  
13 parameter or parameters are significantly exceeded, a corrective action program will be established  
14 (Section 5.7).

#### 15 **5.6.5 Groundwater Monitoring System [D-10f(6)]**

16 The compliance-level groundwater monitoring system will be designed to determine whether groundwater  
17 protection standards have been exceeded. Thus, the compliance-level groundwater monitoring system will  
18 comply with WAC 173-303-645(10) or agreement for a compliance monitoring program.

##### 19 **5.6.5.1 Description of Wells [D-10f(6)(a)]**

20 The system design will consist of those wells installed under the detection-level monitoring program and  
21 any additional wells that are determined to be required after assessing the detection efficiency of the  
22 present well network.

##### 23 **5.6.5.2 Representative Samples [D-10f(6)(b)]**

24 The compliance monitoring system will be designed to provide groundwater samples that are  
25 representative of groundwater composition at the point of compliance.

##### 26 **5.6.5.3 Location of Background Monitoring Wells that Are Not Upgradient [D-10f(6)(c)]**

27 Background groundwater composition could be based on samples from wells that are not upgradient from  
28 the TSD unit. The justification of well locations for unit background water quality is addressed in  
29 unit-specific permit application documentation.

#### 30 **5.6.6 Background Values [D-10f(7)]**

31 Background concentration values, if appropriate, will be proposed for each groundwater monitoring  
32 parameter identified for the compliance-level monitoring program. The exact sampling periods,  
33 frequencies, and statistical methods used to establish the background values will be presented in  
34 unit-specific permit application documentation. Background values will be established in conjunction with  
35 the Hanford Sitewide background study (DOE/RL-96-61). Background will be established for additional  
36 constituents identified in the Appendix IX analysis, if necessary. It is anticipated that those procedures and  
37 techniques used to establish background conditions under the final status detection-level monitoring  
38 program will be applied.

#### 39 **5.6.7 Sampling, Analysis, and Statistical Procedures [D-10f(8)]**

40 A proposed sampling and analysis plan, including procedures for sample collection, sample preservation  
41 and shipment, analytical methods, and chain-of-custody controls, will be prepared if compliance-level  
42 monitoring becomes necessary. The basic information for sample collection, sample preservation and

1 shipment, analytical methods, and chain-of-custody procedures will not likely change from the proposed  
2 plans submitted under the detection-level monitoring program (Section 5.5). To comply with  
3 WAC 173-303-645(10)(f), the compliance-level monitoring wells will be sampled at least semiannually for  
4 the specified groundwater parameters and waste constituents. If verified groundwater monitoring results  
5 indicate that appropriate groundwater protection standards (e.g., maximum concentration limit or alternate  
6 concentration limit; or applicable, relevant, and appropriate requirements) are exceeded at any monitoring  
7 well along the line of compliance, written notification will be made to Ecology within 7 days of the  
8 finding. An application for a permit modification to establish a corrective action program (Section 5.7)  
9 will be submitted within 90 days [WAC 173-303-645(10)(g)] or time agreed to in writing by Ecology. In  
10 the case of a false positive claim, the owner/operator will notify Ecology within 7 days in accordance with  
11 WAC 173-303-645(10)(i).

#### 12 **5.6.7.1 Sample Collection [D-10f(8)(a)]**

13 This information will not likely change from the proposed plans submitted under the detection-level  
14 monitoring program (Section 5.5.4). The number of samples collected will be specified in the unit-specific  
15 documentation (e.g., groundwater monitoring plan).

#### 16 **5.6.7.2 Additional Requirements for Compliance Point Monitoring [D-10f(8)(e)]**

17 Under compliance monitoring, additional activities will be conducted, if necessary, to provide a more  
18 protective monitoring program.

##### 19 **5.6.7.2.1 Sample Frequency [D-10f(8)(e)(I)]**

20 Under compliance monitoring, downgradient compliance wells will be sampled semiannually  
21 [WAC 173-303-645(10)(f)].

##### 22 **5.6.7.2.2 Compliance Point Groundwater Quality Values [D-10f(8)(e)(iii)]**

23 Analytical groundwater quality data will be prepared in an appropriate form for full statistical analysis.  
24 These data will exist primarily in tabular form and will consist of raw data from each individual sample  
25 obtained during each sampling event. The presentation of the statistical evaluation of the data will depend  
26 on the monitoring objectives (Section 5.6.4).

#### 27 **5.6.7.3 Annual Determination of Hydraulic Gradient [D-10f(8)(f)]**

28 Under compliance monitoring, the hydraulic gradient will be determined annually and the efficiency of the  
29 monitoring well network will be addressed. If warranted, additional monitoring wells will be installed.

#### 30 **5.6.7.4 Statistical Determination for Compliance Monitoring Program [D-10f(8)(g)]**

31 Statistical evaluation of groundwater monitoring data will comply with requirements set forth in the  
32 WAC 173-303-645 (8)(h) final status regulations. Procedures outlined in the following EPA technical  
33 guidance documents will be followed:

- 34 • *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Interim Final Guidance*  
35 *(EPA/530-SW-89-026)*
- 36 • *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Draft Addendum to Interim*  
37 *Final Guidance (EPA 1992).*
- 38 • *Provisional Standard Guide for Developing Appropriate Statistical Approaches for Ground-Water*  
39 *Detection Monitoring Programs (ASTM PS64-96).*

40 For a compliance-level groundwater monitoring program, the choice of an appropriate statistical method  
41 depends on the type of groundwater concentration limit and whether the compliance well exceeds the  
42 concentration limit. Appropriate statistical methods include, but are not limited to, tolerance limit,

1 prediction limit, and the Combined Shewhart-CUSUM control chart. Specifics will be proposed in  
2 unit-specific groundwater monitoring documentation (e.g., groundwater monitoring plan).

