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Revision 1

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

U.S. DEPARTMENT OF
ENERGY

Richland Operations Office

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Revision 1

Annual Status Report (FY 2008): Composite Analysis of Low-Level Waste Disposal in the Central Plateau at the Hanford Site

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Executive Summary

In accordance with the U.S. Department of Energy (DOE) requirements in DOE O 435.1[1], *Radioactive Waste Management,* and implemented by DOE/RL-2000-29[2], *Maintenance Plan for the Composite Analysis of the Hanford Site, Southeast Washington*, the DOE Richland Operations Office has prepared this annual status report for fiscal year 2008 of PNNL-11800[3], *Composite Analysis for the Low-Level Waste Disposal in the 200-Area Plateau of the Hanford Site*, hereafter referred to as the Composite Analysis. The main emphasis of DOE/RL-2000-29 is to identify additional data and information to enhance the Composite Analysis and the subsequent PNNL-11800 Addendum[4], *Addendum to Composite Analysis for Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site*, hereafter referred to as the Addendum, and to address secondary issues identified during the review of the Composite Analysis.

This document identifies additional data and information to be considered for purposes of an eventual update to the Hanford Site Composite Analysis.

Preliminary statements and conclusions contained herein do not take into consideration the site-wide cumulative groundwater modeling analyses to be presented in the Tank Closure & Waste Management Environmental Impact Statement.

The Hanford Site is deferring any revision of the Composite Analysis until the final Tank Closure & Waste Management Environmental Impact Statement is completed and issued.

As required by DOE/RL-2000-29, the annual evaluation of new information and data being developed by a number of onsite programs during fiscal year 2008 of relevance to the Composite Analysis was completed and summarized in this annual status report. This included the following work performed in fiscal year 2008 that is considered pertinent to the Composite Analysis:

- Groundwater flow and contamination monitoring
- Solid waste burial performance assessment
- Remediation science and technology program

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[1] DOE O 435.1, 1999, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C. https://www.directives.doe.gov/directives/current-directives/435.1-BOrder-c1/view.

[2] DOE/RL-2000-29, 2003, *Maintenance Plan for the Composite Analysis of the Hanford Site, Southeast Washington*, Rev. 2, U.S. Department of Energy Richland Operations Office, Richland, Washington.

[3] PNNL-11800, 1998, *Composite Analysis for Low-Level Waste Disposal in the 200-Area Plateau of the Hanford Site*, Pacific Northwest National Laboratory, Richland, Washington.

[4] PNNL-11800 Addendum, 2001, *Addendum to Composite Analysis for Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site*, Pacific Northwest National Laboratory, Richland, Washington.

- Integrated disposal facility performance assessment
- *Resource Conservation and Recovery Act of 1976*[5] corrective action program
- Central Plateau remediation activities

This annual evaluation identified no information in any of the above activities that consider results of data collection and analysis from research, field studies, and monitoring that invalidates the continued adequacy of the current version of the Composite Analysis and Addendum as currently approved per "Low-Level Disposal Facility Federal Review Group Review of Maintenance Plan for the Composite Analysis of the Hanford Site, Southeast Washington" (DOE 2004[6]).

DOE announced on January 30, 2006, its intent to prepare the Tank Closure and Waste Management Environmental Impact Statement (TC&WM EIS) for the Hanford Site pursuant to the *National Environmental Policy Act of 1969*[7] and its implementing regulations 40 CFR 1500-1508[8], Chapter V, "Council of Environmental Quality," and 10 CFR 1021[9], "National Environmental Policy Act Implementing Procedures." The Hanford Site is deferring any revision of the Composite Analysis until the final TC&WM EIS is issued.

This report generally covers the time period of October 1, 2007, through September 30, 2008 (in some cases calendar year values are summarized for facilities that report on that basis). The format for this report follows requirements in DOE G 435.1-1[10], *Implementation Guide for Use with DOE M 435.1-1*.

The organization of this report is as follows. Section 1 provides an introduction and description of the report organization. Section 2 discusses the status of Composite

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5 *Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq. http://www.epa.gov/rcraonline/

6 DOE, 2004, "Low-Level Disposal Facility Federal Review Group Review of Maintenance Plan for the Composite Analysis of the Hanford Site, Southeast Washington, April 2003;" (memorandum to R. Schepens, Manager, Department of Energy, Office of River Protection, and K.A. Klein, Manager, U.S. Department of Energy, Richland Operations Office), from J. Talarico, U.S. Department of Energy, Office of Environmental Management, Washington, D.C., May 11.

7 *National Environmental Policy Act of 1969*, 42 USC 4321, et seq. http://ceq.hss.doe.gov/Nepa/regs/nepa/nepaeqia.htm

8 40 CFR 1500-1508, Chapter V, "Council on Environmental Quality," Part 1500, "Purpose, Policy, and Mandate," through Part 1508, "Terminology and Index," *Code of Federal Regulations*. http://www.access.gpo.gov/nara/cfr/waisidx_08/40cfrv31_08.html

9 10 CFR 1021, "National Environmental Policy Act Implementing Procedures," *Code of Federal Regulations*. http://www.access.gpo.gov/nara/cfr/waisidx_08/10cfr1021_08.html

10 DOE G 435.1-1, 1999, *Implementation Guide for Use with DOE M 435.1-1*, U.S. Department of Energy, Washington, D.C. https://www.directives.doe.gov/directives/current-directives/435.1-EGuide-1ch1/view.

Analysis activities. Section 3 summarizes recent onsite monitoring, research, and development results that are relevant to the current Composite Analysis. Section 4 summarizes key site changes that could affect the Composite Analysis. Section 5 summarizes recommended changes to the initial Composite Analysis, and Section 6 summarizes planned Composite Analysis revisions. Section 7 contains the cited references.

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ACKNOWLEDGMENTS

Name (Affiliation)	Topic Areas
W.E. Nichols (CHPRC)	Annual Summary editor
R.D. Hildebrand (RL) S.P. Luttrell (CHPRC)	Findings in the Fiscal Year 2008 Groundwater Monitoring Report
R.D. Hildebrand (RL) M.I. Wood (CHPRC)	Solid Waste Burial Ground Performance Assessments
K.M. Thompson (RL) M.D. Freshley (PNNL) S.W. Petersen (CHPRC)	Hanford Site Science and Technology Program
L.D. Romine (RL) L.L. Lehman (CHPRC)	Integrated Disposal Facility Performance Assessment
R.W. Lober (ORP) S.J. Eberlein (WRPS)	Tank Farm RCRA Corrective Action Program
M.E. Burandt (ORP)	Tank Closure and Waste Management Environmental Impact Statement
B.L. Charboneau (RL)	Remedial Investigation/Feasibility Study/Remediation Activities for the Central Plateau – Source Operable Units
B.L. Charboneau (RL) C.D. Wittreich (CHPRC) G.D. Cummins (CHPRC)	Remedial Investigation/Feasibility Study/Remediation Activities for the Central Plateau – Groundwater Operable Units
O.C. Robertson (RL) M.A. Casbon (WCH)	Environmental Restoration Disposal Facility

CHPRC = CH2M HILL Plateau Remediation Company
ORP = U.S. Department of Energy, Office of River Protection
PNNL = Pacific Northwest National Laboratory
RCRA = *Resource Conservation Recovery Act of 1976*
RL = U.S. Department of Energy, Richland Operations Office
WCH = Washington Closure Hanford, LLC
WRPS = Washington River Protection Solutions, LLC

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Terms

AEA	*Atomic Energy Act of 1954*
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CHPRC	CH2M HILL Plateau Remediation Company
CLUP	Comprehensive Land Use Plan
COC	contaminant of concern
CY	calendar year
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ETF	Effluent Treatment Facility
FHI	Fluor Hanford, Inc.
FS	feasibility study
FY	fiscal year
HCP EIS	Hanford Comprehensive Land-Use Plan Environmental Impact Statement
IDF	Integrated Disposal Facility
LLW	low-level waste
NEPA	*National Environmental Policy Act of 1969*
ORP	U.S. Department of Energy, Office of River Protection
OU	operable unit
PFP	Plutonium Finishing Plant
PNNL	Pacific Northwest National Laboratory
PUREX	Plutonium Uranium Extraction
RCRA	*Resource Conservation and Recovery Act of 1976*
REDOX	reduction and oxidation
RI	remedial investigation

RI/FS	remedial investigation/feasibility study
RL	U.S. Department of Energy, Richland Operations Office
ROD	record of decision
SAP	sampling and analysis plan
STOMP	Subsurface Transport Over Multiple Phases simulator
TC&WM	Tank Closure and Waste Management
TC&WM EIS	Tank Closure and Waste Management Environmental Impact Statement
Tri-Parties	U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology
Tri-Party Agreement	Ecology et al., 1989, *Hanford Federal Facility Agreement and Consent Order*
U Plant	221 U Chemical Processing Facility
UPR	unplanned releases
WCH	Washington Closure Hanford, LLC
WIPP	Waste Isolation Pilot Plant
WMA	waste management area

1 Introduction

As required by the U. S. Department of Energy (DOE) in DOE O 435.1, *Radioactive Waste Management,* and implemented by DOE/RL-2000-29, *Maintenance Plan for the Composite Analysis of the Hanford Site, Southeastern Washington*, the DOE Richland Operations Office (RL) has prepared this annual status report for fiscal year (FY) 2008 of PNNL-11800, *Composite Analysis for Low-Level Waste Disposal in the 200-Area Plateau of the Hanford Site*, hereafter referred to as the Composite Analysis. The main emphasis of DOE/RL-2000-29 is to identify additional data and information that will enhance the Composite Analysis and the subsequent PNNL-11800 Addendum, *Addendum to Composite Analysis for Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site*, hereafter referred to as the Addendum, and to address secondary issues identified during the review of the Composite Analysis.

1.1 Requirements of this Composite Analysis Annual Summary Report

DOE O 435.1 requires that the Hanford Site maintain site performance assessments and composite analyses. Requirements for composite analysis maintenance under DOE M 435.1-1, *Radioactive Waste Management Manual,* are the same as those for performance assessment maintenance and are described in Chapter 3 of DOE G 435.1-3, *Maintenance Guide for U.S. Department of Energy Low-Level Waste Disposal Facility Performance Assessments and Composite Analyses*. The plan for maintaining the Composite Analysis for the Hanford Site is described in DOE/RL-2000-29.

DOE M 435.1-1 requires routine review and revision of performance assessments and composite analyses. The objective of routine review and revision is to ensure that the performance assessments and composite analyses are updated as appropriate, whenever changes in their bases (assumptions, parameters, etc.) are contemplated or effected, in order to maintain the validity and effectiveness of the controls that are based on the performance assessment and composite analysis. These reviews provide a mechanism for routine assessment of the site plans (e.g., remediation, closure, decommissioning, and land use) developed from the results of a composite analysis. This review process allows potential problems to be identified and managed at an early stage. The revisions ensure cohesive documentation providing a reasonable basis to conclude that DOE requirements for radiological protection of the public and the environment will be met in the future. The composite analysis is a planning tool that allows evaluation of the cumulative effects of all sources of radioactive materials that may interact with those in the low-level waste (LLW) disposal facility. The impact of future activities on the dose to hypothetical future members of the public can be evaluated using the composite analysis, and the results used to develop land-use plans, remediation plans, or long-term stewardship documents. The annual review of the composite analysis is used to determine whether actual and planned conditions are consistent with those contained in the composite analysis. Revisions and special analyses provide a mechanism for evaluating conditions not originally included in the composite analysis to determine if these said conditions could be accommodated without violating the conclusions of the composite analysis.

The following text is quoted from DOE G 435.1-1, *Implementation Guide for use with DOE M 435.1-1*:

> IV.P (4) Performance Assessment and Composite Analysis Maintenance. The performance assessment and composite analysis shall be maintained to evaluate changes that could affect the performance, design, and operating bases for the facility. Performance assessment and composite analysis maintenance shall include the conduct of research, field studies, and monitoring needed to address uncertainties or gaps in existing data. The performance assessment shall be updated to support the final facility closure. Additional iterations of the performance assessment and composite analysis shall be conducted as necessary during the post-closure period.

