AR TARGET SHEET

The following document was too large to scan as one unit, therefore, it has been broken down into sections.

EDMC#:	0064545
SECTION:	1 OF 3
DOCUMENT #:	05-AMCP-0230
TITLE:	Transmittal of Proposed Plan for 200-UW-1 OU, Rev 000, FFS for 200-UW-1 OU, Rev 000, and Comment Resolution Table for FFS for 200-UW-1

0064545
part 1/3

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

APR 8 2005

05-AMCP-0230

Mr. Nicholas Ceto, Program Manager
Office of Environmental Cleanup
Hanford Project Office
U.S. Environmental Protection Agency
309 Bradley Blvd., Suite 115
Mail Stop B1-46
Richland, Washington 99352

RECEIVED
APR 21 2005
EDMC

Dear Mr. Ceto:

TRANSMITTAL OF THE PROPOSED PLAN FOR THE 200-UW-1 OPERABLE UNIT, REVISION 0, THE FOCUSED FEASIBILITY STUDY FOR THE 200-UW-1 OPERABLE UNIT, REVISION 0, AND THE COMMENT RESOLUTION TABLE FOR THE FOCUSED FEASIBILITY STUDY FOR THE 200-UW-1 OPERABLE UNIT

Enclosed are the Proposed Plan for the 200-UW-1 Operable Unit, DOE/RL-2003-24, Revision 0 (Enclosure 1), the Focused Feasibility Study for the 200-UW-1 Operable Unit, Revision 0 (Enclosure 2), and the Comment Resolution Table for the Focused Feasibility Study for the 200-UW-1 Operable Unit (Enclosure 3).

Comments received from the State of Washington Department of Ecology (Ecology) and the U.S. Environmental Protection Agency technical staff on Draft C of the Proposed Plan and Draft C of the Focused Feasibility Study are reflected in the enclosed documents. Resolution of comments is currently being confirmed in a series of workshops and follow-on communication with the U.S. Department of Energy, Richland Operations Office and Ecology technical and legal staff.

In the interest of expediting concurrence on the document, as well as starting the public review by May 2, 2005, the enclosed documents are being transmitted to you for final comment and concurrence. Issues that require legal or regulatory evaluation will be reviewed with the appropriate staff prior to final document submittal to the regulatory agencies.

In accordance with the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement), Section 9.0, Documentation and Records, we are requesting EPA concurrence within 30 days of receipt and your approval to begin the public comment period.

If you have questions, please contact me, or your staff may contact Matt McCormick, Assistant Manager for the Central Plateau, on (509) 373-9971.

Sincerely,

Keith A. Klein
Manager

AMCP:FMR

Enclosures

cc w/encls:
D. Bartus, EPA
L. J. Cusack, Ecology
T. Martin, HAB
Administrative Record

cc w/o encls:
G. Bohnee, NPT
R. C. Brunke, FHI
L. D. Crass, FHI
L. G. Dusek, FHI
R. H. Gurske, FHI
S. Harris, CTUIR
J. S. Hertzel, FHI
R. J. Jackson, FHI
R. Jim, YN
M. B. Lackey, FHI
E. J. Murphy-Fitch, FHI
K. Niles, ODOE
M. E. Todd-Robertson, FHI
W. E. Toebe, FHI

200-UW-1 OU

DOCUMENT REVIEW, COMMENT, RESOLUTION LIST

DOCUMENT TITLE: Focused Feasibility Study for the 200-UW-1 Operable Unit, DOE/RL-2003-23, Draft C Regulatory Review.			
Reviewer: Ecology		Date: 31 Jan 05	Company: Washington State Dept of Ecology
Index	**Reference**	**Comment**	**Comment Resolution**
1.	Global	This document precedes Ecology's requirement that COPC lists be generated on the basis of analytical methods. Due to this circumstance and the comments given below, this document shall not be used as a template for other FS documents for the 200 Area OUs.	**Comment Noted.** No action required for this FFS.
2.	Section 1.4, Page 1-6	Change text to read: "The Tri-Party Agreement addresses the need for the cleanup programs to integrate the requirements of CERCLA and RCRA, to provide a standard approach to direct cleanup activities in a consistent manner, and to ensure that applicable regulatory requirements are met. Details of this integration are provided in Article IV and Section 5.5 of the Tri-Party Agreement. Additionally, DOE/RL-98-28 provides a discussion on integration for the Central Plateau. Integration of CPP and RPP, and a RCRA TSD sites in this FFS streamlines the evaluation of remedial alternatives and provides a consistent approach for reaching and implementing remedial decisions, while satisfying the requirements of the different regulations. The 216-U-12 Crib, a TSD unit under RCRA, is incorporated into this FFS. The RCRA closure plan requirements for this TSD unit are identified in Table 1-2. The ~~analysis of the~~ closure activities ~~options~~ for the TSD unit are based on documentation ~~will be documented through the alternatives analysis~~ found in this FFS, ~~and the~~ PP, and the administrative record. Ecology is ~~will separately issue~~ issuing a draft permit modification for incorporation of the 216-U-12 Crib into the *Hanford Facility RCRA Permit*. ~~The modification would consist of two additions: a chapter in Part V, Unit Specific Conditions for Units Undergoing Closure, of the *Hanford*~~	**Comment Accepted.**

200-UW-1 OU

DOCUMENT REVIEW, COMMENT, RESOLUTION LIST

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Reviewer: Ecology		Date: 31 Jan 05	Company: Washington State Dept of Ecology
Index	**Reference**	**Comment**	**Comment Resolution**
		~~*Facility RCRA Permit* and an attachment~~. ~~The Part V chapter would~~ will identify all permit requirements for the TSD unit and is consistent with the CERCLA ROD. ~~The attachment would consist of the enforceable sections from applicable CERCLA documents, or other supporting documents, that correspond to specific RCRA TSD closure plan requirements. The permit conditions in the Part V chapter and the attachment would become an enforceable part of the permit. Changes to the chapter and attachment would be subject to the permit modification process.~~ Information supporting the closure of the 216-U-12 Crib TSD unit is included in this FFS, the PP, or other ~~existing~~ administrative record documents. Table 1-2 provides a crosswalk between the information required in a RCRA closure plan ~~information~~ and the location of the information in the applicable CERCLA document."	
3.	Page 1-12, Table 1-2, Row 2	Reference to FFS Chapter 2, Section 2.5.1.2 should be corrected to reference Section 2.5.1.3.	**Comment Accepted.**
4.	Page 1-12, Table 1-2, Row 5	Ecology would like to see the information in DOE/RL-2000-60, Section 3.4.1, moved into the FFS and this reference deleted.	**Comment Noted.** Per discussions in the PP, this reference has been deleted from this table. Other referenced documents contain the necessary information. As such, additional text is not required in the FFS.
5.	Page 1-12, Table 1-2, Row 7	Change text to read: "Closure actions and requirements described in FFS Chapters 5.0 through 7.0."	**Comment Accepted.**
6.	Page 1-12, Table 1-2, Row 8	Since the 216-U-12 crib will not be clean closed, delete the text: "if needed when clean closure is not achieved."	**Comment Accepted.**
7.	Section 2.5, Page 2-16, Line 33	Delete the text "many source" and insert "multiple waste."	**Comment Accepted.**
8.	Section 2.5, Page 2-17, Line 1	Change text to read: "… representative sites are ~~extended to~~ then ~~apply~~ applied to other waste …"	**Comment Accepted.**
9.	Section 2.5, Page 2-17, Line 4	Change "can" to "will."	**Comment Accepted.**

200-UW-1 OU

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Reviewer: Ecology		Date: 31 Jan 05	Company: Washington State Dept of Ecology
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10.	Section 2.5, Page 2-17, Lines 8 and 9	Change text to read: "...on the ~~evaluation~~ investigation of the representative sites. Confirmation sampling of the analogous sites after remedy selection ~~may~~ will be required and is built into the remedial design planning to demonstrate~~s~~ ..."	**Comment Accepted with Modification.** The text will be revised to read "investigation." However, the confirmation sampling requirements should remain "may" as not all waste sites will undergo confirmatory sampling per the current SAP. An example of this is the 2607-W7 Septic System and the RTD waste sites that are not identified for confirmatory sampling. RTD for example will undergo observational approach and verification sampling in the future.
11.	Section 2.5, Page 2-17, Line 20	Change text to read: "...at representative sites, ~~which include~~ a contaminant distribution model, and risk assessment, are..."	**Comment Accepted.**
12.	Section 2.5.1.1, Page 2-18, Lines 22 through 27	This text describes the UPR-200-W-19 and should be moved to Section 2.5.1.5.	**Comment Accepted.**
13.	Section 2.5.1.1, Page 2-18, Line 33	Replace "placed" with either "drilled" or "installed"	**Comment Accepted.**
14.	Section 2.5.1.3, Page 2-19	Provide a figure showing the crib dimensions and a cross-sectional view of construction. Identify materials of construction.	**Comment Accepted.** A figure will be added showing details of the crib construction and dimensions.
15.	Section 2.5.1.3, Page 2-19, Lines 23 through 29	Add a reference to Plate 1 (located in a pocket at the end of the FFS)	**Comment Accepted.**
16.	Section 2.5.1.3, Page 2-20, Lines 15 through 17	Add text explaining why the 216-U-12 Crib needed a vent riser.	**Comment Noted.** It is assumed that the risers were set within the gravel beds and served to vent the void space. Air was displaced by the liquid influent, however, no specific document reference was found. Due to lack of document reference, no change will be made to the text.
17.	Section 2.5.1.3, Page 2-20, Line 24	Add text explaining why the 216-U-12 Crib is no longer in the 200-PW-2 OU and how it was added to the 200-UW-1 OU.	**Comment Accepted with Modification.** Explanatory text detailing the establishment of the 200-UW-1 OU is already provided in Section 1.0, page 1-2. The referenced text in Section 2.5.1.3 will be updated to remove the reference to 200-PW-2.

200-UW-1 OU

DOCUMENT REVIEW, COMMENT, RESOLUTION LIST

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Reviewer: Ecology		Date: 31 Jan 05	Company: Washington State Dept of Ecology
Index	**Reference**	**Comment**	**Comment Resolution**
18.	Section 2.5.1.5, Page 2-21	This text is not consistent with the description of the UPR-200-W-19 provided on page 2-18 lines 22 through 27. The description on page 2-18 states that "the area was surface stabilized by scraping the contaminated soil and consolidating it near the 241-U-361 Settling Tank ...." Delete contradictory text on page 2-18 and ensure Section 2.5.1.5 is accurate.	**Comment Accepted.** The text of Section 2.5.1.5 is consistent with the source document WHC-SD-DD-TI-063. The text on page 2-18 will be revised for consistency.
19.	Section 2.5.2, Page 2-22, Line 15	Delete "the 216-U-1 and 216-U-2 Cribs and"; they were already listed in Section 2.5.1.	**Comment Accepted.**
20.	Section 2.5.2, Page 2-22	Modify text to read: "Along with the collection of surface and subsurface samples, radionuclide logging using the radionuclide logging system (RLS) was performed at several boreholes at selected sites. Contaminants detected with the RLS generally correlate well with data from sediment samples analyzed in the laboratory. Discrepancies in results between the ~~two analysis techniques~~ RLS and laboratory analysis are likely ~~are~~ the result of differences in the methods ~~used. Samples collected for laboratory analysis typically are high graded (e.g., large particle sizes are removed from the sample, resulting in a concentrated sample). Chemical sampling is not always representative of the entire borehole, because a limited number of samples are collected compared to the RLS, which monitors continuously.~~ Results from the RLS are biased, because inputs to the detector are averaged values 0.6 m (2 ft) above and below the tool. This represents an interval generally larger than the sediment sample interval."	**Comment Accepted.**
21.	Section 2.5.2.1, Page 2-22, Line 31	Delete "for this LFI"	**Comment Accepted.**
22.	Section 2.5.2.1, Page 2-22, Line 40	"receives" should be changed to "received"	**Comment Accepted.**

200-UW-1 OU

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Reviewer: Ecology		Date: 31 Jan 05	Company: Washington State Dept of Ecology
Index	**Reference**	**Comment**	**Comment Resolution**
23.	Section 2.5.2.2, Page 2-23, Lines 17 through 20	Provide additional description of the "camera survey". Clarify – were 14 surface and 14 subsurface soil samples collected, or a total of 14 samples?	**Comment Accepted.**
24.	Section 2.5.2.3, Page 2-24	This section is confusing. Rewrite and provide more detail about the LFI and any RLS conducted at the site.	**Comment Accepted.**
25.	Section 2.5.2.6, Page 2-25, Lines 24 and 25	This sentence is confusing. Clarify – was the integrity investigation (assessment?) conducted on the VCP or a different pipeline?	**Comment Accepted.**
26.	Section 2.5.3, Page 2-25, Lines 36 through 38	Add text to clarify: How was the decay calculated (i.e., what was the starting time)? What was the starting value for the decay calculations? Was the maximum concentration used as a starting value or an average? Provide a reference to this information.	**Comment Accepted with Modification.** The decay calculations are discussed in Appendix C. A reference to the appropriate section of Appendix C will be added.
27.	Section 2.5.3.1, Page 2-27, Line 3	Are borehole numbers incorrect? Should they be 299-W19-95 and 299-W19-97? If so, correct; if not, explain when and where these boreholes were drilled.	**Comment Accepted.** The borehole numbers will be revised to 299-W-19-95 and 299-W19-97.
28.	Section 2.5.3.1, Page 2-27, Lines 10 and 11	Provide text explaining what pipeline was surveyed, where it is located, and what it connects. Is this pipeline included in this OU? If not, where will it be addressed? Line 16 states that "The exterior of the pipe as well as the surrounding soil showed no radiological activity." Add an explanation as to how an in-line camera survey would take these measurements.	**Comment Accepted.**
29.	Section 2.5.3.2, Page 2-27, Lines 29 through 36	Add the following information: the borehole number; the total depth of the borehole; Line 31 states that "Elevated levels of contamination extended ...." Include a list of contaminants.	**Comment Accepted.**
30.	Section 2.5.3.2, Page 2-28, Lines 23 through 30	Add text to clarify: Is 197 ft the total depth of the borehole? Has Sr migrated to groundwater?	**Comment Accepted.**
31.	Section 2.5.3.2, Page 2-28, Line 33	Revise text to read "contaminants of potential concern"	**Comment Accepted.**

200-UW-1 OU

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Reviewer: Ecology		Date: 31 Jan 05	Company: Washington State Dept of Ecology
Index	**Reference**	**Comment**	**Comment Resolution**
32.	Section 2.5.3.3, Page 2-29, Lines 11 through 13	This text states that "Although soil chemistry data are not available to evaluate contamination directly beneath the 216-U-12 Crib, DOE/RL-95-13 and DOE/RL-95-106 suggest that the site is highly analogous to the 216-U-8 Crib. These sites received the same type of waste and are located relatively close together." Provide text explaining how the similarity between the cribs was established. If the sites received the same type of waste, why do they have different COPCs? Provide text explaining the differences.	**Comment Accepted with Modification.** The text will be modified for clarification, as the term "highly analogous" in this context is misleading. While these sites did receive similar waste streams, 216-U-12 was more dilute. As such, the COCs are anticipated to be different. The text will be clarified accordingly.
33.	Section 2.5.3.4, Page 2-30	Add the following information: the borehole number, the total depth of the borehole, a summary of the analytical results.	**Comment Accepted with Modification.** The available analytical data from this borehole are already summarized in this section. Other requested information will be added.
34.	Section 2.5.3.5, Page 2-30	Add text explaining why the 216-U-1/216-U-2 cribs and the 241-U-361 Settling Tank have U contamination but the UPR-200-W-19 (an overflow of the same material) does not.	**Comment Accepted.**
35.	Section 2.5.3.5, Page 2-31, Lines 4 through 6	Delete sentence starting on line 4 and ending on line 6. In Section 2.5.1.5 this contamination was attributed to insect intrusion.	**Comment Accepted.**

200-UW-1 OU

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36.	Section 2.5.4, Page 2-31	Section 2.5.4 needs the following revisions: • Add the major GW plumes to the Plate 1 map (located in the pocket at the end of the document) • Add a reference to the 2004 Annual GW Monitoring Report for additional information. • Add a reference to the 200-UP-1 Interim Record of Decision for additional information. • Add a reference to the 200-UP-1 Remedial Investigation/Feasibility Study Work Plan, DOE/RL-92-76 for additional information. • Delete Section 2.5.4.4 • Delete Section 2.5.4.4.1 • Delete Section 2.5.4.4.2 • Delete Section 2.5.4.4.3 • Delete Section 2.5.4.4.4	**Comment Accepted.** Please note that the 2004 annual report is not available at this time. A general reference to the annual reports will be made.
37.	Section 2.6, Page 2-35, Line 19	Change the word "grouped" to "subdivided."	**Comment Accepted.**
38.	Section 2.6, Page 2-35, Lines 29 and 30	Revise text to read: "...Area incorporates waste sites from several waste category groups, the analogous site concept ~~is~~ has been further ~~defined~~ refined to appropriately regroup these ~~categories~~ waste sites. The following general conclusions can..."	**Comment Accepted.**
39.	Section 2.6.2.1.3, Page 2-41, Number 1	Provide in the text the characteristics of the impermeable barrier overlying the coarse layers in cribs U-16 and U-17.	**Comment Accepted.**
40.	Section 2.6.2.1.3, Page 2-41, Number 2	The U-12 crib had a release volume to soil pore volume of roughly 107. The last sentence of this paragraph states that U-16 came close with 25 times the soil to pore volume. Clarify.	**Comment Accepted.**

200-UW-1 OU

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Index	**Reference**	**Comment**	**Comment Resolution**
41.	Section 2.6.2.1.3, Page 2-41, Number 5	Provide a reference in the text that corroborates the statement that there was little lateral spreading for mobile contaminants, or delete the third statement of this paragraph. Note that Figure D-5 shows lateral spreading for nitrate.	**Comment Accepted.** The "little lateral spreading" text from #5 will be deleted. A new item will be added that provides clarification. Reference to well 299-W22-78 will be incorporated.
42.	Section 2.6.2.3, Page 2-43, Number 1	Change this statement as follows: "~~This criterion is not applicable, because the~~ The unplanned release has a different configuration than the septic systems because the unplanned release is not an engineered structure and was not ~~compared to the septic systems that were designed~~ built to accept sanitary effluent." The criterion, waste site configuration and construction, is an important one for comparison of representative and analogous sites and applies in all cases.	**Comment Accepted.**
43.	Section 2.6.2.3, Page 2-44, Number 3	Describe in the text the nature of UPR-200-W-19. This included a known release of contaminants. Describe what is known about the release.	**Comment Noted.** Details of the release are provided in Section 2.5.1.5, and Table 2-7.
44.	Section 2.6.2.3, Page 2-45, Number 2	Revise this statement as follows: "~~This criterion is not applicable because~~ UPR-200-W-19 had relatively low effluent volume and the solid waste group sites received only solid waste."	**Comment Accepted.**
45.	Section 2.6.2.4, Page 2-45, Number 6	Revise this statement as follows: "It is hypothesized that the potential for contaminant impacts on groundwater is low for these sites, ~~This criterion is not applicable~~ because of the shallow nature of the representative and analogous sites, ..." Note that this hypothesis does not change required soil cleanup levels or PRGs for these sites. The PRGs are the values given in Table 3.1 at these sites.	**Comment Accepted.**

200-UW-1 OU

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46.	Section 2.6.2.5, Page 2-46, Number 6	Revise this statement as follows: "It is hypothesized that the potential for contaminant impacts on groundwater is low for these sites, ~~This criterion is not applicable~~ because of the shallow nature of the representative and analogous sites." Note that this hypothesis does not change required soil cleanup levels or PRGs for these sites. The PRGs are the values given in Table 3.1 at these sites.	**Comment Accepted.**
47.	Section 2.6.2.6, Page 2-47, Number 2	Revise as follows: "~~This criterion is not applicable, because the~~ The representative site and the analogous site in this grouping are unplanned releases, ..." The criterion is applicable.	**Comment Accepted.**
48.	Section 2.6.2.6, Page 2-48, Number 6	Revise this statement as follows: "It is hypothesized that the potential for contaminant impacts on groundwater is low for these sites ~~This criterion is not applicable~~ because of the shallow nature of the representative and analogous sites." Note that this hypothesis does not change required soil cleanup levels or PRGs for these sites. The PRGs are the values given in Table 3.1 at these sites.	**Comment Accepted.**
49.	Section 2.7.1, General	A previous Ecology comment was to be addressed by adding text in this section. The comment was "Crib 216-U-12 is considered a representative (model) site according to Table 2-1. There is inadequate discussion about this site in Section 2.7.1. Consequently, no risk assessment information is provided for sites 216-U-5, U-6, U-15, U-16, and U-17. Also, since a closure plan has been submitted for this crib there should be a detailed discussion about its risks. Add a discussion about risks associated with these sites (including crib 216-U-12) to this section." The response to this comment was "Comment Accepted. A detailed risk discussion was not included in this section because no radiological constituents were identified as COPCs. The text will be revised to indicate this."	**Comment Noted.** Section 2.7.1 provides a summary of the risk assessment, with a reference to Appendix C provided for additional information. A detailed discussion of the risk assessment is provided in Appendix C. The last paragraph in Section 2.7 states this and references Appendix C for further information. Specifically, the discussion for 216-U-12 risk assessment is provided in Section C3.4.1.2, C3.5.1.2, C4.8. No changes proposed.

200-UW-1 OU

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		Explain where the new text has been placed, or add the text if it has not been added.	
50.	Section 2.7.1.2, Page 2-52, 2-53 and throughout document	Since UPR-W-163 and 200-W-42 VCP are considered to be one site always refer to the site as 200-W-42 VCP/UPR-W-163 in the document.	**Comment Accepted.**
51.	Section 2.8, Page 2-59, Line 12	Delete the word "in" and remove the period after the word "column."	**Comment Accepted.**
52.	Section 2.8, Page 2-59, Line 15	Modify the text to read: "...requirements for using an alternative fate and transport models."	**Comment Accepted.**
53.	Section 2.8, Page 2-59, Line 23	Provide a description, or reference, for "baseline conditions."	**Comment Accepted.** Clarification will be provided in text.
54.	Section 2.8, Page 2-59, Lines 23 through 28	This section is not clear. As written, the last sentence implies that the 216-U-1 and 216-U-2 cribs were **not** considered potential threats to groundwater.	**Comment Noted.** The text states: "Results of the modeling indicate there are three sites (216-U-1/2, 216-U-8, and 216-U-12) with contaminant inventories sufficient to pose a threat to groundwater above MCLs within a thousand years," and that the modeling results suggest that Tc-99 may impact groundwater and exceed the MCL within 1000 years at the 216-U-1 and 216-U-2 Cribs.
55.	Section 2.8, Page 2-59, Line 29 through 31	In the PP 216-U-1 and 216-U-2 are counted as separate waste sites. Based on that information, revise the text to read: "Results of the modeling indicate there are ~~three~~ four sites (216-U-1/2, 216-U-8, and 216-U-12) with contaminant inventories sufficient to pose a threat to groundwater above MCLs~~.~~ within a thousand years. The modeling results ..."	**Comment Accepted.**
56.	Section 2.8, Page 2-60, Line 1	Change "amay" to "may".	**Comment Accepted.**

200-UW-1 OU

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57.	Section 2.8, Page 2-60, Line 6	Text states that contaminants "will not impact groundwater within a 1000 years" which leads the reader to believe it will impact groundwater after that. Add text to clarify what may happen after 1000 years.	**Comment Accepted with Modification.** Text will be revised to identify those waste sites that have contamination such that concentrations do exceed the MCLs within the 1000 year decision period. As this is a summary section, only the COCs are identified and discussed. The complete discussion for all modeled contaminants are contained in Appendix D.
58.	Section 2.8, Page 2-60, Lines 7 through 10	Include in this paragraph an explanation of how the modeling results support the choice of the remedies for the 216-U-8 and U-12 cribs, 216-U-4/U-4A well and drain, and 200-W-42 VCP/UPR-W-163.	**Comment Accepted.** Text will be revised to include an explanation on how the modeling results support remedies for each of the sites.
59.	Section 2.8, Page 2-60, Lines 8 and 9	The text states that groundwater concentrations will be below the MCLs for the "constituents listed" but it is not clear which constituents are being referred to or where they are listed.	**Comment Accepted with Modification.** Text will be revised, "constituents listed" will be deleted and list of constituents simulations will be included.
60.	Section 2.9, Page 2-60, Line 16	Replace "O" with "Order"	**Comment Accepted.**
61.	Figure 2-3, Page 2-71	Explain why this figure has been changed relative to that in Figure 2-4 in Draft A. The figure no longer indicates that the cross sections include well 299-W19-43.	**Comment Noted.** Figure 2-3 does indicate that borehole 299-W-19-43 is included in the cross section. This borehole is included in Figures 2-5 and 2-6 as well.
62.	Figures 2-4, 2-5, and 2-6, Pages 2-72 through 2-74	Switch the y-axis to show BGS values. Add the waste site locations to these cross-sectional views.	**Comment Accepted with Modifications.** The waste site locations will be added to the figures. Changing the y-axis was not incorporated due to the fact that the horizontal scale of the figure and variance in ground surface make developing a BGS scale ineffective.

200-UW-1 OU

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63.	Figure 2-7, Page 2-75	Number 4 states that little lateral spreading is believed to have occurred, though Figure D-2 indicates spreading for nitrate. Correct the wording for #4 to make it consistent with Figure D-2.	**Comment Accepted.** Text will be added to Item 4 to include a statement that spreading may have occurred because of heterogeneities within single geologic units. Figure D-2 is a model construct developed from the data available that attempts to encompass whatever contaminant distribution may be present in the vadose zone. As such, the plume in the model likely overstates the actual plume in the vadose zone. That the model construct overestimates the plume size is a conservatism in the model to account for and protect against uncertainty in the plume distribution.
64.	Figure 2-8 and 2-9, Page 2-76 and 2-77	Numbers 4 state that lateral spreading is only expected in association with the Cold Creek Unit and upper Ringold. However, Figures D-4 and D-5 show lateral spreading in the Hanford formation for Tc-99, nitrate, uranium, and arsenic.	**Comment Accepted.** Text will be added to the Item 4 to include a statement that some spreading may have occurred because of heterogeneities within single geologic units.
65.	Figures 2-12 through 2-15, Page 2-80 through 2-85/86	Delete the groundwater figures and associated text. It is not well integrated with the rest of the document and it is not clear what the purpose is for this new information – Draft A did not have this information. Also, there is a risk that it conflicts with the RI/FS in progress for UP-1/ZP-1.	**Comment Accepted with Modification.** The requested groundwater figures and associated discussions will be deleted as suggested.
		However, the figures do reveal an interesting problem in the vadose zone. It appears that several wells (ex. 299-W19-29, 299-W19-19, 299-W19-23, 299-W19-24, 299-W19-30) went dry. Just prior to drying out, the Tc-99, and in some cases U, concentrations in the groundwater were well above MCLs. This indicates that contamination probably exists in the vadose zone in the vicinity of the wells. Provide the operable unit to which this contamination will be assigned.	**Comment Noted.** The 200-UP-1 OU will address this contamination.
66.	Figure 2-16, Page 2-87/2-88	For the row with the box having the text "risks associated with analogous site may significantly exceed representative site	**Comment Accepted with Modification.** Graphic will be updated to more clearly identify the starting point. Also, the

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		risks", note that the text in the 2nd box after this states "Minimal because representative sites are worst case, upper bound". These two boxes conflict. Correct this. Ecology previously made the following comment about this figure: "First, the starting point on the figure is not clearly indicated – is it the diamond-shaped polygon? Add a symbol or arrow to indicate the starting point on the figure. Second, in the case that data are not sufficient for analogous site risk calculations, there is an abrupt progression from 'severe for risk' (consequences) to 'minimal because representative sites are worst-case, upper bound' (likelihood of wrong decision), while two rows down there seems to be some concern about cost. Change the 'minimal because representative sites are worst-case, upper bound' box in the top row to read 'moderate because upper bound may not be adequately established.' There is a known case of this type of error: UPR-200-W-163." The response to this comment was "Comment Accepted. The figure will be modified to clarify the starting point, and the other suggested changes will be incorporated." The starting point on the graph has been clarified, but the other changes were not made as indicated. Change the "minimal because representative sites are worst-case, upper bound" box to read "moderate because upper bound may not be adequately established."	text in question will be reviewed for clarification. Please note however, that the 200-W-42 / UPR-200-W-163 does not follow this path as it is an analogous waste site with data.

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67.	Tables 2-3, 2-4, 2-5, 2-6 and 2-7, global	The Rationale columns in these tables repeat much of the text given in Sections 2.6.1.1 – 2.6.2.6. Comments have been made above about necessary changes to be made in the text in Sections 2.6.1.1 – 2.6.2.6. Make the same changes in the tables so that they are consistent with Sections 2.6.1.1 – 2.6.2.6.	**Comment Accepted.** The revisions will be made to the tables according to the comment dispositions for the comments related to the text sections.
68.	Table 2-3, Page 2-97/2-98	The contaminant inventory is given as 4E03. Is this for uranium? Add column headings to the table for the inventory.	**Comment Accepted.** The inventory is for Uranium. The formatting of the column headings will be corrected.
69.	Table 2-5, Page 2-115/2-116	Site 216-U-15 will be remediated by RTD. However, its exact location is unknown, there are no markings, and no radioactivity has been detected at this site. The SAP should address how this site will be located for remediation. This site should be somewhat distinguishable visibly because it has solid waste such as activated charcoal and diatomaceous earth. Also, add TBP to the COC list for this site for verification samples.	**Comment Noted.** Concurrent with Ecology's review of the FFS, RL was working with Ecology on the confirmatory SAP. This SAP is currently being transmitted to Ecology as Rev. 0 for approval. Confirmatory and design sample definition, requirements, and constituents being analyzed are associated with this SAP. The verification requirements for RTD will be addressed in the future DQO and SAP. No changes required for FFS.
70.	Table 2-5, Page 2-117 and 2-118	The document indicates that lateral spreading occurred at this site (216-U-16), all of the way to the U-1 and U-2 cribs across the street. The extent of contamination may not be known here. This is an MNA site. More sampling is needed to determine the extent of contamination here. Discuss additional samples for this site in the SAP.	**Comment Noted.** Concurrent with Ecology's review of the FFS, RL was working with Ecology on the confirmatory SAP. This SAP is currently being transmitted to Ecology as Rev. 0 for approval. Confirmatory and design sample definition, and requirements, and constituents being analyzed are associated with this SAP. No changes required for FFS.

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71.	Table 2-7, Page 2-125/2-126	In the waste site configuration column, Draft A of the document discussed an overflow of organic waste at this site (200-W-19), including TBP. This statement has been removed from the document since Draft A. Put the statement back in the table or explain why this statement has been removed. Also, add TBP to the COC list for this site for verification samples.	**Comment Noted.** Text regarding the nature of the release (organic wastes and cell drainage from the TBP process) are provided in the "Site and Discharge History Column" of this same table. Concurrent with Ecology's review of the FFS, RL was working with Ecology on the confirmatory SAP. This SAP is currently being transmitted to Ecology as Rev. 0 for approval. Confirmatory and design sample definition, and requirements, and constituents being analyzed are associated with this SAP TBP was not identified as a COC during the risk assessment screening process. As such, it should not be considered a COC.
72.	Table 2-7, Page 2-127/2-128	In the Site and Discharge History column for this site (200-W5 septic tank) new text has been added indicating that a portion of the tile field was decontaminated by scraping off surface soil. It also indicates that the source of the contamination is not clear. The system was only recently abandoned or is still in use. The remedy here is MNA. MNA could be acceptable until the site is taken out of use, but thereafter RTD may be an appropriate remedy at this site. If MNA remains the remedy then sampling should be performed to determine the nature and extent of contamination at this site.	**Comment Noted.** Concurrent with Ecology's review of the FFS, RL was working with Ecology on the confirmatory SAP. This SAP is currently being transmitted to Ecology as Rev. 0 for approval. Confirmatory and design sample definition, and requirements, and constituents being analyzed are associated with this SAP. No changes required for FFS.
73.	Table 2-7, Page 2-131/2-132	Site 200-W-57 dump was rejected by the MP-14 process. Previous meetings between Ecology, DOE, and contractors discussed that this would be left in the FFS with explanatory text in the PP. Why not just add a statement in the table to indicate that this site has been rejected through the MP-14 process?	**Comment Accepted with Modification.** A discussion will be provided in Section 7, consistent with comment # 121.