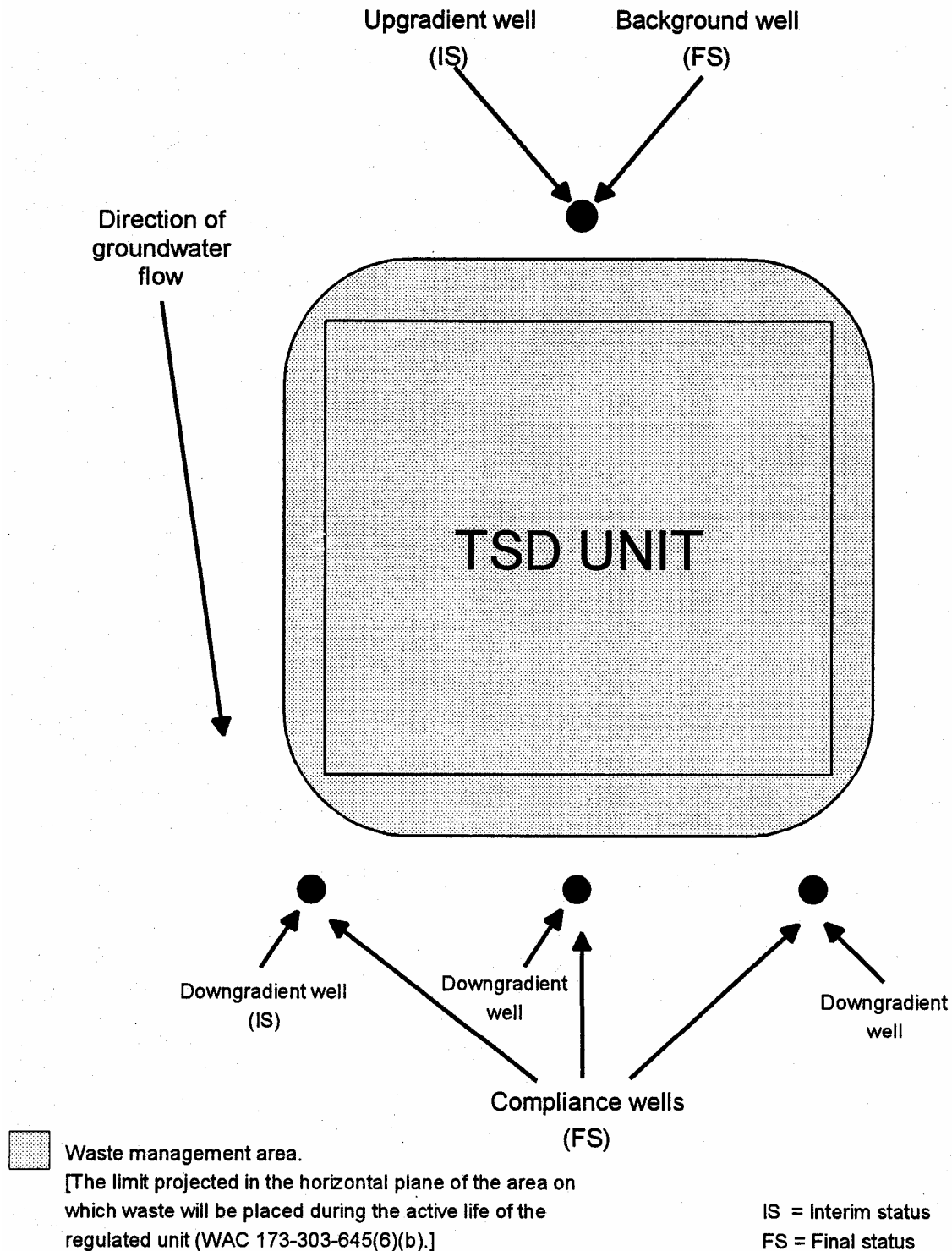
3 Groundwater monitoring records will be retained in the Hanford Facility Operating Record as discussed in  
4 Chapter 12.0, Section 12.1.26.

#### 5 **5.7 CORRECTIVE ACTION PROGRAM [D-10g]**

6 If, at the point of compliance, dangerous constituents are measured in the groundwater at concentrations  
7 that exceed accepted groundwater protection standards, sufficient data, supporting information, and  
8 analyses will be provided to establish a corrective action program.