> Performance assessments and composite analyses shall be reviewed and revised when changes in waste forms or containers, radionuclide inventories, facility design and operations, closure concepts, or the improved understanding of the performance of the waste disposal facility in combination with the features of the site on which it is located alter the conclusions or the conceptual model(s) of the existing performance assessment or composite analysis.

The statements above also appear in DOE M 435.1-1 and constitute the requirements for maintaining a performance assessment or composite analysis. Further guidance is found in DOE G 435.1-3.

1.2 Content of this Composite Analysis Annual Status Report

The format for this report follows requirements established by DOE G 435.1-1. This report covers the time period of October 1, 2007, through September 30, 2008. Section 2 provides a status of activities relevant to the Composite Analysis. Section 3 summarizes recent onsite monitoring and research and development results that are relevant to the current Composite Analysis and Section 4 summarize key site changes that could affect the Composite Analysis. Section 5 summarizes recommended changes to the initial Composite Analysis, and Section 6 summarizes planned Composite Analysis revisions.

2 Status of Composite Analysis Activities

On January 30, 2006, DOE announced its intent to prepare a new environmental impact statement (EIS) for the Hanford Site, the *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland Washington*. The Tank Closure and Waste Management (TC&WM) EIS will provide a single integrated analysis of groundwater at Hanford for all waste types managed at the Hanford Site. Additionally, the scope of the previously announced 69 FR 50178, "Notice of Intent to Prepare an Environmental Impact Statement for the Decommissioning of the Fast Flux Test Facility at the Hanford Site, Richland, Washington," was merged into the scope of the TC&WM EIS to fully integrate presentation of currently foreseeable activities related to waste management and cleanup at Hanford. The Hanford Site is deferring any revision of the Composite Analysis until the final TC&WM EIS is issued.

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3 Summary of Activities Relevant to the Composite Analysis

This section describes the status of Hanford Site activities, including monitoring, modeling, research and development and characterization relevant to the current Composite Analysis, including:

- Relevant findings in FY 2008 groundwater monitoring report
- Results of the solid waste burial ground performance assessment
- Results of Remediation Science and Technology program
- Results from relevant DOE Office of River Protection (ORP) programs including activities associated with the Integrated Disposal Facility (IDF) Performance Assessment, the Tank Farm *Resource Conservation and Recovery Act of 1976* (RCRA) Correction Action and Closure Program, and the TC&WM EIS
- Results from remedial investigation/feasibility study (RI/FS) activities in the Central Plateau areas that include waste site source and groundwater remediation.

3.1 Summary of Flow Conditions and Extent of Groundwater Contamination per the FY 2008 Groundwater Monitoring Report

R.D. Hildebrand, RL, and S.P. Luttrell, CHPRC

The natural pattern of groundwater flow was altered during the Hanford Site's operating years by water-table mounds. These mounds were created by the discharge of large volumes of wastewater to the ground and were present in each reactor area and beneath the 200 Areas. Since effluent disposal decreased significantly in the 1990s, these mounds have dissipated in the reactor areas and have declined considerably in the 200 Areas. Declining water levels from the mounding continue to affect groundwater flow and depth to water.

Table 3-1 provides a comparison of the areal extent of key radiological contaminant plumes in groundwater at levels above drinking water standards in FY 2007 and FY 2008. Of the radionuclides, tritium and iodine-129 continue to have the largest areas where concentrations exceed drinking water standards. The largest plumes of these contaminants have their sources in the 200 East Area and extend toward the east and southeast. Extensive tritium and iodine-129 plumes are also present in 200 West Area. Technetium-99 exceeds standards in plumes within both the 200 East and 200 West Areas. One uranium plume and one technetium-99 plume have moved northward from the 200 East Area. Technetium-99 plumes are present at each of the Single-Shell Tank Farm Waste Management Areas.

Plumes of uranium, an element that is less mobile than tritium, iodine-129, or technetium-99, are found in groundwater within the 200 East, 200 West, and 300 Areas. Strontium-90 is even less mobile in groundwater, but it exceeds standards in the 100 Areas, the 200 East Area, and

DOE has an extensive program to monitor and remediate groundwater contamination at the Hanford Site (DOE/RL-2008-66). Data collected through these monitoring and remediation efforts, including rates and directions of groundwater flow and contaminant migration, are pertinent to the Composite Analysis because of its potential to validate or invalidate near-term groundwater flow and migration predictive results reported in the Composite Analysis.

beneath the former Gable Mountain Pond. Other radionuclides, including cesium-137 and cobalt-60, and plutonium, are even less mobile in the subsurface and exceed drinking water standards in very few wells.

Table 3-1. Area of Radionuclide Contaminant Plumes at Levels Above Drinking Water Standards

Constituent	FY 2007 (km^2)*	FY 2008 (km^2)*
Iodine-129 (1 pCi/L)	64.	65.6
Strontium-90 (8 pCi/L)	2.3	2.3
Technetium-99 (900 pCi/L)	2.3	2.4
Tritium (20,000 pCi/L)	127.	127.
Uranium (30 µg/L)	1.4	1.5

* To obtain mi^2 multiply km^2 by 0.386.

3.2 Solid Waste Burial Ground Performance Assessment

R.D. Hildebrand, RL, and M.I. Wood, CHPRC

Solid waste disposal constitutes one of the sources of radioactive waste inventory; estimates of the current inventory and projections of future inventory disposal in the solid waste burial grounds are refined regularly as additional data continue to be collected and reported through maintenance of the solid waste burial ground performance assessment. This updated information is pertinent to the Composite Analysis because of its potential to change the solid waste burial ground inventory evaluated in the Composite Analysis.

In the annual review of the Hanford solid waste performance assessment for calendar year (CY) 2008, the projected dose estimates from radionuclide inventories disposed in the active low-level burial grounds from September 26, 1988, through December 31, 2008, were calculated using the dose methodology developed in the original solid waste performance assessment analyses (WHC-SD-WM-TI-730, *Performance Assessment for the Disposal of Low-Level Waste in the 200 East Area Burial Grounds*; WHC-EP-0645, *Performance Assessment for the Disposal of Low-Level Waste in the 200 West Area Burial Grounds*). These estimates were compared with performance objectives defined in DOE O 435.1 and its companion documents (DOE M 435.1-1; DOE G 435.1-1). The performance objectives are satisfied, and operational waste acceptance criteria and waste acceptance practices continue to be sufficient to maintain compliance with performance objectives. In the 2008 performance assessment review, dose estimates from disposed waste for groundwater contamination scenarios increased slightly only at the 200 West Area burial grounds. The incremental dose was observed because low-level and mixed-low-level waste disposal is now limited to the mixed waste trenches (trenches 31 and 34) in the 200 West Area. The relative increase in dose was less than 1 percent from the previous year. Naval reactor compartment waste was also disposed in a dedicated trench (trench 94) in the 200 East

Area burial grounds, but this waste is projected to provide negligible impacts to groundwater in the future. Overall, there are no changes to the conclusions of the performance assessment analyses.

Additional data continue to be collected to quantify mobile contaminant migration into concrete from soil and vice versa. Additional measurements from year-long experiments were completed to quantify iodine and rhenium diffusion from spiked soil samples into fractured concrete. The soils were partially saturated (4 percent and 7 percent by weight) and representative of ambient conditions at the burial grounds. Diffusivity increased with increased moisture content. However, changes in diffusion because other concrete pretreatment processes (e.g., carbonation to simulate concrete degradation and addition of iron to evaluate the potential for reduced effective diffusion of mobile contaminations by reduction and oxidation [REDOX] reactions) were inconclusive in this data set. A second set of experiments were initiated to evaluate technetium-99 diffusion from contaminated concrete into partially saturated soils at three different moisture contents representative of a range of conditions expected in a closed disposal facility. In this set the concrete was treated by carbonation and added iron prior to the experiment, but not fractured. In these experiments, the presence of added iron resulted in slightly less technetium-99 in concrete at the end of the experiment, suggesting the inability of iron to act as a reducing agent and the propensity of iron to facilitate microcracking and enhance diffusion. The effect of changes in initial moisture content on diffusion rates was not clearly indicated. Finally, efforts to identify plausible uranium precipitates in Portland-based cements and their thermodynamic properties continued. Solubility measurements for various mineral phases were measured in the presence of concrete conditioned pore waters. Quantification of these results is not complete, but it appears likely that uranium hydroxides over time will react to form secondary minerals (e.g., becquerelite, soddyitte, uuranophaye, autunite) that will provide solubility-controlled release rates.

3.3 Remediation Science and Technology

K.M. Thompson, RL, M.D. Freshley, PNNL, and Scott Petersen, CHPRC

Developments in Remediation Science and Technology are pertinent to the Composite Analysis because new knowledge and tools that serve to refine predictive tools, data analysis, and understanding serve to improve the calculation basis of the Composite Analysis.

The Hanford Site relies on science and technology investigations to provide new knowledge, data and tools needed to successfully accomplish the mission of the Soil and Groundwater Remediation Project. Part of that mission includes resolving key technical issues that help inform and influence decisions for remediation and closure of contaminated soil sites and groundwater. To accomplish this, Fluor Hanford, Inc. (FHI) continued to fund the Remediation Science and Technology Project in FY 2008. Progress continued on geochemical investigations for uranium in the 300 Area, plutonium mobility, and evaluation of subsurface geophysics and soil desiccation technologies.

Laboratory analyses were completed of experiments with different sediments from the 300 Area to study the release of uranium from capillary fringe sediments. The results demonstrated that release of uranium from contaminated sediments occurs kinetically by mass transfer of desorbed uranium from reactive domains in grain interiors and particle coatings. A sample was studied that had a carbonate mineral fraction, distinguishing it from other deep vadose zone sediments from the 300 Area, indicating that it had not experienced incursions of groundwater location at that location. The sample showed kinetic

desorption behavior caused by carbonate mineral dissolution (*Resupply Mechanism to a Contaminated Aquifer: A Laboratory Study of U(VI) Desorption from Capillary Fringe Sediments* [Um et al. 2008]).

Plutonium concentrations and mobility were characterized using sediment samples collected from two wells (299-W15-46 Groundwater Well and 299-W15-48 Vadose Well) drilled near the 216-Z-9 Trench. These studies were performed to elucidate the form and potential for plutonium and americium to be mobilized under present conditions and in future remediation scenarios. The highest concentrations of plutonium and americium were associated with sediments of low silt/clay content and located above silt/clay rich layers within the sediment profile. Leach testing of the sediment samples with Hanford groundwater indicates that release of plutonium and americium from the sediments is correlated most significantly with the final acidity of the extracts and not the initial concentrations of plutonium and americium in the sediments. Only extracts that were acidic after contact with the sediments (pH 4.3 to 5.4) contained detectable concentrations of leachable plutonium and americium. Adsorption is likely to have a major impact on the potential for these species to remain in solution and these species are not likely to remain in solution as pH values approach those of typical Hanford Site groundwater (mildly alkaline, ~ pH 8).

Electrical resistance tomography provides two-dimensional (2-D) and three-dimensional (3-D) subsurface geophysical images and is becoming more widely used at DOE sites for characterization and monitoring. However, data analysis and interpretation tools have had limited success at Hanford and other sites with layered heterogeneity. A new method was developed and tested with the Subsurface Transport Over Multiple Phases (STOMP) simulator code that allows for cell-based or block-based data inversions. The method was applied with synthetic geological models and demonstrated improvement over smooth inversions; results are described in ("Implementation of the Shuffle Complex Evolution Metropolis Alogrithm for Optimization and Uncertainty Assessment of Hydrogeophysical Model Parameters" [Ward and Fu 2008]).