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74.	Table 2-7 Page 2-133/2-134	Site 200-W-71 is an MNA site. However, its nature and extent are not well known. It may be a burn pit, or may be a uranium disposal area, or may have been a laydown area. Sampling is needed to determine the nature and extent of contamination at this site.	**Comment Noted.** Concurrent with Ecology's review of the FFS, RL was working with Ecology on the confirmatory SAP. This SAP is currently being transmitted to Ecology as Rev. 0 for approval. Confirmatory and design sample definition, and requirements, and constituents being analyzed are associated with this SAP. No changes required for this FFS.
75.	Table 2-7, Page 2-141/2-142	In the Waste Site Configuration column of this table text has been removed since Draft A, which described a jumper transfer from a truck to a railroad. Put the text back in the table or explain why this text has been removed.	**Comment Noted.** The text related to the jumper transfer was moved to the "Site and Discharge History" column of the same table.
76.	Table 2-7, Page 2-153/2-154	This site (200-W-89) is an RTD site, which is appropriate. However, it will be necessary after RTD to verify successful cleanup. This site will need COCs. PCBs, uranium, and a set of radionuclides should be COCs. Radionuclides in the groundwater beneath this site are I-129, Tc-99, and uranium. This site is near a former groundwater injection area.	**Comment Noted.** The questions you bring up are related to the future verification sampling DQO and SAP. As such, there are no changes to this FFS.
77.	Table 2-8, Page 2-159	Change the second row of the table to read "Does the site meet Direct Contact Human Health PRGs?"	**Comment Accepted.**
78.	Table 2-8, Page 2-159	For 216-U-4, 216-U-4A, and 216-U-1 and U-2 cribs, it appears that U currently exceeds screening levels in the vadose zone, and it will exceed PRGs in groundwater in the future. Change the NA in the "What constituents exceed?" rows to uranium.	**Comment Noted.** The screening conducted in Appendix C (Sections C3.4.1.3 and C3.4.1.5) and the fate and transport modeling conducted in Appendix D (D5.1 and D5.2) indicate that Uranium is not a contaminant of concern as the RAOs are met.
79.	Table 2-8, Page 2-159	Change the "Predicted to exceed standard (calendar year)" cell to read "Predicted to exceed groundwater standard (calendar year)".	**Comment Accepted.**

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80.	Table 2-8, Page 2-159	Change the cell that reads "Does the Site meet Groundwater Protection PRGs?" to read "Does the site meet gw protection PRGs in the next 1000 yr?" Some contaminants, such as nitrate and uranium, are predicted to reach groundwater in later years. Also, it is not clear in the text of the document that the PRGs only apply to the next 1000 yr. Add clarifying text to the document regarding the time frame for the PRGs.	**Comment Accepted.**
81.	Section 3.1.1, Page 3-2	Change the text to "The DOE-selected use for the 200-UW-1 OU, documented through the land-use record of decision (ROD)(64 FR 61615, "Hanford Comprehensive Land-Use Plan Environmental Impact Statement, Hanford Site, Richland, Washington: Record of Decision) that applies for at least the next 50 years, is industrial (exclusive) for sites located within the exclusive-use boundary (core zone)."	**Comment Accepted.**
82.	Section 3.1.1, Page 3-1, Line 38 through Page 3-2, Line 10	Revise text to read: "...2002, and the 200 East Areas ~~are~~ is the planned disposal location for the vitrified low-activity tank wastes. Past-practice disposal sites in the 200 Areas are being evaluated for remediation ~~and are likely to~~ which may include institutional controls (e.g., deed restrictions or covenants) as part of the selected remedy. Other Federal agencies, such as the U.S. Department of the Navy, ~~also~~ use the Hanford Site 200 East Areas ~~nuclear waste~~ treatment, storage, and disposal (TSD) facilities. ~~A~~ In addition, a commercial low-level radioactive waste disposal facility, is currently operated by US Ecology, Inc., ~~currently operates~~ on a ~~portion of a~~ 100 acre tract of land at ~~in~~ the southeast corner of the 200 East Areas leased to the State of Washington. The DOE-selected land use for the ~~200-UW-1 OU~~ Central Plateau, is documented ~~through~~ in the land-use record of decision (ROD) (64 FR 61615, "Hanford Comprehensive Land-Use Plan Environmental Impact Statement, Hanford Site, Richland, Washington: Record of Decision"), ~~is~~ as	**Comment Accepted.**

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		industrial (exclusive) for sites located within the exclusive-use boundary (core zone)."	
83.	Section 3.1.2, Page 3-3, Lines 3 through 37	Delete text.	**Comment Accepted.**
84.	Section 3.1.2	This section does not adequately capture the "core zone" as defined during the 200 Area Central Plateau Workshops, the future land uses or land use scenarios presented in HAB Advice #132 or the "risk framework" transmitted in the Response to HAB Advice #132. Add text to present this information.	**Comment Accepted.**
85.	Section 3-2, Page 3-6, Line 21	Revise text to read: "contaminant concentrations with regulatory cleanup levels and background, developing a set of data for use in risk assessment"	**Comment Accepted with Modification.** During the COPC screening process, contaminants are not compared against regulatory cleanup levels but rather factors such as background, as discussed in Section C3.2. Once defined as a COPC, the risk assessment carries the constituent further into the quantification process where evaluations against factors such as regulatory cleanup levels occurs. Text will be updated to clarify this process. As stated in the text, this process is consistent with the Risk Assessment Guidance for Superfund (EPA/540/1-89/002).
86.	Section 3.4, Page 3-7, Line 7	The text should state that "The RAOs specific to the 200 Areas for soils~~, solid~~ wastes~~,~~ sites~~and groundwater~~ were developed in the Implementation Plan (DOE/RL-98-28)." The RAOs from the 200 Area Implementation Plan should be inserted directly below this text (on line 8). Additional text should be added to explain that these upper level RAOs (from the 200 Area IP) were used to develop OU specific RAOs which are then provided on lines 8 through 27.	**Comment Accepted.**
87.	Section 3.4, Page 3-7, Lines 12 through 27	Revise the text to read: • RAO 2 – Provide conditions suitable for future industrial land use and protect ecological receptors,	**Comment Accepted with Modification.** RAOs will be updated to be consistent with the PP comment resolutions held with Ecology during the week of January 24, 2005.

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		respectively, by preventing exposure to radiological constituents at concentrations above a dose rate limit of 15 mrem/yr for industrial workers (EPA/540/R-99/006, *Radiation Risk Assessment At CERCLA Sites: Q & A*, OSWER Directive 9200.4-31P) and to protect populations of ecological receptors based on a dose limit of 0.1 rad/day for terrestrial wildlife populations (DOE STD 1153-2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*). A dose rate limit of 15 mrem/yr generally achieves the U.S. Environmental Protection Agency (EPA) excess lifetime cancer risk threshold, which ranges from $1x10^{-6}$ to $1x10^{-4}$. • RAO 3 – Prevent migration of contaminants through the soil column to groundwater, or reduce soil concentrations below WAC 173-340-747, "Deriving Soil Concentrations for Ground Water Protection," groundwater protection criteria so that no further degradation of the groundwater results from contaminant leaching from 200-UW-1 OU waste sites ~~soils or debris occurs~~. • RAO 4 – Minimize the disruption of cultural resources and wildlife habitat and prevent adverse impacts to cultural resources and threatened or endangered species ~~during remediation~~."	

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88.	Section 3.4, Page 3-7, RAO 2	Add text to RAO 2 to make this consistent with Ecology's version of RAO 2 in the Proposed Plan: RAO 2 – For the next 150 years provide conditions suitable for future… At the end of this RAO description, add the following: During the post-institutional control period (> 150 years) provide conditions suitable for a residential land use and continue to protect ecological receptors.	**Comment Accepted with Modification.** RAOs will be updated to be consistent with the PP comment resolutions held with Ecology during the week of January 24, 2005.	
89.	Section 3.4, Page 3-7, RAO 3	Modify RAO 3 as follows: Prevent migration of contaminants…so that no further degradation of the groundwater ~~occurs~~ results from contaminant leaching from ~~soils or debris~~ 200-UW-1 OU waste sites. Soil concentrations for protection of ground water are determined using ground water cleanup levels established in WAC 173-340-720 for potable ground water.	**Comment Accepted with Modification.** RAOs will be updated to be consistent with the PP comment resolutions held with Ecology during the week of January 24, 2005.	
90.	Section 3.4, Page 3-7, 3rd to last bullet on page	Modify this bullet to the following to be consistent with the proposed plan: "Total human health carcinogenic risks do not exceed 1x 10^{-5}." Note that risks for the ground water pathway are not calculated on the basis of industrial land use.	**Comment Accepted with Modification.** RAOs and supporting text will be updated to be consistent with the PP comment resolutions held with Ecology during the week of January 24, 2005.	
91.	Section 3.4, Page 3-7, 2nd to last bullet on page	Modify this bullet to the following to be consistent with the proposed plan: "Human health noncarcinogenic hazard indices do not exceed 1."	**Comment Accepted with Modification.** RAOs and supporting text will be updated to be consistent with the PP comment resolutions held with Ecology during the week of January 24, 2005.	
92.	Section 3.4, Page 3-7, last bullet on page	Modify this bullet to the following to be consistent with the proposed plan: "Soil concentrations of COCs do not exceed applicable thresholds for protection of ecological receptors."	**Comment Accepted with Modification.** RAOs and supporting text will be updated to be consistent with the PP comment resolutions held with Ecology during the week of January 24, 2005.	
93.	Section 3.4, Page 3-7, Line 28 through Page 3-8, Lines 22	This text must be updated so that the criteria used to fulfill RAOs is **exactly** the same as documented in the PP.	**Comment Accepted.** RAOs and supporting text will be updated to be consistent with the PP comment resolutions held with Ecology during the week of January 24, 2005.	

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94.	Section 3.4, Page 3-8, Lines 21-22	Modify this bullet to the following to be consistent with the proposed plan: The flux of contaminants into groundwater is reduced or eliminated, based on a continual decrease in the differences between the concentration of contaminants in up gradient and down gradient wells. Also, add an additional bullet for this RAO: The flux of contaminants into ground water does not result in exceedence of MCLs at the point of compliance.	**Comment Accepted with Modification.** RAOs and supporting text will be updated to be consistent with the PP comment resolutions held with Ecology during the week of January 24, 2005.
95.	Section 3.4, Page 3-8, Lines 21 and 22	Modify this bullet to the following to be consistent with the proposed plan: Cultural and ecological reviews.... (e.g., bird nesting grounds) and appropriate mitigative measures are implemented.	**Comment Accepted with Modification.** RAOs and supporting text will be updated to be consistent with the PP comment resolutions held with Ecology during the week of January 24, 2005.
96.	Section 3.5.1 and 3.5.2 Page 3-9 through 3-13, global	WAC 173-340-745(6) specifies that the hazard index, rather than hazard quotient, should not exceed 1. Change hazard quotient to hazard index throughout this section.	**Comment Accepted.**
97.	Section 3.5, Page 3-9, Lines 3 through 13	Modify text to read: "...below a hazard index (HI) of 1 for noncarcinogens. Documentation of ~~A~~actual soil contaminant concentrations achieving ~~these~~ cleanup objectives would be presented in a cleanup verification package for the ~~facility~~ 200-UW-1 OU. The cleanup verification package would ~~demonstrate how and where specific criteria have been applied and how the remedy protects receptors from the COCs identified for the waste sites~~ describe the remediation activities completed, identify any significant contamination remaining, summarize the sampling and data analysis approach, and demonstrate attainment of cleanup levels." "In addition, PRGs have also been developed for the COPCs ~~screened out through the risk assessment process~~. The purpose of this process is to identify those constituents that may pose an unacceptable risk. This screening process	**Comment Accepted.**

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		compared the observed constituent concentrations of the following:"	
98.	Section 3.5.1.1, Page 3-10, Lines 2 through 4	Delete the sentence that begins on line 2 and ends on line 4. "Therefore, the PRGs for individual nonradioactive contaminants in solid waste and particulate reflect the value that is greatest among risk-based standards, area background values, or PQLs."	**Comment Accepted with Modification.** The referenced text will be deleted from Section 3.5.1.1. In addition, text will be incorporated in Section 3.5 introduction describing this process of comparison against background and PQLs (or RDLs). This comparision of the PRGs against background and the PQLs is consistent with the requirements stated in WAC 173-340-700(6)(d) to determine the overall PRG.
99.	Section 3.5.1.2, Page 3-10, Line 25	Revise text to read: "...presence <u>or absence</u> of protected..."	**Comment Accepted.**
100.	Section 3.5.3.1, Page 3-13	Ecology previously made the following comment about this section: "Provide a discussion of all possible nonradiological COCs for these sites using the COCs given in the Appendix C tables. Cite here the section in this document that describes elimination of COCs." The response to this comment was: "Comment Accepted. The text will be revised to cite Section C3.2 as the text which describes the selection of chemicals of potential concern (COPC) process." The change was not made. Cite in this section the section in this document that describes elimination of COCs.	**Comment Accepted with Modification.** This discussion and reference to Appendix C is provided in Section 3.2 – Contaminants of Potential Concern.
101.	Section 3.5.3, Page 3-13, Line 15	Revise text to read: "... cause groundwater concentrations to exceed..."	**Comment Accepted.**
102.	Section 3.5.3.1, Page 3-13, Lines 21 through 23	Revise text to read: "The PRGs for nonradionuclides in the vadose zone that are protective of groundwater are developed from potential ARARs (e.g., MTCA risk-based standards, MCLs as defined in 40 CFR 141, "National Primary Drinking Water Regulations") and published risk-based standards, whichever is most stringent. Consistent with this...."	**Comment Accepted with Modification.** Included reference to WAC 173-340-747. The other examples are deleted as they are incorporated through the WAC citation.

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103.	Figure 3-1, Page 3-18	Enlarge Figure 3-1 so that it is legible, or modify the figure to show the core zone specifically.	**Comment Noted.** This figure will be deleted. Text will be modified accordingly to indicate the core zone is based on DOE/EIS-0222-F. Discussions are ongoing regarding the specific definition.
104.	Table 3-1, Page 3-19	Is an RDL the same as the PQL? If so, use PQL instead; if not, add a footnote explaining why the RDL is being used to set the PRG.	**Comment Accepted.** A footnote will be added regarding RDL and PQL.
105.	Table 3-1, Page 3-19	Nitrate and nitrite should not be listed as COPCs. They are COCs. Remove them from the list of COPCs.	**Comment Noted.** The risk evaluations conducted in Appendix C and D do not indicate that nitrate and nitrite are COCs. As such they remain on the COPC list.
106.	Table 3-1, Page 3-19	Add tributyl phosphate to the COPC list.	**Comment Accepted.** Table 3-1 will be revised to include the direct contact and groundwater protection PRGs for tributyl phosphate. Terrestrial wildlife PRGs remain unavailable.
107.	Table 3-1, Page 3-19	Check the acenaphthene concentration for protection of groundwater. The previous value was 97.9 mg/kg; the new value is 121 mg/kg. Revise to the old value or explain the change.	**Comment Accepted.** The original entry (97.9) was in error as it represents acenaphthylene rather than acenaphthene. The correct value for acenaphthene is 121.
108.	Table 3-1, Page 3-19	Several contaminants are indicated to have "unlimited" direct contact values. This occurs when the direct contact value exceeds 1E06 mg/kg. However, the state does list direct contact values for these contaminants, and they should be listed in the table. They can be footnoted to indicate that the state's direct contact values exceed concentrations for pure product. Change the values as indicated (all in mg/kg): Chromium (list this as Chromium (III)): 5.2E06 Strontium: 2.1E06 Titanium: leave as unlimited – the state does not have a limit for Ti Zinc: 1.05E06 Acetone: 3.5E05 (explain use of any higher values) Benzoic acid: 1.4E07 2-Butanone: 2.1E06	**Comment Accepted.** Values will be updated to include concentrations greater than pure material.

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109.	Table 3-1, Page 3-19	Change the overall PRG for chloromethane from 0.165 mg/kg to 0.0165 mg/kg to be consistent with the groundwater protection value. There appears to be a typo in the table.	**Comment Accepted.**
110.	Section 5.2, Page 5-6, Lines 2 through 24	The text addresses the regulatory requirements in WAC 173-303-610(2)(a), but does not address the performance standards contained within WAC 173-303-610(2)(b). Add text/information addressing compliance with these regulatory requirements.	**Comment Accepted with modification.** Text has been included to identify the closure standards for a landfill per WAC 173-303-665(6), which is what WAC 173-303-610(2)(b) points to for clarity and consistency.
111.	Section 5.2, Page 5-6, Line 24 throough Page 5-7, Line 3	The text addresses the regulatory requirements in WAC 173-303-646(2)(a) and (b), but does not address the regulatory requirements contained within WAC 173-303-646(2)(c) and (d). Add text/information addressing compliance with these regulatory requirements.	**Comment Noted.** The RCRA corrective action performance standards are consistent with the CERCLA criteria. Corrective action information on design, implementation, and monitoring of the selected remedy for the TSD unit will be included in the CERLCA post-decision documentation. Compliance schedules for corrective action will be integrated with the remedial action schedules required by the CERCLA post-decision documentation. The CERCLA remedial action process fulfills the state remedial investigation and feasibility study requirements in MTCA. The CERCLA criteria include an evaluation of overall protectiveness that fulfills the RCRA corrective action performance standard for protecting human health and the environment. Other CERCLA criteria, such as compliance with ARARs; reduction of toxicity, mobility, and volume; and long-term and short-term implementability, also support this evaluation. No changes to the FFS text.
112.	Section 5.2.1, Page 5-7, Lines 6 through 36	Add text explaining how the 216-U-12 TSD complies with each of these Hanford Facility RCRA Permit conditions.	**Comment Noted.** The TSD has not been incorporated into the Hanford Facility Permit at this time. Consequently, the closure plan would identify which Permit Conditions were applicable. The closure requirements have been identified in Table 1-2, Chapter 1 of this FFS. Additionally, the identification of specific permit conditions in the FFS are questioned. A new RCRA Permit is being drafted by Ecology, and may not look like the existing Hanford Permit.

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113.	Section 5.2.2, Page 5-8, Lines 7 through 11	Modify text to read: "…..with the landfill closure requirements of WAC 173-303-665(6)(a)~~(ii)~~, "Dangerous Waste Regulations," "Closure and Post-Closure," "Landfills," "Closure and Post-Closure Care." The proposed strategy is to close the 216-U-12 Crib as a landfill and to construct a final cover as discussed in Sections 4.2.~~5~~4 and 5.3.4. The proposed final cover is an engineered barrier. The engineered barrier will be designed in compliance with WAC 173-303-665(6)(a) to control the amount of water infiltrating into contaminated…."	**Comment Accepted.**
114.	Section 5.2.3, Page 5-8, Line 26	Revise the regulatory citation to: WAC 173-303-665(6)(a).	**Comment Accepted.**
115.	Section 5.2.5, Page 5-9, Line 19	Revise the regulatory citation to: WAC 173-303-665(6)(a)	**Comment Accepted.**
116.	Section 5.2.5, Page 5-9, Line 20	Revise the regulatory citation to: WAC 173-303-610(2)(a)	**Comment Accepted.**
117.	Section 5.2.5, Page 5-9, Line 35	Revise the regulatory citation to: WAC 173-303-610(2)(a)	**Comment Accepted.**
118.	Section 5.2.6, Page 5-10	Add a table listing the basic sections of a post closure plan, and a short description of what the content of each section should be.	**Comment Noted.** Post closure activities will be addressed in the O&M Plan, as identified in Table 1-2, for groundwater.
119.	Section 5.2.7, Page 5-10	Add a new Section 5.2.7 addressing submittal of a verification SAP.	**Comment** Noted. This section is specific to the 216-U-12 which has the preferred remedy of a barrier. The upcoming verification SAP is specific to the RTD alternative.
120.	Section 7.1, Page 7-1, Line 17	Revise text to read: "…CERCLA nine criteria; then …."	**Comment Accepted with Modification.** The FFS, although discusses the CERCLA nine criteria, only addresses the seven (threshold and balancing criteria). The modifying criteria (state and community acceptance) are addressed through the PP and public review. This is discussed in Section 5.1 of the FFS. Clarifications will be included in Section 7 as well.

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121.	Section 7.1.5, Page 7-3, Lines 27 and 28	Solid Waste Sites 200-W-56 and 200-W-57 have been reclassified and removed from the CERCLA process. Add text explaining this change.	**Comment Accepted.**
122.	Section 7.1.3, Page 7-4, Lines 21 and 22	Delete the sentence on lines 21 and 22: "Because it will be under the 221-U Facility engineered barrier, confirmatory sampling is not necessary."	**Comment Accepted.** Please note however that this is Section 7.1.5
123.	Section 7.2, Page 7-4, Lines 31 through 33	Modify text to: "...closure process with the CERCLA process. In accordance with the Implementation Plan, the ~~elements of~~ RCRA requirements for the TSD unit closure are to be addressed in the CERCLA operable unit ~~remedial investigation/feasibility study~~ documentation. These elements are summarized in Section 1.4 and Table 1-2 of ..."	**Comment Accepted.**
124.	Section 7.2, Page 7-5, Line 2	Revise text to: "These monitoring ~~activities~~ requirements will be..."	**Comment Accepted.**
125.	Section 7.3.1, Page 7-5, Lines 12 through 14	Revise text to: "...prepared to incorporate the ~~proposed actions~~ closure plan into WA 7890007967, *Hanford Facility RCRA Permit*, (i.e., the addition of a chapter in Part V and an attachment) for the TSD unit. ~~and to document that~~ All the waste sites in the 200-UW-1 OU will be remediated in accordance with the record of decision...."	**Comment Accepted.**
126.	Section 7.3.2, Page 7-5, Line 19	Revise text to: "...Implementation Plan (DOE/RL-98-28) ~~defines~~ describes this strategy which serves as a means to streamline remedial ...."	**Comment Accepted.**
127.	Section 7.3.2, Page 7-5, Lines 27 through 29	Delete the sentence starting on line 27 and ending on line 29: "This table builds off the decision logic presented in Chapter 2 and provides a basis for initiating the data quality objectives evaluation."	**Comment Accepted.**
128.	Section 7.3.2, Page 7-5, Lines 30 through 37	Rewrite this paragraph to reflect the pre-ROD DQO and SAP, which will be completed by the time the ROD is out for public comment, and the post-ROD DQO and SAP, which will be conducted after the ROD. Add foot notes to Table 7-7 indicating pre-ROD and post-ROD sampling.	**Comment Accepted with Modification.** Text will be updated to include a discussion of the current SAP addressing both pre- and post- ROD sampling as well as a reference to future SAP(s). Table will be footnoted to indicate anticipated pre- or post-ROD for the category of samples (e.g., confirmatory sampling).

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129.	Section 7.3.2, Page 7-6, Line 1	This text presents "operation and maintenance sampling"; however, Table 7-7 does not have a column reflecting this type of sampling. Add a column and the appropriate "X's."	**Comment Accepted.** Operations and maintenance will be incorporated into Table 7-7.
130.	Section 7.4, Page 7-6 though 7-8	Remove all of Section 7.4 from the FFS and replace with the comparable text from the PP (as revised per discussions with Ecology).	**Comment Accepted.**
131.	Table 7-1,	Add footnote (f) indicating that 241-U-361 Settling Tank remedy is based on the assumption that sludge and liquids have been removed (same change already made to PP).	**Comment Accepted with Modification.** Table will be updated consistent with the PP.
132.	Table 7-5	The first shaded row has a footnote (d) after UPR-200-W-118; the footnote should be "e"	**Comment Accepted.**
133.	Table 7-5,	Solid Waste Sites 200-W-56 and 200-W-57 have been reclassified and removed from the CERCLA process. Modify the table to reflect this change.	**Comment Accepted.**
134.	Table 7-6	Solid Waste Site 200-W-56 has been reclassified and removed from the CERCLA process. Modify the table to reflect this change	**Comment Accepted.**
135.	Table 7-7	Replace Table 7-7 with the revised (attached) Table 7-7.	**Comment Accepted with Modification.** Title will be changed as some sampling is being conducted pre-ROD. Also, the No Action sites will reference the verification sampling consistent with the current SAP.
136.	Appendix B, Section B10, Page B-1, Lines 9 through 12	The sentence that begins on line 9 and ends on line 12 is not clear. "The *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) provides for the identification of to-be-considered (TBC) nonpromulgated advisories, criteria, guidance, or proposed standards that may be consulted to interpret ARAR to-be-determined remediation goals when ARARs do not exist or are insufficient." Revise text to clarify intent.	**Comment Accepted.** Sentence modified to read: "The *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) provides for the identification of to-be-considered (TBC) nonpromulgated advisories, criteria, guidance, or proposed standards that may be consulted to interpret ~~ARAR to-be-determined~~ remediation goals when ARARs do not exist or are insufficient."
137.	Appendix B, Section B1.0, Page B-2, Line 15	Change the word "units" to "unit."	**Comment Accepted.**

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138.	Appendix B, Section B1.1, Page B-3	At the end of this section add a statement that no waivers are being requested for the 200-UW-1 OU.	**Comment Accepted.**
139.	Appendix B, Section B1.2, Page B-3, Line 17	Revise text to: "...standards for nonradioactive ~~and radioactive~~ contaminants at waste sites. The several Federal..."	**Comment Noted.** Language is consistent with the language that has been identified in other documentation.
140.	Appendix B, Section B1.2, Page B-3	Add text addressing the ARARs for radioactive contaminants.	**Comment Noted. See above**
141.	Appendix B, Section B1.2, Page B-3, Lines 22 and 23	Revise text to use the acronym FFS.	**Comment Accepted.**
142.	Appendix B, Section B1.2, Page B-3, Line 26 and 27	Revise text to: "...standards for waste left in place), and *Atomic Energy Act of 1954* regulations (for performance standards for radioactive waste sites)~~, and Federal and state regulations related to air emissions.~~" Air emissions are already addressed on lines 17 through 21.	**Comment Accepted.**
143.	Appendix C, General	The RLS data were not included in the risk assessment. In most cases this is probably appropriate. However, at the 216-U-12 Crib (p. 2-29), the RLS data provide the only data to evaluate contamination directly through the crib, as there are no soil samples at this borehole. The RLS data indicate very high concentrations of Cs-137, which were not evaluated in the risk assessment because there were no soil samples. The risk assessment should address cases where there are no soil samples but the RLS data indicate high contaminant concentrations. In addition, the intruder scenario results for 216-U-12 are probably grossly underestimated because the contaminant data comes from a borehole adjacent to the site. The RLS data from the borehole going through the waste site would provide a more realistic estimate of intruder doses. Text needs to be modified to clarify this and discuss how DOE has addressed it.	**Comment Noted.** RLS (radionuclide logging system) data are not of sufficient quality to include in the risk assessment because it is considered screening data; as such it is not included. This approach is consistent with the EPA Risk Assessment Guidance for Superfund (RAGS) Part A, as well as the application at the Hanford Site. These data are discussed in Section 2 as they are pertinent to the waste site.

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144.	Appendix C, General	Human Health Risk Assessment results for radionuclides are compared to both a 15 mrem/yr radiation dose limit and a 1E-5 risk limit. The 15 mrem/yr limit is specified as an RAO and PRG (p. 3-7 and 3-11), while the 1E-5 limit is not. Clarify the purpose of comparing HHRA results to a standard that is not an RAO or PRG. In addition, 15 mrem/yr and 1E-5 risk are not equivalent. Using the LNT dose response model, 1E-5 risk is approximately equal to 0.7 mrem/yr. Thus, the HHRA is in essence comparing the radionuclide results to two different dose standards. Clarify which of these standards is being used for decision making.	**Comment Noted.** Section C3.5 describes the applicable dose and risk thresholds that were applied to results of the risk assessment. For radiological results, the risk assessment provided both dose and risk results for decision making purposes. RAOs and PRGs for radionuclides were developed based upon the 15 mrem/yr dose standard.
145.	Appendix C, General	To evaluate protection of groundwater, RESRAD was used to obtain drinking water dose estimates, and the results are compared to a 4 mrem/yr drinking water dose limit for screening purposes. This method for evaluating the protection of groundwater is not appropriate. We have addressed this issue before, and are not satisfied with the response. The RAO and PRG for protection of groundwater (p. 3-8 and 3-14) are based on achieving the EPA drinking water MCLs. Yet the risk assessment in the FFS for protection of groundwater is based on comparing the drinking water dose calculated with RESRAD (reported as Effective Dose) with a target Effective Dose level of 4 mrem/yr. This is not appropriate because the Effective Dose results from RESRAD are not comparable to EPA drinking water MCLs or to the EPA criterion of 4 mrem/yr Equivalent Dose (organ dose). It is more appropriate to compare the maximum groundwater concentrations calculated by RESRAD with the EPA MCLs. Change the risk assessment for protection of groundwater to compare the maximum groundwater concentrations calculated by RESRAD to EPA drinking water MCLs. This is easy to	**Comment Noted.** To the best of our knowledge, the use of the approach used for evaluating protection of groundwater has not been raised as a concern from Ecology on previous drafts. Additionally, this approach had been agreed upon in the past by Ecology and is consistent with the approach used at the Hanford Site. A tiered approach was used to evaluate protection of groundwater , the first tier uses the RESRAD as a screening model and the second tier uses STOMP. The RESRAD model is considered a conservative means to identify radiological contaminants that could potentially impact groundwater as it calculates the "cumulative" effective dose which is then compared to 4 mrem/yr. RESRAD sums the effective dose of all contaminants, rather than comparing individual groundwater concentrations to a dose limit of 4 mrem/yr. Those contaminants identified by RESRAD as potentially impacting groundwater are then carried forward into the STOMP model. Because the RESRAD model is only considered adequate for screening, the recommended approach would still require

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		accomplish, as RESRAD automatically calculates groundwater concentrations. Furthermore, comparing the drinking water dose calculated by RESRAD to 4 mrem/yr is not an adequate screening method to test for exceedance of the EPA MCLs. As an example, for Sr-90, a drinking water dose of 4 mrem/yr corresponds to a groundwater concentration of 36 pCi/L, which is several times greater than the 8 pCi/L MCL. Therefore, Sr-90 might pass the "screening", and not be further evaluated, but not meet the RAO.	analysis by a more sophisticated model. As such, the risk assessment will not be revised to incorporate the described approach.
146.	Appendix C, General	Appendix C evaluates both human health and ecological risk. Include a discussion that integrates the results of these two assessments. Specifically, indicate whether the ecological risk assessment resulted in any potential remedial action plans that were not already determined from the human health risk assessment.	**Comment Noted**. The purpose of the risk assessment is to provide the human health and ecological risks that will be used for decision-making purposes. This appendix is considered independent from that of the focused feasibility study and does not describe or compare to remediation actions or alternatives. Section 2 of the FFS presents a summary of the risk assessment, and Table 3-1 provides the PRGs for direct contact, groundwater protection, and terrestrial wildlife receptors and indicates the most protective PRG and the rationale.
147.	Appendix C and Appendix D, General	Protection of groundwater analysis was carried out using both RESRAD and STOMP models. Include a discussion of why two different models were used, and which model's results will be used for decision making. In some cases, the two models' results are significantly different, for example in estimating the time contaminants reach groundwater. Include a discussion on the differences in the models that lead to different results.	**Comment Accepted with Modification.** Section C2.3 currently indicates that RESRAD and the STOMP model are used to evaluate the movement of vadose contaminants to groundwater. Additional text will be included to clarify the intent and use of each of the respective models.
148.	Section C2.4.5, Page C-15	Ecology previously made the following comment about this section: "It is not statistically valid to replace a 95 UCL with a	**Comment Noted**. EPA and Ecology do not recommend a minimum number of samples to be used for the purpose of calculating the distribution of a data set. For the purpose this

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		maximum value detected for a COC. If the 95 UCL exceeds the maximum value detected then there are not enough data points to obtain an accurate UCL – either collect more data or use the 95 UCL that you have calculated. This is the disadvantage of having only a few sample results."	risk assessment, a minimum of five samples must be collected from each exposure area before a distribution can be calculated. For sites where less than five samples were collected, the EPC was identified as the maximum detected concentration. The approach used to calculate exposure point concentrations is consistent with current EPA guidance (*Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*, OSWER 9285.6-10, December 2002.) Section 5.0 of this guidance allows the use of the maximum observed concentration. This is because the Land Method can produce very high estimates of the UCL and EPA allows the maximum observed concentration to be used as the EPC rather than the calculated UCL in cases where the UCL exceeds the maximum concentration. EPA acknowledges that the maximum observed concentration may not be protective when sample sizes are very small because the observed maximum may be smaller than the population mean.
		Ecology is requiring additional sampling at several of the sites and expects that maximum values will be replaced by 95% UCLs at all sites.	Concurrent with Ecology's review of the FFS, RL was working with Ecology on the confirmatory SAP. This SAP is currently being transmitted to Ecology as Rev. 0 for approval. Confirmatory and design sample definition, and requirements, and constituents being analyzed are associated with this SAP. The evaluation of the confirmatory sampling is defined in the RDR/RAWP. It is not our intent to revise the risk assessment with these additional sampling results. No changes required for FFS.