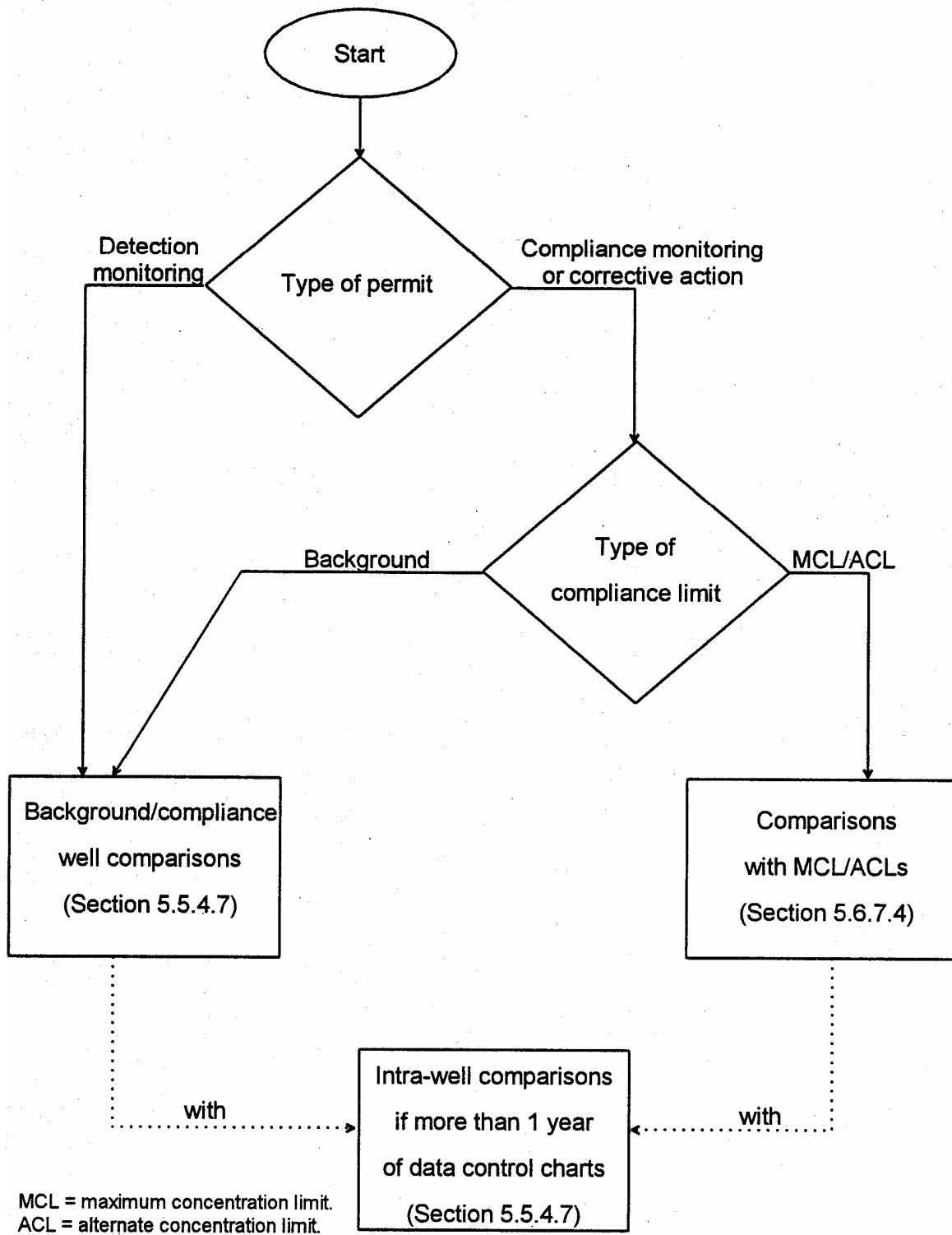
9 A description of the groundwater monitoring plan that will be used to assess the effectiveness of the  
10 corrective action measures will be submitted. This groundwater monitoring plan could be similar in scope  
11 to a compliance-level monitoring program developed under Section 5.6 and will include all relevant  
12 information pertaining to the location and description of monitoring wells, groundwater sampling and  
13 analysis plans, statistical methods, and quality assurance and quality control procedures  
14 [WAC 173-303-645(11)(d)].

15 The concentrations established in the Hanford Sitewide background study, in conjunction with local  
16 background concentrations and applicable risk-based standards, will determine groundwater protection  
17 standards for each land-based TSD unit. This will reduce the time and costs currently being expended for  
18 sampling unit-specific background wells, and will further benefit cleanup efforts by the uniform  
19 application of cleanup standards across the Hanford Site. The Hanford Sitewide groundwater background  
20 study is discussed in DOE/RL-96-61.