Soil desiccation experiments were completed on rectangular and wedge-shaped flow cells to assist with design of a field-scale treatability test that will evaluate this technology as a potential groundwater protection remedy. The first treatability test will begin in FY 2009. A series of detailed wedge-shaped, intermediate-scale laboratory experiments in unsaturated homogeneous and simple heterogeneous systems was conducted to improve the understanding of the impact of energy balance issues on soil desiccation. The experiments were simulated with the multifluid flow simulator STOMP, using independently obtained hydraulic and thermal porous medium properties. As with experiments completed the previous year, the injection of dry air proved to be an effective means for removing essentially all moisture from the test media. Evaporative cooling was observed which generally decreased with increased distance from the gas inlet chamber. The laboratory tests were simulated accurately with the STOMP code when thermal properties of the flow cell walls and insulation material were taken into account, indicating that the proper physics were incorporated into the simulator ("Desiccation of Unsaturated Porous Media: Intermediate-Scale Experiments and Numerical Simulation" [Oostrom et al. 2009]).

3.4 Office of River Protection Activities Relevant to the Composite Analysis

Technical activities of the ORP include these ORP projects pertinent to the Composite Analysis:

- IDF Performance Assessment
- RCRA Corrective Action Program
- TC&WM EIS

These projects are discussed in this section.

3.4.1 Integrated Disposal Facility Performance Assessment

L.D. Romine, RL, L.L. Lehman, CHPRC

DOE approved DOE/ORP-2000-24, *Hanford Immobilized Low-Activity Waste Performance Assessment: 2001 Version* in 2001 ("Disposal Authorization for the Hanford Site Low-Level Waste Disposal Facilities – Revision 2" [DOE 2001]). Continuation of the Hanford Site disposal authorization in 2003 (*Review of the Annual Summary of the Hanford Immobilized Low-Activity Waste Preformance Assessment for 2003* [Frei 2003]) was based in part on RPP-15834, *Integrated Disposal Facility Risk Assessment.* An update of the performance assessment for the IDF is on hold.

3.4.2 RCRA Corrective Action Program

R.W. Lober, ORP, S.A. Eberlein, WRPS

The performance assessments and RCRA activities constitute direct feeds to the Composite Analysis; hence, changes in radioactive waste inventory or results of the contaminant migration studies arising from these activities have the potential to affect the Composite Analysis. The integrated analysis prepared for the TC&WM EIS will provide the basis for future updates to the Composite Analysis.

The Tank Farm Vadose Zone Project, a component of DOE's overall RCRA corrective action program, conducted field efforts in Waste Management Areas (WMAs) C and TX-TY during FY 2008. The direct push technique using a hydraulic hammer was used to advance 46 probe holes, collect 60 samples and install 39 buried electrodes in WMAs C and TX-TY; samples were analyzed in the laboratory. In WMA C, the pushes where focused on releases at unplanned releases (UPRs) 81 and 86 where pipeline losses are potentially the largest contributors to risk. In WMA TX-TY, the pushes were directed at characterizing anomalies identified through the geophysical work discussed below. The WMA TX-TY work was also in support of a proposed FY 2010 interim surface barrier at that farm. The direct push technology has been improved, allowing multiple samples per hole to be obtained with pushes as deep as 73 m (240 ft) below ground surface to be performed in the 200 East Area and multiple depth electrodes to be installed.

Applications of surface geophysical techniques were made in WMA TX-TY (RPP-RPT-38320, *Surface Geophysical Exploration of the TX and TY Tank Farms at the Hanford Site*) to map the extent of subsurface contamination in an electrically complex environment. These techniques include ground-penetrating radar, electromagnetic induction, magnetic gradiometry, and earth resistivity. A survey using drywells as long electrodes was conducted in the SX Tank Farm. The well-to-well resistivity survey supplemented existing knowledge of contaminant distribution and provided information that was used to justify a complete resistivity of that farm. This work is being used to guide the placement of direct push sampling holes is support of a proposed interim surface barrier planned for construction in FY 2011.

In addition, construction of an Interim Surface Barrier was completed to reduce the infiltration of precipitation through the surface overlying the vadose zone plume resulting from the 1973 release from tank T-106. Sensors have been installed to assess pre- and post-barrier construction water movement (PNNL-17306, *T Tank Farm Interim Surface Barrier Demonstration – Vadose Zone Monitoring FY07 Report*). Gamma logging of drywells surrounding and beneath the new barrier was conducted to establish a new baseline on the distribution of gamma emitting contaminants.

3.4.3 Tank Closure and Waste Management Environmental Impact Statement

M.E. Burandt, ORP

The forthcoming TC&WM EIS will provide a single integrated analysis of groundwater at Hanford for all waste types previously addressed in the Hanford Solid Waste EIS and the originally planned Tank Closure EIS. In addition, DOE is including the scope of the previously announced 69 FR 50178 in the TC&WM EIS to provide an integrated presentation of currently foreseeable activities related to waste management and cleanup at Hanford. As part of the TC&WM EIS, a site-wide groundwater model based on the MODFLOW code ("The History of MODFLOW" [McDonald and Harbaugh 2003]) has been developed. The Hanford Site is deferring any revision of the Composite Analysis until the final TC&WM EIS is issued.

3.5 Richland Operations Office Remedial Activities Relevant to the Composite Analysis

B.L. Charboneau, RL, and C.D. Wittreich, CHPRC

Remediation actions are pertinent to the Composite Analysis because these actions result in the planned redistributions of radioactive inventory in time, location, and waste form. Updated knowledge and information acquired in the conduct of remedial actions have the potential to change the analysis evaluated in the Composite Analysis and so are reviewed here to assess any such impact

3.5.1 Central Plateau Remediation

The Central Plateau consists of ~195 km^2 (~75 mi^2) near the middle of the Hanford Site. Most activities are concentrated in two main processing areas – 200 East Area and 200 West Area. The Central Plateau contains about 900 excess facilities formerly used in the plutonium production process including five large chemical processing facilities, commonly known as canyons, and the Plutonium Finishing Plant (PFP), as well as about 1,000 individual waste sites including both buried solid waste and contaminated soil.

In 1999, the Record of Decision (ROD) for DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statements,* determined that the land use in and around the 200 Areas will be industrial-exclusive, meaning industrial uses compatible with waste management and other nuclear-related activities, including waste disposal operations and infrastructure services supporting the cleanup mission. The area encompassing this industrial-exclusive land-use area is about 50 km^2 (20 mi^2) and is sometimes referred to as the core zone. The rest of the Central Plateau was designated conservation (mining) land use. The mining option supports Hanford cleanup by allowing excavation of soils and gravel for use in remediation backfill, covers, and barrier construction.

The 200 Areas will continue to receive waste from Hanford cleanup activities and from limited offsite sources. The Environmental Restoration Disposal Facility (ERDF) was constructed for disposal of waste generated during cleanup of the Hanford Site. Additional cells will be constructed in ERDF as needed to implement cleanup decisions. Low-level or radioactive mixed waste that is generated as a result of Hanford activities may also be disposed of in the low-level burial grounds or mixed waste trenches as appropriate. A future IDF is in the RCRA permitting process for disposal of some waste generated as a result of radioactive liquid waste tank cleanup.

The 221-U Chemical Processing Facility (U Plant) is one of five massive processing facilities at the Hanford Site. The building, called a "canyon," is 246.9 m (810 feet) in length, 20 m (66 ft) wide, and 23 m (77 ft) high – with more than 8 m (26 ft) underground. Its reinforced concrete walls and floor range

from 0.9 to 2.7 m (3 to 9 ft) thick. Built during World War II to extract plutonium from fuel rods irradiated in Hanford's production reactors, it was used for training and equipment work and later converted to recover uranium from waste generated at the other canyon facilities. A ROD for the Canyon Disposition Initiative at U Plant (*Record of Decision 221-U Facility [Canyon Disposition Initiative] Hanford Site, Washington* [DOE et al. 2005]) issued in October 2005 determined that the U Plant canyon would be disposed in place with a suitable surface barrier to prevent infiltration of water and/or to prevent intrusion by human or ecological receptors. Existing contaminated equipment from the canyon deck (a near-ground level portion of this facility) placed in the canyon process cells (a below-ground level portion of this facility) and grouted in place. The upper part of the canyon building will be demolished to approximately the level of the canyon deck. Debris from this partial demolition will be placed on or adjacent to the canyon deck and then filled with grout to minimize voids. The partially demolished building and debris will be covered with a surface barrier. Final decisions for the remaining canyons and the storage tunnels located at the Plutonium Uranium Extraction (PUREX) Plant will be made as part of upcoming CERCLA/RCRA cleanup decisions.

Disposition of remaining facilities, including PFP facilities, is being addressed with a combination of *National Environmental Policy Act of 1969* (NEPA), CERCLA, and RCRA processes. Radioactive or other hazardous substances are removed and treated if necessary and packaged for disposal in approved disposal facilities. Debris and rubble from the demolition process is disposed of in ERDF or offsite in solid waste landfills as appropriate. Limited volumes of transuranic wastes generated during the demolition process are packaged for disposal at the Waste Isolation Pilot Plant (WIPP). The RCRA closure requirements are integrated into the process where necessary. Potential sub-surface contaminants will be addressed in a manner consistent with waste site remedial alternatives discussed below.

Approximately 15,000 m^3 (~20,000 yd^3) of suspect transuranic waste were placed in retrievable storage trenches in four low-level burial grounds starting in 1970. The waste is being retrieved from the trenches and characterized to determine if it is transuranic or LLW. Two additional waste sites located outside the 200 Areas (618-10 and 618-11 burial grounds) contain ~10,000 m^3 (~13,000 yd^3) of suspect transuranic waste. The low-level fraction will be treated and disposed onsite and the transuranic fraction will be shipped to WIPP.

An extensive inventory of radionuclides exists in three other forms that require disposition:

- Thirty-four isotopic heat sources, consisting mainly of cesium-137 and strontium-90 in a radioactive borosilicate glass matrix with some transuranic contamination, are stored at the Central Waste Complex
- Approximately 2,000 cesium and strontium capsules are stored under water at the Waste Encapsulation Storage Facility
- Approximately 2,000 metric tons (2,205 tons) of spent nuclear fuel from N Reactor operations is stored in Multi-Canister Overpacks located at the Canister Storage Building.

The Central Plateau includes approximately 1,000 waste sites consisting of cribs, ponds, ditches, trenches landfills, pipelines, diversions boxes, UPRs, and other types of sites used for liquid or solid waste disposal. Approximately 70 of these sites are outside the core zone. Two areas outside the core zone are currently undergoing some remediation. Sites in the 200 North Area are being remediated in accordance with EPA/541/R-99/039, 1999, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6 and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington (100 Area Remaining Sites)*, issued in 1999. EPA/541/R-99/039 included these sites in the 200-CW-3 OU. Interim

action is ongoing in the BC Control Area to remove surface contamination and reduce the footprint of areas requiring radiological control. Other sites outside the core zone are being evaluated as part of CERCLA-based decision documents in accordance with Ecology et al., 1989, *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement).

Disposition of the Central Plateau core zone waste sites will generally be achieved using one of four alternatives: (1) remove, treat, and dispose to an approved disposal facility; (2) existing soil covers maintained under institutional controls and monitored natural attenuation; (3) capped with a suitable surface barrier; or (4) no action. Other actions may be needed for site-specific circumstances. Surface barriers will be designed to limit the infiltration of water and thereby slow the movement of contaminants currently in the vadose zone into the underlying groundwater. Barriers will be designed to reduce infiltration and prevent intrusion by plants and animals so that the underlying contamination is not dispersed.

Institutional controls under federal control will be integral to appropriate remedies. Controls may include restrictions to prevent intrusion or modifications to the surface barrier, environmental monitoring, and/or deed restrictions.

3.5.1.1 Source OUs

B.L. Charboneau, RL

The Soil and Groundwater Remediation Project implements the process for several source OUs in the Central Plateau. Since the inception of CERCLA programs on the Central Plateau, the configuration of the waste site OUs have been modified as needed to support the RI/FS process. In 2002, DOE, U.S. Environmental Protection Agency (EPA), and Washington State Department of Ecology (Ecology) (Tri-Parties) conducted a thorough review of the cleanup approach and identified improvements to accelerate cleanup of waste sites. As part of this improved approach to accelerating waste site cleanup, the Tri-Parties agreed to consolidate the 23 process-based source OUs into 12 groups based on similarities between contaminant sources. A substantial Remedial Investigation (RI) was conducted in accordance with approved work plans. Data collected during field investigation and through other Hanford Site activities were reported and evaluated through RI reports and Feasibility Studies (FSs).