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149.	Section C3.2, General	Note that early drafts of this document preceded Ecology's requirement that COPCs be selected on the basis of analytical methods. As a result of this timing consequence, Ecology is not requiring this approach for this OU, but will expect it for other OUs within the 200 Areas. Several of the following comments pertain to selection of COCs from the COPC list used for this FFS. These changes are required for this FFS. Similar requirements will apply to FS documents prepared for other OUs in the 200 Areas.	**Comment Noted.** No action required for this FFS.
150.	Section C3.2.2.2, Page C-18	Do not use frequency of detection as a basis for eliminating COCs unless the data set contains greater than 20 observations.	**Comment Noted.** Section C3.2.2.2 indicates that COPCs were not eliminated unless the data set contained greater than 20 observations. It reads as such "Constituents detected in shallow-zone or deep-zone soil samples at a frequency of 5 percent or more were carried to the next step of the screening process.
151.	Section C3.2.2.2, Page C-20	Ecology previously made the following comment about the use of 10x the soil CUL when eliminating COCs: "The contaminants eliminated for 216-U-1 and U-2 cribs should be re-evaluated after referring to WAC 173-340-740 (7)(e). Instead of using a criterion of 10x the soil CUL, use 2x the soil CUL. This alone will not give grounds for elimination. You also need to consider the 95 UCL and whether or not 10% of samples exceed the soil CUL. After re-examining the COCs add those that couldn't be eliminated to risk assessments and reconsider remedial action alternatives." Ecology also requested that the data be analyzed using the criteria from the 3-part rule (WAC 173-340-740 (d) and (e)). In accordance with the above comments, change this section to the following: "Constituents detected in shallow-zone or deep-zone soil samples at a frequency of 5 percent or more <u>for data sets with</u>	**Comment Accepted.** The purpose of this screening criterion is to identify those constituents that are frequently detected and to eliminate those constituents that are infrequently detected and are not present at high concentrations (EPA 1989). The maximum concentrations of all constituents eliminated from the U-1 and U-2 Cribs were below their respective groundwater protection CUL and thus do not exceed 2x the soil CUL. As requested by Ecology, the 3-part test (i.e., WAC 173-340-740(7)(e)) was conducted on the requested analytes and presented in Appendix C. Per this evaluation, additional constituents were carried forward into the fate and transport modeling. To obtain 5% frequency, a sample set must contain at least 20 samples. Although the suggested text is redundant, the requested clarifications will be included regarding

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		greater than 20 observations were carried to the next step of the screening process. Frequency of detection was not used as a criterion for data sets with less than 20 observations. In addition, constituents detected at a frequency of less than 5 percent, but with maximum concentrations greater than ~~10~~ 2 times the soil CUL were retained as ~~COPCs~~ COCs." This is actually rather nonconservative as it allows for some detected contaminants to be eliminated from the COC list. EPA's risk assessment guidance (EPA/540/1-89/002) indicates that such a process is optional and that it is generally not appropriate to exclude any contaminants for which ARARs have been established. This option may not be available for other OUs in the 200 areas.	"20 observations." In addition, the requested change from 10 times to 2 times is incorporated. However, these constituents remain as COPCs as they have yet been carried forward into the risk assessment.
152.	Section C3.2.2.5, Page C-22, Lines 10-11	Since Draft A of this document, Ecology has obtained tributyl phosphate toxicity information; soil CULs are now available for TBP. Eliminate TBP from the list in this section and include it on the COPC list.	**Comment Accepted.** TBP will be eliminated from the referenced text. Note that this constituent is now listed as a COPC in the Section 3 PRG tables.
153.	Section C3.2.2.5, Page C-22, Lines 12 through 19	Eliminate the new text at the end of the paragraph, "Toxicity values were generally…into the RA;" Note that some PAHs have toxicity values and benzo-a-pyrene is used as a basis for assessing PAHs. Also, TICs may have toxicity values; TICs are defined on the basis of analytical constraints, not toxicity constraints.	**Comment Noted.** Text is considered appropriate as it refers to general classes of compounds.
154.	Page C-24	Reference is made to Table C-26. However, Table C-26 and C-67 appear to be the same table, yet have different information. Clarify which of these tables is correct.	**Comment Accepted.** Table C-26 is the version presented in Draft A, Table C-67 reflects the revisions made. Tables will be corrected accordingly.
155.	Page C-24	Include a discussion of the groundwater protection scenario; specifically, define the spatial extent of the contaminated zone that is assumed for the RESRAD calculations. In other words, define the range of depths that the deep zone exposure point concentrations are assumed to reside.	**Comment Noted.** The number of unsaturated strata (and associated properties) for each process waste site group is provided in Table C-67. These depths define the range of depths that the deep zone radiological EPCs reside. Additionally, depth is not an input parameter for the three-phase groundwater protection model.

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156.	Section C3.2.2.2, Page C-24, Line 35, and Table C-25, Page C-T53	Ecology previously made the following comment about this section: "The text states that the Industrial Land-Use Scenario assumes an individual will be exposed to contaminants over a period of 30 years. However, Table C-26 (page C-T51) indicates a value of 20 years was used in the RESRAD analysis for the exposure duration. Determine which value (20 or 30 years) is correct for the exposure duration, and ensure that the RESRAD calculations are run with the correct value. This RESRAD input parameter is important, as it is used in the calculation of lifetime cancer risk. Also, ensure that the text on page C-26 correctly states the value used in the RESRAD calculation." The end of the response to this comment was "Table C-26 will be revised to indicate that a 30 year exposure duration was used; all RESRAD runs were performed correctly with an ED of 30 years." Table C-26 is specific to RESRAD input parameters, and still lists the exposure duration as 20 years. Change the exposure duration in this table to 30 years.	**Comment Noted.** As shown in Table C-67 the recommended changes were made.
157.	Section C3.3.3, Page C-25, and Sections C3.3.4, C3.3.5, C3.3.6	Ecology previously made the following comment about Section C3.3.3: "Since these equations are for non-radionuclides only, please clarify the headings by changing to 'Equations for Non-Radionuclide …'" The response to this comment was "Comment Accepted. Text will be revised to indicate equations apply only to nonradiological constituents." The revision was not made. Revise the title of this section to Equations for Non-Radionuclide Soil Cleanup Levels. Also, revise the titles of Sections C3.3.4, C3.3.5, and C3.3.6 in a similar way.	**Comment Accepted.**

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158.	Section C3.3.7, Page C-28, Lines 23 through 27	There are several sources for toxicity data in addition to those listed. See OSWER Directive 9285.7-53. Toxicity values should be obtained from IRIS, HEAST-rad (FRG13), HEAST-nonrad, EPA Region 9 PRGs, ORNL-RAIS, ATSDR/MRLs, EPA/PPRTV, and scientific literature. Priority is given to IRIS; however, when values are not available in IRIS the other databases and scientific literature should be used. Add ORNL, ATSDR/MRL, EPA/PPRTV, and scientific literature to the list of sources for toxicity information.	**Comment Accepted with Modification**. The text has been updated to incorporate reference to the ORNL database. This database pulls from many sources and provides a cumulative list of values. Note, however, that these additional references do not provide toxicity values for the remaining constituents. Toxicity values are not available for the TICs.
159.	Section C3.4.1.4, PageC-32, Lines 10 through 13	Depth is not a suitable criterion to use for elimination of COCs, unless backed by suitable modeling results. Eliminate the statement: "This makes it unlikely that the concentration of 1,4-dichlorobenzene detected would affect the groundwater because the groundwater table is at approximately 250 ft bgs." This statement is not needed and is not supported with calculations or modeling. The best case for elimination of 1,4-dichlorobenzene is made by considering the detection limit for 1,4-dichlorobenzene, which is above the soil CUL. Inform the laboratory that they need to pursue analytical methods for 1,4-dichlorobenzene with lower detection limits.	**Comment Noted**. Analytical detection limits were defined based on the original agreed upon SAP (e.g., DOE/RL-2000-60) defining the original investigations. As such, the evaluation process appropriately screens against the detection limit.

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160.	Section C3.4.1.4, Page C-34, Lines 1 through 3	Similar to 1,4-dichlorobenzene in UPR-200-W-19, depth is not a suitable criterion to use for elimination of COCs, unless backed by suitable modeling results. Eliminate the statement: "Pentachlorophenol in the concentrations detected is unlikely to affect the groundwater because the groundwater table is at approximately 250 ft bgs." This statement is not needed and is not supported with calculations or modeling. The best case for elimination of pentachlorophenol is made by considering the detection limit for pentachlorophenol, which is above the soil CUL. Inform the laboratory that they need to pursue analytical methods for pentachlorophenol with lower detection limits.	**Comment Noted.** Analytical detection limits were defined based on the original agreed upon SAP (DOE/RL-2000-60) defining the original investigations. Although this contaminant was not modeled in Appendix D, it is not likely to be a groundwater protection concern due to depth and level of contaminant concentration.
161.	Section C3.5, Page C-34, General	For most of the sites there have been increases in risk levels, and in some cases dose levels, since Draft A of the document. This is especially true for the Native American scenario, though it does also apply in some cases to the groundwater protection scenario. Explain the cause of these changes. Several related specific comments follow.	**Comment Noted.** Following the issuance of Draft A, an effort was made to make parameters similar to both RESRAD and STOMP consistent. The modeling modifications resulted in changes to the risk assessment results
162.	Sections C3.5.1.3, C3.5.1.4, and C3.5.1.5, Page C-37 through C-40, Native American scenario	The dose levels for the Native American scenario at 216-U-4/U-4A, UPR-200-W-19 and 216-U-1/U-2 have not changed since Draft A. However, the excess lifetime cancer risk (ELCR) values have increased. Explain.	**Comment Noted.** Following the issuance of Draft A, an effort was made to make parameters similar to both RESRAD and STOMP consistent. The modeling modifications resulted in changes to the risk assessment results.

200-UW-1 OU

DOCUMENT REVIEW, COMMENT, RESOLUTION LIST

DOCUMENT TITLE: Focused Feasibility Study for the 200-UW-1 Operable Unit, DOE/RL-2003-23, Draft C Regulatory Review.			
Reviewer: Ecology		Date: 31 Jan 05	Company: Washington State Dept of Ecology
Index	**Reference**	**Comment**	**Comment Resolution**
163.	Section C3.5.1.5, Page C-40, Lines 21 through 26	The ELCR values for 216-U-1/U-2 groundwater protection scenario have changed somewhat. They are generally higher, though the times modeled have also been changed so it is difficult to make a direct comparison. Draft A included ELCR values for 4800 and 10,000 years for U-238 that were 8E-03 and 5.4E-06, respectively. No values have been provided in this section in Draft C for time periods after 1000 yr, though page D-2 lines 35-37 state that fate and transport models were run to examine low mobility contaminants that peak at times beyond 1000 yr. Explain the changes.	**Comment Noted.** Following the issuance of Draft A, an effort was made to make parameters similar to both RESRAD and STOMP consistent. The modeling modifications resulted in changes to the risk assessment results.
164.	Section C3.5.1.6, Page C-41, Groundwater Protection	The dose levels for this scenario have increased somewhat since Draft A. They have gone from 1.8 mrem/y to 9.1 mrem/y (both at 126 y). Explain the increase.	**Comment Noted.** Following the issuance of Draft A, an effort was made to make parameters similar to both RESRAD and STOMP consistent. The modeling modifications resulted in changes to the risk assessment results.
165.	Section 3.6.3, Page C-43, 2nd paragraph of section	Eliminate TBP from the list in this section since it will be added as a COPC.	**Comment Accepted.** TBP will be eliminated from the referenced text. Note that this constituent is now listed as a COPC in the Section 3 PRG tables.
166.	Section D3.2, Page D-3, last paragraph of page	Cite references in the text for the infiltration rates. Also, provide the November to February recharge rates. These are necessary for Ecology to approve the fate and transport results.	**Comment Accepted with Modification.** References for the infiltration rates used will be cited in the text (WDOH, 1997, *Hanford Guidance for Radiological Cleanup*, WDOH/320-015, Rev. 1, Division of Radiation Protection, Washington Department of Health, Olympia, Washington, and RPP-6296 *Modeling Data Package for S-SX Field Investigation Report (FIR)*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.). The infiltration rate represents the long-term annual average that encompasses the seasonal fluctuations in precipitation. No attempt to partition the recharge on the basis of seasonal fluctuations in precipitation was made.

200-UW-1 OU

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Index	**Reference**	**Comment**	**Comment Resolution**
167.	Section D4.0, Page D-7, 1st paragraph of page	Provide in the text the geologic unit that corresponds to the pressure values given in this paragraph.	**Comment Noted.** The pressures were calculated within the model, and do not correspond to a geologic unit per se. The hydrologic properties of the different units effect the calculations, but not necessarily to the point where the pressure values could be said to correspond to a geologic unit. Using changes in aqueous pressure produced the smoothest continuum (compared to changes in moisture content or saturation) for calculating a difference between pre- and post-operation conditions and assigning contaminant concentrations in the model.
168.	Section D5.0, Page D-7-D-9, General	The fate and transport modeling results are partial support for the remedies for the sites. For this reason, Ecology requires additional information; there are several comments below asking for modeling results between 1000 and 10,000 yr. The requests are made because the length of time required for a contaminant to reach groundwater is not a criterion used in setting cleanup levels according to WAC 173-340. However, if the contaminants do not exceed groundwater MCLs during the longer simulation periods then exceptions can be made for these sites.	**Comment Accepted.** The general comment has been accepted. The specific changes are addressed in the following comments numbered 169 – 173.
169.	Section D5.1, Page D-8, Lines 12 through 15	Describe in the text the fate of uranium between 1000 and 10,000 yr.	**Comment Accepted.** The fate of uranium between 1,000 and 10,000 yrs will be included in the text.
170.	Section D5.2, Page D-8, Lines 28 through 32	Describe in the text the fate of uranium and mercury between 1000 and 10,000 yr.	**Comment Accepted.** The fate of uranium and mercury between 1,000 and 10,000 yrs will be included in the text.
171.	Section D5.3, Page D-9	Describe in the text the fate of Tc-99, Sb, and nitrate between 1000 and 10,000 yr.	**Comment Accepted.** The fate of Tc-99, Sb, and nitrate between 1,000 and 10,000 yrs will be included in the text.
172.	Section D5.4, Page D-9	Describe in the text the fate of uranium and arsenic between 1000 and 10,000 yr.	**Comment Accepted.** The fate of uranium and arsenic between 1,000 and 10,000 yrs will be included in the text.

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173.	Section D5.5, Page D-9	Describe in the text the fate of Tc-99, U, As, nitrate, and nitrite between 1000 and 10,000 yr.	**Comment Accepted.** The fate of Tc-99, uranium, arsenic, nitrate and nitrite between 1,000 and 10,000 yrs will be included in the text.
174.	Figures D-2 through D-6, General	Plot on the y axis m bgs instead of elevation.	**Comment Noted.** Profile sections were plotted using elevation to provide accurate and comparable depths between different profile. Plotting by depth below ground surface would be arbitrary between locations. No changes in figure are planned.
175.	Figures D-2 through D-6, General	The figures have changed significantly since Draft A. Explain the changes in the modeling since Draft A.	**Comment Accepted.** The figures have changed for three primary reasons. First, the input hydrologic parameters were modified to be more specific to the U Plant Area (e.g., updated effective porosity from a more regional value to a value more appropriate for 200 West) and to ensure consistency with other evaluations (e.g., updated lithology in Appendix C and D to be consistent with interpreted well logs). Second, modified the plume profile based on aqueous pressure rather than aqueous saturation. Using the change in aqueous pressure produced more characteristic profiles in the vadose zone and representative distribution of the contaminants. Finally, the contaminant profiles incorporated the full set of data, including non-detects and lesser values in addition to maximum concentrationsto help define the shape of the depth distributions of the contaminants
176.	Figure D-4, Page D-19 and D-20	Explain in the text why antimony concentrations in the soil are so high above and in the Cold Creek unit (they appear to be greater than 100 mg/kg).	**Comment Accepted.** There was an error in creating this figure that incorrectly reflected contaminant concentrations. Figure D-4 will be updated to accurately depict the sampling results.
177.	Appendix D, Figures D-4, D-5, and D-6	Labels on the cross sections conflict with the figure captions in many cases. Many are labeled "Backfill (216-U-1 and 216-U-2)" (see top centers). Correct the labels.	**Comment Accepted.** Backfill labels will be revised to read consistent with profile crib labels.

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178.	Appendix D, Page D-41, Dilution	The description of the STOMP model and its usage does not indicate what compensation has been made to account for the concentrations of contaminants in groundwater from upgradient sources. WAC 173-340-747(8)(b)(vi) requires that dilution factors be adjusted downward when there are upgradient sources of contamination. Upgradient contributions must be considered in modeling. Discuss this in Appendix D.	**Comment Noted.** The impacts from the individual facilities are estimated apart from upgradient sources. This is consistent with the agreements made in the Proposed Plan. WAC 173-340-747(8)(b)(vi) states that adjusting dilution factors to account for upgradient sources in an option, but does not state it as a requirement.
179.	Appendix D, Page D-41, Infiltration	Use of an evapotranspiration rate of 90% for the waste sites must be supported with data. Most of the precipitation arrives during the late fall and winter, during times of low temperatures and low biologic activity. The waste sites are currently disturbed, coarse, or graveled surfaces with enhanced infiltration rates. Provide the data used to arrive at an evapotranspiration rate of 90%.	**Comment Accepted.** Text will be revised to include the WDOH, 1997, Hanford Guidance for Radiological Cleanup, WDOH/320-015, Rev. 1, Division of Radiation Protection, Washington Department of Health, Olympia, Washington reference for the evapotranspiration rate of 91% (the 90% in the text is a roundoff).
180.	Appendix E Page E-2	Waste site 200-W-42 is included in the HHRA, but is omitted from the intruder scenario analysis, yet this site has some of the highest shallow zone contaminant concentrations. Furthermore, this site has no clean cover, so even if the site is capped, contamination will exist with 15 feet of the local surface. This site should be included in the intruder analysis unless an acceptable reason for its omission is given.	**Comment Noted.** The intruder scenario focuses only on the representative waste sites. Although the 200-W-42 waste site does have high contaminant concentrations in the shallow zone, cesium-137 is the only constituent with results above the PRGs. All of the sample results collected along the pipeline that will remain under the barrier are below the PRGs, including those for cesium-137. The cesium-137 results above the PRGs are well to the north of the 216-U-8 barrier footprint and will be remediated as part of the RTD remedial actions. No shallow zone contamination above the PRGs will remain in place at this waste site.

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181.	Appendix E Page E-5	Section E3.3 needs clarification. First, page E-2 indicates that the waste sites were evaluated for an exposure time starting at 150 years in the future. Therefore, we assume that the exposure point concentrations used in the calculations were adjusted to account for radioactive decay over a period of 150 years. Inspection of Table E-1 and the EPC tables in Appendix C seem to verify this. However, this point should be made in the text of Section E3.3. Second, the statement that all radionuclides evaluated present acceptable cancer risks in year 150 is misleading. Change the statement to say that excess cancer risks achieve threshold levels 300 years from now (since time 0 of the calculations is 150 years from now).	**Comment Accepted.** Concentrations have been decayed 150 years. Clarification of this will be added to the text as appropriate.
182.	Appendix E Page E-6	For the rural residential intruder scenario conclusion, include a statement that the dose at 216-U-8 and 216-U-1 is 800 and 1000 mrem/yr at a time 150 years from now (time 0 of the calcs). It is important to note this since the dose results are so high.	**Comment Accepted.**
183.	Appendix E Section E4.0, Page E-6, Lines 1 through 8	Intruder doses exceed guidelines for 216-U-1/U-2 and 218 U-8 for the well driller at 150 yr. For residential intruders the doses exceed guidelines for these two sites plus 216-U-4/U-4A at 150 yr. For these reasons the design of the barriers must include provisions for preventing human intrusion in the distant future.	**Comment Accepted.** Institutional controls (active for first 150 years and passive thereafter) will be in place for the life of the barrier. A statement to this effect will be added to the text.
184.	Appendix F General	With a cost estimate confidence range of +50 percent, -30 percent, 8 significant figures gives the illusion of precision. Recommend to either provide a statement as to the accuracy of the cost estimate, or assure that all cost values presented reflect the appropriate accuracy of the estimate.	**Comment Accepted.** The significant figures will be revised accordingly.
185.	Appendix F, Page F-1, 1st paragraph	Provide the basis for the +50 percent, -30 percent confidence range of the cost estimate.	**Comment Accepted.** Text will be added to clarify the basis of the +50/-30 estimate.
186.	Appendix F, Page F-3, 1st paragraph	Provide the cost estimate basis for the $2,000 per sample; needs to be based on actual sampling and analytical costs.	**Comment Accepted.** The backup information for this cost will be clarified in a footnote.

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Index	**Reference**	**Comment**	**Comment Resolution**
187.	Appendix F, Page F-3, 3rd paragraph	Clarify the sentence that "present net worth for surveillance and maintenance … are added to the common costs discussed in Section F2.1 to reach the total present worth cost for this alternative." Section F2.1 is the No Action, assumes the costs to be zero.	**Comment Accepted.** The sentence referencing Section 2.1 should reference that the cost of the independent work elements in Section F2.5 (241-U-361 sludge removal) is added to the cost of this alternative.
188.	Appendix F, Page F-3, Section F2.3, 3rd paragraph	Incorporate into the estimate the escalation rate to account for the costs associated with the RTD alternative. Even though the logics state that the alternative is to take place within one year, the site schedule is indicating something longer. The same statement "present net worth for surveillance and maintenance … are added to the common costs discussed in Section F2.1 to reach the total present worth cost for this alternative." Section F2.1 is the No Action, assumes the costs to be zero.	**Comment Noted.** The FH project schedule still anticipates a one year duration. No change to FFS cost estimates. **Comment Accepted.** Section reference will be corrected.

200-UW-1 OU

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Index	**Reference**	**Comment**	**Comment Resolution**
189.	Appendix F, Page F-4, Section F2.4	Engineered barrier alternative requires upfront engineering design, construction QA/QC, and independent inspections, for example. Incorporate into the cost estimate these costs. As preciously stated, the same statement "present net worth for surveillance and maintenance ... are added to the common costs discussed in Section F2.1 to reach the total present worth cost for this alternative." Section F2.1 is the No Action, assumes the costs to be zero.	**Comment Accepted with Modification.** Engineering design: Section 6.2.3.7 of "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA: (EPA-540/G-89/004) indicates that the standard cost estimates for a FS do not include engineering design. Engineering costs during remedial action are included as part of the labor costs. This is consistent with other FS cost estimates on site. Independent inspections are not included and typically have not been included previously. Construction QA/QC costs are included as a part of the cost model, however, they are not separated into a separate line item. A footnote will be added to indicate that QA/QC costs are included in the estimates. The sentence referencing Section F2.1 should correctly reference that the cost of the independent work elements in Section F2.5 .
190.	Appendix F, Page F-45, Section F2.5	Provide a cost estimate comparison of the cost models used in the estimate to actual project costs. Such a sensitivity analysis would lend credence to the estimate uncertainty range provided earlier in Section F1.0.	**Comment Noted.** Fluor Hanford does not have actual project costs for removal of liquid sludge from settling tanks. Actual project costs for projects outside of the Hanford site cannot be reliably compared to Hanford project site costs.
191.	Appendix F, Page F-16, Footnote 2	Provide the basis for the cost estimate of $1,500/site for less than an acre; $6,000/site for site 1 to 4 acres; and $1,500 x acreage for sites larger than 4 acres.	**Comment Accepted.** The backup information for this cost will be clarified in the footnotes.

200-UW-1 OU

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Index	**Reference**	**Comment**	**Comment Resolution**	
192.	Appendix F, Page F-24, Footnote 2	Provide the basis for the cost estimate of $50,000/yr for Barrier Performance Monitoring, etc.	**Comment Accepted.** The backup information for this cost will be clarified in the footnotes.	
193.	Plate 1	Add well 299-W19-43 to the map, since data are presented in Figures 2-12 through 2-15 and Table 2-2 for this well.	**Comment Accepted.** This well will be added to Plate 1.	

DOE/RL-2003-24
REVISION 0

Proposed Plan for the 200-UW-1 Operable Unit

DRAFT

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

United States Department of Energy
P.O. Box 550
Richland, Washington 99352

DOE/RL-2003-24
Revision 0

Proposed Plan for the 200-UW-1 Operable Unit

Date Published
February 2005

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

United States Department of Energy
P.O. Box 550
Richland, Washington 99352

Release Approval _____ Date _____

DOE/RL-2003-24
Revision 0

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United States
Department of Energy

United States
Environmental Protection
Agency

Washington State
Department of Ecology

DOE/RL-2003-24
REVISION 0
FEBRUARY 2005

PROPOSED PLAN FOR THE

200-UW-1 OPERABLE UNIT

HANFORD SITE
RICHLAND, WASHINGTON

INTRODUCTION

The U Plant Area, located on the Central Plateau of the Hanford Site, contains numerous contaminated waste sites, structures, and facilities that pose a potential risk to human health and the environment. To reduce these risks, the waste sites and facilities will be cleaned up (i.e., remedial actions will be implemented). The project divides the U Plant Area (shown in Figure 1) into five distinct components. The following five components make up the U Plant Area:

- 221-U Facility[1] (to be addressed by the Canyon Disposition Initiative [CDI])
- Facilities that are ancillary or related to the 221-U Facility
- Underground pipelines
- Soil waste sites (such as 200-UW-1 Operable Unit [OU])
- Groundwater underlying the area (200-UP-1 OU).

The enforceable schedules for the other components will be established either in approved decision documents (Action Memos or Records of Decision [RODs]), or in milestones under the Hanford Federal Facility Agreement.

Remedial action for the U Plant Area is required by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA). As individual cleanup strategies are developed for each of the above components, decisions proposed for each component will be presented to the public for feedback. This document presents the Proposed Plan (Plan) for the 33 waste sites contained in the 200-UW-1 OU. The 33 waste sites have been categorized into 6 groups. This plan describes and evaluates 4 cleanup alternatives and identifies the preferred alternative for for each group. In some cases it was beneficial to pick individual alternatives for individual sites. The preferred alternatives for the groups and sites have been consolidated into this single cleanup proposal. The evaluations of these four alternatives provide the basis for future "plug-in" approaches that can be used for similar waste sites currently identified in the U Plant Area (such as unplanned releases and underground pipelines) and newly discovered waste sites that are similar to the ones in this Plan. The Plan supports selection of a final remedy or remedies that will be documented in a record of decision (ROD).

In addition, this Plan identifies the closure strategy for the 216-U-12 Crib, a *Resource Conservation and Recovery Act of 1976* (RCRA) treatment, storage, and/or disposal (TSD) unit. The closure performance standards for this TSD unit are contained within the CERCLA documentation for the soil waste sites.

HOW YOU CAN PARTICIPATE

The "Public Participation" section of this document provides dates for the public review period and other information regarding public involvement.

The Tri-Parties will accept written comments on the Proposed Plan from April 4, 2005 through May 18, 2005. Comments can be sent to John Price at the Washington State Department of Ecology via:

- **mail: ATTN: Mr. John Price, 3100 Port of Benton Blvd., Richland, WA 99354-1670**
- **fax: (509) 372-7921**
- **email: jpri461@ecy.wa.gov**

Waste Sites
Sites that are contaminated or potentially contaminated from past operations. Contamination may be contained in environmental media (e.g., soil, groundwater) or in manmade structures or solid waste (e.g., debris).

CERCLA
Comprehensive Environmental Response, Compensation and Liability Act of 1980, commonly known as Superfund.

Proposed Plan
The plan provided by the responsible parties that presents the preferred alternatives for remedial action of waste sites to the public. The proposed plan is based on, and is essentially a summary of, the feasibility study.

Plug-In Approach
Under this approach, a standard remedy is selected that applies to waste sites with similar attributes, rather than to a specific waste site.

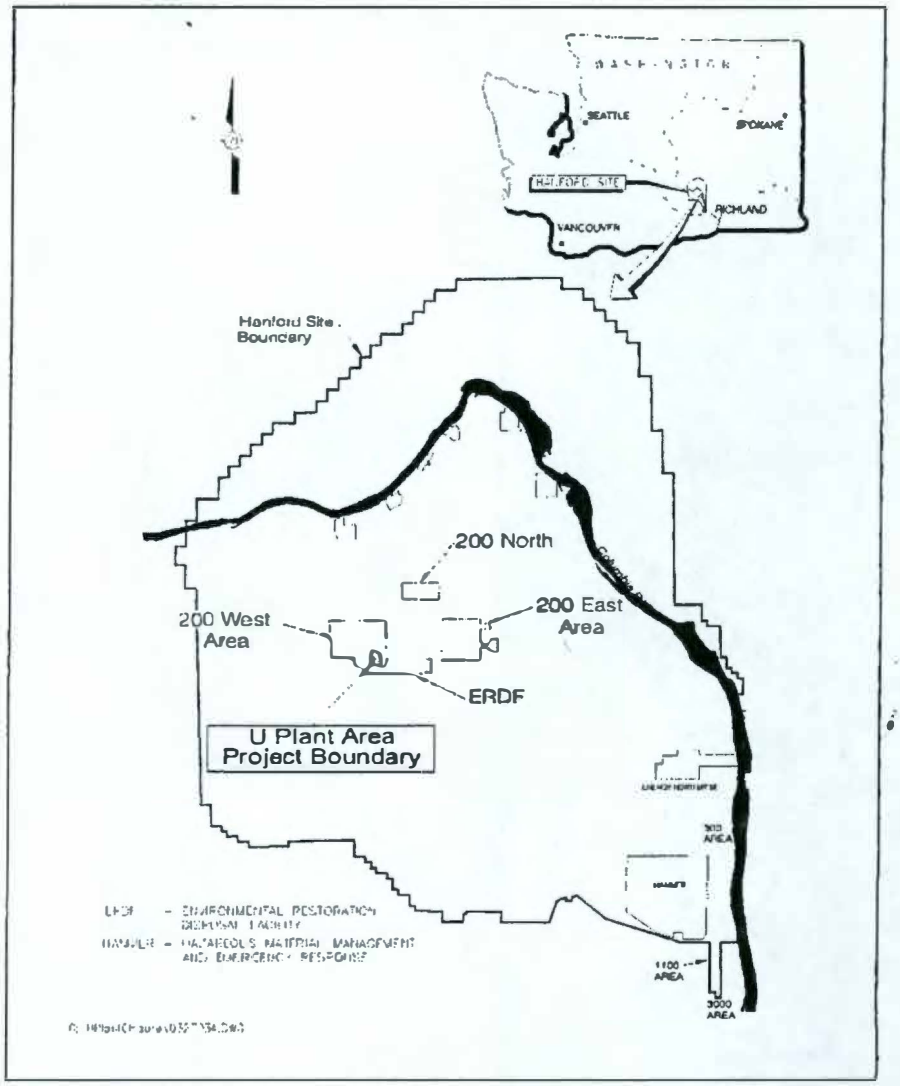
Record of Decision (ROD)
The document in which the lead regulatory agency sets forth the selected remedial measure and provides the rationale for its selection.

RCRA
Resource Conservation and Recovery Act of 1976.

TSD Unit
A facility used for treatment, storage, and/or disposal (TSD) of dangerous wastes.

[1] The 221-U Facility includes the 271-U Support Services Building, the 276-U Solvent Handling Facility, and other surrounding structures and waste sites within the footprint of the CDI barrier.

FIGURE 1. U PLANT AREA



EPA
U.S. Environmental Protection Agency

Ecology
Washington State Department of Ecology

DOE
U.S. Department of Energy

Tri-Parties
DOE, EPA, and Ecology

Hanford Federal Facility Agreement and Consent Order
An agreement and consent order between DOE, EPA, and Ecology that details the process to be used to address CERCLA, RCRA, and state requirements for cleaning up the Hanford Site. Also known as the Tri-Party Agreement.

NEPA
National Environmental Policy Act of 1969 (NEPA).