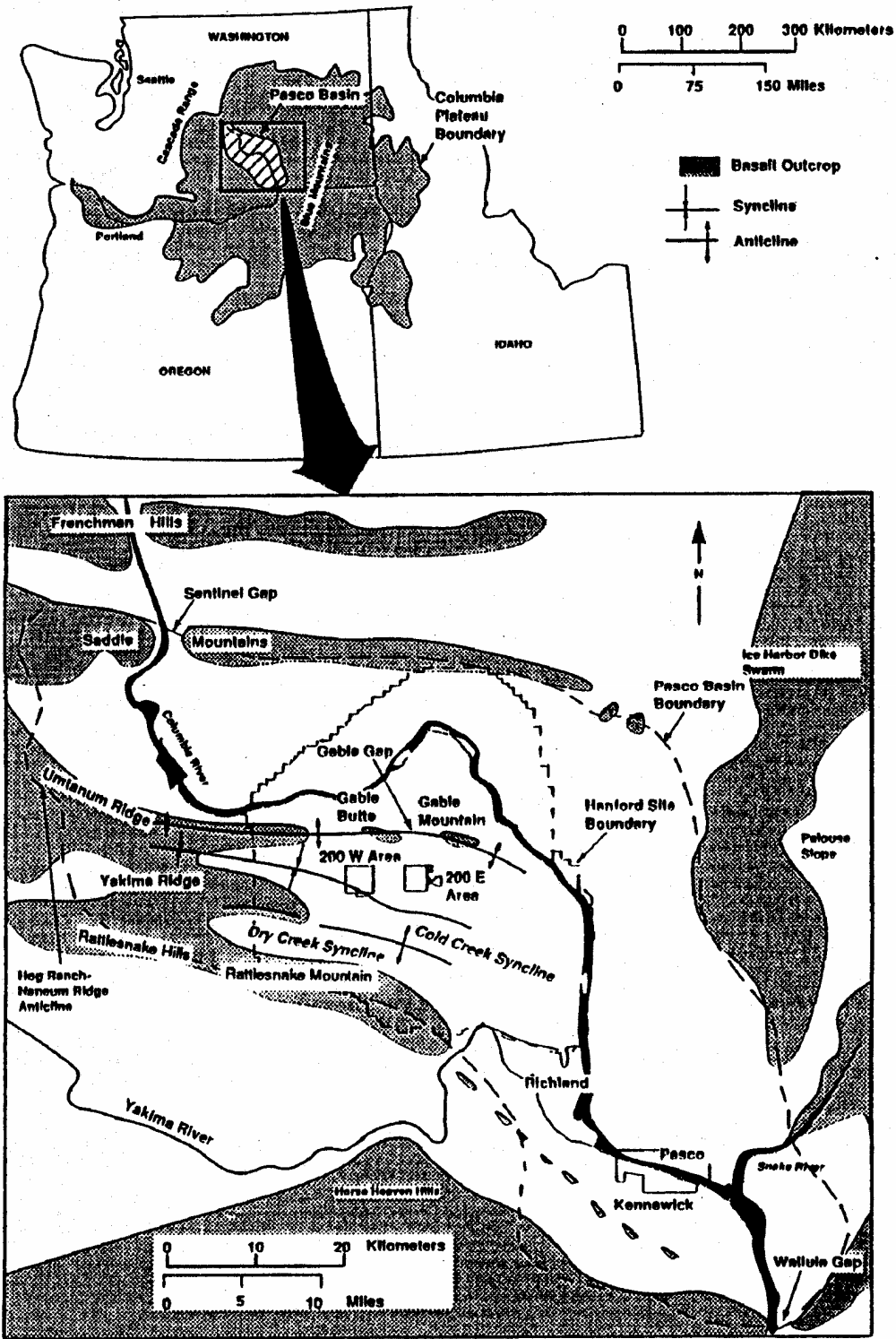


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3 Figure 5-1. Generalized Configuration for a Detection Monitoring Groundwater Well System.



1  
2 Figure 5-2. Flow Chart for Selection of Appropriate Statistical Method Used for Data Interpretation.



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Figure 5-3. Location of Bounding Structures of the Pasco Basin.

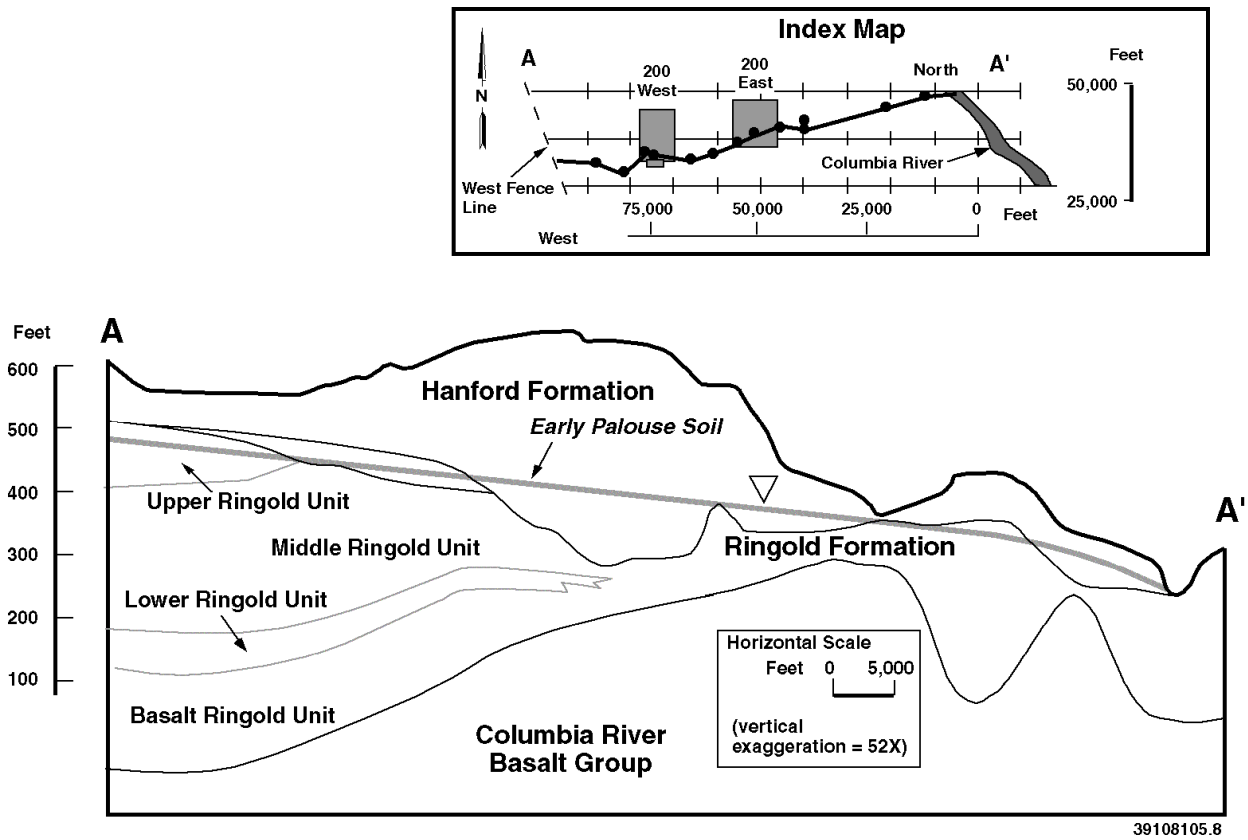
Period	Epoch	Group	Subgroup	Formation	K-Ar Age Years x 10 <sup>6</sup>	Member (Formal and Informal)	Sediment Stratigraphy or Basalt Flows					
QUATERNARY	Pleistocene	Columbia River Basalt Group	Yakima Basalt Subgroup	Saddle Mountains Basalt	Hanford	Surtidal Units	Loess Sand Dunes Alluvium and Alluvial Fans Land Slides Talus Colluvium					
						Touchat beds						
	Pasco gravels											
	Five informal facies					Plio-Pleistocene unit subdivision 3						
						subdivision 2						
						subdivision 1						
	TERTIARY					Miocene	Columbia River Basalt Group	Yakima Basalt Subgroup	Saddle Mountains Basalt	Ringold	8.5 Ice Harbor Member	basalt of Goose Island basalt of Martindale basalt of Basin City
											10.5 Elephant Mountain Member	Levey Interbed basalt of Ward Gap basalt of Elephant Mountain
											12.0 Pomona Member	Rattlesnake Ridge interbed basalt of Pomona
											Esquatzel Member	Selah interbed basalt of Gable Mountain
13.5 Asotin Member		Cold Creek interbed basalt of Huntzinger										
Wilbur Creek Member		basalt of Lapwai basalt of Wahluke										
Umatilla Member		basalt of Sillusi basalt of Umatilla										
14.5		Mabton interbed										