During a regulatory agency review of several Central Plateau RI/FSs, EPA and Ecology identified a need for additional data beyond that described in the approved work plans. The Tri-Parties undertook a systematic process to evaluate data needs and to reach agreement on a path forward to collect supplemental data that would augment existing RI data and other data already collected. The scope of the supplemental characterization program is documented in DOE/RL-2007-02, *Supplemental Remedial Investigation Feasibility Study Work Plan for 200 Areas Central Plateau Operable Units*. The Soil and Groundwater Remediation Project is currently implementing the supplemental characterization requirements.

The need for supplemental data led the Tri-Parties to make changes to the milestones for completing the CERCLA process for the Central Plateau source OUs to accommodate the additional data and resulting evaluation (Ecology et al. 1989). The milestone changes extend the time for completion of the CERCLA RI/FS process from December 2008 to December 2011. This approach is intended to provide greater confidence that cleanup decisions are protective of human health and the environment.

As part of this change, the OU configurations were also modified to group waste sites into OUs that facilitate the continued RI and separated those sites that could continue in the CERCLA process without further investigation. A number of the OU groups were split up to accommodate differing characterization

needs and regulatory agency requests. Three new OUs were created to include waste site groups separated from other sites and several OUs were eliminated when all of their sites were transferred to different OUs. The current source OU group configuration and status of CERCLA process activities are shown in Table 3-3.

In addition to the RI/FS process, an overarching Central Plateau Ecological Risk Assessment has been performed which supports ecological assessment at all the OUs. DOE/RL-2007-50, *Central Plateau Terrestrial Ecological Risk Assessment Report,* was submitted to regulatory agencies for review in March 2008. Regulator comments were received, and DOE directed several revisions to this ecological assessment that are currently in progress.

Table 3-3. Status of Central Plateau Source OUs in FY 2008

Source OU	Scope	Status
200-BC-1	BC Cribs & Trenches	Separated from 200-TW-1/200-TW-2 OUs in 2004. FS (DOE/RL-2004-66, Draft A) for BC Cribs submitted to regulatory agency for review in June 2005. Treatability Test Plan (DOE/RL-2007-15, Rev. 0) issued and approved by EPA in April 2008, and excavation of the 216-B-26 Trench as part of the test commenced in May 2008 with excavation completed in June 2008 (total of 181 containers of contaminated soil disposed of at the ERDF from this site). Preparations began to support use of direct push borehole equipment to characterize 216-B-14 Crib and 216-B-53A Trench. An Engineering Study report (PNNL-17176) on the effectiveness of barriers was completed. Draft B FS report and proposed plan due April 2010 (Tri-Party Agreement Milestone M-15-51).
200-CS-1	Chemical Sewer Sites	RI/FS Work Plan (DOE/RL-99-44, Rev. 0) approved October 2000. RI Report (DOE/RL-2004-17, Rev. 0) finalized in November 2004. Draft A FS (DOE/RL-2005-63, Draft A), submitted to regulatory agencies for review in March 2006; Draft B (DOE/RL-2005-63, Draft B) submitted September 2007; final document pending resolution of RCRA/CERCLA integration issues. The Revision 0 versions of FS (DOE/RL-2005-63, Rev. 0), Proposed Plan (DOE/RL-2005-64, Rev. 0), and TSD Closure Plans (DOE/RL-2006-11, Rev. 0; DOE/RL-2006-12, Rev. 0); DOE/RL-2008-53, Rev. 0) were provided to RL for their review and/or use on September 29, 2008.
200-CW-1	Gable Mountain, B Pond and Ditches Cooling Water Sites	RI/FS Work Plan (DOE/RL-99-07, Rev. 0) approved December 2000. RI Report (DOE/RL-2000-35) approved March 2001. Draft A FS (DOE/RL-2002-69) submitted to regulatory agencies for review in March 2003. 200-MG-5/200-CW-1 OU Sampling and Analysis Plan (SAP) (DOE/RL-2006-57, Draft A) was approved by Ecology in January 2008. Supplemental characterization being conducted 2008/2009: direct pushes were made starting in April 2008 including Gable Mountain Pond (216-A-25 Crib), 216-S-16 and 216-S-17 Ponds, 216-U-11 Ditch, and 216-U-10 Pond with slim line geophysical logging. Draft B FS due May 2009 (Tri-Party Agreement Milestone M-015-38B).

Table 3-3. Status of Central Plateau Source OUs in FY 2008

Source OU	Scope	Status
200-CW-5	Z-Ditches	RI/FS Work Plan (DOE/RL-99-66, Draft A) approved August 2003. RI Report (DOE/RL-2003-11, Draft A) conditionally approved October 2004. Draft A FS (DOE/RL-2004-24, Draft A Reissue) submitted to regulatory agencies for review in October 2004. Separated from 200-CW-2/4 OU and 200-SC-1 OU in 2007 when all remaining 200-CW-2/4 OU waste sites were transferred to other OUs and 200-SC-1 OU became a stand-alone group. FS (DOE/RL-2004-24, Draft B) and Proposed Plan (DOE/RL-2004-26, Draft B) were issued in 2008 (Tri Party Agreement Milestone M-15-40D).
200-IS-1	Tanks, Lines, Pits, Boxes, Septic Tank, And Drain Fields	RI/FS Work Plan (DOE/RL-2002-14, Rev. 0) finalized May 2004; Draft revision (DOE/RL-2002-14, Rev. 1 Draft B) submitted to regulatory agencies for review in June 2007; approval pending resolution of regulatory agency comments. Investigation activities planned for 2008/2009 began with approval of SAP (DOE/RL-2002-14, Rev.1 Draft B) by Ecology on April 15, 2008. 68 direct pushes and associated logging completed in September 2008.
200-LW-1	Chemical Laboratory Waste Sites	RI/FS Work Plan (DOE/RL-2001-66, Draft A) approved August 2002. Draft A RI Report (DOE/RL-2005-61, Draft A) submitted to regulatory agencies for review in February 2006. Supplemental characterization being conducted 2008/2010: 216-B-6 Reverse Well direct push (200-BP-5 Rejection Well) drilling concluded September 16, 2008 (casing was pushed to refusal at a depth of 216.25 ft. bgs. Geophysical logging of the first 167 ft. was completed. Radiological contamination is significantly less than originally thought). Draft A FS due December 2011 (Tri Party Agreement Milestone M-015-46B).
200-MG-1/200-MG-2	Model Group I, Small Shallow Waste Sites	Operable unit created by extracting small, shallow sites from other OUs; no further characterization required to support decision-making. EPA and Ecology approved Tri Party Agreement Change Requests that changed the milestone definition from completion of FS and Proposed Plans FS Draft A that was due December 2008 (Tri Party Agreement Milestones M-015-49A for 200-MG-1 OU and M-15-49B for 200-MG-2 OU) to completion of an Engineering Evaluation/Corrective Action and Action Memos.
200-MW-1	Miscellaneous Waste Sites	RI/FS Work Plan (DOE/RL-2001-65, Draft A) approved July 2002. Draft A RI Report (DOE/RL-2005-62, Draft A) submitted to regulatory agencies for review in April 2006. Supplemental characterization conducted in 2007/2008; activities in FY 2008 limited to decommissioning of boreholes. Draft A FS due September 2009 (Tri Party Agreement Milestone M-015-44B).

Table 3-3. Status of Central Plateau Source OUs in FY 2008

Source OU	Scope	Status
200-PW-1/3/6	Process Waste Sites	RI/FS Work Plan (DOE/RL-2001-01, Rev. 0) approved August 2004 Draft A RI Report (DOE/RL-2006-51, Draft A) submitted to regulatory agencies for review in October 2006. Draft A FS (DOE/RL-2007-27, Draft A) submitted to regulatory agencies for review September 2007 (Tri Party Agreement Milestone M-015-45B); on July 21, 2008 DOE directed inclusion of partial remove, treatment, and dispose (RTD) as the preferred remedy for 200-PW-1 and the 200-PW-3/6 OUs are not being revised from the Draft A FS (DOE/RL-2007-27, Draft A) and PP (DOE/RL-2007-40, Draft A).
200-PW-2/4	Process Waste Sites	RI/FS Work Plan (DOE/RL-2000-60, Rev. 1 Reissue) approved September 2004. Draft A RI Report (DOE/RL-2004-25, Draft A) submitted to regulatory agencies for review in June 2004. Draft A FS (DOE/RL-2004-85, Draft A) submitted to regulatory agencies for review in May 2006. RL and Ecology signed the SAP (DOE/RL-2007-2, Volume II, Addendum 5, Rev. 0) and waste control plan (SGW-37320, Rev. 0) for the high-risk boreholes at the 216-A-5 Crib and 216-S-1/2 Crib; supplemental characterization is planned in 2009. Draft B FS due December 2010 (Tri Party Agreement Milestone M-015-43D).
200-SC-1	Steam Condensate Sites	Separated from 200-CW-5 OU in 2007. The Supplemental Work Plan (DOE/RL-2007-02, Volume I and II, Draft A) was approved by EPA and Ecology and Volume II, 200-SC-1 Field Sampling Plan Addendum (DOE/RL-2007-02, Volume II, Addendum 1, Rev. 0) was approved by RL and EPA in December 2007, paving the way to start 200-SC-1 OU field activities. Direct pushes in the 216-B-55 Crib waste site began December 12, 2007 and was followed by direct pushes in sites 216-A-30 Crib and 216-S-6 Crib. FS Draft A due December 2010 (Tri Party Agreement Milestone M-15-40E).
200-SW-1/2	Non-Radioactive/ Radioactive Landfills and Dumps	Draft A RI/FS Work Plan (DOE/RL-2004-60, Draft A) submitted to regulatory agencies for review in December 2004; Draft B (DOE/RL-2004-60, Draft B) submitted to regulatory agencies for review in September 2007 and Revision 0 (DOE/RL-2004-60, Rev. 0) was issued late in FY 2008 (Tri Party Agreement Milestone M-013-28); Agreement between DOE, Ecology, and FHI was reached in June 2008 for all 265 comments on the RI/FS Work Plan (DOE/RL-2004-60, Draft B) and revision incorporation begun. Investigation activities planned for 2009 pending approval of DOE/RL-2004-60.

Table 3-3. Status of Central Plateau Source OUs in FY 2008

Source OU	Scope	Status
200-TW-1 200-PW-5	Tank Waste & Process Waste Sites	Separated from 200-TW-2 OU in 2007 at regulatory agency request. RI/FS Work Plan (DOE/RL-2000-38, Rev. 0) approved in May 2001. RI Report (DOE/RL-2002-42, Rev. 0) approved provisionally March 2004. Draft A FS (DOE/RL-2003-64, Draft A) submitted to regulatory agencies for review in March 2004. Waste Control Plan (SGW-37529, Rev. 0) for 200-TW-1/200-PW-5 OUs was approved by DOE and EPA in May 2008. Supplemental characterization is planned in 2008/2009. Draft B due in December 2011 under Tri Party Agreement Milestone M-15-42D.
200-TW-2	Tank Waste Sites	Separated from 200-TW-1/200-PW-5 OUs in 2007 at regulatory agency request. RI/FS Work Plan (DOE/RL-2000-38, Draft A) approved in May 2001. RI Report (DOE/RL-2002-42, Draft A) approved provisionally March 2004. Draft A FS (DOE/RL-2003-64, Draft A Reissue) submitted to regulatory agencies for review in March 2004. Site Specific Sampling Plan (SGW-37530) for Waste Sites on the 200-TW-2 OU was approved by DOE in April 2008 and EPA in May 2008. Supplemental characterization is planned in 2009. Draft B due December 2011 under Tri Party Agreement Milestone M-15-42E.
200-UR-1	UPRs (West Lake & BC Control Area)	RI/FS Work Plan (DOE/RL-2004-39, Draft A) finalized in May 2005; Revision 1 to be submitted in 2008. Interim action ongoing in BC Control Area to remove surface contamination. West Lake DQO report (SGW-35643, DRAFT) sent to Ecology and comments received in May 2008. Downposting survey of the eastern section of the BC Control Area (RSP-GRP-07-007, Rev. 1) completed in 2008. Characterization of West Lake is planned in 2009.
200-UW-1	U-Plant waste sites that are part of the U-Zone Closure	M-15-83 Tri-Party Agreement proposed milestone is due March 31, 2010 to submit a revised Proposed Plan for the 200-UW-1 OU. Draft E of the ROD has been completed and will eventually be publically available. Regulatory review of the RAGs documents (DOE/RL-2007-34, Rev. 0; DOE/RL-2007-35, Rev. 0) have been completed and external review comments will be evaluated starting 3/9/09. Major DQOs have been completed for the most challenging waste sites in the OU.