This Plan is issued by the U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology), and the U.S. Department of Energy (DOE). These three agencies – collectively known as the Tri-Parties – are proposing the preferred remedies for these waste sites under the authority of CERCLA, and in accordance with the *Hanford Federal Facility Agreement and Consent Order*, also known as the Tri-Party Agreement (Ecology et al. 1989). Also incorporated into this Plan are elements necessary to meet DOE's responsibilities under the *National Environmental Policy Act of 1969* (NEPA).

The Tri-Parties are issuing this Plan as part of the public participation responsibilities under Section 117(a) of CERCLA and 40 CFR 300.430(f)(3) of the *National Oil and Hazardous Substance Pollution Contingency Plan*. Final remedies will be selected only after the public comment period has ended and the comments received have been reviewed and considered. The public is encouraged to review and comment on all of the alternatives presented in this Plan. If requested, the Tri-Parties will hold a public meeting to explain the content of this Plan and to

obtain additional comments. Responses to comments will be presented in a responsiveness summary that will be part of the ROD.

Ecology is issuing a draft permit for closure of the 216-U-12 Crib RCRA TSD unit as required by WAC 173-303-840, "Procedures for Decision Making" in conjunction with this Plan. A combined public meeting/public hearing for the CERCLA Proposed Plan and RCRA draft Closure Plan will be held in April 2005.

Throughout this Plan there are references or highlights to key information that can be found in greater detail in the focused feasibility study (FFS) (DOE/RL-2003-23, *Focused Feasibility Study for the 200-UW-1 Operable Unit*) and other documents contained in the Administrative Record. These documents provide a more comprehensive understanding of the history, previous studies, and site descriptions that are considered in the evaluation of remedial alternatives and selection of preferred remedies.

The Tri-Party Agreement states that CERCLA and RCRA requirements should be integrated to achieve compliance with CERCLA, the corrective action requirements of the "Hazardous Waste Management Act" (WAC 173-303), RCRA, and will meet or exceed applicable or relevant and appropriate federal and stated requirements to the extent required by CERCLA. This is accomplished by coordinating the TSD unit closure with the OU investigation and remediation to minimize overlap and duplication of work. Details of this integration are provided in Article IV and Section 5.5 of the Tri-Party Agreement.

Ecology will issue a separate draft permit modification for closure of the 216-U-12 Crib RCRA TSD unit. Ecology intends to base the closure activities for the 216-U-12 Crib on the closure documentation presented in the FFS and administrative record. This is consistent with provisions for CERCLA-RCRA integration contained in the Tri-Party Agreement. Also, because of similarities in design and construction requirements for the CERCLA remedy and the 216-U-12 Crib closure, Ecology intends to implement closure activities for the 216-U-12 Crib by using the Remedial Design/Remedial Action Work Plan for the CERCLA remedies.

WAC 173-303-840
"Procedures for Decision Making."

Administrative Record
The files containing the documents used to select the remedial action. The Administrative Record can be accessed through the Information Repositories (IR). See Public Participation for IR locations at the end of this plan.

Remedial Alternative
General or specific actions that are evaluated to determine the extent to which they can eliminate or minimize threats posed by contaminants to human health and the environment.

Overview of the Proposed Plan

This Plan proposes remedial actions for the 200-UW-1 OU waste sites. These remedial actions are primarily proposed for liquid-waste disposal sites and a few solid waste sites associated with the 221-U Facility operations. The liquid-waste disposal sites include cribs, trenches, French drains, septic systems, unplanned release sites, one underground settling tank, and one underground pipeline. The solid waste sites include debris piles and a burial trench.

Table 1 provides a summary of the key contaminant information (based on existing conditions) associated with several of the waste sites in this Plan. Table 1 includes information on risk-based concerns, contaminants, their maximum concentrations and distribution below ground surface. Table 1 also identifies the period of time for remedial action objectives (RAO) to be met *without* implementing a remedial action (consistent with no action).

To select preferred remedies, the Tri-Parties evaluated the following range of alternatives:

- Alternative 1 – No Action
- Alternative 2 – Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation
- Alternative 3 – Removal, Treatment, and Disposal

- Alternative 4 – Engineered Barrier (includes Monitored Natural Attenuation for short-lived radioisotopes at shallow depth, that are principal threat wastes).

These alternatives are described in "Summary of Remedial Alternatives" later in this Plan. This Plan presents a remedy, or a combination of remedies, for each waste site. The evaluation of alternatives is conducted based on the CERCLA criteria.

TABLE 1. SUMMARY OF CONTAMINANTS AND RISK INFORMATION FROM REPRESENTATIVE SITES AND 200-W-42 VCP/UPR-200-W-163[a].

Waste Site	Risk-Based Concern	Contaminant	Maximum Concentration and Associated Depth Below Ground Surface (pCi/g or mg/kg)[b]	(ft)	Range of Contaminant Below Ground Surface (ft)	No Action Timeframe to meet RAOs (yr)
216-U-1 and 216-U-2 Cribs	Direct Contact	Cesium-137	259	6	0 – 13	128
	Groundwater Protection	Technetium-99	350	43	0 – 168	> 1,000
		Antimony	11.4	0.5	0 – 182	0
		Uranium	32,700	29.5	0 – 182	0
216-U-8 Crib	Direct Contact	Cesium-137	429	2	0 – 6	141
	Groundwater Protection	Uranium	280	189	0 – 199	> 1,000
		Nitrogen as nitrate and nitrite	304	199	0 – 199	> 1,000
		Antimony	11.2	0.5	0 – 199	0
216-U-12 Crib	Groundwater Protection	Nitrogen as nitrate and nitrite	197	212	4 – 233	> 1,000
		Arsenic	8.6	6	4 – 6	0
		Uranium	5.1	40.6	4 – 233	0
216-U-4 Reverse Well/ 216-U-4A French Drain	Direct Contact	Cesium-137	342	5	4 – 14	125
	Groundwater Protection	Mercury	4.7	6.2	4 – 193	0
		Uranium	12.5	62	4 – 193	0
Unplanned Release UPR-200-W-19	Direct Contact	Cesium-137	259	6	0 – 13	129
	Groundwater Protection	Antimony	11.4	0.5	0 – 12.5	0
200-W-42 VCP / UPR-200-W-163	Direct & Ecological Contact	Cesium-137	40,081	11	5 – 13	831
	Groundwater Protection	Arsenic	19.1	12	5 – 13	0
		Nitrogen as nitrate and nitrite	116	12	5 – 13	0
		Uranium	160	7.5	5 – 13	0

[a] Although this site is not a representative site (described on page 6), enough data has been collected to determine site-specific risk and contaminant distribution.
[b] Concentrations for radionuclides are shown as picocurie per gram (pCi/g); concentrations for chemicals are shown as milligrams per kilogram (mg/kg).

RAO = remedial action objective (described on page 13).
VCP = vitrified clay pipeline

Direct Contact
Risk based concern indicative of adverse health effects due to contact with contaminated soil.

Given the varied nature and extent of the contamination across the waste sites, no single alternative was selected for all the waste sites.

Table 2 provides an overview of the alternatives selected for each site along with estimated present-worth costs. Figure 2 provides a graphical summary of the preferred alternatives.

The combined present-worth cost for implementing the preferred alternatives is estimated to be approximately $18 million, based on the CERCLA requirement of +50% / -30% accuracy. Present-worth costs for each of the waste sites are provided in Appendix A.

The remaining sections of this Plan provide information on the following:

- Background of the U Plant Area
- Scope and role of the proposed actions, including strategies used to characterize the waste sites, and regulatory requirements and goals for the remedial actions
- Site risks
- Summaries and evaluations of remedial alternatives
- Preferred alternatives for the different waste sites
- Strategies for streamlining future actions at other U Plant Area waste sites (plug-in approach)
- Cleanup strategy for the RCRA TSD unit closure
- Public participation.

Since preparation of the FFS, the 200-W-56 and 200-W-57 Dump in the 200-UW-1 OU has been removed from the CERCLA process with no further actions required. Therefore, there are only 31 waste sites identified in this Plan. This removal is consistent with the Tri-Party Agreement and has been approved by the Tri-Parties.

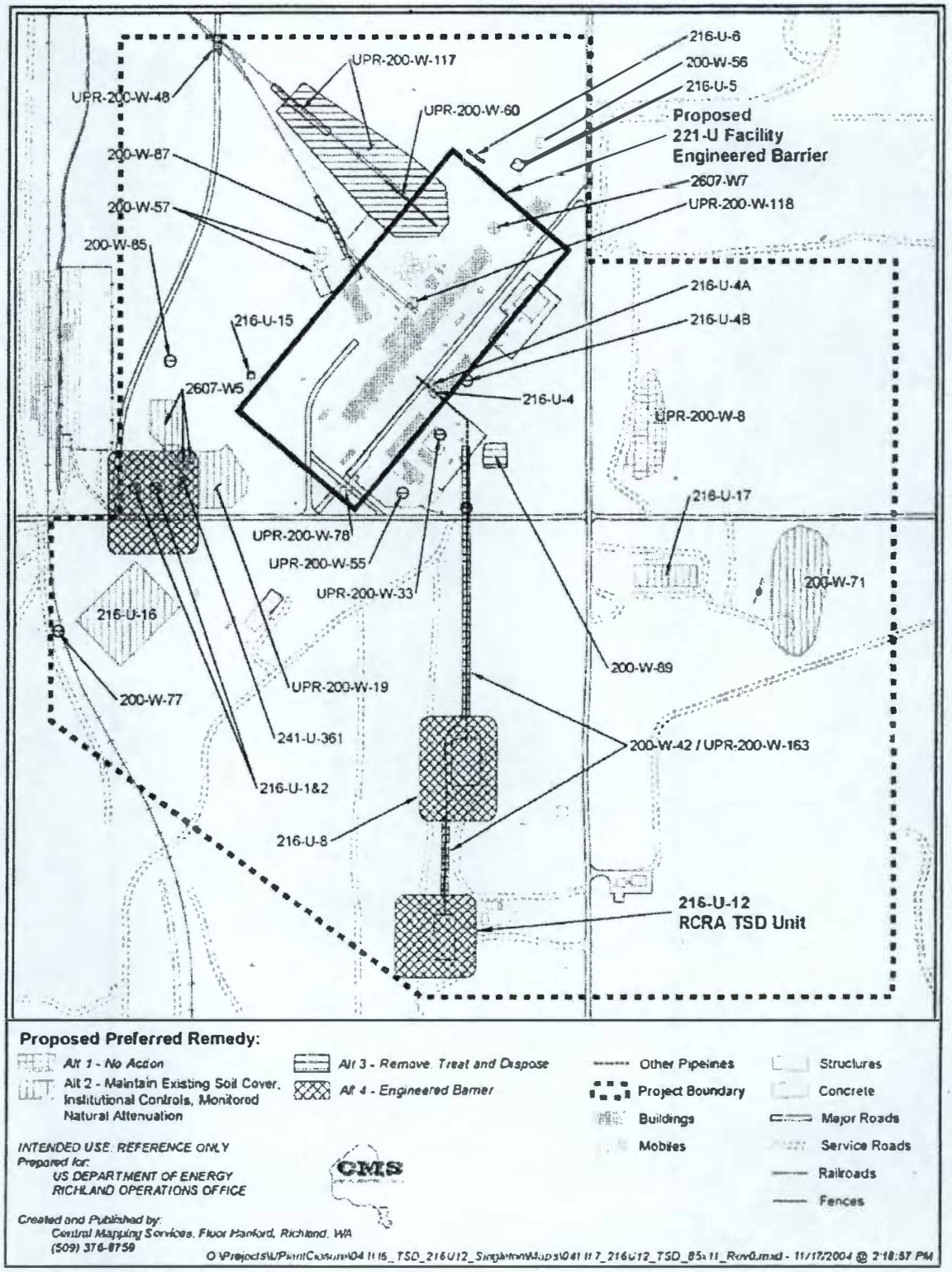
TABLE 2. PREFERRED ALTERNATIVES FOR INDIVIDUAL WASTE SITES.

Alternative 3 – Removal, Treatment, and Disposal	
Number of waste sites associated with the Preferred Remedy	15
Estimated total cost of this Preferred Remedy ($1,000)[a]	$6,553
Associated Waste Sites	
200-W-42 VCP and UPR-200-W-163	UPR-200-W-48
	UPR-200-W-55
216-U-5 Trench	200-W-77
216-U-6 Trench	200-W-85
216-U-15 Trench	200-W-87
216-U-48 French Drain	200-W-89 Foundation
UPR-200-W-33	UPR-200-W-117 and UPR-200-W-60
Alternative 4 – Engineered Barrier	
Number of waste sites associated with the Preferred Remedy	5
Estimated total cost of this Preferred Remedy ($1,000)[a]	$9,725
Associated Waste Sites	
216-U-1 Crib / 216-U-2 Crib	216-U-8 Crib
241-U-361 Settling Tank	216-U-12 Crib (RCRA TSD unit)
Alternative 2 – Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation	
Number of waste sites associated with the Preferred Remedy	9
Estimated total cost of this Preferred Remedy ($1,000)[a]	$1,377
Associated Waste Sites	
216-U-16 Crib	2607-W5 Septic Tank and Tile Field
216-U-17 Crib	200-W-71 Pit
216-U-4 Reverse Well / 216-U-4A French Drain	UPR-200-W-118
UPR-200-W-19	UPR-200-W-78
Alternative 1 – No Action	
Number of waste sites associated with the Preferred Remedy	3
Estimated total cost of this Preferred Remedy ($1,000)[a]	$ 0
Associated Waste Sites	
2607-W7 Septic Tank and Tile Field	UPR-200-W-8 Burning Ground

[a] Present-worth estimates are a rough order of magnitude and can be 30% under or 50% over due to uncertainties that exist at this time.

UPR = unplanned release
RCRA = *Resource Conservation and Recovery Act of 1976.*
TSD = treatment, storage, and/or disposal (unit).
VCP = vitrified clay pipeline.

FIGURE 2. PROPOSED PREFERRED REMEDIES FOR 200-UW-1 OPERABLE UNIT WASTE SITES.



SITE BACKGROUND

Hanford Site

The Hanford Site (Figure 1) is a 1517 km² (586-mi²) Federal facility located in southeastern Washington State along the Columbia River. From 1943 to 1990, the primary mission of the Hanford Site was the production of nuclear materials for national defense. In July 1989, the 100, 200, 300, and 1100 Areas of the Hanford Site were placed on the National Priorities List (NPL) (40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Appendix B, "National Priorities List") pursuant to CERCLA.

Central Plateau

The Central Plateau is located in the central portion of the Hanford Site and is divided into three areas: 200 East Area, 200 West Area, and 200 North Area. Operations in the 200 East and 200 West Areas were related to chemical separation, plutonium and uranium recovery, processing of fission products, and waste partitioning. Major chemical processes in the Central Plateau resulted in delivery of high-activity waste streams to systems of large underground tanks called "tank farms." The liquid wastes were often neutralized before being sent to the tanks and later evaporated (concentrated). The storage tanks were used to allow the heavier constituents to settle from the liquid effluents, forming sludge. Low-activity liquid wastes were discharged to trenches, cribs, drains, and ponds, most of which were unlined. The 200 North Area formerly was used for the interim storage and staging of irradiated fuel.

U Plant Area and 200-UW-1 Operable Unit

Within the 200 West Area, the U Plant Area is approximately 0.84 km² (0.32 mi²) and consists of the 221-U Facility, facilities that are ancillary or related to the facility, underground pipelines, soil waste sites, and the groundwater underlying the area.

The 200-UW-1 OU addresses 33 soil waste sites located within the U Plant Area. These sites are primarily liquid-waste disposal sites with a few solid waste sites, as summarized in Table B-1, Appendix B. These sites range from being rather small (approximate surface area of 2.7 m² [30 ft²] and 1 m [3 ft] in depth) to very large (approximate surface area of 4645 m² [50,000 ft²] and 61 m [200 ft] in depth). The contaminants at depth exceed the groundwater protection criteria.

The groundwater underlying the U Plant Area is located approximately 255 ft below ground surface. The groundwater currently has elevated levels of nitrates, technetium-99, uranium, and carbon tetrachloride. The 200-UW-1 OU high-risk waste sites are suspected to have contributed to the already contaminated groundwater by supplying additional concentrations of uranium, technetium-99, and nitrates. Monitoring and treatment of the groundwater currently are ongoing within the 200-UP-1 OU. Results of these treatment efforts indicate a general downward trend in contaminant concentrations. However, concentrations still exceed maximum contaminant levels (MCL).

SCOPE AND ROLE OF ACTION

This Plan presents remedial actions for contaminated soils, structures (e.g., concrete, tanks), and debris (e.g., timbers) associated with liquid-waste disposal sites and solid waste sites in the 200-UW-1 OU. The preferred remedial

NPL
National Priorities List. A list of top-priority hazardous waste sites in the United States that are eligible for investigation and cleanup under Superfund (40 CFR 300, Appendix B).

Crib
An underground structure designed to receive liquid waste that can percolate directly into the soil.

Reverse / Injection Well
A well (sometimes drilled into the water table) designed to receive liquid wastes that percolate into the underlying vadose zone.

Characterization of Waste Sites
Waste sites within the 200-UW-1 have been characterized through a series of three investigations:

(1) A scoping-level investigation (e.g., *U Plant Source Aggregate Area Management Study Report* [DOE/RL-91-52]).

(2) A limited field investigation (e.g., *Limited Field Investigation for the 200-UP-2 Operable Unit* [DOE/RL-95-13]).

(3) The application of the analogous sites approach (DOE/RL-2003-23).

High Risk Sites
Waste sites suspected of contributing to groundwater contamination. Capping is proposed for these sites.

All of the known high-risk sites have been sampled, and the remaining OU waste sites have been characterized through process knowledge and the analogous site approach.

A separate ROD will address the 221-U Facility and a separate engineering evaluation/cost analyses and action memorandums will address ancillary facilities and pipelines. The remediation of contaminated groundwater located under the 200-UW-1 OU is being addressed by the 200-UP-1 OU (EPA/541/R-97/048, Record of Decision for the 200-UP-1 Interim Remedial Measure). The public will have future opportunities to review and comment on these documents.

MCL
Maximum Contaminant Level. The maximum concentration of a chemical allowed in public drinking water systems.

Characterization
Identification of the characteristics of a site through review of existing site information and/or sampling and analysis of environmental media and materials, to determine the nature and extent of contamination so that informed decisions can be made as to the level of risk presented by the site, and the protective remedial action that is needed.

Analogous Site Approach
Source sites can be similar geologically, have similar process and waste disposal histories, and have similar contaminant inventories. Based on these similarities, the site conceptual model is expected to be similar or analogous. In these situations, the analogous site concept is used to reduce the amount of site characterization and evaluation required to support remedial action decision making. Within each group of similar sites, a representative site(s) is selected for comprehensive field investigations, including sampling and analyses. Findings from site investigations at representative sites are used to develop a site conceptual model that is applied to other "analogous" sites that were not sampled.

It is assumed that the nature and extent of contamination at analogous sites is similar to the nature and extent of contamination described by the site conceptual model for representative site(s) that were sampled. The site conceptual model, along with other site-specific knowledge, then is used as the basis for evaluating and identifying the preferred remedy (as accomplished in this Plan). Confirmatory investigations are conducted through the remedial design/remedial action to confirm the accuracy of the site conceptual model with respect to the analogous site.

actions identify and reduce potential future threats to human health and the environment from waste site contaminants. The scope of this Plan does not include remediation of the groundwater beneath these waste sites.

Integration of CDI with Other U Plant Area Activities

The CDI has been developed to address potential threats to human health and the environment at the 221-Facility. At this time, the preferred alternative being considered is to partially demolish the structure, place equipment in the process cells, fill void spaces with grout, and dispose in place under an engineered barrier. Because the 221-U Facility engineered barrier will cover several 200-UW-1 waste sites, the integration of the U Plant Area activity is vital. Details on each of the alternatives considered are available in DOE/RL-2001-11, *Final Feasibility Study for the Canyon Disposition Initiative (221-U Facility).*

Characterization Approach

An analogous site approach was used in the characterization of the waste sites discussed in this Plan. As discussed in DOE/RL-98-28, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program* (Implementation Plan), the analogous site approach streamlines the investigation process by grouping similar sites together. This approach is generally implemented by selecting representative sites for comprehensive evaluation by site investigation. The representative sites are selected based on process and characterization data such as effluent volume, contaminant inventory, and contaminant distribution. The data from the representative sites typically suggest greater environmental impact and risk relative to other similar OU waste sites. Thus, representative sites are generally considered worst case relative to similar OU waste sites. Findings from the site investigation are used to assess conditions and develop site conceptual models at other OU sites with similar disposal histories. Confirmatory site investigations (additional sampling and analysis) are conducted through the remedial design/remedial action, to confirm the accuracy of the site conceptual models/site conditions. The confirmatory sampling approaches applicable to the preferred remedies (Alternatives 1 through 4) are described below.

- For waste sites where the preferred remedy is Alternative 3, data will be collected using an observational approach, where samples are taken from the open excavation during various stages of the removal, verification samples will be collected at the proposed end of excavation.
- For waste sites where the preferred remedy is Alternative 4, data will be collected to support design activities, as well as to confirm the assumptions of the conceptual site model, and the extent of contamination..
- For those waste sites where the preferred remedy is Alternative 1 or Alternative 2, data will typically be collected to confirm the assumptions of the site conceptual model, and verify the nature and/or vertical extent of contamination. Site specific data needs are specified in the sampling and analysis plan (SAP).

Representative Waste Sites and Site Conceptual Models

The site conceptual models used to describe the waste distribution were developed using sample data from representative waste sites. The representative sites are the 216-U-1 and 216-U-2 Cribs, the 216-U-8 Crib, the 216-U-12 Crib, the 216-U-4 Reverse Well/216-U-4A French Drain, and unplanned release (UPR) 200-W-19.

Table 3 identifies the representative sites, the analogous sites, and the rationale for applying the representative waste site conceptual models to the analogous sites. Appendix B provides additional information on these waste sites.

TABLE 3. CONCEPTUAL MODELS, ANALOGOUS SITES, AND RATIONALE FOR APPLICATION.

Representative Waste Site	Analogous Sites	Site Conceptual Model Rationale	Further Information
Group 1: 216-U-1 and 216-U-2 Cribs	241-U-361 Settling Tank	• The waste sites received the same waste, because waste passed through the 241-U-361 Settling Tank before being disposed of in the 216-U-1 and 216-U-2 Cribs. • The contaminant concentrations are expected to be much higher for the 216-U-1 and 216-U-2 Cribs, because the tank was not 100% efficient for removing solids, and the suspended and soluble contaminants were discharged to the cribs.	See Tables B-1 and B-2
Group 2: 216-U-8 Crib	200-W-42 VCP / UPR-200-W-163	• The waste sites received the same waste, because waste was routed to the 216-U-8 Crib via the 200-W-42 VCP. UPR-200-W-163 is the contaminated surface soil above the pipeline. • The contaminant concentrations are expected to be much higher at the crib, because it was designed to discharge wastes. The pipeline was designed to transfer wastes.	See Tables B-1 and B-3
Group 3: 216-U-12 Crib (RCRA TSD unit)	216-U-5 Trench 216-U-6 Trench 216-U-15 Trench 216-U-16 Crib 216-U-17 Crib	• The volume and magnitude of effluent discharged to the 216-U-12 Crib is greater than that of the analogous sites. • The primary constituent in the 216-U-12 Crib waste inventory is nitrogen as nitrate and nitrite. • Similarities exist in the contaminant inventories, release depths, and distributions.	See Tables B-1 and B-4
Group 4: 216-U-4 Reverse Well / 216-U-4A French Drain	216-U-4B French Drain	The 216-U-4 Reverse Well and 216-U-4A French Drain have a single site conceptual model because of their proximity to one another and because they received the same waste stream. This conceptual model applies to the 216-U-4B French Drain for the following reasons. • The waste sites were constructed similarly. • Each waste site received waste from the 222-U Laboratory, with the 216-U-4B French Drain receiving less volume. • The contaminant concentrations are expected to be significantly deeper for the representative site than for the 216-U-4B French Drain.	See Tables B-1 and B-5
Group 5: UPR-200-W-19 Unplanned Release	2607-W5 Septic Tank and Tile Field 2607-W7 Septic Tank and Tile Field	• Similar depth of discharge. • Limited contaminants discharged and minimal distribution anticipated. • No suspected impacts to groundwater. • Waste sites have been or will be abandoned per WAC 246-272-18501. Completion of this abandonment will verify the appropriate action under CERCLA.	See Tables B-1 and B-6
	200-W-71 Pit UPR-200-W-8 Burning Ground	• Similar depth of discharge. • The limited contaminants discharged and minimal distribution anticipated at UPR-200-W-19 are expected to be higher than those for the analogous sites listed, because less contaminants and volume were disposed of at these waste sites. • No suspected impacts to groundwater.	

	UPR-200-W-118
	And shallow/ surface sites:
	UPR-200-W-33
	UPR-200-W-48
	UPR-200-W-55
	UPR-200-W-78
	200-W-77
	200-W-85
	200-W-87
	200-W-89 Foundation
	UPR-200-W-117 / UPR-200-W-60.
		• Similar depth of discharge and contaminant distribution.
		• Limited contaminants discharged and minimal distribution are anticipated at UPR-200-W-19 the risk at this site would bound the analogous sites in terms of risk.
		• No suspected impacts to groundwater.
		• With respect to the shallow / surface waste sites, the site conceptual model characterizes the site risks because of the following
		  • They are expected to be limited to surface soils within 3 m (10 ft) of the ground surface for the representative site, and within 1 m (3 ft) of the ground surface for the analogous sites of the ground surface, based on the nature of the releases.
		  • Limited contaminants discharged and minimal distribution are anticipated at UPR-200-W-19.
		  • No suspected impacts to groundwater.	

Note: The contaminants of concern are included in Table B-1.

Comprehensive descriptions of the waste sites and all of the alternatives considered in this plan are provided in greater detail in the focused feasibility study (DOE/RL-2003-23, *Focused Feasibility Study for the 200-UW-1 Operable Unit*)

RCRA = *Resource Conservation and Recovery Act of 1976*
TSD = treatment, storage, and/or disposal (unit)
UPR = unplanned release.
VCP = vitrified clay pipeline.

Confirmatory Sampling
Sampling before or after the ROD, but before the remedial design is completed, to confirm the accuracy of the site conceptual model used for remedial decision making.

Industrial-Exclusive
A land-use designation under DOE/EIS-0222-F, Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement, that applies to the 200 Areas Core Zone. Under this land-use designation, waste management activities would continue. This land use assumes an industrial worker scenario—an exposure scenario in which the receptor works on site on a full-time basis (i.e., worker spends 2,000 h/yr over the duration of his or her entire career). The evaluation assumes that the Central Plateau exposure pathways include direct exposure to radiation, incidental ingestion of soil, and inhalation of resuspended dust and volatile constituents (exposure to groundwater is not considered).

ARARs
Applicable or relevant and appropriate requirements. Those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, or that address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site.

Land Use

Site risks were evaluated based on a reasonably anticipated future land use for the Central Plateau. These evaluations were based on the criteria presented in, and are consistent with, the Tri-Party's response to Hanford Advisory Board (HAB) Advice #132 (Klein et al. 2002, "Consensus Advice #132: Exposure Scenarios Task Force on the 200 Area" http://www.hanford.gov/boards/hab/advice/habadv-132.pdf).

The HAB acknowledged that some waste will remain in the Core Zone when cleanup of the Central Plateau is completed and advised that the Core Zone be as small as possible and not include contamination outside the 200 Area fences.

The DOE is expected to continue industrial-exclusive land use activities for at least 50 yr, in accordance with DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, and 64 FR 61615, "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement."

Based on this documentation and current Central Plateau assumptions, the alternative evaluations considered the following anticipated land-use requirements.

- The Core Zone will have an industrial scenario for the foreseeable future. The evaluation considers the following uses:
  - Industrial-exclusive use for the next 50 yr (through 2050)
  - Industrial land use (non-DOE worker) for 100 yr after 2050 (through 2150)
  - Industrial land use (passive institutional controls) post - 150 years.
- Groundwater contamination under the Core Zone will preclude beneficial use for the foreseeable future. This evaluation considers the following:
  - No consumptive use of groundwater for the next 150 yr, based on the expected period of waste management and institutional controls
  - Any selected remedy will provide for no further degradation of groundwater from the 200-UW-1 OU waste sites
  - No drilling for water or other purposes will be allowed in the Core Zone.

In addition, risks were calculated considering the possibility of intruders 150 yr from now (2150), based on the assumption that active institutional controls would no longer be in place.

Applicable or Relevant and Appropriate Requirements

Applicable or relevant and appropriate requirements (ARARs) are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations placed into Federal or state law that:

- Specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, or
- Address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site.

A more detailed discussion of the potential ARARs associated with the 200-UW-1 OU waste sites is found in the FFS. These potential ARARs are incorporated into the RAOs and preliminary remediation goals that drive the evaluation of alternatives and the selection of preferred remedies.

The key potential ARAR used for the remedy selection of these waste sites was WAC 173-340-745(5)(b), "Soil Cleanup Standards for Industrial Properties," "Method C, Industrial Soil Cleanup Levels."

Remedial Action Objectives

These RAOs have been developed taking into consideration information currently available for the 200-UW-1 OU and the Central Plateau. The development of the RAOs has not taken into consideration the cumulative impact of RAOs for other OUs (which have yet to be determined) and potential implications from the Central Plateau closure as a whole. Therefore, these RAOs will need to be reevaluated as closure of the 200 NPL Sites comes to fruition. The RAOs identified for the waste sites are based on evaluations of reasonably anticipated future land use, site conceptual models, potential ARARs, and To Be Considered (TBC) requirements. Below are the four RAOs identified for the 200-UW-1 OU.

- RAO 1 – Prevent unacceptable risk to human health and ecological receptors by exposure to nonradiological constituents in soils and debris at concentrations above the industrial use criteria, as defined in WAC 173-340-745(5).
- RAO 2 – Provide conditions suitable for future industrial land use and protect ecological receptors, respectively, by preventing exposure to radiological constituents at concentrations above a dose rate limit of 15 mrem/yr for industrial workers (OSWER Directive 9200.4-31P, EPA/540/R-99/006, Radiation Risk Assessment at CERCLA Sites: Q&A) and to protect ecological receptors based on a dose rate limit of 0.1 rad/day for terrestrial wildlife populations (DOE-STD-1153-2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*, which is a TBC requirement), respectively. A dose rate limit of 15 mrem/yr generally achieves the EPA excess lifetime cancer risk threshold, which ranges from 1×10^{-6} to 1×10^{-4}.
- RAO 3 – Prevent migration of contaminants through the soil column to groundwater or reduce soil concentrations below WAC 173-340-747, "Deriving Soil Concentrations for Ground Water Protection," groundwater protection criteria so that no further degradation of the groundwater results from contaminant leaching from 200-UW-1 OU waste sites. Note: Protection of the Columbia River is achieved through RAO 3. There is no surface water in the immediate vicinity of the waste sites.
- RAO 4 – Minimize the disruption of cultural resources and wildlife habitat and prevent adverse impacts to cultural resources and threatened or endangered species.

These four RAOs were used to develop the preliminary remediation goals discussed below, and will be finalized as remediation goals in the 200-UW-1 OU ROD.

Preliminary Remediation Goals

As described in the FFS, preliminary remediation goals were developed to establish residual soil concentrations for individual contaminants that are protective of human health and the environment. The FFS screening process compared the observed constituent concentrations at the waste sites to the following concentrations:

- Naturally occurring levels
- Radiological dose exposure limits
- Cleanup levels consistent with the RAOs.

The comprehensive list of contaminants of potential concern (COPC) developed for the waste sites was based on historical U Plant Area operations and

TBC
To Be Considered requirement.

RAO 1
RAO 1 is satisfied if the following conditions are met:
- Total human health carcinogenic risks do not exceed 1×10^{-5}
- Human health noncarcinogenic hazard indexes do not exceed 1
- Soil concentrations of COCs do not exceed applicable thresholds for protection of ecological receptors.

RAO 2
RAO 2 is satisfied if the following conditions are met:
- Industrial worker dose rates do not exceed 15 mrem/yr
- Terrestrial animal exposure rates do not exceed 0.1 rad/day
- Waste is 15 ft or more below the ground surface.

RAO 3
RAO 3 is satisfied if the following conditions are met:
- Soil concentrations are below WAC 173-340-747, "Deriving Soil Concentrations for Ground Water Protection," groundwater protection methods, or
- The flux of contaminants into groundwater does not cause groundwater concentrations to exceed MCLs at the point of compliance, or
- The flux of contaminants into groundwater are reduced or eliminated, based on a decreasing trend in the difference between the concentration of contaminants in up gradient and down gradient wells.

