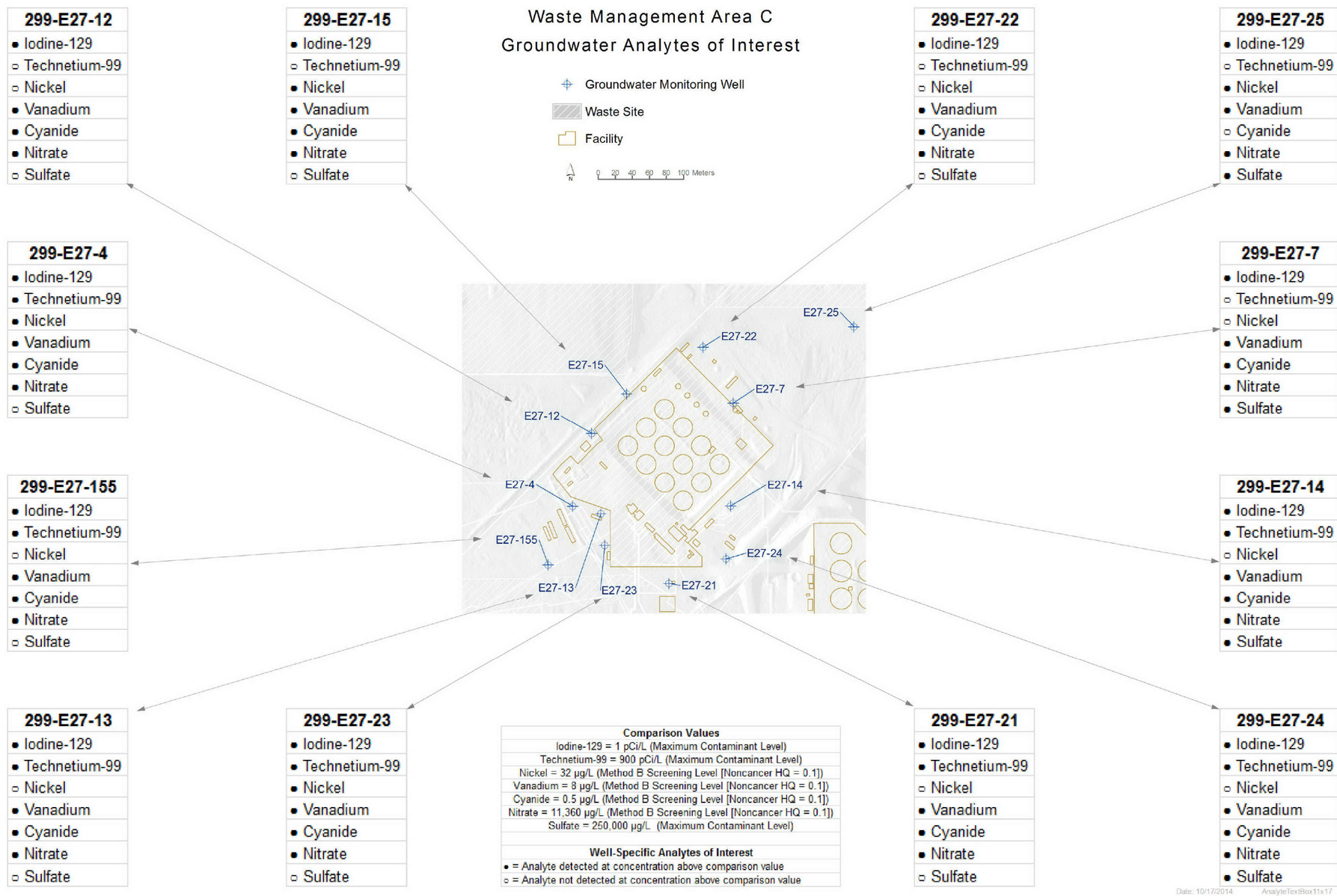
1228921

RPP-RPT-58339 DRAFT A

PHASE 2 RCRA FACILITY INVESTIGATION REPORT FOR WASTE MANAGEMENT C

SECTION 2 OF 5

Figure 7-9. Well-Specific Analytes of Interest in the Vicinity of WMA C (2004 through 2013)



8.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This RFI report was developed to provide the information and contaminant distribution data necessary to draw conclusions about the nature and extent of soil contamination at WMA C and to support future corrective action decision-making for WMA C. This section of the report provides a summary of investigation findings, conclusions, information gaps, and recommendations for future action at WMA C.