Table 3-3. Status of Central Plateau Source OUs in FY 2008

Source OU	Scope	Status
Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq.		
DOE/RL-99-07, 2000, 200-CW-1 *Operable Unit Remedial Investigation/Feasibility Study Work Plan and 216-B-3 RCRA TSD Unit Sampling Plan*, Rev. 0		
DOE/RL-99-44, 2000, *200-CS-1 Operable Unit Remedial Investigation/Feasibility Study Work Plan and RCRA TSD Unit Sampling Plan*, Rev. 0		
DOE/RL-99-66, 1999, *200-CW-5 U-Pond/Z-Ditches Cooling Water Group Operable Unit Remedial Investigation/Feasibility Study Work Plan*, Draft A		
DOE/RL-2000-35, 2001, *200-CW-1 Operable Unit Remedial Investigation Report*, Rev. 0		
DOE/RL-2000-38, 2000, *200-TW-1 Scavenged Waste Group Operable Unit and 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan*, Draft A		
DOE/RL-2000-38, 2001, *200-TW-1 Scavenged Waste Group Operable Unit and 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan*, Rev. 0		
DOE/RL-2000-60, 2004, *Uranium-Rich/General Process Condensate & Process Waste Group Operable Unit RI/FS Work Plan & RCRA TSD Unit Sampling Plan*, Rev. 1 Reissue		
DOE/RL-2001-01, 2004, *Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit RI/FS Work Plan: includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, Rev. 0 Reissue		
DOE/RL-2001-65, 2001, *200-MW-1 Miscellaneous Waste Group Operable Unit RI/FS Work Plan*, Draft A		
DOE/RL-2001-66, 2001, *200-LW-1 300 Area Chemical Laboratory Waste Group Operable Unit RI/FS Work Plan*, Draft A		
DOE/RL-2002-14, 2003, *Tanks/Lines/Pits/Boxes/Septic Tank and Drain Field Waste Group Operable Units RI/FS Work Plan and RCRA TSD Unit Sampling Plan Includes: 200-IS-1 and 200-ST-1 Operable Units*, Rev. 0		
DOE/RL-2002-14, 2007, *Tanks/Lines/Pits/Boxes/Septic Tank and Drain Field Waste Group Operable Units RI/FS Work Plan and RCRA TSD Unit Sampling Plan Includes: 200-IS-1 and 200-ST-1 Operable Units*, Rev. 1 Draft B		
DOE/RL-2002-42, 2003, *Remedial Investigation Report for the 200-TW-1 and 200-TW-2 Operable Unit (includes the 200-PW-4 Operable Unit)*, Draft A		
DOE/RL-2002-42, 2003, *Remedial Investigation Report for the 200-TW-1 and 200-TW-2 Operable Unit (includes the 200-PW-5 Operable Unit)*, Rev. 0		
DOE/RL-2002-69, 2003, *Feasibility Study for the 200-CW-1 and 200-CW-3 Operable Units and the 200 North Area Waste Sites*, Draft A		
DOE/RL-2003-11, 2003, *Remedial Investigation Report for the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, 200-CW-4 T Pond and Ditches Cooling Water Group and the 200-SC-1 Steam Condensate Group*, Draft A		
DOE/RL-2003-64, 2004, *Feasibility Study for the 200-TW-1 Scavenged Waste Group, the 200-TW-2 Tank Waste Group, and the 200-PW-5 Fission-Product Rich Waste Group Operable Units*, Draft A		
DOE/RL-2003-64, 2004, *Feasibility Study for the 200-TW-1 Scavenged Waste Group, the 200-TW-2 Tank Waste Group, and the 200-PW-5 Fission-Product Rich Waste Group Operable Units*, Draft A Reissue		
DOE/RL-2004-17, 2004, *Remedial Investigation Report for the 200-CS-1 Chemical Sewer Group Operable Unit*, Rev. 0		
DOE/RL-2004-24, 2004, *Feasibility Study for the 200-CW-5 (U Pond/Z Ditches Cooling Water Waste Group), 200-CW-2 (S Pond and Ditches Cooling Water Waste Group), 200-CW-4 (T Pond and Ditches Cooling Water Waste Group), and 200-SC-1 (Steam Condensate Waste Group) Operable Units*, Draft A Reissue		
DOE/RL-2004-24, 2008, *Feasibility Study for the 200-CW-5 Cooling Water Operable Unit*, Draft B		
DOE/RL-2004-25, 2004, *Remedial Investigation Report for the 200-PW-2 Uranium-Rich Process Waste Group and the 200-PW-4 General Process Condensate Group Operable Units*, Draft A		

Table 3-3. Status of Central Plateau Source OUs in FY 2008

Source OU	Scope	Status
DOE/RL-2004-26, 2008, *Proposed Plan for the 200-CW-5 Cooling Water Operable Unit,* Draft B		
DOE/RL-2004-39, 2005, *200-UR-1 Unplanned Release Waste Group Operable Unit Remedial Investigation/Feasibility Study Work Plan*, Draft A		
DOE/RL-2004-60, 2004, *200-SW-1 Nonradioactive Landfills and Dumps Group Operable Unit and 200-SW-2 Radioactive Landfills and Dumps Group Operable Unit Remedial Investigation/Feasibility Study Work Plan*, Draft A		
DOE/RL-2004-60, 2007, *200-SW-1 Nonradioactive Landfills and Dumps Group Operable Unit and 200-SW-2 Radioactive Landfills and Dumps Group Operable Unit Remedial Investigation/Feasibility Study Work Plan*, Draft B		
DOE/RL-2004-60, 2008, *200-SW-1 Nonradioactive Landfills Group Operable Unit and 200-SW-2 Radioactive Landfills Group Operable Unit Remedial Investigation/Feasibility Study Work Plan*, Revision 0		
DOE/RL-2004-66, 2005, *Focused Feasibility Study for the BC Cribs and Trenches Area Waste Sites*, Draft A		
DOE/RL-2004-85, 2006, *Feasibility Study for the 200-PW-2 Uranium-Rich Process Waste Group and the 200-PW-4 General Process Condensate Group Operable Units,* Draft A		
DOE/RL-2005-61, 2006, *Remedial Investigation Report for the 200-LW-1 (300 Area Chemical Laboratory Waste Group) and 200-LW-2 (200 Area Chemical Laboratory Waste Group) Operable Units*, Draft A		
DOE/RL-2005-62, 2006, *Remedial Investigation Report for the 200-MW-1 Miscellaneous Waste Group Operable Unit*, Draft A		
DOE/RL-2005-63, 2006, *Feasibility Study for the 200-CS-1 Chemical Sewer Group Operable Unit*, Draft A		
DOE/RL-2005-63, 2007, *Feasibility Study for the 200-CS-1 Chemical Sewer Group Operable Unit*, Draft B		
DOE/RL-2005-63, 2008, *Feasibility Study for the 200-CS-1 Chemical Sewer Group Operable Unit*, Rev. 0		
DOE/RL-2005-64, 2008, *Proposed Plan for the 200-CS-1 Chemical Sewer Group Operable Unit*, Rev. 0		
DOE/RL-2006-11, 2008, *Hanford Facility Dangerous Waste Closure/Postclosure Plan for the 216-B-63 Trench*, Rev. 0		
DOE/RL-2006-12, 2008, *Hanford Facility Dangerous Waste Closure/Postclosure Plan for the 216-S-10 Pond*, Rev. 0		
DOE/RL-2006-57, 2007, *Sampling and Analysis Plan for Supplemental Remedial Investigation Activities at Model Group 5, Large Area Ponds, Waste Sites*, Draft A		
DOE/RL-2007-02, 2007, *Supplemental Remedial Investigation Feasibility Study Work Plan For 200 Areas Central Plateau Operable Units,* Volume I, "Work Plan And Appendices," and Volume II, "Site-Specific Field Sampling Plan Addenda," Draft A		
DOE/RL-2007-02, 2007, *Supplemental Remedial Investigation Feasibility Study Work Plan For 200 Areas Central Plateau Operable Units,* Volume II, "Site-Specific Field Sampling Plan Addenda," Addendum 1, "Site-Specific Field Sampling Plans for the 216-S-5, 216-S-6, 216-T-36, 216-B-55, 216-A-37-2, & 216-A-30 Cribs in the 200-SC-1 Operable Unit," Rev. 0		
DOE/RL-2007-02, 2008, *Supplemental Remedial Investigation Feasibility Study Work Plan For 200 Areas Central Plateau Operable Units,* Volume II, "Site-Specific Field Sampling Plan Addenda," Addendum 5, "Site-Specific Field Sampling Plans for the 216-A-5 Crib and 216-S-1 & 216-S-2 Cribs, 200-PW-2/4 Operable Unit," Rev. 0		
DOE/RL-2007-15, 2008, *Excavation-Based Treatability Test Plan for the BC Cribs and Trenches Area Waste Sites*, Rev. 0		
DOE/RL-2007-27, 2007, *Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, Draft A		

Table 3-3. Status of Central Plateau Source OUs in FY 2008

Source OU	Scope	Status

DOE/RL-2007-34, 2008, *Regulatory Criteria for the Selection of Vadose Zone Modeling in Support of the 200-UW-1 Operable Unit*, Rev. 0;

DOE/RL-2007-35, *200-UW-1 Operable Unit Remedial Action Goals for Removal/Treatment/Disposal Waste Sites*, Rev. 0

DOE/RL-2007-40, 2007, *Proposed Plan for 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, Draft A

DOE/RL-2008-53, 2008, *Hanford Facility Dangerous Waste Closure/Postclosure Plan for the 216-A-29 Ditch*, Rev. 0

PNNL-17176, 2007, *200-BP-1 Prototype Hanford Barrier Annual Monitoring Report for Fiscal Years 2005 Through 2007*

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

RSP-GRP-07-007, 2008, *Posting Survey Plan Eastern Section BC Controlled Area*, Rev. 1

SGW-35643, 2008, *West Lake Data Quality Objectives Summary Report*, DRAFT

SGW-37320, 2008, *Waste Control Plan for the 200-PW-2/4 Operable Unit*, Rev. 0

SGW-37529, 2008, *Waste Control Plan for the 200-TW-1/200-PW-5 Operable Units*, Rev. 0

SGW-37530, 2008, *Waste Control Plan for the 200-TW-2 Operable Unit*, Rev. 0

DQO	=	data quality objective	RTD	=	remove, treat, and dispose
PP	=	project plan	SAP	=	sampling and analysis plan
RAG	=	remedial action goal			

3.5.1.2 Groundwater OUs

M.E. Byrnes and C.J. Wittreich, CHPRC

Seven pump-and-treat systems were operated by FHI at the Hanford Site during FY 2008 under interim RODs (*Declaration of the Interim Record of Decision for the 200-ZP-1 Operable Unit* [EPA et al. 1995]; EPA/ROD/R10-96/134, *Declaration of Record of Decision for 100-HR-3 and 100-KR-4 Operable Units USDOE Hanford 100 Area*; EPA/ROD/R10-97/048, *Declaration of Record of Decision for 200-UP-1 Operable Unit USDOE Hanford*; EPA/AMD/R10-00/122, *Amended Record of Decision Summary and Responsiveness Summary 100-HR-3 Operable Unit USDOE Hanford 100 Area*). Three of the pump-and-treat systems are located in the 200 West Area (Table 3-3); four other pump-and-treat systems and one barrier system are located at sites along the Columbia River. These seven pump-and-treat systems are:

- The 200-UP-1 Pump-and-Treat System is removing primary contaminants uranium and technetium-99 and secondary contaminants carbon tetrachloride and nitrate. Groundwater from the two active 200-UP-1 Groundwater OU extraction wells is transported by pipeline to the Effluent Treatment Facility (ETF) for contaminant treatment and removal.