RAO 4
RAO 4 is satisfied if the following conditions are met:
- RAOs 1 and 2 are met
- Cultural and ecological reviews are performed to evaluate the construction area for potential impacts (e.g., bird nesting grounds) and appropriate mitigative measures are implemented.

RCRA TSD UNIT CLOSURE PERFORMANCE STANDARDS AND CLOSURE STRATEGY

Because the 216-U-12 Crib cannot be clean closed in accordance with WAC 173-303-610(2)(b), the TSD will be closed as a landfill in accordance with WAC 173-303-665(6). This closure strategy is consistent with the requirements specified in WAC 173-303-665(6), "Landfills," "Closure and Post-Closure Care"; the land-disposal unit closure requirements of the Tri-Party Agreement, Section 6.3.2; and the landfill closure requirements of Condition II.K.4 of WA7890008967, *Hanford Facility RCRA Permit*.

Alternative 4 will provide long-term minimization of infiltration by rain, snowmelt, and water. This will be achieved by construction of a structure which will minimize the movement of water over the closed crib and by maintaining the barrier (inspection and repair), managing drainage, erosion, settling, and subsidence.

After the TSD is closed, postclosure requirements for the barrier will be established. These requirements will ensure that the engineered barrier is maintained (that is, repaired), monitored to ensure it is performing as expected, and that water run-on/runoff is maintained. These postclosure activities will be conducted through the U Plant Area Operations and Maintenance Plan, which will integrate the monitoring needs associated with the various projects within the U Plant Area.

Because the 216-U-12 Crib is currently identified as a TSD unit, the information needed to meet the closure standards in WAC 173-303-610, "Dangerous Waste Regulations," "Closure and Post-Closure," and the relevant closure standards for a landfill in WAC 173-303-665, is included in the CERCLA documentation and groundwater monitoring documentation for this remedial action. Ecology has used information identified in Table 11 and information from other CERCLA documents to prepare a draft closure permit modification in accordance with Section 5.5 of the Tri-Party Agreement. After public review and comment, Ecology will incorporate the draft closure permit into WA7890008967, *Hanford Facility RCRA Permit*.

TABLE 11. CROSSWALK BETWEEN RCRA TREATMENT, STORAGE, AND DISPOSAL CLOSURE PLAN REQUIREMENTS AND SUPPORTING DOCUMENTATION.

RCRA Treatment, Storage, and Disposal Closure Plan Section	Information Contained	Location in Supporting Documents
1.0 Introduction	Permitting history	DOE/RL-2003-23, Section 2.5.1.3
	Closure strategy	DOE/RL-2003-23, Section 7.2
	Part A Permit Application	DOE/RL-88-21, Section 4.2.3.8
2.0 Facility Description and Location	Location maps and discussion	DOE/RL-88-21, Section 4.2.3.8 DOE/RL-2003-23, Section 2.5.1.3
	Operational history	DOE/RL-88-21, Section 4.2.3.8 DOE/RL-2003-23, Section 2.5.1.3
3.0 Process Information	Process history for waste streams discharged to the TSD	DOE/RL-88-21, Section 4.2.3.8 DOE/RL-2003-23, Section 2.5.1.3
4.0 Waste Characteristics	Waste types and characteristics discharged to the TSD	DOE/RL-88-21, Section 4.2.3.8 DOE/RL-2003-23, Section 2.5.1.3
5.0 Groundwater Monitoring	Groundwater impacts and monitoring activities	PNNL-14301, Part I
6.0 Closure Performance Standards	Closure strategy and performance standards	DOE/RL-2003-23, Section 5.2 and Section 7.2
7.0 Closure Activities	Sampling and analysis; closure alternatives and closure requirements; includes schedule and certification of closure	DOE/RL-2003-23, Section 2.5.2.2 DOE/RL-2003-23 Appendix C, Table C-3 and C-9 Closure alternatives and requirements evaluated through DOE/RL-2003-23 (Sections 5.0 through 7.0) Closure schedule included in the remedial design report/remedial action work plan and closure certification through the actual remediation and closeout verification process
8.0 Post-Closure Plan	Groundwater monitoring, cover design, surveillance and maintenance, inspection plan, if needed when clean closure is not achieved	Incorporated through the U Plant Area Operations and Maintenance Plan, as necessary PNNL-14301, Part I

DOE/RL-88-21, *Hanford Facility Dangerous Waste Part A Permit Application*

DOE/RL-2000-60, *200-PW-2 Uranium-Rich Process Waste Group Operable Unit RI/FS Work Plan and Process Waste RCRA TSD Unit Sampling Plan.*

DOE/RL-2003-23, *Focused Feasibility Study for the 200-UW-1 Operable Unit.*

PNNL-14301, *Monitoring Plan for RCRA Groundwater Assessment at the 216-U-12 Crib.*

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq.

TSD = treatment, storage, and/or disposal (unit).

Public Comment Period:
April 4, 2005 through May 18, 2005

Public Meetings:
To be Scheduled during the public comment period

Information Repositories
This Proposed Plan is available for viewing at the following public information repositories:

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  email:
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  Foley Center
  East 502 Boone
  Spokane, Washington 99258
  509/323-3834
  ATTN: Linda Pierce
  email: pierce@gonzaga.edu

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  Richland, Washington 99352
  509/372-7443
  ATTN: Janice Parthtree
  email: reading_room@pnl.gov

PUBLIC PARTICIPATION

Public Involvement

Tribal nations, stakeholders, and the general public are encouraged to review and provide comments on the 200-UW-1 Plan during the 45-day public comment period that runs from April 4, 2005 through May 18, 2005.

Public Meetings

A combined public meeting/public hearing will be scheduled during the public comment period.

Submitting Comments

The Tri-Parties will accept written comments on this Plan from April 4, 2005 through May 18, 2005. Comments should be sent to John Price at the Washington State Department of Ecology via:

- mail: ATTN: Mr. John Price, 3100 Port of Benton Blvd., Richland, WA 99354-1670
- fax: (509) 372-7971
- email: jpri461@ecy.wa.gov

Backup information pertaining to the 200-UW-1 OU is also in the Administrative Record at http://www2.hanford.gov/arpir/.

Hanford Public Information Repository Locations

Copies of this Plan are available at the Hanford Public Information Repositories located at the University of Washington in Seattle, Washington; Gonzaga University in Spokane, Washington; Portland State University in Portland, Oregon; and Washington State University in Richland, Washington.
The proposed plan is also available electronically at http://www.hanford.gov/calendar/ under the Public Comment Period section.

Points of Contact

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APPENDIX A

SUMMARY OF SITE COST ESTIMATES

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TABLE A-1. COST ESTIMATES (IN $1,000).

Waste Site/Group and Associated Cost Summary[a]	Alternative 1 No Action	Alternative 2 MESC/IC/MNA[b]	Alternative 3 RTD[c]	Alternative 4 Engineered Barrier
Group 1: Representative Waste Sites 216-U-1/216-U-2 Cribs				
216-U-1/216-U-2 Cribs				
Total Capital Cost	-	-	$52,973[1]	$696
Implementation Time (Yr)	-	1,000	<4	1,000
Total Operations and Maintenance Cost	-	$16,325	-	$13,805
Present Worth Cost	-	$393	$52,973	$1,347
241-U-361 Settling Tank				
Total Capital Cost	-	$4,762	$5,078	$5,037
Implementation Time (Yr)	-	128	<1	128
Total Operations and Maintenance Cost	-	$2,090	-	$2,042
Present Worth Cost	-	$5,148	$5,078	$5,674
Group 2: Representative Waste Site 216-U-8 Crib				
216-U-8 Crib				
Total Capital Cost	-	-	$62,266[1]	$944
Implementation Time (Yr)	-	1000	<4	1,000
Total Operations and Maintenance Cost	-	$16,325	-	$13,960
Present Worth Cost	-	$393	$62,266	$1,598
200-W-42 Vitrified Clay Pipeline/UPR-200-W-163				
Total Capital Cost	-	-	$4,039	$2,244
Implementation Time (Yr)	-	831	<1	831
Total Operations and Maintenance Cost	-	$13,566	-	$11,920
Present Worth Cost	-	$393	$4,039	$2,906
Group 3: Representative Waste Site 216-U-12 Crib				
216-U-12 Crib				
Total Capital Cost	-	-	$42,950[1]	$460
Implementation Time (Yr)	-	1,000	<4	1,000
Total Operations and Maintenance Cost	-	$16,325	-	$13,610
Present Worth Cost	-	$393	$42,950	$1,106
216-U-5 Trench				
Total Capital Cost	-	-	$552	$366
Implementation Time (Yr)	-	141	<1	141
Total Operations and Maintenance Cost	-	$2,302	-	$2,223
Present Worth Cost	-	$389	$552	$1,007
216-U-6 Trench				
Total Capital Cost	-	-	$494	$353
Implementation Time (Yr)	-	141	<1	141
Total Operations and Maintenance Cost	-	$2,302	-	$2,222
Present Worth Cost	-	$389	$494	$994

Waste Site/Group and Associated Cost Summary[a]	Alternative 1 No Action	Alternative 2 MESC/IC/MNA[b]		Alternative 3 RTD[c]	Alternative 4 Engineered Barrier
216-U-15 Trench					
Total Capital Cost	-	-		$155	$260
Implementation Time (Yr)	-	141		<1	141
Total Operations and Maintenance Cost	-	$2,302		-	$2,209
Present Worth Cost	-	$389		$155	$899
216-U-16 Crib					
Total Capital Cost	-	-		$4,928	$1,334
Implementation Time (Yr)	-	141		<1	141
Total Operations and Maintenance Cost	-	$2,936		-	$2,364
Present Worth Cost	-	$528		$4,928	$1,998
216-U-17 Crib					
Total Capital Cost	-	-		$1,484	$550
Implementation Time (Yr)	-	141		<1	141
Total Operations and Maintenance Cost	-	$2,302		-	$2,249
Present Worth Cost	-	$389		$1,484	$1,195
Group 4: Representative Waste Sites 216-U-4 Reverse Well/216-U-4A French Drain					
216-U-4 Reverse Well/216-U-4A French Drain					
			d		
Total Capital Cost	-	-	-	$124	$251
Implementation Time (Yr)	-	125	20	<1	125
Total Operations and Maintenance Cost	-	$916	$107	-	$874
Present Worth Cost	-	$193	$74	$124	$695
216-U-4B French Drain					
Total Capital Cost	-	-		$115	$248
Implementation Time (Yr)	-	125		<1	125
Total Operations and Maintenance Cost	-	$916		-	$874
Present Worth Cost	-	$193		$115	$692
Group 5: Representative Waste Site Unplanned Release UPR-200-W-19					
UPR-200-W-19					
Total Capital Cost	-	-		$5,184	$2,056
Implementation Time (Yr)	-	129		<1	129
Total Operations and Maintenance Cost	-	$774		-	$1,130
Present Worth Cost		$184		$5,184	$2,541
2607-W5 Septic Tank and Tile Field					
Total Capital Cost	-	-		$1,407	$1,466
Implementation Time (Yr)	-	129		<1	129
Total Operations and Maintenance Cost	-	$194		-	$990
Present Worth Cost	-	$46		$1,407	$1,927
2607-W7 Septic Tank and Tile Field					
			d		
Total Capital Cost	-	-	-	$648	$805
Implementation Time (Yr)	-	129	20	<1	129
Total Operations and Maintenance Cost	-	$194	$30	-	$934
Present Worth Cost	-	$46	$22	$648	$1,257

Waste Site/Group and Associated Cost Summary[a]	Alternative 1 No Action	Alternative 2 MESC/IC/MNA[b]		Alternative 3 RTD[c]	Alternative 4 Engineered Barrier
200-W-71 Pit					
Total Capital Cost	-	-		$845	$553
Implementation Time (Yr)	-	129		<1	129
Total Operations and Maintenance Cost	-	$194		-	$928
Present Worth Cost	-	$46		$845	$1,003
UPR-200-W-8 Burning Ground					
Total Capital Cost	-	-		$2,501	$1,192
Implementation Time (Yr)	-	129		<1	129
Total Operations and Maintenance Cost	-	$194		-	$1,011
Present Worth Cost	-	$46		$2,501	$1,657
UPR-200-W-118					
			d		
Total Capital Cost	-	-	-	$4,040	$1,131
Implementation Time (Yr)	-	129	20	<1	129
Total Operations and Maintenance Cost	-	$774	$120	-	$1,015
Present Worth Cost	-	$184	$88	$4,040	$1,596
200-W-77 Unplanned Release					
Total Capital Cost	-	-		$106	$252
Implementation Time (Yr)	-	129		<1	129
Total Operations and Maintenance Cost	-	$194		-	$891
Present Worth Cost	-	$46		$106	$696
200-W-85 Unplanned Release					
Total Capital Cost	-	-		$111	$261
Implementation Time (Yr)	-	129		<1	129
Total Operations and Maintenance Cost	-	$194		-	$891
Present Worth Cost	-	$46		$111	$705
200-W-87 Unplanned Release					
Total Capital Cost	-	-		$187	$340
Implementation Time (Yr)	-	129		<1	129
Total Operations and Maintenance Cost	-	$194		-	$900
Present Worth Cost	-	$46		$167	$785
200-W-89 Foundation					
Total Capital Cost	-	-		$274	$479
Implementation Time (Yr)	-	129		<1	129
Total Operations and Maintenance Cost	-	$194		-	$919
Present Worth Cost	-	$46		$274	$928

Waste Site/Group and Associated Cost Summary[a]	Alternative 1 No Action	Alternative 2 MESC/IC/MNA[b]		Alternative 3 RTD[c]	Alternative 4 Engineered Barrier
UPR-200-W-33					
Total Capital Cost	-	-		$106	$258
Implementation Time (Yr)	-	129		<1	129
Total Operations and Maintenance Cost	-	$194		-	$891
Present Worth Cost	-	$46		$106	$702
UPR-200-W-46					
Total Capital Cost	-	-		$121	$277
Implementation Time (Yr)	-	129		<1	129
Total Operations and Maintenance Cost	-	$194		-	$894
Present Worth Cost	-	$46		$121	$721
UPR-200-W-55					
Total Capital Cost	-	-		$105	$251
Implementation Time (Yr)	-	129		<1	129
Total Operations and Maintenance Cost	-	$194		-	$891
Present Worth Cost	-	$46		$105	$695
UPR-200-W-78					
			d		
Total Capital Cost	-	-	-	$104	$252
Implementation Time (Yr)	-	129	20	<1	129
Total Operations and Maintenance Cost	-	$194	$30	-	$891
Present Worth Cost	-	$46	$22	$104	$696
UPR-200-W-117/UPR-200-W-60					
Total Capital Cost	-	-		$208	$399
Implementation Time (Yr)	-	129		<1	129
Total Operations and Maintenance Cost	-	$194		-	$909
Present Worth Cost	-	$46		$208	$846

NOTE: The bolded boxes indicate the preferred alternatives.

[1]. Estimated costs are due to full excavation from surface to 200 ft below ground surface.

a. The cost summary includes the total undiscounted capital as well as operations and maintenance costs. The present worth is based on an interest rate of 3.2% (Office of Management and Budget Circular No. A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*.)

b. Alternative 2 is Maintain Existing Soil Cover (MESC) Institutional Controls (IC), and Monitored Natural Attenuation (MNA).

c. Alternative 3 is Removal/Treatment/Disposal (RTD).

d. For the split boxes, the costs shown in the left column are based on maintaining the required institutional controls at the given site for the full implementation period of Alternative 2 (for example, 129 yr for UPR-200-W-78). Potentially, however, Alternative 2 for these sites may be combined with implementation of the proposed barrier over the U Plant Canyon Building. If, as anticipated, the barrier were to be placed within the next 20 yr, maintaining institutional controls at the site correspondingly would be reduced to 20 yr. The costs shown in the right column are based on the reduced institutional controls costs resulting from this potential combination of Alternative 2 and the proposed barrier.

APPENDIX B

200-UW-1 OPERABLE UNIT DETAILED WASTE SITE INFORMATION

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TABLE B-1. WASTE SITE AREAS AND VOLUMES. (2 PAGES)

Waste Site	Dimensions[a] (length x width [ft])	Surface Area (ft^2)[a]	Estimated Contaminated Volume (ft^3)[a]	COCs for Representative Site	Discharge Volume[b] Gal (m^3) (Except as Noted)
Group 1 – Representative Site 216-U-1 Crib/216-U-2 Crib				Cs-137 Tc-99	
216-U-1 Crib/216-U-2 Crib	174 x 102	17,750	3,549,600	N/A	12, 204, 749 (46,200)
241-U-361 Settling Tank	30 x 30	900	22,500	N/A	27, 474 (104)[c]
Group 2 – Representative Site 216-U-8 Crib	N/A	N/A	N/A	Uranium Nitrogen as nitrate/nitrite	N/A
216-U-8 Crib	222 x 112	24,870	4,972,800	N/A	100, 121, 207 (379,000)
200-W-42 VCP/UPR-200-W-163	1,965 x 20	39,300	589,600	N/A	N/A
Group 3 – Representative Site 216-U-12 Crib	N/A	N/A	N/A	Nitrogen as nitrate/nitrite	N/A
216-U-12 Crib (RCRA TSD unit)	150 x 60	9,000	1,962,090	N/A	39, 625, 808 (150,000)
216-U-5 Trench	70 x 70	4,900	73,500	N/A	1, 188, 774 (4500)
216-U-6 Trench	105 x 40	4,200	63,000	N/A	1, 188, 774 (4500)
216-U-15 Trench	20 x 20	400	6,000	N/A	17, 963 (68)
216-U-16 Crib	262 x 191	50,050	850,720	N/A	108, 046, 369 (409,000)
216-U-17 Crib	204 x 64	13,060	235,010	N/A	557, 403 (2110)
Group 4 – Representative Site 216-U-4 Reverse Well/216-U-4A French Drain	N/A	N/A	N/A	Cs-137	N/A
216-U-4 Reverse Well/216-U-4A French Drain	10 x 10	100	1,500	N/A	79, 252 (300)/ 143, 974 (545)
216-U-4B French Drain	5 x 5	30	140		8 718 (33)
Group 5 – Representative Site UPR-200-W-19	N/A	N/A	N/A	Cs-137	N/A
UPR-200-W-19	425 x 197	83,730	837,250	N/A	N/A
2607-W5 Septic Tank and Tile Field	30 x 13 136 x 100 (Active Tile Field) 174 x 100 (Inactive Tile Field)	32,400	168,170	N/A	3 196 (12.1)/day
2807-W7 Septic Tank and Tile Field	4 x 2 (Tank) 136 x 100 (Tile Field)	13,600	68,000	N/A	264 (1)/day
200-W-71 Pit	262.5 x 49.2	12,920	129,150	N/A	N/A
UPR-200-W-8 Burning Ground	425 x 100	42,500	425,000	N/A	N/A
UPR-200-W-118	209 x 209	43,690	655,220	N/A	N/A
UPR-200-W-33	10 x 15	150	450	N/A	N/A
UPR-200-W-48	32 x 32	1,000	3,000	N/A	N/A
UPR-200-W-55	10 x 10	100	300	N/A	N/A
UPR-200-W-78	5 x 8	40	120	N/A	N/A
200-W-77 Unplanned Release	8 x 15	120	360	N/A	N/A
200-W-85 Unplanned Release	20 x 20	400	1,200	N/A	N/A

TABLE B-1. WASTE SITE AREAS AND VOLUMES. (2 PAGES)

Waste Site	Dimensions[a] (length x width [ft])	Surface Area (ft^2)[a]	Estimated Contaminated Volume (ft^3)[a]	COCs for Representative Site	Discharge Volume[b] Gal (m^3) (Except as Noted)
200-W-87 Unplanned Release	120 x 30	3,600	10,800	N/A	N/A
200-W-89 Foundation (Unplanned Release)	100 x 100	10,000	30,000	N/A	N/A
UPR-200-W-117/UPR-200-W-60	200 x 30	6,000	18,000	N/A	N/A

[a]DOE/RL 2003-23, Appendix F.

[b]DOE/RL 2003-23, Chapter 2.0.

[c]241-U-361 Tank residual waste volume.

COC = contaminant of concern.

N/A = not applicable.

RCRA = *Resource Conservation and Recovery Act of 1976.*

DOE/RL-2003-23, 2003, *Focused Feasibility Study for the 200-UW-1 Operable Unit*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

TABLE B-2. 216-U-1 AND 216-U-2 CRIBS AND ASSOCIATED ANALOGOUS WASTE SITES. (2 Pages)

Waste Site	Site Construction and Discharge History	Rationale
		Representative Site
216-U-1 and 216-U-2 Cribs	*Waste sites configuration/construction:* • Located west of the 221-U Building and north of 16th Street, the 174- by 102-ft site consists of two wooden structures open at the bottom, each measuring 12 by 12 by 4 ft and constructed of wooden timbers, located at the bottom of a 20-ft-deep excavation. The wooden structures are spaced 60 ft apart and are connected by stainless steel pipeline. U Plant wastes flowed from the 241-U-361 Settling Tank to the cribs through a stainless steel pipeline. • In 1992, contaminated soil in the vicinity of the 216-U-1 and 216-U-2 Cribs was scraped and consolidated near the 241-U-361 Settling Tank. The surface surrounding the 241-U-361 Settling Tank was surface stabilized with shotcrete. The area then was covered with 18 to 24 in. of clean backfill and posted as an Underground Radioactive Material Area. *Release history/volume/depth:* • From 1952 to 1957 until the uranium recovery process operations were shut down, the cribs received cell drainage from the 5-6 tank in the 221-U Building and waste from the 224-U Building. • From 1957 through 1967, the cribs received 224-U Building and equipment decontamination waste, and reclamation waste from the 221-U Building Canyon • In January 1985, wastewater from the 216-U-16 Crib had migrated north along a subsurface caliche layer and flushed vadose zone contamination from beneath the cribs through unsealed well casings to groundwater. During a remedial action from June until November 28, 1985, an estimated 687 kg of uranium were removed.	The 216-U-1 and 216-U-2 Cribs have been selected as a representative site because of the amount of available characterization data, their significant impact to groundwater, and their direct association with the 241-U-361 Settling Tank. The criteria considered to evaluate the suitability of this site as representative are as follows. (1) *Waste site configuration and construction:* The 218-U-1 and 216-U-2 Cribs are below grade timber crib structures constructed in an open excavation, which was backfilled with soil. The 241-U-381 Settling Tank is a circular reinforced concrete underground tank structure. This criterion is only partially applicable, because only the depth of the engineered structure for these sites is similar. (2) *Volume of effluent received in relation to the available pore volume:* This criterion is not applicable, because the 241-U-361 Settling Tank was not designed to discharge waste to the vadose zone (3) *Contaminant inventory*: The contaminant type for the representative and the analogous waste sites should be identical, because the 241-U-361 Settling Tank was not 100% efficient for removing solids, and the suspended and soluble contaminants were discharged to the cribs. The contaminant inventory in the 241-U-361 Settling Tank should be bounded by the 216-U-1 and 216-U-2 Cribs, because the tank only held a portion of the total waste stream. (4) *Depth of waste discharge:* The structure depths are similar for the representative and analogous sites; however, this criterion is not applicable, because the tank was not designed to discharge waste to the vadose zone. (5) *Expected distribution of contaminants:* The distribution of contaminants in the vadose zone is expected to be much higher for the 216-U-1 and 216-U-2 Cribs as compared to the 241-U-361 Settling Tank, because the cribs were designed to discharge liquid wastes and the tank was not. (6) *Potential for hydrologic and contaminant impacts to groundwater:* The 216-U-1 and 216-U-2 Cribs are known to have impacted groundwater. The zone of highest contamination is at the base of the crib, from 6 to 12 m (20 to 40 ft) bgs. Maximum concentrations in this interval include Sr-90 at 2,400,000 pCi/g, and Cs-137 at 1,700,000 pCi/g. Uranium was detected throughout the vadose zone with peak values around 12 m (40 ft) (maximum concentration for U-233/234 of 1400 pCi/g, for U-235 of 148 pCi/g, and for U-238 of 10,080 pCi/g) and within the Cold Creek unit (32 pCi/g for U-233/234, 2.2 pCi/g for U-235, and 10, 080 pCi/g for U-238). Spectral gamma borehole logging indicated a maximum U-238 activity of 5000 pCi/g at 12 m (39.5 ft). The 241-U-361 Settling Tank was not designed to discharge liquid waste to the vadose zone; however, the unplanned tank overflow would have had the potential to follow the tanks outside surface and reach the crib discharge depth, so it has a small potential to have impacted groundwater. Therefore, the 216-U-1 and 216-U-2 Cribs would bound the 241-U-361 Settling Tank in terms of impacts to groundwater.

TABLE B-2. 216-U-1 AND 216-U-2 CRIBS AND ASSOCIATED ANALOGOUS WASTE SITES. (2 Pages)

Waste Site	Site Construction and Discharge History	Rationale
Process Waste Group Analogous Sites to be Evaluated using the 216-U-1 and 216-U-2 Cribs Representative Site Conceptual Model		
241-U-361 Settling Tank	*Waste sites configuration/construction:* • Located west of the 221-U Building and north of 16th Street, the 30- by 30-ft site consists of a circular underground settling tank 20 ft in diameter by 19 ft in height constructed of 8 in. steel-reinforced concrete. The top of the tank is approximately 6 ft below grade, and several vents and risers penetrated the ground surface. The bottom of the tank is located approximately 25 ft below grade. U Plant wastes flowed to the 241-U-361 Settling Tank to the 216-U-1 and 216-U-2 Cribs through a stainless steel pipeline. • In 1992, contaminated soil in the vicinity of the 216-U-1 and 216-U-2 Cribs was scraped and consolidated near the 241-U-361 Settling Tank. The surface surrounding the 241-U-361 Settling Tank was surface stabilized with shotcrete. The area then was covered with 18 to 24 in. of clean backfill and posted as an Underground Radioactive Material Area. *Release history/volume/depth:* • From 1952 to 1957 until the uranium recovery process operations were shut down, the tank received cell drainage from the 5-6 tank in the 221-U Building and waste from the 224-U Building. • From 1957 through 1967, the tank received 224-U Building and equipment decontamination waste, and reclamation waste from the 221-U Building Canyon. • In 1953, an unknown volume of liquid wastes from the uranium recovery process in the 221-U Building and the 224-U Building overflowed from the vents on the 241-U-361 Settling Tank and the 216-U-1 and 216-U-2 Cribs and on to the ground. Contamination was reported over an area of approximately 50 ft^2. Soil removal and backfill were performed. The area originally was marked by a wooden fence, and posted with Radiation Zone signs. Over the years, contamination from windblown soil and vegetation extended the area of surface contamination until it was stabilized in 1992 (see UPR-200-W-19). • Approximately 106,000 L (28,000 gal) of waste sludge are believed to remain in the tank.	This settling tank is analogous to the 216-U-1 and 216-U-2 Cribs because of the following. (1) *Waste site configuration and construction:* The 216-U-1 and 216-U-2 Cribs and the 241-U-361 Settling Tank are associated structures. This criterion is only partially applicable, because only the depth of the engineered structure for these sites is similar. (2) *Volume of effluent received in relation to the available pore volume:* The volume of effluent discharged from the 216 U 1 and 216-U-2 Cribs is significantly higher than the available soil pore volume (46,200 m^3 compared to 400 m^3). Because the volume and precise location of leakage from the 241-U-361 Settling Tank overflow (UPR-200-W-19) are unknown, a direct comparison cannot be made to the 216-U-1 and 216-U-2 Cribs. However, because the overflow was unplanned and not part of normal operation, it is reasonable to assume that the volume of waste discharged to the crib would be much higher than the amount of waste that overflowed from the tank. (3) *Contaminant Inventory*[a]: The contaminant type for the representative and the analogous waste sites should be identical, because the 241-U-361 Settling Tank was not 100% efficient for removing solids, and the suspended and soluble contaminants were discharged to the cribs. The contaminant inventory in the 241-U-361 Settling Tank should be bounded by the 216-U-1 and 216-U-2 Cribs, because the tank only held a portion of the total waste stream. (4) *Depth of waste discharge:* The structure depths are similar for the representative and analogous sites; however, this criterion is only partially applicable, because the tank was not designed to discharge waste to the vadose zone and only the unplanned tank overflow would have had the potential to follow the tanks outside surface and reach the crib discharge depth. (5) *Expected distribution of contaminants:* The distribution of contaminants in the vadose zone is expected to be much higher for the 216-U-1 and 216-U-2 Cribs compared to the 241-U-361 Settling Tank, because the cribs were designed to discharge liquid wastes and the tank (regardless of the unplanned tank overflow) was designed as a containment structure. (6) *Potential for hydrologic and contaminant impacts to groundwater:* The 216-U-1 and 216-U-2 Cribs are known to have impacted groundwater. The 241-U-361 Settling Tank was not designed to discharge liquid waste to the vadose zone; however, the unplanned tank overflow would have had the potential to follow the tanks outside surface and reach the crib discharge depth, so it has a small potential to have impacted groundwater. Therefore, the 216-U-1 and 216-U-2 Cribs would bound the 241-U-361 Settling Tank in terms of impacts to groundwater.

[a] Note that the contaminant inventory (e.g., total mass of a constituent) is based on historic disposal records. Actual vadose zone concentrations were determined based on the field investigation phase of the project. The vadose zone concentrations were utilized in the risk assessment calculations.

bgs = below ground surface.

TABLE B-3. 216-U-8 CRIB AND ASSOCIATED ANALOGOUS WASTE SITES. (2 Pages)

Waste Site	Site Construction and Discharge History	Rationale
	Representative Site	
216-U-8 Crib	*Waste sites configuration/construction:* • Located south of the 221-U Building and west of Beloit Avenue, the 222- by 112-ft site consists of three wooden structures open at the bottom and set in series at the bottom of a trench that measures 160 by 50 ft by 31 ft. Each wooden structure is 16 by 16 by 10 ft deep. The trench was filled with crushed stone to the tops of the wooden structures and backfilled to the existing grade. • In 1995, the site-contaminated soil from the area above the 200-W-42 VCP/UPR-200-W-163 was removed and placed over the top of the 216-U-8 Crib. The area over the crib and consolidated soils was covered with clean soil and the site posted as an Underground Radioactive Material Area. *Release history/volume/depth:* • From 1952 to 1960, the site received process condensate from the 221-U uranium recovery process, 291-U-1 Stack drainage, and 224-U Plant uranium oxide production (calcining) process condensate. In 1960, because of internal collapse of the crib, the 216-U-12 Crib was replaced by the 216-U-8 Crib.	The criteria considered to evaluate the suitability of the 216-U-8 Crib as representative of the analogous sites assigned to it are as follows. (1) *Waste site configuration and construction:* The 216-U-8 Crib consists of three wooden structures constructed in a 9 m (31 ft) deep open excavation, which was filled with 1.3 cm (0.5-in.) crushed stone to the tops of the wooden structures and backfilled to the existing grade with soil. The analogous site, 200-W-42 VCP, consists of a 15 cm (6-in.) diameter underground VCP buried approximately 3 to 4 m (10 to 12 ft) deep, and its associated surface unplanned release UPR-200-W-163. Although the structures are different, the representative site is deeper within the vadose zone and therefore bounds its analogous site in terms of depth. (2) *Volume of effluent received in relation to the available pore volume:* The volume of effluent discharged from the 216-U-8 Crib is significantly higher than the available soil pore volume (379,000 m^3 compared to 11,100 m^3). Because the volume and precise location of leakage from the 200-W-42 VCP are unknown, a direct comparison cannot be made to the 216-U-8 Crib. Because the pipeline discharged to the 216-U-8 Crib, it is reasonable to assume that the volume of waste discharged to the crib would be much higher than the amount of waste that leaked from the pipeline. Therefore, the volume of effluent discharged to the 216-U-8 Crib is believed to bound the volume released from the 200-W-42 VCP. (3) *Contaminant inventory[a]:* The contaminant inventory for the 216-U-8 Crib bounds the contaminant inventory for the 200-W-42 VCP, because only a portion of the waste was released from the pipeline. The pipeline did, however, carry the same uranium-rich waste stream that was discharged to the crib, so it is expected that the contaminants would be the same. (4) *Depth of waste discharge:* The 216-U-8 Crib discharged wastes at a depth of between 6 and 9 m (21 and 31 ft) bgs (crib structure was 3 m [10 ft] tall) compared to the depth of the pipeline, which was 3 to 4 m (10 to 12 ft) bgs. The representative site bounds the analogous site in terms of discharge depth. (5) *Expected distribution of contaminants:* The expected distribution of contaminants in the vadose zone from the 216-U-8 Crib is expected to be similar to that of the 200-W-42 VCP, because the waste streams are the same, and the sites are located adjacent to each other. Less mobile contaminants, such as Cs-137, are found near the depth of release at both sites. The distribution of these contaminants is shallower at 200-W-42 VCP because of the shallower discharge depth. Insufficient data exist to evaluate the distribution of contaminants deeper in the vadose zone beneath the 200-W-42 VCP. (6) *Potential for hydrologic and contaminant impacts to groundwater:* The 216-U-8 Crib is known to have impacted groundwater. The potential for contaminants to impact groundwater at the 216-U-8 Crib is expected to be greater than that of the 200-W-42 VCP, because the volume of waste discharged is believed to be much greater than that of the 200-W-42 VCP and the discharge depth of the crib was greater. Significant zones of contamination are at the base of the crib (9 m [31 ft] bgs) to 13 m [42 ft] bgs and in the deep vadose zone (50 m [165 ft] to 61 m [199 ft]). Cesium-137 concentrations are highest from 9 to 13 m (30 to 42 ft) bgs (maximum value of 91,190 pCi/g at 9 m [30 ft] bgs) with no detectable concentrations below 30 m (100 ft). Strontium-90 was detected from 9 to 61 m [31 to 199 ft] with the value near the base of the crib (130 pCi/g and between 35 and 50 m (115 and 165 ft) (maximum value of 520 pCi/g at 35 and 50 m [115 and 165 ft] bgs) with concentrations <20 pCi/g between 12 to 50 m [40 to 165 ft]). Uranium near the base of the crib is 28 pCi/g for U-233/234 and 94 pCi/g for U-238, and within the Cold Creek unit, maximum values of uranium are 140 pCi/g U-233/234 and 150 pCi/g U-238 at 56 m [185 ft] bgs). Spectral gamma borehole logging indicated a maximum U-238 activity of 831 pCi/g at 12 m (38 ft). Levels of Tc-99, Am-241, plutonium, and Np-237 are less than 1 pCi/g in the deep vadose zone.