This RFI report focuses primarily on the results of the Phase 2 RFI conducted under the WMA C Phase 2 work plan (RPP-PLAN-39114), which described characterization work to be performed at and around WMA C. This information is presented in context of previous investigations and other historic information regarding WMA C. This collective body of information has been factored into updated contaminant distribution models to draw conclusions about the nature and extent of contamination at WMA C in order to inform future corrective action decision-making.

As described in RPP-PLAN-39114, this RFI report was developed specifically to address the soil contamination in WMA C, including the areas within the tank farm fenceline and closely adjacent areas that are likely to be under the footprint of a closure cap. Summary information on non-soil sources of residual contamination (structures to be closed as described in HFFACO Appendix I) and groundwater impacts are included to provide the context necessary to make informed decisions regarding WMA C corrective actions. During the development of this RFI report, commitments were made to Ecology on the content of the report. These commitments have been addressed as described in Appendix C. An important commitment for Section 8 of the RFI report is to identify data gaps and the impact of these gaps.

8.1 ADVANCES IN UNDERSTANDING FROM THE PHASE 2 RFI

At the beginning of the Phase 2 field investigation, it was already known that there had been significant soil contamination in WMA C due to past losses from tank system operations (including tank leaks, tank overfill events, pipeline and other ancillary equipment leaks). The Phase 1 RFI and other bodies of work had provided an understanding that waste entering the soil would have varying mobility depending on the chemical characteristics of the waste constituents. For example, ^{137}Cs and other immobile constituents would remain near the source of the waste loss. Technetium-99, nitrate, and other highly mobile constituents would likely travel through the soil with water. A number of constituents (including uranium) could exhibit a range of mobility based on their molecular form.

The Phase 2 RFI work plan (RPP-PLAN-39114) was designed with certain expectations derived from the work documented in the Phase 1 RFI and related technical studies. In particular:

1. The work plan did not represent a random statistical sampling scheme. It targeted locations where contamination was expected to be found based on historic records of waste losses.

2. The logging and sampling schemes were developed with an expectation that the primary direction of flow in the vadose zone was vertical.

3. The initial expectation was that the mobile waste constituents would still be concentrated at depths considerably above the groundwater. Note that this expectation relied heavily on information reported in previous field investigation reports (RPP-7884, *Field Investigation Report for Waste Management Area S-SX*; RPP-10098, *Field Investigation Report for Waste Management Area B-BX-BY*; and RPP-23752, *Field Investigation Report for Waste Management Areas T and TX-TY*). This expectation is summarized in Chapter 16 of the Phase 1 RFI report (DOE/ORP-2008-01) and also in Section 9 of RPP-RPT-41918, *Assessment Context for Performance Assessment for Waste in C Tank Farm Facilities after Closure*. This expectation was based in part because higher concentrations of ^{99}Tc had been identified at depths of 29 to 35 m (95 to 115 ft) bgs.

Several observations could be made from the Phase 2 RFI characterization efforts. For instance, gamma logging showed higher gamma spectra near the soil surface and near locations of suspected waste loses, confirming that waste had entered the soil and that many gamma emitting radionuclides did not show significant mobility. Moisture logging showed layers of higher moisture interspersed with lower moisture. These observations were consistent with expectations.

For the most part, sampling did not show high concentrations of mobile constituents in any specific depth range. A number of observations should be noted:

- Many sampling locations showed concentrations of mobile constituents somewhat above background, suggesting that for the most part, the mobile constituents had migrated through the region, to greater depths.

- Increased concentrations of some mobile contaminants above background were found in samples from all depths.

- As the Phase 2 RFI characterization was proceeding, the groundwater sampling program was finding additional evidence that waste from the WMA C tank system had reached groundwater.

- Historic information about water use in the tank farms during the operations period showed evidence of large quantities of water being used in the tank farms (e.g., for washing down contaminated equipment).

- Information collected in and near other tank farms suggested that geologic layers in the soil were providing significant lateral movement of water and mobile contaminants. In at least some parts of WMA C, there appears to be lateral movement within the vadose zone.

Overall, the field characterization performed for the WMA C Phase 2 RFI extended the body of knowledge, but also provided information that requires changes to the conceptual site models in

place at the beginning of the investigation. Specifically, this information has been integrated into the conceptual site models in use for the WMA C Appendix I Performance Assessment.

8.2 CONCLUSIONS REGARDING NATURE AND EXTENT OF SOIL CONTAMINATION

It has been well established that waste was lost to the soil from tanks and other ancillary equipment in WMA C during the operational period. The key conclusions on the nature and extent of soil contamination in WMA C in the shallow (top 5 m [15 ft]) and deeper vadose zone (below 5 m [15 ft]) are summarized below.