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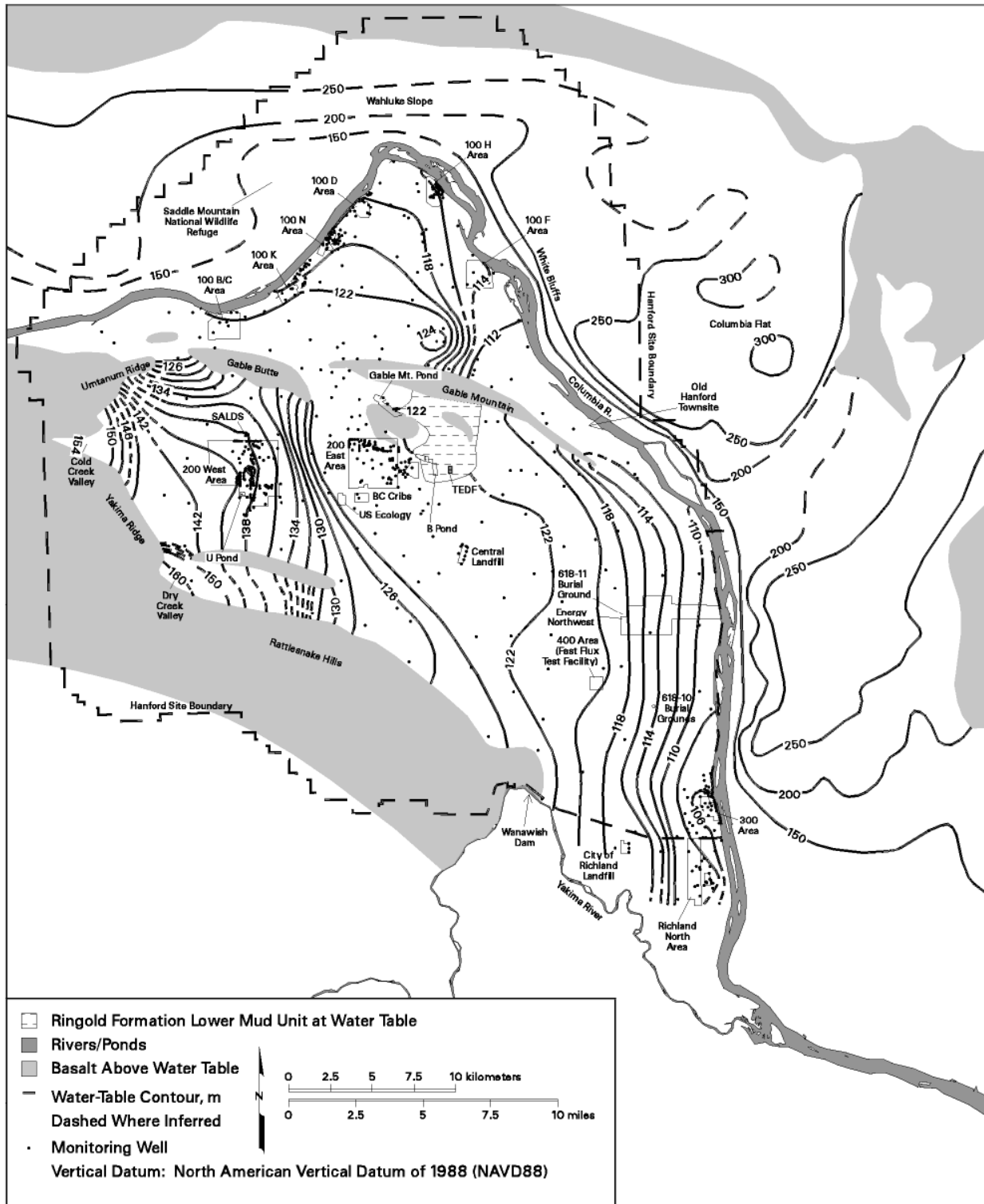
3 Figure 5-4. Generalized Stratigraphic Column of Formations at the Hanford Site.