TABLE B-3. 216-U-8 CRIB AND ASSOCIATED ANALOGOUS WASTE SITES. (2 Pages)

Waste Site	Site Construction and Discharge History	Rationale
Process Waste Group Analogous Sites to be Evaluated using the 216-U-8 Crib Representative Site Conceptual Model		
200-W-42 VCP/ UPR-200-W-163	*Waste sites configuration/construction:* • Located south of the 221-U Building and west of Beloit Avenue, the 1,965- by 20-ft site consists of vitrified clay pipeline buried approximately 10 ft below grade extending from the 270-W Neutralization Tank beneath the 2715-UA Building south to the 216-U-8 Crib and then to the 216-U-12 Crib. • In 1995, the site-contaminated soil from the area above the 200-W-42 VCP/UPR-200-W-163 south of Beloit Avenue to the 216-U-8 was removed and placed over the top of the 216-U-8 Crib. The area over the crib and consolidated soils was covered with soil and the site posted as an Underground Radioactive Material Area. *Release history/volume/depth:* • From 1952 to 1960, the pipeline carried process condensate from the 221-U uranium recovery process, 291-U-1 Stack drainage, and 224-U Plant uranium oxide production (calcining) process condensate. • From 1960 to 1988, the pipeline carried 291-U-1 Stack drainage and 224-U Plant uranium oxide production (calcining) process condensate. Contaminated water that was discharged to the crib from the 241-WR Vault in October 1965 included 3.14 kg (6.9 lb) thorium.	This VCP/unplanned release is considered to be analogous to the 216-U-8 Crib, because of the following criteria. (1) *Waste site configuration and construction*: This criterion is partially applicable. Although the crib and pipeline structures are different, the representative site is deeper within the vadose zone and therefore bounds its analogous site in terms of depth. (2) *Volume of effluent received in relation to the available pore volume*: Because the section of pipeline associated with the unplanned release discharged to the 216-U-8 Crib and only a portion of the effluent volume leaked from the pipeline, the volume of effluent discharged to the 216-U-8 Crib is believed to bound the volume released from the 200-W-42 VCP. (3) *Contaminant inventory*[a]: The contaminant inventory for the 216-U-8 Crib bounds the contaminant inventory for the 200-W-42 VCP, because only a portion of the waste was released from the pipeline. (4) *Depth of waste discharge*: The representative site bounds the analogous site in terms of discharge depth. (5) *Expected distribution of contaminants*: The distribution of less mobile contaminants is expected to be shallower at the 200-W-42 VCP than at the 216-U-8 Crib, because of the shallower discharge depth. Insufficient data exist to evaluate the distribution of contaminants deeper in the vadose zone beneath the 200-W-42 VCP. (6) *Potential for hydrologic and contaminant impacts to groundwater*: The potential for contaminants to impact groundwater at the 216-U-8 Crib is expected to be greater than that of 200-W-42 VCP, because the volume of waste discharged to the crib is believed to be much greater than the volume that leaked from the 200-W-42 VCP and the discharge depth of the crib was greater than the leak depth of the VCP. Surface soil samples collected during the VCP limited field investigation in 1994 typically showed low levels of activity for analyzed constituents. However, the highest Sr-90 and Tc-99 activities were detected in adjacent vegetation samples at 1,380 pCi/g for Sr-90 and 117 pCi/g for Tc-99. Significantly higher levels of contamination (maximums of 420 pCi/g Am-241, 40,081 pCi/g Cs-137, 146 pCi/g Sr-90, 50 pCi/g Tc-99, 43 pCi/g U-238, 3.3 pCi/g U-235, and 38 pCi/g U-233/234) were detected throughout the 4 m (12-ft) depth of the investigation above the pipeline. The data also suggested that minor lateral spreading (no more than 1 to 2 m [3 to 5 ft]) was apparent.

[a] Note that the contaminant inventory (e.g., total mass of a constituent) is based on historic disposal records. Actual vadose zone concentrations were determined based on the field investigation phase of the project. The vadose zone concentrations were utilized in the risk assessment calculations.

bgs = below ground surface.
VCP = vitrified clay pipeline.

TABLE B-4. 216-U-12 CRIB AND ASSOCIATED ANALOGOUS WASTE SITES. (6 Pages)

Waste Site	Site Construction and Discharge History	Rationale
	Representative Site	
216-U-12 Crib	*Waste sites configuration/construction:* • Located south of the 221-U Building and west of Beloit Avenue, the 150- by 60-ft site consists of a backfilled trench with gravel overlain by a polyethylene barrier and soil backfill. A perforated VCP is placed along the bottom of the trench. The bottom of the trench is approximately 15 ft deep and measures 10 by 100 ft. The crib was constructed by first filling the bottom few feet with gravel. Then the VCP was placed along the centerline and covered with gravel for a total depth of 5 ft. A plastic barrier was placed over the gravel layer, and the trench was backfilled to grade with the original excavated sediment. • In 1992, the site surface was radiologically surveyed and down posted from a Surface Contamination Area to an Underground Radioactive Material Area. *Release history/volume/depth:* • From 1960 to 1988, the site received 291-U-1 Stack drainage and 224-U Plant uranium oxide production (calcining) process condensate. Contaminated water that was discharged from the 241-WR Vault to the crib in October 1965 included 3.14 kg (6.9 lb) thorium. In 1988, the 216-U-12 Crib was replaced by the 216-U-17 Crib.	The criteria considered to evaluate the suitability of the 216-U-12 Crib as representative of the analogous sites assigned to it are as follows. (1) *Waste site configuration and construction:* The 216-U-12 Crib was constructed in a 5 m (15 ft) deep open excavation, which was backfilled with drainage layers of gravel, overlain by a polyethylene barrier and soil backfill. The 216-U-16 Crib and 216-U-17 Crib are constructed similarly, while the 216-U-5, 216-U-6, and 216-U-15 Trenches were open excavations that were intended for short-term use, contained no structure, and were backfilled with soil after use. The depths of the analogous sites range between 3 and 6 m (10 and 18 ft). (2) *Volume of effluent received in relation to the available pore volume:* The volume of effluent discharged to the 216-U-12 Crib is significantly greater than the soil pore volume beneath the site (150,000 m^3 compared to 1400 m^3). The 216-U-12 Crib bounds the analogous sites, because it had a significantly higher ratio of effluent volume to soil pore volume compared to analogous sites. (3) *Contaminant inventory[a]:* The primary constituents in the 216-U-12 Crib waste inventory are uranium, Tc-99, and nitrate. Of these constituents, actual inventories for the 216-U-12 Crib were calculated only for uranium (2010 kg). Total uranium, Tc-99, and nitrate inventories for the 216-U-16 Crib and 216-U-17 Crib are expected to be lower than for the 216-U-12 Crib, because they received similar process condensate wastes from the 224-U Plant but received a smaller volume of waste. Because the 216-U-5 and 216-U-6 Trenches received unirradated fuel waste streams, no Tc-99 is expected to be present. The 216-U-15, 216-U-5, and 216-U-6 Trenches uranium inventories were estimated at 2.25 kg, 363 kg, and 363 kg, respectively. Nitrate inventories at the 216-U-5, and 216-U-6 Trenches were estimated at 200 kg for each trench. The 216-U-15 Trench received approximately 1 Ci of fission products (compared to about 6 Ci of fission products at 216-U-12) and significant amounts of organic solution, whereas none of the other sites, including the 216-U-12 Crib, did. (4) *Depth of waste discharge:* The discharge depth for the 216-U-12 Crib is 5 m (15 ft) compared to a range of 3 to 6 m (10 to 18 ft). The discharge depth for the representative site is consistent with the analogous sites. (5) *Expected distribution of contaminants:* The distribution of contaminants at the 216-U-12 Crib in the vadose zone is expected to bound the distribution of mobile contaminants at the 216-U-15, 216-U-5, and 216-U-6 Trenches. Because of the relatively small volume of waste discharged (approximately equal to or less than 1 pore volume), the contaminants would not be carried very deep into the vadose zone and would be found primarily near the point of release. Contaminant distributions for the 216-U-16 Crib and 216-U-17 Crib primarily were mobile contaminants that would have a distribution similar to those of the 216-U-12 Crib. (6) *Potential for hydrologic and contaminant impacts to groundwater:* The 216-U-12 Crib is bounding, because it is known to have impacted groundwater as evidenced by the presence of Tc-99 and nitrate in the groundwater.

TABLE B-4. 216-U-12 CRIB AND ASSOCIATED ANALOGOUS WASTE SITES. (6 Pages)

Waste Site	Site Construction and Discharge History	Rationale
216-U-12 Crib (cont)		The 216-U-16 Crib also may have impacted groundwater, primarily because of the large volume of water discharged to this site. No other analogous sites in this group impacted groundwater because of the limited volumes of waste discharged to these sites. Limited characterization data are available for the crib from a 1994 borehole placed adjacent to the crib footprint, which showed no contaminants above background. A spectral gamma borehole logging of a borehole through the crib to 53 m (175 ft) bgs indicates Cs-137 from 5 to 18 m (16 to 59 ft) (maximum activity of 16,100 pCi/g at 7 m [23 ft]) and U-238 from 5 to 24 m (17 to 80 ft) (maximum activity of 500 pCi/g at 23 m [76 ft] bgs). Uranium-235 was detected by the radionuclide logging system at 20 pCi/g between 22 and 24 m (73 and 80 ft). Levels of Am-241, plutonium, and Np-237 are less than 1 pCi/g in the vadose zone.
Process Waste Group Analogous Sites to be Evaluated using the 216-U-12 Crib Representative Site Conceptual Model		
216-U-5 Trench	*Waste sites configuration/construction:* • Located northwest of the 221-U Building and contains an unlined trench 70 by 70 by 10 ft deep covered by backfill. • In 1994, the crib surface was interim-stabilized with 18 to 24 in. of uncontaminated backfill. This site is posted as an Underground Radioactive Material Area. *Release history/volume/depth:* • A single discharge of liquid waste in 1952 consisting of unirradiated uranium waste from the cold startup run at the 221-U Building.	This trench is considered to be analogous to the 216-U-12 Crib, based on the following criteria. (1) *Waste site configuration and construction.* The site is an inactive unlined trench; however, it lacks drainage layers and an impermeable barrier. (2) *Volume of effluent received in relation to the available pore volume.* The trench received a volume of effluent comparable to the soil pore volume (4500 m^3 compared to 3300 m^3), which is significantly less than the volume received by the 216-U-12 Crib. (3) *Contaminant inventory*[a]. The trench received an uranium-rich waste stream estimated to contain 363 kg of uranium and 200 kg of nitrate. (4) *Depth of waste discharge.* The trench was constructed to a depth that is similar to the 216-U-12 Crib. (5) *Expected distribution of contaminant.* The trench has primary contaminants of uranium and nitrate; and is expected to have similar contaminant distributions with maximum concentrations expected at the base of the trench (3 to 6 m [10 to 12 ft] bgs) and little lateral spreading. (6) *Potential for hydrologic and contaminant impacts to groundwater.* The site is not believed to have impacted groundwater, because of the limited discharge volumes from the site. This site is bounded by the 216-U-12 Crib; however, contaminant concentrations, vertical distribution, and risks likely are lower than those of the crib, based on (1) the site receiving orders of magnitude less wastewater than the 216-U-12 Crib (4500 m^3 compared to 150,000 m^3); (2) the site receiving a smaller inventory of contaminants (an order of magnitude less uranium, which was unirradiated); and (3) the site receiving a single short-duration discharge (lacks a persistent driving source of wastewater), which likely would further limit the vertical movement of contaminants from the point of discharge.

TABLE B-4. 216-U-12 CRIB AND ASSOCIATED ANALOGOUS WASTE SITES. (6 Pages)

Waste Site	Site Construction and Discharge History	Rationale
216-U-6 Trench	*Waste sites configuration/construction:* • Located northwest of the 221-U Building and contains an unlined trench 105 by 40 by 10 ft deep covered by backfill. • In 1994, the crib surface was interim-stabilized with 18 to 24 in. of uncontaminated backfill. This site is posted as an Underground Radioactive Material Area. *Release history/volume/depth:* • A single discharge of liquid waste in 1952 consisting of unirradiated uranium waste from the cold startup run at the 221-U Building.	This trench is considered to be analogous to the 216-U-12 Crib based on the following criteria. (1) *Waste site configuration and construction.* The site is an inactive unlined trench; however, it lacks drainage layers and an impermeable barrier. (2) *Volume of effluent received in relation to the available pore volume.* The trench received a volume of effluent comparable to the soil pore volume (4500 m^3 compared to 3300 m^3) and significantly less than the volume received by the 216-U-12 Crib. (3) *Contaminant inventory*[a]. The trench received a uranium-rich waste stream estimated to contain 363 kg of uranium and 200 kg of nitrate. (4) *Depth of waste discharge.* The trench was constructed to a depth similar to that of the 216-U-12 Crib. (5) *Expected distribution of contaminant.* The trench has primary contaminants of uranium and nitrate, and is expected to have similar contaminant distributions with maximum concentrations expected at the base of the trench (3 to 6 m [10 to 12 ft] bgs) and little lateral spreading. (6) *Potential for hydrologic and contaminant impacts to groundwater.* The site is not believed to have impacted groundwater because of the limited discharge volumes from the site. This site is bounded by the 216-U-12 Crib; however, contaminant concentrations, vertical distribution, and risks likely are lower than those ofthe crib, based on (1) the site receiving orders of magnitude less wastewater than the 216-U-12 Crib (4500 m^3 compared to 150,000 m^3); (2) the site receiving a smaller inventory of contaminants (an order of magnitude less uranium, which was unirradiated); and (3) the site receiving a single short-duration discharge (lacks a persistent driving source of wastewater), which likely would further limit the vertical movement of contaminants from the point of discharge.

TABLE B-4. 216-U-12 CRIB AND ASSOCIATED ANALOGOUS WASTE SITES. (6 Pages)

Waste Site	Site Construction and Discharge History	Rationale
216-U-15 Trench	*Waste sites configuration/construction:* • Located north of 16th Street and west of the 271-U Building, the site contains an unlined trench 20 by 20 by 15 ft deep covered by backfill. • No surface markers exist to identify the exact location of this waste unit. *Release history/volume/depth:* • A single discharge of liquid waste consisting of 7,000 gal of interface crud, activated charcoal, and diatomaceous earth containing approximately 1 Ci of fission products. The site is associated with the 388-U Tank and the 276-U Solvent Storage Tank.	This trench is considered to be analogous to the 216-U-12 Crib because of the following criteria. (1) *Waste site configuration and construction.* The site is an inactive unlined trench; however, it lacks drainage layers and an impermeable barrier. (2) *Volume of effluent received in relation to the available pore volume.* The trench received a volume of effluent less than the soil pore volume (66 m^3 compared to 560 m^3). (3) *Contaminant inventory[a].* The trench received an inventory of fission products (approximately 1 Ci) less than that of the 216-U-12 Crib (approximately 6 Ci); however, it is reported that this trench received organic solutions containing tributyl phosphate. (4) *Depth of waste discharge.* The trench was constructed to a depth similar to that of the 216-U-12 Crib. (5) *Expected distribution of contaminant.* The trench is expected to have similar contaminant distributions, with maximum concentrations expected at the base of the trench (3 to 6 m [10 to 12 ft] bgs) and little lateral spreading. (6) *Potential for hydrologic and contaminant impacts to groundwater.* The site is not believed to have impacted groundwater because of the limited discharge volumes from the site. This site is bounded by the 216-U-12 Crib; however, radionuclide contaminant concentrations, vertical distribution, and risks likely are lower than those of the crib based on (1) the site receiving several orders of magnitude less wastewater (68 m^3 compared to 150,000 m^3); (2) the site receiving a smaller inventory of radionuclides (3 orders of magnitude less uranium); and (3) the site receiving a single short-duration discharge (lacks a persistent driving source of wastewater), which likely would further limit the vertical movement of contaminants from the point of discharge. The 216-U-12 Crib, however, does not bound the chemical inventory of the 216-U-15 Trench, which received organics including tributyl phosphate and normal paraffin hydrocarbon. No analytical data are available for this site other than a report of core samples taken in 1970, which was not radioactive. There is some uncertainty as to the exact location of this site.

TABLE B-4. 216-U-12 CRIB AND ASSOCIATED ANALOGOUS WASTE SITES. (6 Pages)

Waste Site	Site Construction and Discharge History	Rationale
216-U-16 Crib	*Waste sites configuration/construction:* • Located south of 16th Street, between Beloit and Cooper Avenues, and southwest of the 224-U Building, the crib covers a 262- by 191-ft area. Its distribution system consists of two 8-in.-diameter polyvinylchloride header pipes (reducing to 6 in.) set 3 ft above the crib bottom and running on opposite sides of the crib. The header pipes are connected by a series of 4 in. perforated polyvinylchloride pipes on 10-ft centers that run across the crib. Each header pipe and cross line has a vent pipe. The bottom around the distribution system is filled with 5 ft of gravel covered by a 36 mil reinforced polyethylene liner. The volume above the liner is backfilled to grade. The crib bottom is approximately 17 ft below grade surface. • The crib is identified with concrete markers and is posted with Underground Radioactive Material Area signs. *Release history/volume/depth:* • Between 1984 and February 1985, liquid waste from the 224-U Uranium Oxide Processing Facility steam condensate, chemical sewer waste, 271-U compressor cooling water, and 221-U chemical sewer waste were released to the crib.	This crib is considered to be analogous to the 216-U-12 Crib. The following criteria were used to evaluate this relationship. (1) *Waste site configuration and construction.* The site is an inactive gravel-filled crib similar in construction to the 216-U-12 Crib. (2) *Volume of effluent received in relation to the available pore volume.* Although the site received large volumes of effluent (409,000 m^3 compared to 150,000 m^3 for the 216-U-12 Crib), its pore volume was significantly larger (16,500 m^3 compared to 1400 m^3) and therefore is bounded by 216-U-12 in terms of effluent volume in relation to available pore volume. (3) *Contaminant inventory[a].* The site received a dilute uranium-bearing process waste stream. (4) *Depth of waste discharge.* The crib was constructed to a depth similar to the 216-U-12 Crib. (5) *Expected distribution of contaminants.* The primary radionuclide contaminants (uranium, Tc-99, and nitrate) are similar, and the site is expected to have a similar contaminant distribution with maximum concentrations at the base of the crib (5 m [17 ft] bgs). (6) *Potential for hydrologic and contaminant impacts to groundwater.* The 216-U-16 Crib also may have impacted groundwater, primarily due to the large volume of water discharged to this site. The water discharged from the 216-U-16 Crib formed a perched groundwater table that spread laterally along the caliche to the 216-U-1 and 216-U-2 Cribs, where uranium and Tc-99 were mobilized from beneath the 216-U-1 and 216-U-2 Cribs and moved to groundwater through an improperly sealed well near the 216-U-1 Crib. Characterization is limited to geophysical well logs. The site operated for less than 1 yr, but received a high enough rate of effluent to create a perched groundwater table. This site is bounded by the 216-U-12 Crib; however, contaminant concentrations and risks likely are lower based on (1) the site receiving a smaller inventory of contaminants (2 orders of magnitude less uranium) and (2) wastewater was distributed over a much larger crib-base area.

TABLE B-4. 216-U-12 CRIB AND ASSOCIATED ANALOGOUS WASTE SITES. (6 Pages)

Waste Site	Site Construction and Discharge History	Rationale
216-U-17 Crib	*Waste sites configuration/construction:* • Located southeast of the intersection of Beloit Avenue and 16th Street, the crib covers a 204 by 64 ft area. It consists of a single below-surface perforated distribution pipe running down the centerline of the crib in a coarse gravel layer 150 by 10 by 6.5 ft deep. The gravel is covered with a 10 mil polyvinylchloride membrane and 10 ft of backfill. The crib bottom is approximately 18 ft below grade surface. • A surface radiological survey in 1997 found no contamination. The crib is posted as an Underground Radioactive Material Area. *Release history/volume/depth:* • Between 1989 and 1992, 224-U Plant uranium oxide production (calcining) process condensate from the off-gas condensers was neutralized and pumped to the crib for disposal.	This crib is considered to be analogous to the 216-U-12 Crib. The following criteria were used to evaluate this relationship. (1) *Waste site configuration and construction.* The 216-U-17 Crib is an inactive crib of similar construction (drainage layers and overlain by an impermeable barrier) that was built to replace the 216-U-12 Crib. (2) *Volume of effluent received in relation to the available pore volume.* The 216-U-17 Crib received a liquid effluent equal to its pore volume (2110 m^3). (3) *Contaminant inventory*[a]. The crib received a uranium-rich waste steam, although significantly less inventory than the 216-U-12 Crib. (4) *Depth of waste discharge.* The 216-U-17 Crib was constructed to a depth similar to that of the 216-U-12 Crib. (5) *Expected distribution of contaminant.* The 216-U-17 Crib and 216-U-12 Cribs are expected to have similar contaminant distributions with maximum concentrations expected at the base of the crib and little lateral spreading (6) *Potential for hydrologic and contaminant impacts to groundwater.* The 216-U-17 Crib and 216-U-12 Cribs have similar hydrogeology and a thick vadose zone; however, the volume of effluent discharged is equal to the soil pore volume. Therefore, it is not believed that the contaminants from the crib significantly impacted groundwater. Logging of six boreholes with the Radionuclide Logging System in the 216-U-17 Crib was completed in May 1993, after the crib received approximately 1.12×10^5 L of waste, and no man-made radionuclides were detected in the vadose zone beneath the crib. In addition, sampling of the UO_3 Facility process condensate discharged to the crib detected only low concentrations of tritium, uranium, Tc-99, nitrate, and fluoride (WHC-EP-0664). Risks associated with this site are expected to be bounded by those of the 216-U-12 Crib, because the waste inventory and volume are significantly less than at the 216-U-12 Crib logging results.

[a] Note that the contaminant inventory (e.g., total mass of a constituent) is based on historic disposal records. Actual vadose zone concentrations were determined based on the field investigation phase of the project. The vadose zone concentrations were utilized in the risk assessment calculations.

bgs = below ground surface.
VCP = vitrified clay pipeline.
WHC-EP-0664, 1993, *Groundwater Impact Assessment for the 216-U-17 Crib*, Westinghouse Hanford Operations, Richland, Washington.

TABLE B-5. 216-U-4 REVERSE WELL/216-U-4A FRENCH DRAIN AND ASSOCIATED ANALOGOUS WASTE SITES. (2 Pages)

Waste Site	Site Construction and Discharge History	Rationale
	216-U-4 Reverse Well/216-U-4A French Drain Representative Site	
216-U-4 Reverse Well/216-U-4A French Drain	*Waste sites configuration/construction:* • A 10- by 10-ft area containing a reverse well (a 3-in. diameter pipe extending 75 ft into the ground with the bottom 25 ft of pipe perforated) connected to a French drain (a 51-in.-diameter concrete pipe extending 4 ft into the ground) located near the northwest corner of the 222-U Building. • Area stabilized with clean backfill and posted as an Underground Radioactive Material Area. *Release history/volume/depth:* • The reverse well received acidic decontamination liquid waste containing fission products from the 222-U Laboratory hood sinks from 1947 until it plugged in 1955. An overflow line was installed to the 216-U-4A French Drain, which continued to receive similar wastes until 1970 when laboratory operations were shut down.	Because of the proximity of the 216-U-4 Reverse Well and 216-U-4A French Drain sites, they have been combined into one conceptual contaminant distribution model. The 216-U-4 Reverse Well and 216-U-4A French Drain were selected as a representative site based on the following criteria. (1) *Waste site configuration and construction.* The 216-U-4 Reverse Well is the only reverse well among the U Plant Closure Area waste sites, and the 216-U-4A French Drain and the 216-U-4B French Drain were constructed similarly (having similar materials and depth). (2) *Volume of effluent received in relation to the available pore volume.* The volume of effluent discharged through the 216-U-4 Reverse Well and the 216-U-4A French Drain is 845 m^3 compared to 33 m^3 for the 216-U-4B French Drain. (3) *Contaminant inventory[a].* The 216-U-4 Reverse Well, the 216-U-4A Drain, and the 216-U-4B French Drain received waste from the 222-U Laboratory. The primary contaminants discharged to the 216-U-4 Reverse Well and the 216-U-4A French Drain are uranium (8.63 kg), plutonium (9.00 E-03 g), Cs-137 (1.85 E-01 Ci), Sr-90 (1.59 E-02 Ci), and nitrate (1,300 kg). The contaminant inventory for the 216-U-4B French Drain is higher in terms of plutonium (5.40 E-02 g), similar in terms of Cs-137 (1.97 E-01 Ci), lower in Sr-90 (1.65 E-03 Ci) and nitrate (10 kg), and lacks uranium altogether. (4) *Depth of waste discharge.* The depth of discharge is similar for the 216-U-4A French Drain and 216-U-4B French Drain; however, the 216-U-4 Reverse Well is approximately 20 m (66 ft) deeper. (5) *Expected distribution of contaminant.* Because of the greater depth of the reverse well and much greater combined volume of discharge from the 216-U-4 Reverse Well and 216-U-4A French Drain, the contaminant distribution is expected to be significantly deeper for the representative site than for the analogous site (the 216-U-4B French Drain). Similar to other waste sites in the U Plant Closure Area, immobile contaminants such as Cs-137 are found near the point of release, and more mobile contaminants such as nitrate are migrating lower in the vadose zone. The representative site bounds the analogous site in terms of the depth of the contaminant distribution. (6) *Potential for hydrologic and contaminant impacts to groundwater.* Because of the depth of the 216-U-4 Reverse Well, the volume of effluent discharged in comparison to the soil pore volume, and the detection of uranium at the caliche layer in excess of the background concentration, it is believed that the representative site may have impacted groundwater.

TABLE B-5. 216-U-4 REVERSE WELL/216-U-4A FRENCH DRAIN AND ASSOCIATED ANALOGOUS WASTE SITES. (2 Pages)

Waste Site	Site Construction and Discharge History	Rationale
Reverse Well/French Drain Group Analogous Sites to be Evaluated using the 216-U-4 Reverse Well/216-U-4A French Drain Representative Site Conceptual Model		
216-U-4B French Drain	*Waste sites configuration/construction:* • A 5- by 5-ft area containing a French drain (a 36-in. concrete pipe extending 10 ft into the soil) located south of the 222-U Building. The French drain is a Washington State-registered underground injection well. • This site is posted as an Underground Radioactive Material Area. *Release history/volume/depth:* • From 1960 to 1970, the site received contaminated liquid laboratory waste from hot cells and hoods in the 222-U Laboratory.	This site is analogous to the 216-U-4 Reverse Well/216-U-4A French Drain, based on the following criteria. (1) *Waste site configuration and construction.* This site is an inactive French drain of construction similar to that of the 216-U-4A French Drain. (2) *Volume of effluent received in relation to the available pore volume.* This site received a smaller effluent volume than the 216-U-4A French Drain and therefore is bounded by it. (3) *Contaminant Inventory*[a]. This site received a similar contaminant inventory (see discussion under 216-U-4 Reverse Well). (4) *Depth of waste discharge.* The 216-U-4A and 216-U-4B French Drains have similar structure depths. (5) *Expected distribution of contaminant.* The contaminant distribution is expected to be similar to the 216-U-4A French Drain, although bounded by it because of smaller release volume and inventory. (6) *Potential for hydrologic and contaminant impacts to groundwater.* The site has a thick vadose zone and depth similar to the caliche layer of the representative site because of the proximity of the two sites. Because the waste inventory for nitrate, the release depth, and effluent volume are all significantly less for the 216-U-4B French Drain, *the representative site is believed to bound it in terms of impacts to groundwater.*

[a] Note that the contaminant inventory (e.g., total mass of a constituent) is based on historic disposal records. Actual vadose zone concentrations were determined based on the field investigation phase of the project. The vadose zone concentrations were utilized in the risk assessment calculations.

TABLE B-6. UNPLANNED RELEASE UPR-200-W-19 AND ASSOCIATED ANALOGOUS WASTE SITES. (10 Pages)

Waste Site	Site Construction and Discharge History	Rationale
	UPR-200-W-19 Representative Site	
UPR-200-W-19	*Waste sites configuration/construction:* • The 425- by 197-ft soil area is located north of 16th Street, west of the 221-U Building, and east of the 207-U Retention Basin. This site contains the 216-U-1 and 216-U-2 Cribs, the 241-U-361 Settling Tank, and the 2607-W5 Septic Tank and diversion boxes. • In 1992, contaminated soil in the vicinity of the 216-U-1 and 216-U-2 Cribs was scraped and consolidated near the 241-U-361 Settling Tank. The surface surrounding the 241-U-361 Settling Tank was surface stabilized with shotcrete. The area then was covered with 16 to 24 in. of clean backfill and posted as an Underground Radioactive Material Area. *Release history/volume/depth:* • In 1953, an unknown volume of liquid wastes from the uranium recovery process in the 221-U Building and the 224-U Building overflowed from the vents on the 241-U-361 Settling Tank and the 216-U-1 and 216-U-2 Cribs and on to the ground. Contamination was reported over an area of approximately 50 ft^2. Soil removal and backfill were performed. The area originally was marked by a wooden fence, and posted with Radiation Zone signs. Over the years, contamination from windblown soil and vegetation extended the area of surface contamination until it was stabilized in 1992.	The criteria considered to evaluate the suitability of UPR-200-W-19 as a representative of the sites assigned to it are as follows. (1) *Waste site configuration and construction.* UPR-200-W-19 is an unplanned release site where contaminated liquid from a high-risk waste site was known to have been released to the ground. (2) *Volume of effluent received in relation to the available pore volume:* This criterion is only applicable when a known volume of waste is released to a site of defined size. Because the volume of the release for UPR-200-W-19 is not known, the relationship to pore volume cannot be determined. (3) *Contaminant inventory[a]:* Because UPR-200-W-19 was an unplanned release, contaminant inventory is not known. (4) *Depth of waste discharge:* The UPR-200-W-19 was a surface release of liquid that was later spread to a wider area by plant and animal/insect intrusion. The depth of the release is expected to be 1 to 2 m below the clean backfill. (5) *Expected distribution of contaminants:* Immobile contaminants from UPR-200-W-19 have remained near the surface and have been spread laterally by windblown soil and vegetation. More mobile contaminants are anticipated to be relatively shallow, because the effluent volume released was small relative to the volume discharged to the cribs. (6) *Potential for hydrologic and contaminant impacts to groundwater:* No impacts to groundwater are anticipated because of the small effluent volume believed to have been released to the site compared to the volumes released at high-risk waste sites.