8.2.1 Shallow Impact

Leaks from the base of a tank would enter the soil below the top 5 m (15 ft). However, overfills, losses from spare inlet pipes, pipeline leaks, and losses from other ancillary equipment have certainly impacted the soil in the top 5 m (15 ft). This RFI report confirms the expectation that a number of immobile waste constituents remain near the source of the waste leak. It is not possible to look for every point where waste many have entered the soil from a pipeline or other ancillary equipment.

A prudent assumption regarding shallow soil is that some amount of contamination may be present at any location within the tank farm. Thus a protective action to prevent direct contact to the top 5 m (15 ft) of soil is warranted.

8.2.2 Deeper Vadose Zone Impact

Mobile constituents have moved into the vadose zone to varying depths, depending on the driving force associated with the waste loss itself and with subsequent water addition (meteoric or human action). In addition to vertical movement of the contamination, lateral migration has occurred. Although there may be a preferential direction in some parts of the farm, spreading in other directions due to smaller lenses of less permeable soil cannot be ruled out.

Based these observations, it is possible that some amount of contamination could exist at both varying depths and lateral locations within the WMA C soil. At depths greater than the excavated backfill of the farm, lateral migration in a geologic layer may have caused some contamination to extend laterally beyond the surface location of the tank farm fenceline.

The deeper contamination does not present a direct contact risk. However, it will continue to present a groundwater risk. Since contamination is everywhere in WMA C at varying levels of concentrations and depths in the vadose zone soil, there is no practicable method to remediate the deep soil contamination. Several considerations must be applied when evaluating its future impact.

- Since the contamination apparently spans multiple depths, it will continue to move into groundwater over a period of time.

- Due to the depth of the contamination and the presence of moisture in the soil already (to act as a driving force), a surface barrier is unlikely to provide much mitigation of the continued migration to groundwater. Likewise, contamination that has migrated outside the effective footprint of a surface barrier would continue to migrate.

Groundwater contamination in the WMA C area is being evaluated as part of the CERCLA 200-BP-5 groundwater OU Remedial Investigation. The combined CERCLA 200-BP-5 and 200-PO-1 OUs Feasibility Study will determine the remediation decision for the groundwater at WMA C.

8.2.3 Data Gaps

A limited number of investigation sites were identified in the Phase 2 RFI work plan that could not be accessed during the field investigation. Specifically, Site X, which was to be located near Tank C-105, was added to Revision 2 of the work plan to better define the area of contamination associated with a historic waste loss from Tank C-105. In particular, the goal of the investigation was to gain information about a contamination under the tank, which might be accomplished with an angled direct push under the tank. Due to the location of surface and sub-surface infrastructure, an angled direct push has not been possible near Tank C-105. In absence of more complete information regarding the size of a contamination area adjacent to Tank C-105, a decision has been made to model the impact of the potential larger plume in the WMA C Integrated Performance Assessment. It is unlikely that any future action regarding a corrective measure would change based on additional data of the Tank C-105 contamination area. Therefore, no further field characterization is recommended at this site.

As identified in Section 3, the C-301 Catch Tank contains a mixture of liquids and solids with limited characterization information on the contents. Direct pushes at Site R were completed to assess a potential waste release from the catch tank. Characterization data obtained through the field effort yielded less than expected contamination levels (i.e., minimal soil background exceedances). Additional information is required to make retrieval and closure decisions for C-301 Catch Tank, beyond the scope of the characterization covered in this RFI. An effort is currently underway to obtain information about the waste remaining in C-301 Catch Tank as a precursor to waste retrieval. When last measured, there was a liquid layer overlaying solids in C-301 Catch Tank. The initial plan for C-301 Catch Tank waste characterization involves visual inspection of the tank contents, which will discern whether or not the tank has leaked, based on the presence or absence of liquid. Following the visual inspection, radiological measurements and sampling are planned. This effort will provide information on the current contents, as well as information on what may have leaked (if there is evidence of a leak). The C-301 waste characterization plan should be pursued, and no further soil characterization is needed.

With respect to the 200-series tanks, the original Phase 2 RFI work plan identified several sampling locations near the 200-series tanks to evaluate whether the 200-series tanks had leaked (Investigation Group C+D). As identified in Section 4, it was agreed that the area could be characterized with limited sampling near the 200-series tanks and a more extensive SGE campaign, including the use of electrodes placed at depths (Revision 2 of the work plan). Although the SGE campaign did not determine conclusively whether individual 200-series tanks

leaked, it did identify that soil anomalies in the area suggested the presence of moisture (possibly including contaminants). A reasonable conclusion for planning purposes is that waste from the 200-series tanks or some of the associated infrastructure has entered the soil, and the area surrounding these tanks should be treated as potentially contaminated.