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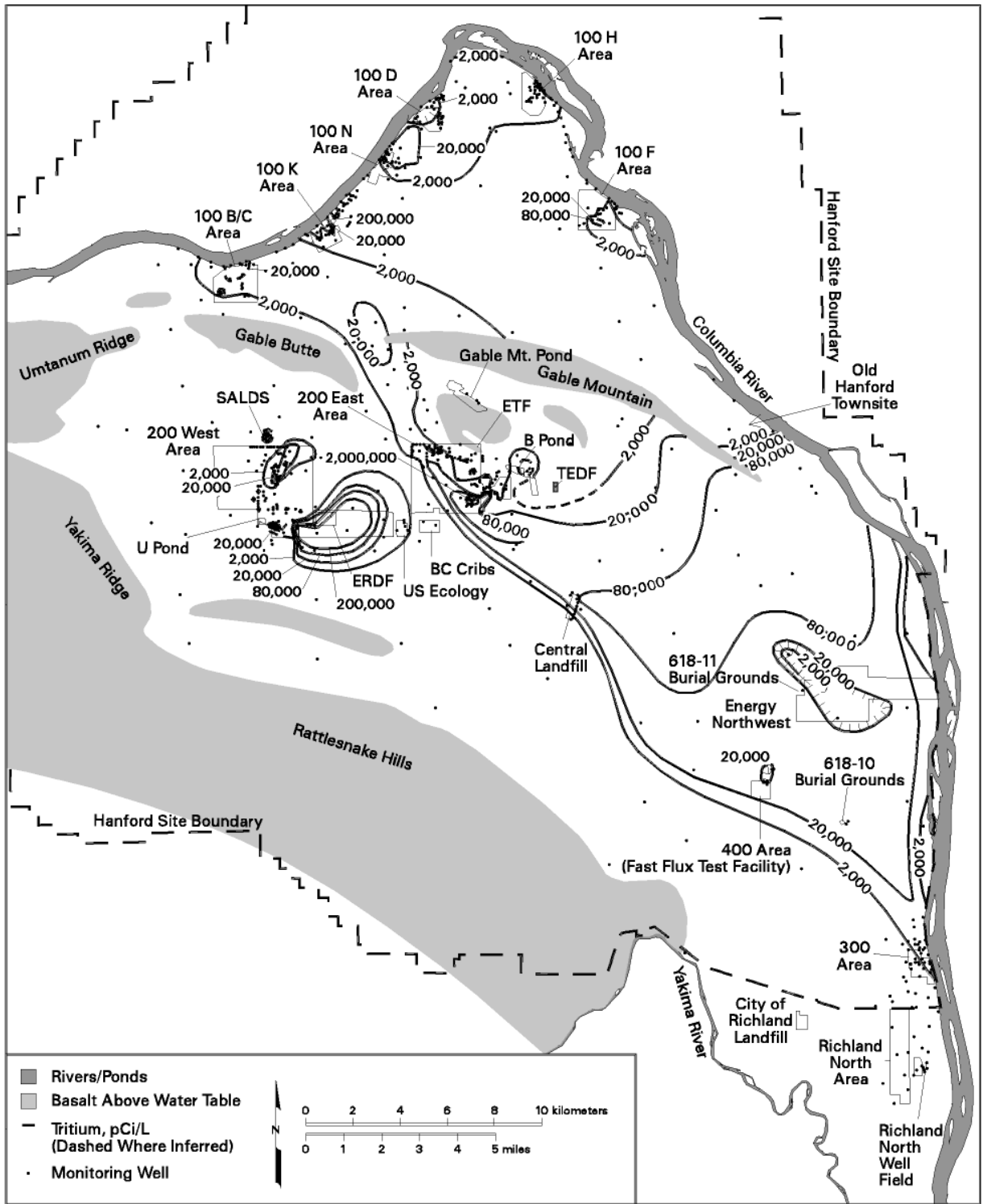
3 Figure 5-5. Generalized Geologic Cross-Section Through the Hanford Site (RHO-ST-23).



1

2

Figure 5-6. Water Table Map of the Hanford Site.



1

2 Figure 5-7. Distribution of Tritium on the Hanford Site (PNNL-13116).

1 **Chapter 6.0** **Procedures to Prevent Hazards**

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1 **6.0 PROCEDURES TO PREVENT HAZARDS [F]**

2 This chapter addresses the provisions of Section F of Ecology's permit application guidance  
3 (Ecology 1996), and includes the following topics:

- 4 • Security
- 5 • Inspection schedule
- 6 • Preparedness and prevention requirements
- 7 • Preventive procedures, structures, and equipment
- 8 • Prevention of reaction of ignitable, reactive, and/or incompatible wastes.