- The main 200-ZP-1 Pump-and-Treat System is a standalone treatment system removing primarily carbon tetrachloride, but also chloroform and trichloroethene. In FY 2008, four monitoring wells were converted to extraction wells to expand this system. In support of expansion activities, the 200-ZP-1 Pump-and-Treat System was shutdown in May 2008 and except for process and acceptance testing, remained offline until early September 2008.

- The secondary 200-ZP-1 Groundwater OU extraction system started as a test at the T Tank Farm in FY 2007. Groundwater from the two active extraction wells of the T Tank Farm Pump-and-Treat System is transported by pipeline to the ETF for treatment and removal of technetium-99 and other contaminants.

- The 100-KW Pump-and-Treat System was started in January 2007 to remediate a recently discovered chromium plume associated with the KW Reactor.

- The 100-DR-5 Pump-and-Treat System in the 100-D Area was activated in July 2004 and uses ion-exchange technology to treat hexavalent chromium from the 100-D Area groundwater that is not controlled by the 100-HR-3 Pump-and-Treat System.

- The In Situ REDOX Manipulation Barrier System was installed in the 100-D Area in phases from FY 2000 through FY 2002 to control movement of hexavalent chromium. A treatability test for a chromium electrocoagulation system was conducted in the 100-D Area.

- The 100-NR-2 Groundwater OU system was removing strontium-90 from groundwater at the 100-N Area. This system is currently in cold-standby status after completion of a rebound study following shutdown of the strontium-90 treatment system in the 100-N Area. At the same time, an alternate treatment technology test, apatite sequestration, is being conducted in the 100-N Area (PNNL-16346, *Hanford Site Groundwater Monitoring for Fiscal Year 2006*).

Within the Central Plateau, the groundwater OUs pertinent to the Composite Analysis are shown in Figure 3-1 and include 200-UP-1, 200-ZP-1, 200-BP-5, and 200-PO-1. These groundwater OUs are discussed in the following subsections, as relevant to radionuclide constituents.

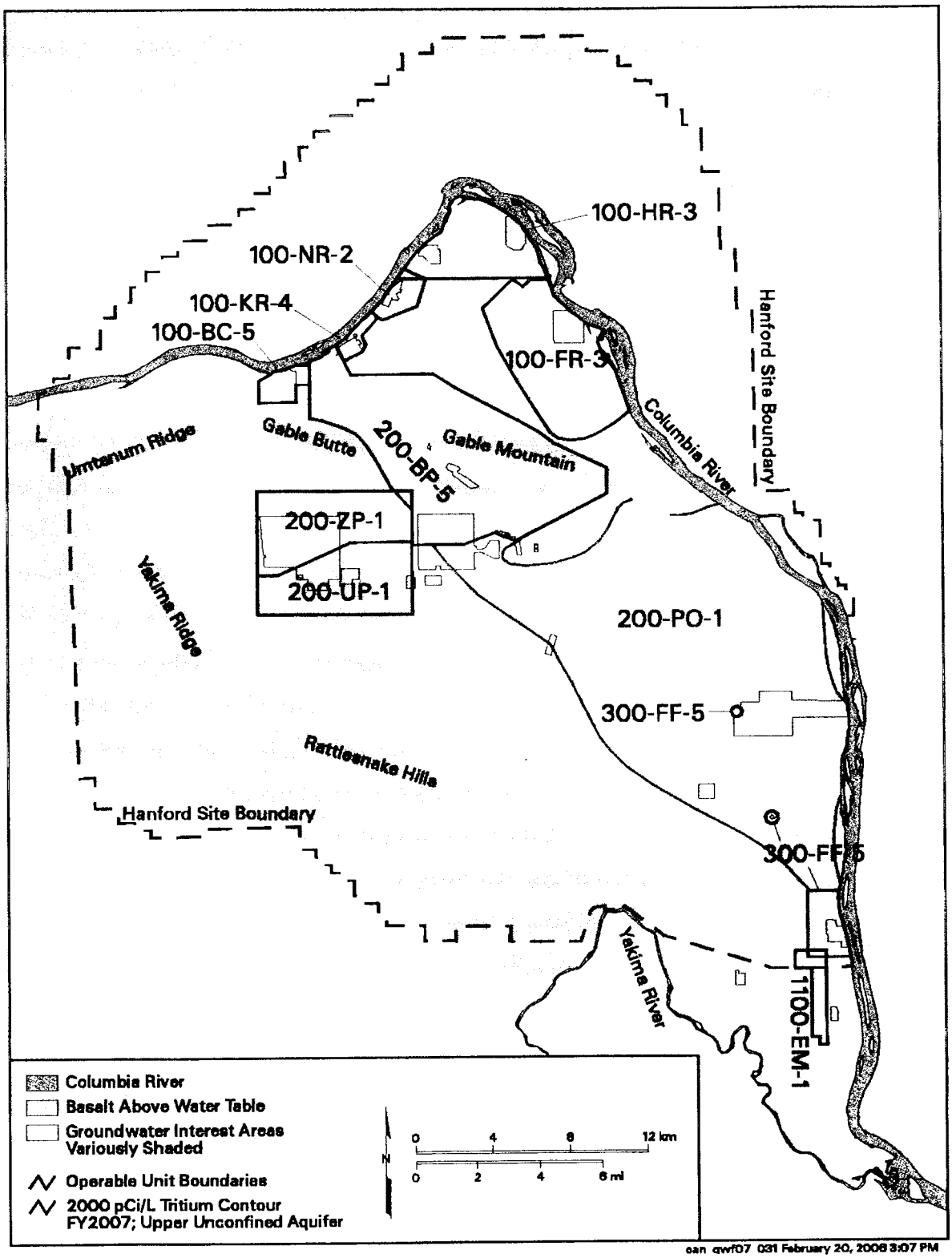

Figure 3-1. Groundwater OUs and Groundwater Interest Areas on the Hanford Site

3.5.1.2.1 200-UP-1 Groundwater OU

Activities during FY 2008 in the 200-UP-1 Groundwater OU consisted of the interim action pump-and-treat system operating near the 216-U-17 Crib and responses to the second CERCLA five-year review. The sampling and analysis plan (SAP) for FY 2008 sampling of the OU is incorporated into the RI/FS work plan for the 200-UP-1 Groundwater OU (DOE/RL-92-76, *Remedial Investigation/Feasibility Study Work Plan for the 200-UP-1 Groundwater Operable Unit, Hanford Site*).

Fifty-three wells were scheduled for sampling during the FY 2008, and fifty were sampled successfully. Six groundwater monitoring wells were installed for the 200-UP-1 Groundwater OU during FY 2008. These wells fulfill the need for additional spatially distributed groundwater data and to complete the RI. Depth and monitoring requirements were identified in DOE/RL-92-76. Well installations began in February 2008 and were completed by May 2008.

FY 2008 activities for the 200-UP-1 Groundwater OU are summarized in DOE/RL-2008-66. Review of these activities (CERCLA five year review, pump and treat activities, and monitoring) did not reveal any new information associated with this OU with potential to alter the conclusions of the Composite Analysis presented in PNNL-11800 and the subsequent addendum.

3.5.1.2.2 200-ZP-1 Groundwater OU

During FY 2008 within the 200-ZP-1 Groundwater OU, interim actions were implemented for remediation of carbon tetrachloride, chloroform, and trichloroethene in the vicinity of the 216-Z Liquid Waste Disposal Units (comprised primary of cribs and trenches). The final remedy for the 200-ZP-1 Groundwater OU will remediate carbon tetrachloride and seven other contaminants of concern (COCs) throughout the vertical extent of the aquifer in accordance with the *Declaration of the Record of Decision Hanford 200 Area 200-ZP-1 Superfund Site, Benton County, Washington* [EPA et al. 2008] signed in September 2008. Several reports provide the most recent update of the status of the remediation including SGW-38923, *200-UP-1 and 200-ZP-1 Pump and Treat Semi-Annual Technical Memorandum Fiscal Year 2008*, and DOE/RL-2008-02, *200-UP-1 and 200-ZP-1 Operable Units Pump and Treat System Annual Report for FY07*.

FY 2008 activities in the 200-ZP-1 Groundwater OU are summarized in DOE/RL-2008-66. Review of these activities (CERCLA investigations, interim actions for carbon tetrachloride, ion exchange treatability test, pump and treat for technetium 99) did not reveal any new information associated with this OU with potential to alter the conclusions of the Composite Analysis presented in PNNL-11800 and the subsequent addendum.

3.5.1.2.3 200-BP-5 Groundwater OU

The CERCLA monitoring requirements in the groundwater OU have been defined in DOE/RL-2001-49, *Groundwater Sampling and Analysis Plan for the 200-BP-5 Operable Unit*. The SAP was revised in late FY 2004 to integrate *Atomic Energy Act of 1954* (AEA) monitoring and make minor modifications in the monitoring network. The revised monitoring plan DOE/RL-2006-55, *Sampling and Analysis Plan for FY 2006 200-BP-5 Groundwater Operable Unit Remedial Investigation/Feasibility Study*, was implemented in FY 2005. The CERCLA monitoring includes sampling of the regional plumes, 216-B-5 Rejection Well site, BY Cribs, and Gable Mountain Pond. An interim or final ROD is yet to be established for this groundwater OU.

FY 2008 activities in the 200-BP-5 Groundwater OU are summarized in DOE/RL-2008-66. Review of these activities (CERCLA investigations, CERCLA monitoring) did not reveal any new information

associated with this OU with potential to alter the conclusions of the Composite Analysis presented in PNNL-11800 and the subsequent addendum.

3.5.1.2.4 200-PO-1 Groundwater OU

The 200-PO-1 Groundwater OU area encompasses the south portion of the 200 East Area and a large triangle-shaped portion of the Hanford Site extending to the Hanford town site to the east and to the 300-FF-5 Groundwater OU to the southeast. The 216-B-3 Pond straddles two OUs, but is considered part of the 200-PO-1 Groundwater OU. Tritium, nitrate, and iodine-129 are the contaminants of greatest significance in groundwater. Other contaminants of potential concern include arsenic, chromium, cyanide, manganese, strontium-90, technetium-99, and vanadium.

The primary monitoring objective within this groundwater OU is to meet the groundwater monitoring requirements for the CERCLA, RCRA, *Washington Administrative Code*, and AEA as directed in DOE Orders. The long-term goal for CERCLA is to monitor the COCs until final cleanup decisions are made.

Included within the groundwater OU are six RCRA units including the PUREX cribs (called the RCRA PUREX cribs), WMA A-AX (single-shell tanks), 216-A-29 Ditch, IDF, 216-B-3 Pond, and the Nonradioactive Dangerous Waste Landfill. Two other facilities that are not regulated under RCRA but are subject to *Washington Administrative Code* requirements are the 200 Area Treated Effluent Disposal Facility and the Solid Waste Landfill.

FY 2008 activities in the 200-PO-1 Groundwater OU are summarized in DOE/RL-2008-66. Review of these activities (CERCLA RI/FS work planning, CERCLA monitoring) did not reveal any new information associated with this OU with potential to alter the conclusions of the Composite Analysis presented in PNNL-11800 and the subsequent addendum.

3.5.1.3 Other Central Plateau Remediation Activities

Other remediation activities on the Central Plateau aside from source and groundwater OUs are presented in this section.