TABLE B-6. UNPLANNED RELEASE UPR-200-W-19 AND ASSOCIATED ANALOGOUS WASTE SITES. (10 Pages)

Waste Site	Site Construction and Discharge History	Rationale
Septic System Group Analogous Sites to be Evaluated using the UPR-200-W-19 Representative Site Conceptual Model		
2607-W5 Septic Tank and Tile Field	*Waste sites configuration/construction:* • The septic tank (a buried concrete box 30 ft long, 13 ft wide, and 11 ft deep) and two concrete diversion boxes are located north of the 216-U-1 and 216-U-2 Cribs and the 241-U-361 Settling Tank in an Underground Radioactive Material Area. The two tile fields are located outside the Underground Radioactive Material Area boundary also to the north. One tile field (174 by 100 ft) has been inactive since 1954. The second tile field (136 by 100 ft) is active and receives waste from U Plant facilities. • The septic tank and the two concrete diversion boxes were decontaminated and surface stabilized with clean backfill in 1992 and posted as an Underground Radioactive Material Area. Radiological contamination on the surface within the active tile field was decontaminated by scraping off surface soils and the posting removed *Release history/volume/depth:* • Contamination from windblown soil and vegetation from the 241-U-361 unplanned release probably was the source of the contamination. However, no radionuclides or hazardous chemicals are known to have been associated with discharges to this septic system. The system was designed to receive up to 3,200 gal/day of sanitary waste from U Plant facilities.	This site is considered to be similar to and bounded by UPR-200-W-19 based on the following criteria. (1) *Waste site configuration and construction:* This criterion is not applicable, because the unplanned release is not an engineered structure compared to the 2607-W5 Septic Tank and Tile Field, which was designed to accept sanitary effluent. (2) *Volume of effluent received in relation to the available pore volume:* The volume of effluent received at the 2607-W5 Septic Tank and Tile Field is expected to exceed the soil pore volume. This is not the case for UPR-200-W-19; however, this may not be of significance, because the septic tank and tile field system was intended to accept sanitary effluent, not contaminated effluents. Therefore, the waste inventory transported with that liquid effluent is expected to be minimal. (3) *Contaminant inventory[a]:* The waste inventory of the septic system is unknown, but is believed to be bounded by the contaminant inventory released to UPR-200-W-19, where a known release of contaminants from a high-risk waste site was documented and confirmed through characterization. No releases of radiological contaminants have been documented for the 2607-W5 Septic Tank and Tile Field, because it was not intended for disposal of sanitary effluent. (4) *Depth of waste discharge:* The depth of discharge for the septic system is considered similar to UPR-200-W-19, because the septic tank and tile fields are near the surface. (5) *Expected distribution of contaminants:* The contaminant distribution is expected to be near the surface for immobile contaminants such as Cs-137 that may have been inadvertently released into the septic system. More mobile contaminants inadvertently discharged into the septic system could migrate deeper into the vadose zone; however, the amounts of these contaminants are expected to be small, because these contaminants were not purposely discharged into the septic system, and no unplanned releases have been documented. Because surface contamination has been documented and characterized at UPR-200-W-19, it is believed that the representative site would bound the analogous sites in terms of risk. (6) *Potential for hydrologic and contaminant impacts to groundwater:* Because of the limited contaminant inventory released to the sites compared with the inventory release to other U Plant waste sites designed to accept liquid effluent, the site is not believed to have impacted groundwater. Characterization data from borehole 299-W19-97 placed adjacent to the south west corner of the tile fields as part of a 1994 investigation showed no evidence of impact to the vadose zone from the tile field. Low levels of Cs-137 associated with UPR-200-W-19 were detected near the surface.

TABLE B-6. UNPLANNED RELEASE UPR-200-W-19 AND ASSOCIATED ANALOGOUS WASTE SITES. (10 Pages)

Waste Site	Site Construction and Discharge History	Rationale
2607-W7 Septic Tank and Tile Field	*Waste sites configuration/construction:* • The 350-gal septic tank and 136- by 100-ft drain field. This unit lies 45.9 ft north of the northernmost corner of the 221-U Canyon Building. • This system was abandoned in 1999 in accordance with the requirements of WAC 246-272-18501. All sewage inside the tank was removed, and the empty tank was filled to eliminate void spaces. *Release history/volume/depth:* • No radionuclides or hazardous chemicals are known to have been associated with this septic system. The system was designed to receive up to 264 gal/day of sanitary waste from the restroom located in the 221-U Canyon Building.	This site is considered to be similar to and bounded by UPR-200-W-19 based on the following criteria. (1) *Waste site configuration and construction:* This criterion is not applicable, because the unplanned release is not an engineered structure like the 2607-W7 Septic Tank and Tile Field, which was designed to accept sanitary effluent. (2) *Volume of effluent received in relation to the available pore volume:* The volume of effluent received at the 2607-W7 Septic Tank and Tile Field is expected to exceed the soil pore volume. This is not the case for UPR-200-W-19, however, this may not be of significance, because the septic tank and tile field system was intended to accept sanitary effluent, not contaminated effluents. Therefore, the waste inventory transported with that liquid effluent is expected to be minimal. (3) *Contaminant inventory[a]:* The waste inventory of the septic tank and tile field system is unknown, but is believed to be bounded by the contaminant inventory released to UPR-200-W-19, where a known release of contaminants from a high-risk waste site was documented and confirmed through characterization. No releases of radiological contaminants have been documented for the 2607-W7 Septic Tank and Tile Field, because it was not intended for disposal of sanitary effluent. (4) *Depth of waste discharge:* The depth of discharge for the septic tank and tile field system is considered similar to UPR-200-W-19, because the septic tank and tile fields are near the surface. (5) *Expected distribution of contaminants:* The contaminant distribution is expected to be near the surface for immobile contaminants such as Cs-137 that may have been inadvertently released into the septic tank and tile field system. More mobile contaminants inadvertently discharged into the septic tank and tile field system could migrate deeper into the vadose zone; however, the amounts of these contaminants are expected to be small, because these contaminants were not purposely discharged into the septic system, and no unplanned releases have been documented. Because surface contamination has been documented and characterized at UPR-200-W-19, it is believed that the representative site would bound the analogous sites in terms of risk. (6) *Potential for hydrologic and contaminant impacts to groundwater:* Because of the shallow nature of the site, and the limited contaminant inventory released to the sites in comparison to other U Plant Closure Area waste sites designed to accept liquid effluent, the site is not believed to have impacted groundwater.
Solid Waste Group Analogous Sites to be Evaluated using the UPR-200-W-19 Representative Site Conceptual Model		
		(1)
200-W-71 Pit	*Waste sites configuration/construction:* • A 262.5- by 49.2-ft soil area originally containing a burning pit located southeast of the 221-U Building, south of 16th Street, and east of Beloit Avenue. • The site was identified from aerial photos taken in the late 1940s. The site is not marked. *Release history/volume/depth:* • Suspected uranium-contaminated debris was burned at this site in the late 1940s and apparently covered with soil. No radioactive contamination has been discovered in or around this site.	Significant uncertainties exist concerning the nature of any releases at this 200-W-71 Pit site as well as the location of the site. Based on the historical photographs and the general lack of information on this site and on the UPR-200-W-8 Burning Ground, this site may be the burn pit that is described in the UPR-200-W-8 Burning Ground waste site. See the UPR-200-W-8 Burning Ground rationale in the following description.

TABLE B-6. UNPLANNED RELEASE UPR-200-W-19 AND ASSOCIATED ANALOGOUS WASTE SITES. (10 Pages)

Waste Site	Site Construction and Discharge History	Rationale
UPR-200-W-8 Burning Ground	*Waste sites configuration/construction:* • A 425- by 100-ft soil area located east of the 221-U Building, adjacent to the northwest corner of Beloit Avenue and 16th Street. • The site was cleaned up and removed from radiation zone status in 1970. The site is no longer marked or posted. *Release history/volume/depth:* • Suspected fission-product-contaminated debris was burned here in the 1950s and covered with about 10 ft of clean fill. NOTE: Based on historical photographs and the general lack of information on this site, the 200-W-71 Pit may be the burn pit that is described as the 200-W-8 Burning Ground waste site.	This site is considered to be similar to and bounded by the representative site based on the following criteria. (1) *Waste site configuration and construction:* This criterion is not applicable, because the 200-W-8 Burning Ground site consisted of a trench that may have been used as a burning ground, compared to UPR-200-W-19, which was an unplanned release with no structure. (2) *Volume of effluent received in relation to the available pore volume:* This criterion is not applicable to the 200-W-8 Burning Ground, because no effluent is known to have been discharged to the site. (3) *Contaminant inventory[a]:* The contaminant inventory discharged to this site was not documented, but the maximum dose rate of 45 rem/h at 5 cm (2 in.) is comparable to the 11.5 rem/h at a distance of 7.6 cm (3 in.) measured at UPR-200-W-19. However, because surface contamination has been documented by soil sampling at UPR-200-W-19, and the release occurred from a high-risk site, it is believed that the representative site would bound the analogous site in terms of risk. (4) *Depth of waste discharge:* The 200-W-8 Burning Ground site consisted of a shallow trench that is believed to have been backfilled, and therefore the release depth of the contamination is similar to that of UPR-200-W-19. (5) *Expected distribution of contaminants:* The contaminant distribution at the 200-W-8 Burning Ground is expected to be near the surface, because only solid waste was released at this site. Because contamination at the 200-W-8 Burning Ground is believed to have been cleaned up, UPR-200-W-19 would bound the 200-W-8 Burning Ground in terms of contaminant distribution. (6) *Potential for hydrologic and contaminant impacts to groundwater:* This criterion is not applicable to the 200-W-8 Burning Ground, because no liquid was discharged at this site.

TABLE B-6. UNPLANNED RELEASE UPR-200-W-19 AND ASSOCIATED ANALOGOUS WASTE SITES. (10 Pages)

Waste Site	Site Construction and Discharge History	Rationale
Unplanned Release Group Analogous Sites to be Evaluated using the UPR-200-W-19 Representative Site		
UPR-200-W-118	*Waste sites configuration/construction:* • A 209- by 209-ft soil area located around the railroad spur and 211-U Chemical Tank Farm northwest of the 221-U Building. • Area stabilized with gravel and posted as an Underground Radioactive Material Area. *Release history/volume/depth:* • Drips and spills from the reclaimed nitric acid unloading station at the 211-U Chemical Tank Farm in the 1960s and 1970s was spread by the wind to the ground surface outside the concrete unloading station and onto surrounding soils.	This site is considered to be similar to and bounded by the representative site based on the following criteria. (1) *Waste site configuration and construction:* The representative site and the analogous site in this grouping are unplanned releases expected to be limited to surface soils within 3 m (10 ft) of the ground surface, based on the nature of the releases. (2) *Volume of effluent received in relation to the available pore volume:* This criterion is not applicable, because the volume of liquid discharged is not known. (3) *Contaminant inventory[a]:* The contaminant inventory discharged to this site was not documented. However, because surface contamination has been documented at UPR-200-W-19, and the release occurred from a high-risk site, it is believed that the representative site would bound the analogous site in terms of risk. (4) *Depth of waste discharge:* Both the representative site UPR-200-W-19 and the analogous site UPR-200-W-118 were released to surface soil and therefore have similar release depths. (5) *Expected distribution of contaminants:* Because the release depths are similar, it is anticipated that contaminant distributions at the representative site and the analogous site would be similar. Because surface contamination has been documented and characterized at UPR-200-W-19, and the release occurred from a high-risk waste site, it is believed that the representative site would bound the analogous site in terms of risk. (6) *Potential for hydrologic and contaminant impacts to groundwater:* This criterion is not applicable because of the shallow nature of the representative and analogous sites.
Shallow/Surface Waste Site Group Analogous Sites to be Evaluated using the UPR-200-W-19 Representative Site Conceptual Model		
UPR-200-W-33	*Waste sites configuration/construction:* • A 10- by 15-ft soil area located approximately 90 ft east of the 224-U Building. • In 1955, the top 4 in. of contaminated soil were removed and new soil was used to fill the excavation. The site was removed from radiation zone status in 1970. The site is no longer marked or posted. *Release history/volume/depth:* • A leaking flange of the C-5 Condensate Line from the 224-U Building caused a small area of the ground to become contaminated in March 1955.	This site is considered to be similar to and bounded by the representative site based on the following criteria. (1) *Waste site configuration and construction:* This site is an unplanned release of liquid waste to surface soil, similar to UPR-200-W-19, and therefore has no structure associated with it. (2) *Volume of effluent received in relation to the available pore volume:* This criterion is not applicable, because the volume of effluent discharged to UPR-200-W-33 is not known. (3) *Contaminant inventory[a]:* The contaminant inventory at UPR-200-W-33 was not documented. However, because UPR-200-W-33 was a small release compared to UPR-200-W-19, it is believed that the representative site would bound the analogous sites in terms of risk. (4) *Depth of waste discharge:* UPR-200-W-33 was an unplanned release to surface soil and therefore similar to UPR-200-W-19 in terms of discharge depth. (5) *Expected distribution of contaminants:* Contaminant distribution from UPR-200-W-33 is believed to be limited to surface soils within 1 m (3 ft) of the ground surface, because the release was small and was cleaned up. Because the release depths are similar, and the effluent volume and contaminant inventory of UPR-200-W-19 is significantly higher, the representative site bounds this site. (6) *Potential for hydrologic and contaminant impacts to groundwater:* This criterion is not applicable because of the shallow nature of the representative and analogous sites.

TABLE B-6. UNPLANNED RELEASE UPR-200-W-19 AND ASSOCIATED ANALOGOUS WASTE SITES. (10 Pages)

Waste Site	Site Construction and Discharge History	Rationale
UPR-200-W-48	*Waste sites configuration/construction:* • A 32- by 32-ft soil area located at the west end of the 221-U Building railroad cut at Bridgeport Avenue. • Contaminated soil was removed and a patch of gravel at the site may be part of the 1958 stabilization effort. The site is no longer marked or posted. *Release history/volume/depth:* • Suspected fission-product-contaminated particulates that spread from a jumper, wrapped in plastic, as it was transferred from a flatbed truck to a railroad flatcar at the railroad crossing in 1958.	This site is considered to be similar to and bounded by the representative site based on the following criteria. (1) *Waste site configuration and construction:* This site is an unplanned release of liquid waste to surface soil, similar to UPR-200-W-19, and therefore has no structure associated with it. (2) *Volume of effluent received in relation to the available pore volume:* This criterion is not applicable, because the UPR-200-W-48 effluent volume discharged is unknown. (3) *Contaminant inventory[a]:* The contaminant inventory at UPR-200-W-48 was not documented but the maximum dose rate of 9 rem/h is comparable to the 11.5 rem/h at a distance of 7.6 cm (3 in.) measured at UPR-200-W-19. However, because UPR-200-W-48 was a small release compared to the release at UPR-200-W-19, it is believed that the representative site would bound the analogous sites in terms of contaminant inventory. (4) *Depth of waste discharge:* UPR-200-W-48 was an unplanned release to surface soil, and therefore similar to UPR-200-W-19 in terms of discharge depth. (5) *Expected distribution of contaminants:* Contaminant distribution from UPR-200-W-48 is believed to be limited to surface soils within 1 m (3 ft) of the ground surface, because the release was small. Because the release depths are similar, and the effluent volume and contaminant inventory of UPR-200-W-19 are significantly higher, the representative site bounds this site. (6) *Potential for hydrologic and contaminant impacts to groundwater:* This criterion is not applicable, because of the shallow nature of the representative and analogous sites.
UPR-200-W-55	*Waste sites configuration/construction.* • A 10- by 10-ft soil area located adjacent to the 224-UA Building loading ramp at the southwest end of the building • The site is no longer marked or posted. *Release history/volume/depth:* • An unknown amount of uranium powder remaining from cleanup of a 1960, 1.5-ton spill was washed off the asphalt, and it soaked into the adjacent soil surface.	This site is considered to be similar to and bounded by the representative site based on the following criteria. (1) *Waste site configuration and construction:* This site is an unplanned release to the surface, similar to UPR-200-W-19, and therefore has no structure associated with it. (2) *Volume of effluent received in relation to the available pore volume:* This criterion is not applicable, because the volume of water used to wash off the asphalt is unknown. (3) *Contaminant inventory[a]:* The contaminant inventory at UPR-200-W-55 was not documented. However, because most of the uranium oxide powder was swept up and recovered from UPR-200-W-55, and only a small release would remain, it is believed that UPR-200-W-19 would bound this site in terms of contaminant inventory. (4) *Depth of waste discharge:* UPR-200-W-55 was an unplanned release at the surface, and therefore similar to UPR-200-W-19 in terms of discharge depth. (5) *Expected distribution of contaminants:* Contaminant distribution from UPR-200-W-55 is believed to be limited to surface soils within 1 m (3 ft) of the ground surface, because the release was small. Because the release depths are similar, and the effluent volume and contaminant inventory of UPR-200-W-19 are significantly higher, the representative site bounds this site. (6) *Potential for hydrologic and contaminant impacts to groundwater:* This criterion is not applicable because of the shallow nature of the representative and analogous sites.

TABLE B-6. UNPLANNED RELEASE UPR-200-W-19 AND ASSOCIATED ANALOGOUS WASTE SITES. (10 Pages)

Waste Site	Site Construction and Discharge History	Rationale
UPR-200-W-78	*Waste sites configuration/construction:* • A 5- by 8-ft soil area located approximately 120 ft south of the 224-U building at the former uranium trioxide barrel storage area. • Contaminated soil removed after discovery in 1970. The site is no longer marked or posted. *Release history/volume/depth:* • Suspected uranium-oxide-contaminated particulates from pallets of stored barrels.	This site is considered to be similar to and bounded by the representative site based on the following criteria. (1) *Waste site configuration and construction:* This site is an unplanned release to surface soil, similar to UPR-200-W-19, and therefore has no structure associated with it. (2) *Volume of effluent received in relation to the available pore volume:* This criterion is not applicable, because UPR-200-W-78 was believed to have been caused by a spill of uranium oxide powder, and therefore had no liquid effluent. (3) *Contaminant inventory*[a]*:* The contaminant inventory at UPR-200-W-78 was not documented. However, because contaminated soil was removed from UPR-200-W-78, it is believed that the UPR-200-W-19 would bound this site in terms of contaminant inventory. (4) *Depth of waste discharge:* UPR-200-W-78 was an unplanned release to surface soil, and therefore similar to UPR-200-W-19 in terms of discharge depth. (5) *Expected distribution of contaminants:* Because contaminant distribution from UPR-200-W-78 is believed to be limited to surface soils within 1 m (3 ft) of the ground surface, and contaminated soil was removed from the site, the representative site bounds this site. (6) *Potential for hydrologic and contaminant impacts to groundwater:* This criterion is not applicable because of the shallow nature of the representative and analogous sites.
200-W-77 Unplanned Release	*Waste sites configuration/construction:* • An 8- by 15-ft soil area located adjacent to the railroad track, west of the 216-U-16 Crib and east of the stabilized 216-U-14 Ditch. • Area stabilized with clean backfill in 2000 and posted as a Contamination Area. *Release history/volume/depth:* • Suspected fission-product-contaminated vegetation from the 216-U-14 Ditch (before stabilization of the ditch) blown in by the wind that contaminated the surface soils.	This site is considered to be similar to and bounded by the representative site based on the following criteria. (1) *Waste site configuration and construction:* This site is an unplanned release to surface soil, similar to UPR-200-W-19, and therefore has no structure associated with it. (2) *Volume of effluent received in relation to the available pore volume:* This criterion is not applicable, because the 200-W-77 Unplanned Release was believed to have been caused by windblown vegetation that was contaminated, and therefore had no liquid effluent. (3) *Contaminant inventory*[a]*:* The contaminant inventory at the 200-W-77 Unplanned Release was not documented. However, because the 200-W-77 Unplanned Release was a small release, it is believed that UPR-200-W-19 would bound this site in terms of contaminant inventory. (4) *Depth of waste discharge:* The 200-W-77 Unplanned Release was an unplanned release at the surface, and therefore similar to UPR-200-W-19 in terms of discharge depth. (5) *Expected distribution of contaminants:* Contaminant distribution from the 200-W-77 Unplanned Release is believed to be limited to surface soils within 1 m (3 ft) of the ground surface, because the release was small. Because the release depths are similar, and the effluent volume and contaminant inventory of UPR-200-W-19 is significantly higher, the representative site bounds this site. (6) *Potential for hydrologic and contaminant impacts to groundwater:* This criterion is not applicable because of the shallow nature of the representative and analogous sites.

TABLE B-6. UNPLANNED RELEASE UPR-200-W-19 AND ASSOCIATED ANALOGOUS WASTE SITES. (10 Pages)

Waste Site	Site Construction and Discharge History	Rationale
200-W-85 Unplanned Release	*Waste sites configuration/construction:* • A 20- by 20-ft soil area located approximately 100 ft east of the 2727-WA Sodium Storage Building equipment storage yard • Area stabilized with clean backfill in 2001 and posted as an Underground Radioactive Material Area. *Release history/volume/depth.* • Suspected fission-product-contaminated particulates from unknown source contaminated surface soils.	This site is considered to be similar to and bounded by the representative site based on the following criteria. (1) *Waste site configuration and construction:* This site is an unplanned release to surface soil, similar to UPR-200-W-19, and therefore has no structure associated with it. (2) *Volume of effluent received in relation to the available pore volume:* This criterion cannot be evaluated, because the exact source of the 200-W-85 Unplanned Release is not known. (3) *Contaminant inventory*[a]: The contaminant inventory at the 200-W-85 Unplanned Release was not documented; however, because this site is a small release, it is believed that UPR-200-W-19 would bound this site in terms of contaminant inventory. (4) *Depth of waste discharge:* The 200-W-85 Unplanned Release was an unplanned release to surface soil, and therefore similar to UPR-200-W-19 in terms of discharge depth. (5) *Expected distribution of contaminants:* Contaminant distribution from the 200-W-85 Unplanned Release is believed to be limited to surface soils within 1 m (3 ft) of the ground surface and, because the release is small, the representative site bounds this site. (6) *Potential for hydrologic and contaminant impacts to groundwater:* This criterion is not applicable because of the shallow nature of the representative and analogous sites.
200-W-87 Unplanned Release	*Waste sites configuration/construction:* • A 120- by 30-ft soil area located adjacent to the railroad track northwest of the 2714-U Building and T-Hopper yard on the U Plant chemical spur railroad track. • Area stabilized with clean backfill in 2001 and posted as an Underground Radioactive Material Area. *Release history/volume/depth:* • Suspected fission product from contaminated along a railroad spur. The site was discovered in 2000.	This site is considered to be similar to and bounded by the representative site based on the following criteria. (1) *Waste site configuration and construction:* This site is a potential unplanned release to surface soil associated with a potentially contaminated train; therefore, this site has no structure associated with it. (2) *Volume of effluent received in relation to the available pore volume:* This criterion cannot be evaluated, because it is unknown if any waste was released. (3) Contaminant inventory[a]: This criterion cannot be evaluated, because it is unknown if any waste was released. (4) *Depth of waste discharge:* If any releases had occurred from the 200-W-87 Unplanned Release, they would have been to surface soil and therefore similar to UPR-200-W-19 in terms of discharge depth. (5) *Expected distribution of contaminants:* This criterion cannot be evaluated, because it is unknown if any waste was released. (6) *Potential for hydrologic and contaminant impacts to groundwater:* This criterion cannot be evaluated, because it is unknown if any waste was released.

TABLE B-6. UNPLANNED RELEASE UPR-200-W-19 AND ASSOCIATED ANALOGOUS WASTE SITES. (10 Pages)

Waste Site	Site Construction and Discharge History	Rationale
200-W-89 Foundation (Unplanned Release)	*Waste sites configuration/construction:* • Decommissioned 252-U Electrical Substation east of the 224-U Building near the intersection of Beloit Avenue and 16th Street with transformer left in place. Concrete pad and surrounding soil area dimensions are 100 ft long by 100 ft wide. • Area stabilized with gravel and posted as an Underground Radioactive Material Area in 1999. *Release history/volume/depth:* • Fission product containing particulates contaminated pad and soils. No polychlorinated biphenyls have been identified at the site.	This site is considered to be similar to and bounded by the representative site based on the following criteria. (1) *Waste site configuration and construction:* This site is an unplanned release to surface soil, similar to UPR-200-W-19. A concrete foundation is associated with this site. (2) *Volume of effluent received in relation to the available pore volume:* This criterion would not be applicable, because the release is associated with the release of contaminated particles. (3) *Contaminant inventory[a]:* This criterion cannot be evaluated, because the exact source of the 200-W-89 Foundation (Unplanned Release) is not known. (4) *Depth of waste discharge:* The 200-W-89 Foundation (Unplanned Release) was an unplanned release at the surface and therefore similar to UPR-200-W-19 in terms of discharge depth. (5) *Expected distribution of contaminants:* Contaminant distribution from the 200-W-89 Foundation (Unplanned Release) is believed to be limited to surface soils within 1 m (3 ft) of the ground surface, because the release was small and may have been caused by emissions from the 291-U-1 Stack. Because the release depths are similar, the representative site bounds this site. (6) *Potential for hydrologic and contaminant impacts to groundwater:* This criterion is not applicable because of the shallow nature of the representative and analogous sites.
UPR-200-W-117/ UPR-200-W-60	*Waste sites configuration/construction:* • UPR-200-W-117/UPR-200-W-60 surface sites dimensions are 200 ft long by 30 ft wide co-located in the railroad cut northwest of the 221-U Building. • Area stabilized with gravel to a depth of 0.3 m (1 ft) and posted as an Underground Radioactive Material Area in 2001. *Release history/volume/depth:* • Fission product containing liquids and particulates of very low volume dropped onto soils from railroad cars moving equipment in and out of the 221-U Building.	This site is considered to be similar to and bounded by the representative site based on the following criteria. (1) *Waste site configuration and construction:* This site is an unplanned release of liquid and particulate waste to surface soil, similar to UPR-200-W-19, and therefore has no structure associated with it. (2) *Volume of effluent received in relation to the available pore volume:* This criterion is not applicable, because UPR-200-W-117 and the representative site UPR-200-W-19 had relatively low volumes of effluent discharged to them. (3) *Contaminant inventory[a]:* This criterion cannot be compared directly, because the contaminant inventory at UPR-200-W-117 was not documented. However, because UPR-200-W-117 was a widely spread release compared to UPR-200-W-19, it is believed that the representative site would bound the analogous sites in terms of risk. (4) *Depth of waste discharge:* UPR-200-W-117 was an unplanned release to surface soil and therefore similar to UPR-200-W-19 in terms of discharge depth. (5) *Expected distribution of contaminants:* Contaminant distribution from UPR-200-W-117 is believed to be limited to surface soils within 1 m (3 ft) of the ground surface, because the release was spread over a large area. Because the release depths are similar, and the effluent volume and contaminant inventory per unit area of UPR-200-W-19 is believed to be significantly higher, the representative site bounds this site. Both UPR-200-W-117 and UPR-200-W-19 are believed to have had contamination spread laterally through windblown vegetation and soil. (6) *Potential for hydrologic and contaminant impacts to groundwater:* This criterion is not applicable because of the shallow nature of the representative and analogous sites.

TABLE B-6. UNPLANNED RELEASE UPR-200-W-19 AND ASSOCIATED ANALOGOUS WASTE SITES. (10 Pages)

Waste Site	Site Construction and Discharge History	Rationale

[a] Note that the contaminant inventory (e.g., total mass of a constituent) is based on historic disposal records. Actual vadose zone concentrations were determined based on the field investigation phase of the project. The vadose zone concentrations were utilized in the risk assessment calculations.

WAC = *Washington Administrative Code.*

WAC 246-272-18501, "Department of Health," "On-Site Sewage Systems," "Abandonment," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

APPENDIX C

DETAILED EVALUATION DISCUSSIONS

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APPENDIX C
DETAILED EVALUATION DISCUSSIONS

Alternatives Evaluated for Representative Waste Sites

The following four alternatives were evaluated for each of the representative waste sites:
Alternative 1 - No Action
Alternative 2 - Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation
Alternative 3 - Removal, Treatment, and Disposal
Alternative 4 - Engineered Barrier.

Group 1 – Representative Waste Sites 216-U-1 and 216-U-2 Cribs

Overall Protection of Human Health and the Environment

Alternative 1 provides no protection for human health and groundwater, because constituents remain above the acceptable values.

Alternative 2 is protective of human health exposure during the 150-yr timeframe, but exceeds the groundwater protection values for the 216-U-1 and 216-U-2 Cribs.

Alternative 3 limits human health and environmental impacts by removing the contaminants and disposing of them in an on-site engineered facility. Alternative 3 requires a significantly large excavation at the 216-U-1 and 216-U-2 Cribs (approximately 934 by 862 ft at the surface of the open pit) and exposes workers to contaminants during the action. This alternative meets remedial action objectives (RAO) 1, 2, and 3. However, because of the extent of excavation, impacted surface area, and need for additional backfill material, it is anticipated that a significant area will be disrupted and that worker risk will be increased due to the extended direct exposure to the contaminated material. For the 241-U-361 Settling Tank, Alternative 3 provides the greatest overall protection to human health and the environment, because contaminants (sludge, tank, and surrounding soils) are removed, treated (as appropriate), and disposed of at the on-site engineered facility. However, there are difficulties with implementing this remedy because of the proximity of the 241-U-361 Settling Tank to the 216-U-1 and 216-U-2 Cribs.

Alternative 4 provides the greatest overall protection to human health and the environment for the 216-U-1 and 216-U-2 Cribs and the 241-U-361 Settling Tank. Alternative 4 removes the exposure pathway by creating a barrier and significantly reduces infiltration, thereby supporting all four RAOs. Institutional controls will provide use limitations around the barrier. The engineered barrier also will limit short-term exposure risks to workers.

Compliance with ARARs

Alternative 1 does not comply with applicable or relevant and appropriate requirements (ARAR), because the waste sites currently exceed the RAOs.

Alternative 2 does not comply with ARARs for the 216-U-1 and 216-U-2 Cribs, because the contaminants exceed human health and groundwater protection preliminary remediation goals (PRG). Alternative 2 meets the ARARs for the 241-U-361 Settling Tank, given the institutional control period of 150 yr and the anticipation that contaminants will reach acceptable levels within this timeframe.

Alternative 3 meets the ARARs through the removal of the contaminated material and disposal at the Environmental Restoration Disposal Facility (ERDF).

Alternative 4 meets the ARARs for the 216-U-1 and 216-U-2 Cribs and 241-U-361 Settling Tank. The technetium-99 contaminant at the 216-U-1 and 216-U-2 Cribs is present at elevated levels to approximately 200 ft below ground surface (bgs) and currently is present in the groundwater (located at approximately 250 ft bgs). Preliminary fate and transport modeling was conducted to simulate the reduced infiltration associated with the

placement of an engineered barrier. This modeling indicates that the engineered barrier reduces the flux of contaminants into groundwater to an amount that, in the absence of other existing contaminant sources in groundwater, results in groundwater concentrations below the maximum contaminant level (MCL). Appendix D of DOE/RL-2003-23, *Focused Feasibility Study for the 200-UW-1 Operable Unit* (FFS), contains a detailed discussion of this modeling.

Long-term Effectiveness and Permanence

Alternatives 1 and 2 do not provide long-term effectiveness or permanence, because contaminants are not remedied and remain after the industrial land-use timeframe (2150). The exception is the 241-U-361 Setting Tank. For the 241-U-361 Settling Tank, Alternative 2 provides some long-term effectiveness and permanence, because it is assumed that the sludge within the tank is removed and minimal contamination is expected beyond the tank itself.

Alternative 3 provides long-term effectiveness and permanence for the 216-U-1 and 216-U-2 Cribs, because contaminants are removed and disposed of at the ERDF. The technetium-99 contaminant is present at elevated levels to approximately 200 ft bgs and currently is found in groundwater (located at approximately 255 ft bgs). Alternative 3 requires a significantly large excavation at the 216-U-1 and 216-U-2 Cribs (approximately 934 by 862 ft at the surface of the open pit) and exposes workers to contaminants during the action. Alternative 3 meets RAOs 1, 2, and 3. However, because of the extent of excavation, impacted surface area, and need for additional backfill material, it is anticipated that a significant area will be disrupted. Alternative 3 is the most reliable and permanent for the 241-U-361 Settling Tank, based on the conceptual site model, because contaminant concentrations above the PRGs will be removed.