9 Also addressed are provisions contained in Hanford Facility RCRA Permit (Permit) Conditions II.M,  
10 Security and II.O, General Inspection Requirements. Procedures to prevent hazards for individual TSD  
11 units are included in the unit-specific documentation.

12 **6.1 SECURITY [F-1]**

13 The following sections describe the security measures, equipment, and warning signs used to control entry  
14 to the Hanford Facility and to meet Permit Condition II.M. Security information for individual TSD units  
15 is provided in the unit-specific documentation.

16 **6.1.1 Security Procedures and Equipment [F-1a]**

17 This section describes the 24-hour surveillance system, warning signs, and barriers used to provide security  
18 and control access to the Hanford Facility. WAC 173-303-310(2)(b), a 24-hour surveillance system, or  
19 WAC 173-303-310(2)(c), artificial or natural barriers, are met at the Hanford Facility level and are not the  
20 responsibility of the TSD unit. Operating TSD units contained in Part III of the Permit may be required to  
21 comply with requirements in WAC 173-303-310(2)(c) based on established Part III Permit Conditions. A  
22 24-hour surveillance system, warning signs, and artificial and natural barriers are used to provide security  
23 and control access to the Hanford Facility. The entire Hanford Facility is a controlled access area. The  
24 Hanford Facility maintains around-the-clock surveillance for protection of government property, classified  
25 information, and special nuclear materials. The Hanford Patrol maintains a continuous presence of  
26 protective force personnel to provide additional security.

27 The majority of TSD units are located within, or near, the 200 Areas (refer to Hanford Facility Part A,  
28 DOE/RL-88-21). Vehicular access to roads leading to these areas is through controlled access points at the  
29 Yakima, Wye, and Rattlesnake Barricades (refer to DOE/RL-91-28, Chapter 2.0, Figure 2.9 and  
30 Appendix 2A, Location Maps), which are posted with restrictive signage. Perimeter fences, restrictive  
31 signage, and random protective force patrols are used to control access to the 300 Area. All personnel  
32 accessing locations on the Hanford Site (except for publicly accessible locations) must possess and display  
33 a U.S. DOE issued security identification badge indicating the appropriate authorization. All personnel  
34 entering or exiting the Hanford Site are subject to random security badge inspections by protective force  
35 personnel to validate access authorization. All vehicles and hand-carried items entering or exiting the  
36 Hanford Site are subject to random security badge inspections and searches by protective force personnel  
37 to validate access authorization and preclude the unauthorized introduction of prohibited/controlled  
38 articles, or the unauthorized removal of government or contractor assets. Additional means to bar entry or  
39 control access (e.g., fences, locked entry doors) are discussed in the unit-specific portion.

40 Operating TSD units in Part III of the Permit must comply with the requirements found in  
41 WAC 173-303-310(2)(a) regarding the placement of signs. Security information for operating TSD units  
42 regarding the placement of signs is provided in the unit-specific portion. Security information for non-  
43 operating TSD units incorporated into Part III, Part V, or Part VI of the Permit regarding the placement of

1 signs is determined on a case-by-case basis. Security information for non-operating TSD units may be  
2 documented in the unit-specific portion as appropriate.

3 Signs are, or will be, posted at area boundaries within the Hanford Site stating *NO TRESPASSING.*  
4 *SECURITY BADGES REQUIRED BEYOND THIS POINT. AUTHORIZED VEHICLES ONLY. PUBLIC*  
5 *ACCESS PROHIBITED* (or an equivalent legend). In addition, warning signs stating  
6 *DANGER--UNAUTHORIZED PERSONNEL KEEP OUT* (or an equivalent legend) are, or will be, posted  
7 at operating TSD units or at active portions of operating TSD units within the Hanford Facility. These  
8 signs are, or will be, written in English, legible from a distance of 7.6 meters, and visible from all angles of  
9 approach.

#### 10 **6.1.2 Waiver [F-1b]**

11 Waivers of the security procedures and equipment requirements for the Hanford Facility currently are not  
12 requested.

### 13 **6.2 INSPECTION SCHEDULE [F-2]**

14 This section addresses the general inspection requirements for the Hanford Facility. The TSD unit-specific  
15 inspection activities are addressed in the unit-specific documentation.

#### 16 **6.2.1 General Inspection Requirements [F-2a]**

17 General inspection requirements for the Hanford Facility are specified in Permit Condition II.O. This  
18 condition requires the following:

- 19 • Facility inspections to be conducted in accordance with the provisions of WAC 173-303-320(2)
- 20 • Inspections of the 100, 200 East, 200 West, 300, and 400 Areas to be conducted annually
- 21 • Inspection of the banks of the Columbia River, contained within the Hanford Facility boundary, to be  
22 conducted two times per year (i.e., one at the low water mark of the year, and one at a time chosen by  
23 the Permittees)
- 24 • Visual inspection for malfunctions, deterioration, operator errors, and discharges that might cause or  
25 lead to the release of dangerous waste constituents to the environment or that threaten human health
- 26 • Notification to Ecology at least 7 days before conducting these inspections to allow Ecology  
27 representatives to be present during the inspection
- 28 • Remedial action to be taken, if required, in accordance with a schedule agreed to by Ecology.

#### 29 **6.2.2 Inspection Log [F-2b]**

30 Documentation of the inspections conducted in accordance with Permit Condition II.O is placed in the  
31 Hanford Facility Operating Record, General Information File (refer to §12.1.30).