3.5.1.3.1 Status of ERDF

O.C. Robertson, RL, M.A. Casbon, WCH

Washington Closure Hanford, LLC (WCH) operates the ERDF to dispose of Hanford Site low-level radioactive, hazardous or dangerous, and low-level mixed waste generated during waste site closures and some remediation activities from other Hanford contractors as authorized by CERCLA. EPA/ROD/R10-95/100, *Record of Decision for the USDOE Hanford Environmental Restoration Disposal Facility Remedial Action,* including amendments (EPA/AMD/R10-97/101, *Amendment to the Record of Decision for the USDOE Hanford EnvironmentRestoration Disposal Facility*; EPA/AMD/R10-99/038, *Amended Record of Decision Summary and Responsiveness Summary ERDF Benton County, Washington*; EPA/AMD/R10-02/030, *U.S. Department of Energy Environmental Restoration Disposal Facility Hanford Site 200 Area Benton County, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary*; EPA et al. 2007, *U.S. Department of Energy Environmental Restoration Disposal Facility Hanford Site-200 Area Benton County, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary*), identified the requirements associated with the facility.

Leachate Monitoring. The ERDF began operating in July 1996. Situated between the 200 East and 200 West Areas, the facility operates six cells covering 22.5 hectares (55.6 acres). Construction of cells 7 and 8 is in progress and will be completed in the first quarter of CY 2009. Each cell is double-lined to

collect leachate resulting from water added as a dust suppressant and from precipitation. The liner is sloped to a sump in each cell and the leachate pumped from the sump to holding tanks. From there, the leachate is pumped to the ETF for treatment.

Additionally, the ERDF leachate is sampled for constituents identified in the 1999 ERDF ROD amendment EPA/AMD/R10-99/038 and the WCH-173, *Environmental Restoration Disposal Facility Leachate Sampling and Analysis Plan.* The 2002 ERDF ROD amendment EPA/AMD/R10-02/030 delisted the leachate and identified the necessary sampling frequency. Leachate samples are obtained directly from the holding tanks. The constituents detected in the ERDF leachate samples are then compared with the groundwater monitoring analyte list to determine whether additional analytes should be added to the Groundwater Performance Assessment Project. The target analytes for groundwater monitoring are consistent with the leachate-monitoring program. Furthermore, the leachate data are evaluated for trends. Based on the groundwater sampling and leachate data, no impact to groundwater has occurred from ERDF operations because of the double-lined leachate collection system and other design features. Although technetium-99 has slightly increased in the leachate over time, it represents no impact to groundwater, and the groundwater sampling data indicate that no technetium-99 values exceed the tolerance interval. WCH produces an annual report summarizing the leachate and groundwater monitoring data and providing conclusions and recommendations as appropriate. The most recent is WCH-295, *Groundwater and Leachate Monitoring and Sampling at the Environmental Restoration Disposal Facility, Calendar Year 2007.*

Current Inventory Estimates. The annual summary inventory of key radionuclides for ERDF is listed in Table 3-4 for CY 2004 through CY 2008. More detail on CY 2008 and the totals since inception of the ERDF are provided in Table 3-5. In 1996, Bechtel Hanford, Inc. estimated fewer than 500 curies were disposed in the ERDF. Table 3-5 shows that after almost 12 years of operations, over 51,500 curies have been disposed at ERDF since inception of operations on July 1, 1996. The data source for this summary is the monthly inventory disposal report from the WCH Waste Management Information System. It is apparent that the annual curie count increased in CY 2006, in CY 2007, and again in CY 2008. The predominant source of these increases appears to be higher levels of radionuclides received in activated metals from remediation of burial grounds. The ERDF Waste Acceptance Criteria was revised in 2008. The changes included modification of some of the existing radionuclide limits, as well as the addition of new radionuclides to the list. These are reflected in Table 3-4.The ERDF inventory estimate is considered to be very conservative. The ERDF inventories are derived from the ERDF waste acceptance system, which is operated to ensure no waste above the established limits (based on the ERDF, Waste Acceptance Criteria, and Safety Analysis) enters ERDF. The waste acceptance achieves this by biasing every element of the process, such as profiles and onsite waste tracking forms (the ERDF manifest), to the highest possible levels before comparison with the established limits. The net effect of this bias is to artificially inflate the ERDF inventory. A comparison of the ERDF inventory for waste from the N Cribs with the waste generator's records showed that the ERDF inventory was higher by a factor of three. The factor for inventories from other waste sites may be higher. While this bias does not allow for a precise knowledge of the actual inventory, it does provide excellent assurance that inventory limits are not being exceeded. Because of this deliberate bias, it is inappropriate to expect that the ERDF inventories listed here will match best-estimate inventories prepared for other purposes.

Table 3-4. Summary of ERDF Annual Radionuclide Inventory CY 2004 through CY 2008

Radionuclide	CY 2004 (Ci)	CY 2005 (Ci)	CY 2006 (Ci)	CY 2007[b] (Ci)	CY 2008[b] (Ci)
Ac-227				0.00	0.00000
Ag-108m				40.17	50.41570
Am-241	9.98	24.69	14.34	4.57	4.12147
Am-242m				0.00	0.00023
Am-243	0.00	0.00	0.00	0.00	0.000187
Ba-133				0.17	0.49109
Be-7				0.00	0.00000
C-14[a]	0.47	0.10	3.64	0.10	4.12670
C-14A[a]	30.53	329.81	439.19	427.86	64.56900
Ca-41				3.80	0.31195
Cd-113m				0.00	1.00597
Ce-144				0.00	0.00026
Cf-249					0.00000
Cm-242				0.02	0.00363
Cm-243				0.01	0.00117
Cm-244				0.13	0.06594
Cm-245				0.00	0.00000
Cm-246				0.00	0.00000
Cm-247				0.00	0.00000
Cm-248				0.00	0.00000
Co-58	0.00	0.00	0.00	0.00	0.00000
Co-60	373.36	839.46	1398.21	2246.67	2244.93764
Cs-134	2.64	0.97	0.06	0.04	0.01564
Cs-135				0.00	0.00022
Cs-137	128.43	1521.19	1527.56	419.67	443.73091
Eu-152	40.87	29.17	38.54	67.24	123.72958
Eu-154	9.30	19.23	22.41	34.60	50.57995
Eu-155	6.58	2.40	1.73	0.34	6.29012
Fe-55				0.00	0.00050
Fe-59				0.00	0.00000
H-3	35.33	337.96	748.91	1326.27	259.38944
I-129				0.00	0.01487
K-40				0.59	13.20018
Kr-85				0.03	0.00012
Mn-54				0.00	0.00000

Table 3-4. Summary of ERDF Annual Radionuclide Inventory CY 2004 through CY 2008

Radionuclide	CY 2004 (Ci)	CY 2005 (Ci)	CY 2006 (Ci)	CY 2007[b] (Ci)	CY 2008[b] (Ci)
Mo-93				0.67	0.33376
Na-22	0.00	0.00	0.00	0.00	0.00000
Nb-93m				1.56	0.39290
Nb-94	0.00	0.00	2.21	1.20	1.35813
Nb-94A				0.42	0.14147
Ni-59				14.54	8.43715
Ni-59A				490.89	66.18899
Ni-63	124.27	252.52	40.46	76.22	15449.56362
Ni-63A	44.16	583.52	1536.11	6865.66	3395.08401
Np-237	0.02	0.00	0.01	0.00	0.09375
Pa-231				0.00	0.00000
Pb-210				0.00	0.00000
Pd-107				0.00	0.00006
Pm-147				0.06	0.16309
Pu-238	3.02	4.99	1.78	0.42	1.28384
Pu-239	13.09	26.26	12.67	4.58	1.08262
Pu-240	6.03	10.43	4.44	1.59	0.39254
Pu-241	250.32	437.19	88.56	20.98	12.14003
Pu-242	0.00	0.00	0.00	0.00	0.02953
Pu-244				0.00	0.00000
Ra-226	0.00	0.00	0.13	0.14	0.35186
Ra-228	0.00	0.00	0.00	0.05	0.09829
Ru-103				0.00	0.00000
Ru-106				0.00	0.01492
Sb-125				0.03	2.09370
Se-79				0.00	13.65787
Sm-151				0.18	2.96163
Sn-113				0.00	0.00000
Sn-121m				0.00	0.00020
Sn-126				0.00	0.12619
Sr-90	116.82	909.44	1179.24	906.34	293.77468
Tc-99	4.95	0.68	7.81	3.47	0.24856
Th-228	0.03	0.20	0.04	0.31	0.30121
Th-230				0.00	0.00054
Th-232	0.00	0.01	0.03	0.06	0.47445

Table 3-4. Summary of ERDF Annual Radionuclide Inventory CY 2004 through CY 2008

Radionuclide	CY 2004 (Ci)	CY 2005 (Ci)	CY 2006 (Ci)	CY 2007[b] (Ci)	CY 2008[b] (Ci)
Th-234				0.00	0.00000
U-232				0.00	0.00001
U-233/234	3.43	6.25	17.76	0.69	11.52186
U-235	0.16	1.17	7.38	0.07	1.09679
U-236				0.00	0.30442
U-238	1.36	11.24	19.32	2.14	29.10838
Zn-65				0.00	0.00000
Zr-93				0.00	16.99525
Total Activity	**1205.18**	**5349.22**	**7112.55**	**12964.55**	**22576.81868**

a. C-14 and C-14A inventories have been adjusted per (Letter CCN 088793, "White Paper on Environmental Restoration Disposal Facility Inventory and Waste Acceptance Practices")

b. Expanded inventory tracking began in 2007

Letter CCN 088793, 2001, "White Paper on Environmental Restoration Disposal Facility Inventory and Waste Acceptance Practices," from Bechtel Hanford, Inc., Richland, Washington.

Ac = actinium	Co = cobalt	Na = sodium	Sb = antimony
Ag = silver	Cs = cesium	Nb = niobium	Se = selenium
Am = americium	Eu = europium	Ni = nickel	Sm = samarium
Ba = barium	Fe = iron	Np = neptunium	Sn = tin
Be = beryllium	H = hydrogen	Pa = protectinium	Sr = strontium
C = carbon	I = iodine	Pb = lead	Tc = technetium
Ca = calcium	K = potassium	Pm = promethium	Th = thorium
Cd = cadmium	Kr = krypton	Pu = plutonium	U = uranium
Ce = cerium	Mn = manganese	Ra = radium	Zn = zinc
Cf = californium	Mo = molybdenum	Ru = ruthenium	Zr = zirconium
Cm = curium			

Table 3-5. Summary of ERDF Radionuclide Inventory CY 2008 and Total Since Inception