Alternative 4 is reliable for the 216-U-1 and 216-U-2 Cribs. Alternative 4 meets RAOs 1, 2, and 3, because it reduces the exposure to contaminants beyond 2150 by limiting both human and ecological intrusion and reducing infiltration through the contaminated zone. Additional modeling was conducted to simulate the reduced infiltration associated with the placement of an engineered barrier. This modeling indicates that an engineered barrier reduces the flux of contaminants into groundwater to an amount that, in the absence of other groundwater contaminant sources already present from upgradient sources, results in groundwater concentrations below the MCL. The proposed engineered barrier is designed to provide long-term isolation of contaminants contained within these sites. This is supported through the natural soil analogs present on the Hanford Site, which provide an indication of the long-term stability and effectiveness of evapotranspiration barriers that would exploit such locally available soil.

The residual risks to groundwater significantly decrease because of the reduced infiltration rate, coupled with natural radioactive decay. It is anticipated that groundwater monitoring will be required to corroborate the model results with the actual flux and resulting groundwater concentration of technetium-99, thereby supporting RAO 3. For the 241-U-361 Settling Tank, Alternative 4 provides reliability by reducing exposure through the use of an engineered barrier. During the design life of the barrier, the residual risk of contaminants is expected to decrease to acceptable levels through natural radioactive decay.

Short-term Effectiveness

Alternative 1 would be effective in the short term, because it does not involve any remedial actions.

Alternatives 2 and 4 would be more effective in the short term when compared to Alternative 3, primarily because of the lower risk to remediation workers and limited impacts to the environment.

Alternative 3 will involve excavating contaminated soil and debris to a depth of 200 ft bgs, creating greater potential for short-term worker impacts (i.e., an increased exposure rate) during the excavation, transportation, and disposal of materials. Risks to workers from potential exposure to contaminated soil and fugitive dust would be greater. Because the U Plant Area is a highly disturbed area with limited habitat in proximity to the waste sites, short-term impacts to vegetation and wildlife in the area are believed to be minimal. However, because of the deep excavations that would occur, Alternative 3 would result in a greater impact to habitat in those areas used for backfill materials. Alternative 3 requires a significantly large excavation (approximately 934 by 862 ft at the surface

of the open pit) and exposes workers to contaminants and associated industrial hazards (e.g., heavy equipment, heat stroke) during the action.

Reduction of Toxicity, Mobility, or Volume through Treatment

All of the alternatives identified rely on natural attenuation in the form of radiological decay that is expected to result in reduced toxicity and volume over time.

Alternative 3 includes treatment. However, treatment is not anticipated, because constituents are expected to meet the disposal facility waste-acceptance criteria. Therefore, reduction in toxicity, mobility, or volume of the contaminants is not expected. The sludge removed from the 241-U-361 Settling Tank may require some form of stabilization before disposal.

Implementability

Alternative 1 will be easy to implement, because it requires no remedial action.

Alternative 2 currently is used for all of the waste sites. The waste sites are under a surveillance and monitoring program where the area is posted with signs and/or restricted by fencing. In addition, access to the waste sites is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easy to implement, although there currently is some coverage from the site-wide monitoring network.

Alternative 3 will be difficult to implement in the near term because of increased worker exposure from contaminated soil and debris; safety requirements associated with deep excavation; and the availability of backfill material, transportation, and disposal capacity for the contaminated material. Alternative 3 is not easy to implement for the 216-U-1 and 216-U-2 Cribs because of the extreme depth of excavation. Excavation is not practical at this depth because of the following:

- Potential impacts to existing facilities and the infrastructure (e.g., roads and utilities)
- Required ERDF capacity for disposal, laydown areas, and backfill material needs
- Increased worker risks, given that the contaminants impacting groundwater are at an estimated depth of 200 ft bgs
- Diminishing return of risk reduction versus cost expended.

Because of the proximity of the 216-U-1 and 216-U 2 Cribs to the 241-U-361 Settling Tank, excavation activities would be more complicated, because the excavation itself likely would encroach on the cribs. Chapter 5.0 of the FFS provides a more detailed discussion of Alternative 3.

Alternative 4 is easy to implement. An evapotranspiration barrier was constructed at the Hanford Site, and similar barrier types were regulatory approved and constructed at other western arid sites. These barriers are easy to construct and maintain.

Cost

Capital costs along with operation and maintenance costs are shown in Table 6 of this Proposed Plan. These costs are based on an individual waste site and do not reflect economies of scale that might be obtained by implementing a common alternative or aggregated remedies across multiple waste sites. The present worth is calculated with a discount rate of 3.2 percent, and the costs are estimated based on the +50/-30 percent accuracy in accordance with U.S. Environmental Protection Agency (EPA) guidance (EPA/540/G-89/004).

Group 2 – Representative Waste Site 216-U-8 Crib

Overall Protection of Human Health and the Environment

Alternative 1 provides no protection for human health and groundwater, because constituents remain above the acceptable levels.

Alternative 2 is protective of human health exposure during the 150-yr timeframe, but exceeds the groundwater protection values for the 216-U-8 Crib.

Alternative 3 limits human health and environmental impacts by removing the contaminants and disposing of them in an on-site engineered facility. Alternative 3 requires a significantly large excavation for the 216-U-8 Crib (approximately 982 by 872 ft at the surface of the open pit) and exposes workers to contaminants during the action. Alternative 3 meets RAOs 1, 2, and 3. However, because of the extent of excavation, impacted surface area, and need for additional backfill material, it is anticipated that a significant area will be disturbed and worker risk will be increased due to the extended direct exposure to the contaminated material and associated industrial hazards. For the 200-W-42 Vitrified Clay Pipeline (VCP) and the associated unplanned release, UPR-200-W-163, Alternative 3 is the most protective of human health and the environment. Contaminants are removed, treated as appropriate, and disposed of at the on-site engineered facility.

Alternative 4 provides the greatest overall protectiveness of human health and the environment for the 216-U-8 Crib. Alternative 4 removes the exposure pathway by creating a barrier and significantly reduces infiltration, thereby supporting all four RAOs. Institutional controls will provide use limitations around the barrier. The engineered barrier will limit short-term exposure risks to workers. Alternative 4 also is protective for the 200-W-42 VCP and UPR-200-W-163, because the exposure pathway is removed and institutional controls provide use limitations around the barrier.

Compliance with ARARs

Alternative 1 does not comply with ARARs, because the waste sites currently exceed the RAOs.

Alternative 2 does not comply with ARARS, because the contaminants exceed human health and groundwater protection PRGs for an extended period of time.

Alternative 3 meets the ARARs for the 216-U-8 Crib, 200-W-42 VCP, and UPR-200-W-163 waste sites through the removal of the contaminated material and disposal at the ERDF.

Alternative 4 meets the ARARs through the use of an engineered barrier. The uranium and nitrogen as nitrate and nitrite contaminants at the 216-U-8 Crib are present at elevated levels to approximately 200 ft bgs and currently are present in groundwater (located at approximately 250 ft bgs). Preliminary fate and transport modeling was conducted to simulate the reduced infiltration associated with the placement of an engineered barrier. This modeling indicates that the engineered barrier reduces the flux of contaminants into groundwater to an amount that, in the absence of other existing contaminant sources in the groundwater, results in groundwater concentrations below the MCL. Appendix D of the FFS contains a detailed discussion of this modeling.

Long-term Effectiveness and Permanence

Alternatives 1 and 2 do not provide long-term effectiveness or permanence, because contaminants are not remedied and will remain after the industrial land-use timeframe (2150).

Alternative 3 provides reliability for the 216-U-8 Crib, because contaminants are removed and disposed of at the ERDF. The constituents exceeding groundwater protection values are present at elevated levels to approximately 200 ft bgs and currently are found in groundwater (located at approximately 255 ft bgs). Alternative 3 requires a significantly large excavation for the 216-U-8 Crib (approximately 982 by 872 ft at the surface of the open pit) and exposes workers to contaminants during the action. This alternative meets RAOs 1, 2, and 3. However, because of the extent of excavation, impacted surface area, and need for additional backfill material, it is anticipated that a significant area will be disturbed. Alternative 3 is most reliable and permanent for the 200-W-42 VCP and the associated unplanned release, UPR-200-W-163, because contaminant concentrations will be removed above the PRGs.

Alternative 4 is reliable for the 216-U-8 Crib. Alternative 4 meets RAOs 1, 2, and 3, because it reduces the exposure to contaminants beyond 2150 by limiting both human and ecological intrusion and reducing infiltration through the contaminated zone. Preliminary modeling was conducted to simulate the reduced infiltration associated with the placement of an engineered barrier. This modeling indicates that the engineered barrier reduces the flux of contaminants into groundwater to an amount that, in the absence of other contaminant sources already present from upgradient sources, results in groundwater concentrations below the MCL. The proposed engineered barrier is designed to provide long-term isolation of contaminants contained within these waste sites.

This is supported through the natural soil analogs present on the Hanford Site, which provide an indication of the long-term stability and effectiveness of evapotranspiration barriers that would exploit such locally available soil.

The residual risks to groundwater significantly decreases because of the reduced infiltration rate, coupled with natural radioactive decay. It is anticipated that groundwater monitoring will be required to corroborate the model results with the actual flux and resulting groundwater concentration of technetium-99, thereby supporting RAO 3. For the 200-W-42 VCP and associated unplanned release UPR-200-W-163, Alternative 4 provides reliability by reducing exposure through the use of an engineered barrier. During the design life of the barrier, the residual risk of contaminants is expected to decrease to acceptable levels because of natural radioactive decay.

Short-term Effectiveness

Alternative 1 would be effective in the short term, because it does not involve any remedial actions.

Alternatives 2 and 4 would be more effective in the short term when compared to Alternative 3, primarily because of their lower risk to remediation workers and limited impacts to the environment.

Alternative 3 will involve excavating contaminated soil and debris to a depth of 200 ft bgs, creating greater potential for short-term worker impacts (i.e., an increased exposure rate) during excavation, transportation, and disposal of the materials. Risk to workers from potential exposure to contaminated soil and fugitive dust would be greater. Because the U Plant Area is a highly disturbed area with limited habitat in proximity to the waste sites, short-term impacts to vegetation and wildlife are believed to be minimal. However, because of the deep excavations that would occur, this alternative would result in a greater impact to habitat in those areas used for backfill materials. Alternative 3 requires a significantly large excavation for the 216-U-8 Crib (approximately 982 by 872 ft at the surface of the open pit) and exposes workers to contaminants and associated industrial hazards (e.g., heavy equipment, heat stroke) during the action.

Reduction of Toxicity, Mobility, or Volume through Treatment

All of the alternatives evaluated rely on natural attenuation in the form of radiological decay that is expected to result in reduced toxicity and volume.

Alternative 3 includes treatment. However, treatment is not anticipated, because the constituents are expected to meet the disposal facility waste-acceptance criteria. Therefore, a reduction in toxicity, mobility, or volume of the contaminants is not expected.

Implementability

Alternative 1 would be easy to implement, because it requires no action.

Alternative 2 currently is used at all of the waste sites. The waste sites are under a surveillance and monitoring program where the area is posted with signs and/or restricted by fencing. In addition, access to the waste sites is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easy to implement, although there currently is some coverage from the site-wide monitoring network.

Alternative 3 will be difficult to implement in the near term because of increased worker exposure from contaminated soil and debris; safety requirements associated with deep excavation; and the availability of backfill material, transportation, and disposal capacity for the contaminated material. Alternative 3 is not easy to implement for the 216-U-8 Crib because of the extreme depth of excavation. Excavation is neither practical nor cost effective at this depth because of the following:

- Potential impacts to existing facilities and the infrastructure (e.g., roads, utilities)
- Required ERDF capacity for disposal, laydown areas, and backfill material needs
- Increased risks to the workers, given that the contaminants impacting groundwater are at an estimated depth of 200 ft bgs
- Diminishing return of risk reduction versus cost expended.

Alternative 3 is implemented more easily for the 200-W-42 VCP and associated unplanned release UPR-200-W-163 because of its limited contaminant depth.

Alternative 4 is easy to implement. An evapotranspiration barrier was constructed at the Hanford Site, and similar barrier types were regulatory approved and constructed at other western arid sites. These barriers are easy to construct and maintain.

Cost

Capital costs along with operation and maintenance costs are shown in Table 7 of this Proposed Plan. These costs are based on an individual waste site and do not reflect economies of scale that might be obtained by implementing a common alternative or aggregated remedies across multiple waste sites. The listed present worth is based on a discount rate of 3.2 percent, and the costs are estimated based on the +50/-30 percent accuracy in accordance with EPA guidance (EPA/540/G-89/004).

Group 3 – Representative Waste Site 216-U-12 Crib

Overall Protection of Human Health and the Environment

Alternative 1 provides no protection for human health and groundwater, because constituents remain above the acceptable values.

Alternative 2 is protective of human health exposure during the 150-yr timeframe, but exceeds the groundwater protection values for the 216-U-12 Crib.

Alternative 3 limits human health and environmental impacts by removing the contaminants and disposing of them in an on-site engineered facility. Alternative 3 requires a significantly large excavation for the crib (approximately 910 by 820 ft at the surface of the open pit) and exposes workers to contaminants during the action. This alternative meets RAOs 1, 2, and 3. However, because of the extent of excavation, impacted surface area, and need for additional backfill material, it is anticipated that a significant area will be disrupted and worker risk will be increased due to the extended direct exposure to the contaminated material and associated industrial hazards. Alternative 3 is the most protective of human health and the environment for the 216-U-5, 216-U-6, and 216-U-15 Trenches and the 216-U-16 and 216-U-17 Cribs. Contaminants are removed, treated as appropriate, and disposed of at the on-site engineered facility.

Alternative 4 provides the greatest overall protection to human health and the environment for the 216-U-16 and 216-U-17 Cribs and 216-U-5, 216-U-6, and 216-U-15 Trenches. Alternative 4 removes the exposure pathway by creating a barrier and significantly reduces infiltration, thereby supporting all four RAOs. Institutional controls will provide use limitations around the barrier. The engineered barrier also will limit short-term exposure risks to workers.

Compliance with ARARs

Alternative 1 does not comply with ARARs, because the waste sites currently exceed the RAOs.

Alternative 2 does not comply with ARARs for the 216-U-12 Crib, because the contaminants exceed the groundwater protection PRGs. Alternative 2 meets the ARARs for the 216-U-16 and 216-U-17 Cribs and 216-U-5, 216-U-6, and 216-U-15 Trenches given the institutional control period of 150 yr.

Alternatives 3 and 4 also meet the ARARs for these waste sites. Alternative 3 meets the ARARs by removing the contaminated material and disposing of it at the ERDF.

Alternative 4 meets the ARARs through the use of an engineered barrier. The nitrogen as nitrate and nitrite contaminant at the 216-U-12 Crib is present at elevated levels to approximately 200 ft bgs and currently is present in the groundwater (located at approximately 250 ft bgs). Preliminary fate and transport modeling was conducted to simulate the reduced infiltration associated with the placement of an engineered barrier. This modeling indicates that the engineered barrier reduces the flux of contaminants into groundwater to an amount that, in the absence of other existing contaminant sources in the groundwater, results in groundwater concentrations below the MCL. Appendix D of the FFS contains a detailed discussion of this modeling.

Long-term Effectiveness and Permanence

Alternative 1 does not provide long-term effectiveness or permanence. Contaminants are not remedied and will remain after the industrial land-use timeframe (2150).

Alternative 2 does not provide long-term effectiveness or permanence for the 216-U-12 Crib. For the 216-U-16 and 216-U-17 Cribs and 216-U-5, 216-U-6, and 216-U-15 Trenches, however, Alternative 2 does meet the effectiveness and permanence criteria, because the contaminants are expected to reach acceptable levels by 2150 (the end of the identified institutional control period).

Alternative 3, based on the conceptual site model, is a reliable and permanent alternative for the 216-U-5, 216-U-6, and 216-U-15 Trenches as well as the 216-U-16 and 216-U-17 Cribs, because contaminants above the PRGs will be removed. The nitrogen as nitrate and nitrite at the 216-U-12 Crib is present at elevated levels to approximately 200 ft bgs and currently is found in groundwater (located at approximately 255 ft). Alternative 3 requires a significantly large excavation at the crib (approximately 910 by 820 ft at the surface of the open pit) and exposes workers to contaminants during the action. Alternative 3 meets RAOs 1, 2, and 3. However, because of the extent of excavation, impacted surface area, and need for additional backfill material, it is anticipated that a significant area will be disrupted.

Alternative 4 is reliable for the 216-U-12 Crib. Alternative 4 meets RAOs 1, 2, and 3, because it reduces the exposure to contaminants beyond 2150 by limiting both human and ecological intrusion and reducing infiltration through the contaminated zone. Preliminary modeling was conducted to simulate the reduced infiltration associated with the placement of an engineered barrier. This modeling indicates that the engineered barrier reduces the flux of contaminants into groundwater to an amount that, in the absence of other contaminant sources already present from upgradient sources, results in groundwater concentrations below the MCL. The proposed engineered barrier is designed to provide long-term isolation of contaminants contained within the 216-U-12, 216-U-16, and 216-U-17 Cribs and 216-U-5, 216-U-6, and 216-U-15 Trenches. This is supported through the natural soil analogs present on the Hanford Site, which provide an indication of the long-term stability and effectiveness of evapotranspiration barriers that would exploit such locally available soil.

The residual risks to groundwater significantly decrease because of the reduced infiltration rate, coupled with natural radioactive decay. It is anticipated that groundwater monitoring will be required to corroborate the model results with the actual flux and resulting groundwater concentration, thereby supporting RAO 3. For the 216-U-16 and 216-U-17 Cribs and 216-U-5, 216-U-6, and 216-U-15 Trenches, Alternative 4 provides reliability by reducing exposure through the use of an engineered barrier. During the design life of the barrier, the residual risk of contaminants is expected to decrease to acceptable levels because of natural radioactive decay.

Short-term Effectiveness

Alternative 1 would be effective in the short term, because it does not involve any remedial actions.

Alternatives 2 and 4 would be more effective in the short term when compared to Alternative 3, primarily because of their lower risk to remediation workers.

Alternative 3 will involve excavating contaminated soil and debris to a depth of 200 ft bgs, creating a greater potential for short-term worker impacts (i.e., an increase in exposure rates) during excavation, transportation, and disposal of the materials. Risks to workers from potential exposure to contaminated soil and fugitive dust would be greater. Because the U Plant Area is a highly disturbed area with limited habitat in proximity to the waste sites, short-term impacts to vegetation and wildlife are believed to be minimal. However, because of the deep excavations that would occur, this alternative would result in a greater impact to habitat in those areas used for backfill materials. Alternative 3 requires a significantly large excavation for the crib (approximately 910 by 820 ft at the surface of the open pit) and exposes workers to contaminants and associated industrial hazards (e.g., heavy equipment, heat stroke) during the action.

Reduction of Toxicity, Mobility, or Volume through Treatment

All of the alternatives evaluated rely on natural attenuation in the form of radiological decay, which is expected to result in reduced toxicity and volume.

Alternative 3 includes treatment. However, treatment is not anticipated, because constituents are expected to meet the disposal facility waste-acceptance criteria. Therefore, a reduction in toxicity, mobility, or volume of the contaminants is not expected.

IMPLEMENTABILITY

Alternative 1 would be easy to implement, because it requires no action.

Alternative 2 currently is used for all of the waste sites. The waste sites are under a surveillance and monitoring program where the area is posted with signs and/or restricted by fencing. In addition, access to the waste sites is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easy to implement, although there currently is some coverage from the site-wide monitoring network.

Alternative 3 will be difficult to implement in the near term for the 216-U-12 Crib because of increased worker exposure from contaminated soil and debris; safety requirements associated with excavation; and the availability of backfill material, transportation, and disposal of the contaminated material. Alternative 3 is not easy to implement for the 216-U-12 Crib because of the extreme depth of excavation. Excavation is not practical at this depth because of the following:

- Potential impacts to existing facilities and the infrastructure (e.g., roads, utilities)
- Required ERDF capacity for disposal, laydown areas, and backfill material needs
- Increased worker risks, given that the contaminants impacting groundwater are at an estimated depth of 200 ft bgs
- Diminishing return of risk reduction versus cost expended.

Alternative 3 is implemented more easily for the 216-U-16 and 216-U-17 Cribs and 216-U-5, 216-U-6, and 216-U-15 Trenches because of their limited contaminant depth. Chapter 5.0 of the FFS contains a more detailed discussion of this alternative.

Alternative 4 is easy to implement. An evapotranspiration barrier was constructed at the Hanford Site, and similar barrier types were regulatory approved and constructed at other western arid sites. These barriers are easy to construct and maintain.

COST

Capital costs along with operation and maintenance costs are shown in Table 8 of this Proposed Plan. These costs are based on an individual waste site and do not reflect economies of scale that might be obtained by implementing a common alternative or aggregated remedies across multiple waste sites. The listed present worth is based on a discount rate of 3.2 percent, and the costs are estimated based on the +50/-30 percent accuracy in accordance with EPA guidance (EPA/540/G-89/004).

Group 4 – Representative Waste Sites 216-U-4 Reverse Well and the 216-U-4A French Drain

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 1 provides no protection for human health, because constituents remain above the acceptable values.

Alternative 2 is protective of human health exposure during the 150-yr timeframe. This alternative has the added benefit that the 216-U-4 Reverse Well and 216-U-4A French Drain waste sites are under the proposed 221-U Facility engineered barrier.

Alternative 3 limits human health and environmental impacts at the 216-U-4 Reverse Well and the 216-U-4A and 216-U-4B French Drains by removing the contaminants and disposing of them in an on-site engineered facility.

Alternative 4 is protective at the 216-U-4 Reverse Well and the 216-U-4A and 216-U-4B French Drains, because the exposure pathway is removed and institutional controls provide use limitations around the barrier. It should be noted that controls will need to be in place for 125 yr, the time required for the constituents to decay naturally.

COMPLIANCE WITH ARARS

Alternative 1 does not comply with ARARs, because the waste sites currently exceed the RAOs.

Alternative 2 meets the ARARs for these waste sites before the end of the 150-yr institutional control period. For the 216-U-4 Reverse Well and 216-U-4A French Drain waste sites, the combination of Alternative 2 with the proposed 221-U Facility engineered barrier would accelerate achieving the ARARs, because the pathway for exposure would be removed.

Alternative 3 meets the ARARs at the 216-U-4 Reverse Well and the 216-U-4A and 216-U-4B French Drains by removing the contaminated material and disposing of it at the ERDF.

Alternative 4 meets the ARARs at the 216-U-4 Reverse Well and the 216-U-4A and 216-U-4B French Drains through the use of an engineered barrier designed to be protective for the needed duration.

LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 1 does not provide long-term effectiveness or permanence, because contaminants are not remedied and remain at the waste sites.

Alternative 2 meets the effectiveness and permanence criteria for the 216-U-4 Reverse Well and the 216-U-4A and 216-U-4B French Drains, because the contaminants are expected to reach acceptable levels within 125 yr (25 yr earlier than the designated institutional control period). For the 216-U-4 Reverse Well and 216-U-4A French Drain waste sites, Alternative 2 would be used until the proposed barrier over the 221-U Facility is in place. This proposed barrier would provide additional effectiveness and permanence, as noted in the Alternative 4 discussion.

Alternative 3 is the most reliable and permanent alternative for the 216-U-4 Reverse Well and the 216-U-4A and 216-U-4B French Drains. Based on the conceptual site model, the contaminants above the PRGs will be removed.

Alternative 4 provides reliability by reducing exposure through the use of an engineered barrier to isolate the contaminants contained within the 216-U-4 Reverse Well and the 216-U-4A and 216-U-4B French Drains. During the design life of the barrier, the residual risk of contaminants is expected to decrease to acceptable levels because of natural radioactive decay.

SHORT-TERM EFFECTIVENESS

Alternative 1 would be effective in the short term, because it does not require any remedial actions.

Alternatives 2 and 4 would be more effective in the short term when compared to Alternative 3, primarily because of their lower risk to remediation workers.

Alternative 3 requires the excavation of contaminated soil and debris, creating a greater potential for short-term worker impacts (i.e., an increase in exposure) during excavation, transportation, and disposal of the materials. Risks to workers from potential exposure to contaminated soil and fugitive dust would be greater with Alternative 3 than with Alternative 4. Short-term impacts to vegetation and wildlife are minimal, because the U Plant Area is a highly disturbed area that has limited habitat in proximity to the 216-U-4 Reverse Well and the 216-U-4A and 216-U-4B French Drains. However, Alternative 3 would have a slightly greater impact to habitat in those areas used for backfill materials as well as additional worker safety associated with industrial hazards (e.g., heavy equipment, heat stroke).

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

All of the alternatives incorporate natural attenuation in the form of radiological decay that is expected to reduce toxicity and volume.

Alternative 3 includes treatment. However, treatment is not anticipated because constituents are expected to meet the disposal facility waste-acceptance criteria. Thus, reduction in toxicity, mobility, or volume of the contaminants is not expected.

IMPLEMENTABILITY

Alternative 1 would be easy to implement because no action is performed.

Alternative 2 currently is used for all of the waste sites. The waste sites are under a surveillance and monitoring program where the area is posted with signs and/or restricted by fencing. In addition, access to the 216-U-4 Reverse Well and the 216-U-4A and 216-U-4B French Drains is controlled through Hanford Site access requirements, an excavation permit program, and a radiation work area permit program. The addition of monitoring wells or boreholes is easy to implement, although there currently is some coverage from the site-wide monitoring network.

Alternative 3 will be more difficult to implement in the near term because of increased worker exposure from contaminated soil and debris; safety requirements associated with excavation; and the availability of backfill material, transportation, and disposal of the contaminated material.

Alternative 4 is easy to implement. An evapotranspiration barrier was constructed at the Hanford Site, and similar barrier types were regulatory approved and constructed at other western arid sites. These barriers are easy to construct and maintain. In addition, the activities at the 216-U-4 Reverse Well and 216-U-4A French Drain waste sites can be coordinated easily with the proposed barrier for the 221-U Facility.

Cost

Capital costs along with operation and maintenance costs are shown in Table 9 of this Proposed Plan. These costs are based on an individual waste site and do not reflect economies of scale that might be obtained by implementing a common alternative or aggregated remedies across multiple waste sites. The listed present worth is based on a discount rate of 3.2 percent. An additional cost is provided for the 216-U-4 Reverse Well and 216-U-4A French Drain waste sites for implementation of Alternative 2, based on the proposed 221-U Facility barrier. These costs are based on an assumption that the proposed barrier would be in place within the next 20 yr. All costs are estimated based on the +50/-30 percent accuracy in accordance with EPA guidance (EPA/540/G-89/004).

Group 5 – Representative Waste Site Unplanned Release UPR-200-W-19

Overall Protection of Human Health and the Environment

Alternative 1 is protective for the 2607-W7 Septic Tank and Tile Field and UPR-200-W-8 Burning Ground solid waste sites. The 2607-W7 Septic Tank and Tile Field was cleaned up in 1999 in accordance with WAC 246-272-18501, "Department of Health," "On-Site Sewage Systems," "Abandonment." No known hazardous substances were disposed of at these waste sites. Alternative 1 is not protective for the remaining waste sites in Group 5, because contaminants currently exceed human health PRGs.

Alternative 2 is protective of human health exposure during the 150-yr timeframe. This alternative has the added benefit of the 2607-W7 Septic Tank and Tile Field, UPR-200-W-118, and UPR-200-78 waste sites being under the proposed 221-U Facility barrier.

Alternative 3 limits human health and environmental impacts by removing the contaminants and disposing of them in an on-site engineered facility.

Alternative 4 is protective, because the exposure pathway is removed and institutional controls provide use limitations around the barrier. It should be noted that controls will need to be in place for 129 yr, the time required for the constituents to decay naturally. Alternative 2 is considered protective, because institutional controls are expected to be in place for 150 yr.

Compliance with ARARs

Alternative 1 complies with ARARs for the 2607-W7 Septic Tank and Tile Field (because this site was cleaned up in 1999 in accordance with WAC 246-272-18501) and UPR-200-W-8 Burning Ground solid waste sites. No known hazardous substances were disposed of at these waste sites. Alternative 1 does not comply with ARARs for the remaining waste sites, because they currently exceed the RAOs.

Alternative 2 meets the ARARs for the remaining waste sites within the identified 150-yr institutional control period timeframe. The combination of Alternative 2 along with the proposed 221-U Facility barrier would

accelerate achieving the ARARs for the UPR-200-W-118 and UPR-200-78 waste sites, because the pathway for exposure would be removed.

Alternative 3 meets ARARs for all the Group 5 waste sites by removing the contaminated material and disposing of it at the ERDF.

Alternative 4 meets the ARARs for all the Group 5 waste sites with the use of an engineered barrier designed to be protective for the necessary duration.

Long-term Effectiveness and Permanence

Alternative 1 is effective for the 2607-W7 Septic Tank and Tile Field, because this site was cleaned up in 1999 in accordance with WAC 246-272-18501. Alternative 1 also is effective for the UPR-200-W-8 Burning Ground solid waste sites, because no known hazardous substances were disposed of at this waste site. Confirmatory sampling will be conducted at the solid waste sites to validate this information. Because the 2607-W7 Septic Tank and Tile Field is under the proposed 221-U Facility barrier, additional sampling is not planned. Alternative 1 does not provide long-term effectiveness or permanence for the remaining waste sites, because contaminants are not remediated and will remain at the waste sites.

Alternative 2 meets the effectiveness and permanence criteria, because the contaminants are expected to reach acceptable levels within 129 yr (21 yr earlier than the designated institutional control period). In addition, the anticipated areas of higher contamination at UPR-200-W-19 will be addressed concurrently with the remedies proposed for the 216-U-1 and 216-U-2 Cribs and the 241-U-361 Settling Tank because of proximity of the sites. For waste sites UPR-200-W-118 and UPR-200-W-78, Alternative 2 would be needed only until the proposed 221-U Facility barrier is in place. This proposed barrier would provide the additional effectiveness and permanence previously discussed under Alternative 4.

Alternative 3 is the most reliable and permanent alternative for the Group 5 waste sites because, based on the conceptual site model, contaminants are expected to be removed above the PRGs.

Alternative 4 provides reliability by reducing exposure through the use of an engineered barrier to isolate the wastes. During the design life of the barrier, the residual risk of contaminants is expected to decrease to acceptable levels because of natural radioactive decay.

Short-term Effectiveness

Alternative 1 would be effective in the short term, because it does not require any remedial actions.

Alternatives 2 and 4, when compared to Alternative 3, would be more effective in the short term because of the lower risk to workers.

Alternative 3 requires excavation of contaminated soil and debris, creating the potential for short-term worker impacts during excavation, transportation, and disposal of materials. The risks to workers from potential exposure to contaminated soil and fugitive dust increases with Alternative 3 when compared to Alternative 4. Short-term impacts to vegetation and wildlife are minimal, because the U Plant Area is a highly disturbed area that has limited habitat in proximity to the waste sites.

Reduction of Toxicity, Mobility, or Volume through Treatment

All of the alternatives incorporate natural attenuation in the form of radiological decay, which is expected to reduce toxicity and volume.

Alternative 3 includes treatment. However, treatment is not anticipated, because constituents are expected to meet the disposal facility waste-acceptance criteria. Given this assumption, a reduction in toxicity, mobility, or volume of the contaminants is not expected.

Implementability

Alternative 1 would be easy to implement, because no action is required.

Alternative 2 currently is used for all of the waste sites. The waste sites are under a surveillance and monitoring program where the area is posted with signs and/or restricted by fencing.

Alternative 3 when compared to Alternative 4 would be more difficult to implement in the near term because of increased worker exposure from contaminated soil and debris; safety requirements associated with excavation; and the availability of backfill material, transportation, and disposal of the contaminated material.

Alternative 4 is easy to implement. A barrier was constructed at the Hanford Site, and similar barrier types were regulatory approved and constructed at other western arid sites. These barriers are easy to construct and maintain. In addition, these activities can be coordinated easily with the proposed 221-U Facility barrier for those waste sites (2607-W7, UPR-200-W-118, UPR-200-W-78, 216-U-4A, and 216-U-4) currently under the planned footprint.

Cost

Capital costs along with operation and maintenance costs are shown in Table 10 of this Proposed Plan. These costs are based on an individual waste site and do not reflect economies of scale that might be obtained by implementing a common alternative or aggregated remedies across multiple waste sites. The listed present worth is based on a discount rate of 3.2 percent. An additional cost for the implementation of Alternative 2 is provided for those waste sites under the proposed 221-U Facility barrier. These costs are based on an assumption that the proposed barrier would be placed within 20 yr. All costs are estimated based on the +50/-30 percent accuracy in accordance with EPA guidance (EPA/540/G-89/004).