#### 32 **6.2.3 Schedule for Remedial Action for Problems Revealed [F-2c]**

33 In accordance with Permit Condition II.O, remedial action schedules will be developed for any problems  
34 discovered during a Hanford Facility inspection. These schedules will be agreed to by Ecology.

1 **6.2.4 Specific Process or Waste Type Inspection Requirements [F-2d]**

2 As noted in the Hanford Facility Part A (DOE/RL-88-21), the Hanford Facility includes TSD units with  
3 container handling capabilities, tank systems, surface impoundments, containment buildings, landfills,  
4 waste piles, and miscellaneous units. Inspections requirements for each of the TSD units are addressed in  
5 the unit-specific documentation.

6 **6.3 PREPAREDNESS AND PREVENTION REQUIREMENTS [F-3]**

7 The emergency preparedness and prevention measures taken for the Hanford Facility are described in this  
8 section. Most of the Hanford Facility 'final status operating' TSD units are equipped with internal  
9 communication systems to relay emergency or other information to unit personnel. The internal  
10 communication systems include telephones, various alarm systems, and hand-held or vehicle two-way  
11 radios. Alarm systems exist at various locations throughout the Hanford Facility to allow personnel to  
12 respond appropriately to various emergencies, including the following: building evacuations, take-cover  
13 events, and fire and/or explosion. Telephones are located throughout the Hanford Facility and provide  
14 both internal and external communication. In addition, the following external communication systems are  
15 available for notifying persons assigned to emergency response organizations:

- 16 • Fire alarm pull boxes and fire sprinkler flow monitoring devices – connected to a system monitored  
17 around the clock by the Hanford Fire Department
- 18 • Emergency telephone numbers 911 (or 375-2400 for PNNL facilities) – on notification, the Hanford  
19 Patrol Operations Center notifies and/or dispatches required emergency responders
- 20 • Crash alarm telephone system – consists of selected telephones that are disassociated from the regular  
21 system and are connected automatically to control stations
- 22 • Two-way radio system – consists of hand-held or vehicle radios; the system accesses the Hanford  
23 Facility emergency network and can summon the Hanford Fire Department, Hanford Patrol, and/or any  
24 other assistance needed to deal with emergencies.

25 **6.3.1 Equipment Requirements [F-3a]**

26 Equipment requirements are listed in Permit Attachment 4. Unit-specific equipment requirements are  
27 listed in the unit-specific documentation.

28 **6.3.2 Aisle Space Requirement [F-3b]**

29 Aisle space requirements for 'final status operating' TSD units are addressed in the unit-specific  
30 documentation.

31 **6.4 PREVENTIVE PROCEDURES, STRUCTURES, AND EQUIPMENT [F-4]**

32 Preventive procedures are in place to ensure that unloading activities are conducted in a safe manner and  
33 that run-off of liquid, if spilled during waste unloading operations, is contained and disposed of properly.  
34 In those areas of TSD units where significant risk of exposure to dangerous and/or mixed waste exists,  
35 personnel are required to wear protective suits and/or respiratory devices, depending on the specific  
36 hazard. Provisions are in place at specific TSD units to ensure that backup power is provided for  
37 equipment critical to operations. Preventive measures information specific to TSD units is contained in the  
38 unit-specific documentation.

1 Description of actions designed to control and mitigate effects to human health and the environment for  
2 any spill or release between TSD unit boundaries (i.e., onsite transportation) are described in Permit  
3 Attachment 4, and where appropriate in the unit-specific documentation.

4 **6.5 PREVENTION OF REACTION OF IGNITABLE, REACTIVE, AND/OR INCOMPATIBLE**  
5 **WASTES [F-5]**

6 Procedures and precautions to prevent the reaction of ignitable and reactive waste, and the management of  
7 incompatible waste, at final status operating TSD units are described in the unit-specific documentation.

1 **Chapter 7.0** **Contingency Plan**

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2 7.0 CONTINGENCY PLAN [G]..... 7.1  
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## 7.0 CONTINGENCY PLAN [G]

2 The WAC 173-303 requirements for a contingency plan are satisfied by portions of the *Hanford*  
3 *Emergency Management Plan* [Hanford Facility RCRA Permit(Permit) Attachment 4], together with  
4 TSD unit-specific documentation established to meet contingency plan requirements. TSD unit-specific  
5 contingency plan documentation is contained in the unit-specific documentation. In other cases, unit-  
6 specific contingency documentation could be contained in the Hanford Facility operating record.

7 *The Hanford Emergency Management Plan* includes description of actions pertaining to certain releases of  
8 hazardous substances as defined in WAC 173-303-040. Releases of hazardous substances that threaten  
9 human health and the environment resulting from transportation activities occurring on the Hanford  
10 Facility are subject to the Permit (refer to Permit Condition II.A. and to Permit Attachment 3, Permit  
11 Applicability Matrix).

12 A matrix describing which portions of the *Hanford Emergency Management Plan* meet contingency  
13 planning requirements is included as an appendix to the *Hanford Emergency Management Plan*. A matrix  
14 will also be included for 'final status operating' units, as necessary, in the TSD unit-specific documentation.

15 The emergency preparedness documentation approach described above will also be used for dangerous and  
16 mixed waste management activities subject to WAC 173-303-350 at the Hanford Facility.

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