Radionuclide	ERDF Waste Acceptance Criteria	CY 2008[a]		Inception Through Dec. 2008	
	Ci/m^3	Ci	Ci/m^3	Ci	Ci/m^3
Ac-227	7.60E+04	0.000	5.17E-15	0.000	6.79E-13
Ag-108m	N/A	50.416	1.63E-04	90.588	2.61E-05
Am-241	5.40E-02	4.121	1.33E-05	84.243	2.43E-05
Am-242m	4.01E-01	0.000	7.44E-10	0.000	6.64E-11
Am-243	5.60E-02	0.000	6.05E-10	0.149	4.30E-08
Ba-133	N/A	0.491	1.59E-06	0.656	1.89E-07
Be-7	N/A	0.000	8.32E-12	0.000	7.43E-13
C-14[b]	5.10E+00	4.127	1.33E-05	38.439	1.11E-05
C-14 Activated Metal[b]	5.10E+01	36.973	1.19E-04	1270.829	3.66E-04
C-14 Insoluble	N/A	27.596	8.92E-05	63.999	1.85E-05
Ca-41	N/A	0.312	1.01E-06	4.108	1.18E-06
Cd-113m	N/A	1.006	3.25E-06	1.006	2.90E-07
Ce-144	N/A	0.000	8.25E-10	0.000	7.54E-11
Cf-249		0.000		0.000	
Cm-242	3.20E+01	0.004	1.17E-08	0.022	6.48E-09
Cm-243	8.60E+01	0.001	3.79E-09	0.006	1.87E-09
Cm-244	3.90E+01	0.066	2.13E-07	0.191	5.52E-08
Cm-245	5.60E-02	0.000	0.00E+00	0.000	0.00E+00
Cm-246	1.00E-01	0.000	0.00E+00	0.000	0.00E+00
Cm-247	3.00E-02	0.000	0.00E+00	0.000	0.00E+00
Cm-248	2.70E-02	0.000	0.00E+00	0.000	0.00E+00
Co-58	N/A	0.000	5.18E-12	0.786	2.27E-07
Co-60	N/A	2244.938	7.26E-03	9183.159	2.65E-03
Cs-134	N/A	0.016	5.05E-08	13.345	3.85E-06
Cs-135	8.80E+00	0.000	7.18E-10	0.000	6.41E-11
Cs-137	3.20E+01	443.731	1.43E-03	7694.382	2.22E-03
Eu-152	2.10E+07	123.730	4.00E-04	5722.416	1.65E-03
Eu-154	N/A	50.580	1.63E-04	1703.822	4.91E-04
Eu-155	N/A	6.290	2.03E-05	145.127	4.19E-05
Fe-55	N/A	0.001	1.63E-09	0.001	1.45E-10
Fe-59	N/A	0.000	1.39E-11	0.000	1.24E-12
H-3	N/A	259.389	8.38E-04	5723.075	1.65E-03
I-129	8.00E-02	0.015	4.80E-08	0.015	4.29E-09

Table 3-5. Summary of ERDF Radionuclide Inventory CY 2008 and Total Since Inception

Radionuclide	ERDF Waste Acceptance Criteria	CY 2008[a]		Inception Through Dec. 2008	
	Ci/m^3	Ci	Ci/m^3	Ci	Ci/m^3
K-40	1.20E-03	13.200	4.27E-05	13.786	3.98E-06
Kr-85	N/A	0.000	3.91E-10	0.030	8.60E-09
Mn-54	N/A	0.000	0.00E+00	0.000	0.00E+00
Mo-93	5.10E+01	0.334	1.08E-06	1.007	2.90E-07
Na-22	N/A	0.000	0.00E+00	10.201	2.94E-06
Nb-93m	N/A	0.393	1.27E-06	1.957	5.64E-07
Nb-94	1.20E-02	1.358	4.39E-06	4.808	1.39E-06
Nb-94A	1.20E-01	0.141	4.57E-07	0.564	1.63E-07
Ni-59	2.10E+02	8.437	2.73E-05	22.975	6.63E-06
Ni-59A	2.20E+02	66.189	2.14E-04	557.078	1.61E-04
Ni-63	7.00E+02	15449.564	4.99E-02	19012.796	5.48E-03
Ni-63A	7.00E+03	3395.084	1.10E-02	12429.810	3.58E-03
Np-237	1.50E-03	0.094	3.03E-07	0.317	9.14E-08
Pa-231	7.40E-03	0.000	0.00E+00	0.000	0.00E+00
Pb-210	5.10E+05	0.000	0.00E+00	0.000	0.00E+00
Pd-107	8.20E+02	0.000	1.93E-10	0.000	2.01E-11
Pm-147	N/A	0.163	5.27E-07	0.226	6.53E-08
Pu-238	1.50E+00	1.284	4.15E-06	25.458	7.34E-06
Pu-239	2.90E-02	1.083	3.50E-06	154.112	4.44E-05
Pu-240	2.90E-02	0.393	1.27E-06	58.552	1.69E-05
Pu-241	5.60E+00	12.140	3.92E-05	3118.204	8.99E-04
Pu-242	1.10E-01	0.030	9.54E-08	0.145	4.17E-08
Pu-244	3.20E-02	0.000	0.00E+00	0.000	0.00E+00
Ra-226	1.40E-04	0.352	1.14E-06	0.715	2.06E-07
Ra-228	2.20E-04	0.098	3.18E-07	0.181	5.21E-08
Ru-103	N/A	0.000	0.00E+00	0.000	0.00E+00
Ru-106	N/A	0.015	4.82E-08	0.018	5.11E-09
Sb-125	N/A	2.094	6.77E-06	2.122	6.12E-07
Se-79	2.70E+01	13.658	4.41E-05	13.658	3.94E-06
Sm-151	5.30E+04	2.962	9.57E-06	3.137	9.05E-07
Sn-113	N/A	0.000	0.00E+00	0.000	0.00E+00
Sn-121m	5.60E+03	0.000	6.53E-10	0.000	5.82E-11
Sn-126	8.40E-03	0.126	4.08E-07	0.126	3.64E-08

Table 3-5. Summary of ERDF Radionuclide Inventory CY 2008 and Total Since Inception

Radionuclide	ERDF Waste Acceptance Criteria	CY 2008[a]		Inception Through Dec. 2008	
	Ci/m^3	Ci	Ci/m^3	Ci	Ci/m^3
Sr-90	7.00E+03	293.775	9.49E-04	6508.821	1.88E-03
Tc-99	1.30E+00	0.249	8.03E-07	77.279	2.23E-05
Th-228	1.20E-04	0.301	9.73E-07	1.215	3.50E-07
Th-230	3.80E-02	0.001	1.73E-09	0.001	1.58E-10
Th-232	5.80E-03	0.474	1.53E-06	0.870	2.51E-07
Th-234	N/A	0.000	0.00E+00	0.000	0.00E+00
U-232	1.20E+00	0.000	1.73E-11	0.000	1.58E-12
U-233/234	7.40E-02	11.522	3.72E-05	83.650	2.41E-05
U-235	2.70E-03	1.097	3.54E-06	26.353	7.60E-06
U-236	5.10E-01	0.304	9.84E-07	0.305	8.79E-08
U-238	1.20E-02	29.108	9.41E-05	222.297	6.41E-05
Zn-65	N/A	0.000	0.00E+00	0.000	0.00E+00
Zr-93	1.40E+02	16.995	5.49E-05	16.996	4.90E-06
Total		**22,576.819**		**74,110.135**	

a. Weight of waste received in CY 2008= 708,581 U.S. tons; total received since inception = 7,941,020 U.S. tons.

Volume of waste received in CY 2008 = 309,400 m^3 (404,700 yd^3); total received since inception = 3,468,000 m^3 (4,536,000 yd^3).

b. C-14 and C-14A inventories have been adjusted per (Letter CCN 088793, "White Paper on Environmental Restoration Disposal Facility Inventory and Waste Acceptance Practices")

Letter CCN 088793, 2001, "White Paper on Environmental Restoration Disposal Facility Inventory and Waste Acceptance Practices," from Bechtel Hanford, Inc., Richland, Washington.

Ac = actinium	Co = cobalt	Na = sodium	Sb = antimony
Ag = silver	Cs = cesium	Nb = niobium	Se = selenium
Am = americium	Eu = europium	Ni = nickel	Sm = samarium
Ba = barium	Fe = iron	Np = neptunium	Sn = tin
Be = beryllium	H = hydrogen	Pa = protectinium	Sr = strontium
C = carbon	I = iodine	Pb = lead	Tc = technetium
Ca = calcium	K = potassium	Pm = promethium	Th = thorium
Cd = cadmium	Kr = krypton	Pu = plutonium	U = uranium
Ce = cerium	Mn = manganese	Ra = radium	Zn = zinc
Cf = californium	Mo = molybdenum	Ru = ruthenium	Zr = zirconium
Cm = curium			

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4 Summary of Changes

4.1 Changes in Site-wide Inventories for Major Programs

No major changes have occurred to the site-wide inventories for major programs since DOE/RL-2006-28, *Annual Status Report (FY 2005): Composite Analysis of Low-Level Waste Disposal in the Central Plateau at the Hanford Site.*

4.2 Land-Use Issues

The single land use issue pertinent to the Composite Analysis during FY 2008 was the release of the DOE/EIS-0222-SA-01, *Supplement Analysis to the Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement,* and DOE 6450-01-P, *Amended Record of Decision for the Hanford Comprehensive Land-Use Plan Environmental Impact Statement.*

4.2.1 Supplement Analysis Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement and Amended Record of Decision

The supplement analysis DOE/EIS-0222-SA-01 to DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (HCP EIS), was issued in June 2008. DOE/EIS-0222-SA-01 reviewed the Hanford Comprehensive Land-Use Plan (CLUP) issued in the ROD 64 FR 61615 in 1999 that consists of four key elements (a land-use map that addressed the Hanford Site as five geographic areas; a set of nine land-use designations that define the permissible uses of each area of the site; the planning policies; and the implementing procedures that would govern the review and approval of future land uses) per the recommendation in HCP EIS (and consistent with Council on Environmental Quality guidance on NEPA reviews for on-going projects).

These elements were developed to ensure consistency in land-use decision-making and application of DOE institutional controls to the Hanford Site. DOE 6450-01-P adopted the Hanford CLUP for at least the next 50 years.

DOE/EIS-0222-SA-01 examined whether there are significant new circumstances or information relating to the Hanford land-use map, the land-use definitions, policies directing land-use action and implementing procedures since both DOE/EIS-0222-F and 64 FR 61615 were issued that would require DOE to prepare a new or supplemental EIS.

Based on DOE/EIS-0222-SA-01 evaluations, DOE determined:

- There are no identified significant changes in circumstances or substantial new information that have evolved since 1999 that would affect the basis for its decision as documented in 64 FR 61615
- Preparation of a new EIS, or a supplement to the existing EIS DOE/EIS-0222-F, is not warranted at this time.

More than 280 action/decision documents were examined to determine if the comprehensive land-use plan policy and procedures have been implemented in accordance with 64 FR 61615. Of these, approximately 200 were subject to further evaluation to complete the supplement analysis DOE/EIS-0222-SA-01 determination. Results of the document evaluation indicated no documented actions or decisions had been made since 1999 that were not implemented consistent with the policy and procedures of the Hanford CLUP.

As a result of the document evaluation process, DOE found that other regulatory processes have been used in addition to the Hanford CLUP implementing procedures adopted by 64 FR 61615 in determining whether proposed activities at the Hanford Site would be consistent with the comprehensive land-use plan. Due to the increased focus and attention on Hanford Site cleanup and waste management activities, regulatory processes have been followed under the CERCLA and RCRA/Hazardous Waste Management Act Corrective Action in accordance with the Tri-Party Agreement; for RCRA/*State of Washington Hazardous Waste Management Act of 1976* (RCW 70.105) permitting actions; and using independent NEPA reviews. These processes involve the same or expanded representation of Federal, state, and local agencies, American Indian Tribes, stakeholders, and members of the public to what is contemplated using the Hanford CLUP implementing procedures. Consideration of land use and consistency with the Hanford CLUP is actively considered and documented using these other public processes. DOE considers these other processes to be acceptable for purposes of evaluating whether land-use is being implemented at the Hanford Site consistent with the Hanford CLUP.

Based on DOE/EIS-0222-SA-01, DOE issued the amended ROD DOE 6450-01-P in September 2008. In amending 64 FR 61615, DOE clarified two points: that when considering land-use proposals, DOE will use regulatory processes in addition to the implementing procedures in Chapter 6 of the DOE/EIS-0222-F to ensure consistency with CLUP land-use designations, and that DOE will continue to apply the process under DOE/EIS-0222-F Chapter 6 to modify or amend the CLUP, as needed.

5 Recommended Changes

Based on this annual evaluation of new information and data from data collection and analysis from research, field studies, and monitoring developed by a number of Hanford Site programs, no information was identified that would invalidate the continued adequacy of the current version of PNNL-11800 and the subsequent addendum.

As previously stated, DOE is preparing the TC&WM EIS for the Hanford Site that will provide an integrated analysis of groundwater at Hanford. The Hanford Site is deferring any revision of Composite Analysis until the final TC&WM EIS is issued.

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6 Status of Composite Analysis Activities

The Hanford Site is deferring any revisions to the Composite Analysis until the final TC&WM EIS is issued; accordingly, no revisions to the Composite Analysis are needed at this time.

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