Based on a review of the total body of data acquired in the Phase 2 RFI along with the data obtained from the other RFI phases (approximately 180 logging and sampling holes over 6 hectares [16 acres]), there does not appear to be any data gap that requires additional information to enable a corrective measure decision to be made, with the exception of additional information from the C-301 Catch Tank (as identified above).

8.3 CONCLUSION

Operations in WMA C have led to soil contamination. The nature and extent of shallow contamination (less than 5 m [15 ft]) requires that action be taken to prevent direct contact with the near surface soil throughout WMA C. The nature and extent of deep contamination has already impacted the groundwater, and is likely to continue having a groundwater impact in the future. Given the highly dispersed nature of the contamination in the soil, there does not appear to be any specific area where soil remediation will mitigate or reduce the need for future groundwater monitoring and action.

This page intentionally left blank.

9. NATURE AND EXTENT OF CONTAMINATION

11-NWP-053, 2011, *Re: Organic Analyses Optimization for Waste Management Area (WMA) C,* Department of Ecology, Richland, Washington.

11-TPD-020, 2011, *Organic Analyses Optimization for Waste Management Area (WMA) C,* Department of Energy, Office of River Protection, Richland, Washington.

40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," Subpart F "Ground-Water Monitoring," §265.93, "Preparation, evaluation, and response," *Code of Federal Regulations*, as amended.

40 CFR 300, 1990, "National Oil and Hazardous Substances Pollution Contingency Plan", *Code of Federal Regulations*, as amended.

63 FR 3629, 1998, "Record of Decision for the Department of Energy's Waste Management Program: Treatment and Storage of Transuranic Waste," *Federal Register*, Vol. 63, pp. 3629-3633, January 23.

65 FR 10061, 2000, "Record of Decision for the Department of Energy's Waste Management Program: Treatment and Disposal of Low-Level Waste and Mixed Low-Level Waste; Amendment of the Record of Decision for the Nevada Test Site," *Federal Register*, Vol. 65, pp. 10061-10066, February 25.

65 FR 37253, "Establishment of the Hanford Reach National Monument," *Federal Register*, Vol. 65, pp. 37253-37256, June 13.

65633-128, 1984, *Status of the BWIP Water Balance Study* (internal letter from K. L. Dillon to P. M. Rogers), Rockwell International, Richland, Washington, September 19.

71 FR 74929, 2006, "Notice of Availability of the Draft Comprehensive Conservation Plan and Environmental Impact Statement for the Hanford Reach National Monument and Notification of Public Meetings," *Federal Register*, Vol. 71, pp. 74929-74931, December 13.

73 FR 55824, 2008, "Amended Record of Decision for the Hanford Comprehensive Land-Use Plan Environmental Impact Statement," *Federal Register*, Vol. 73, pp. 55824-55826, September 26.

78 FR 75913, 2013, "Record of Decision: Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington," *Federal Register*, Vol. 78, pp. 75913-75919, December 13.

7G400-03-SMM-003, 2003, "Shipments of Cesium-137 and Strontium-90 from the Hanford Site (1961 through 1977)," (Interoffice Memo from Process Analysis to B.A. Higley), CH2M HILL Hanford Group, Inc., Richland, Washington, April 22.

89018-32 R1, 1989, *Single-Shell Tank Leak Volumes,* R.J. Baumhardt, Westinghouse Hanford Company, Richland, Washington.

AC-07-A-51, 2009, *2007 Census of Agricultural, United States Summary and State Data, Volume 1, Geographic Area Series, Part 51*, National Agricultural Statistics Service, U.S. Department of Agriculture, Washington, D.C.

ANL 2009, *RESRAD for Windows*, Version 6.5, Computer Code, Argonne National Laboratory, Environmental Assessment Division, October 30.

ARH-1945, 1971, *B Plant Ion Exchange Feed Line Leak,* Atlantic Richfield Hanford Company, Richland, Washington.

ARH-2794-D, 1974, *Manufacturing and Waste Management Division Waste Status Summary October 1, 1973 through December 31, 1973*, Atlantic Richfield Hanford Company, Richland, Washington.

ARH-LD-132, 1976, *Geology of the 241-C Tank Farm*, Atlantic Richfield Hanford Company, Richland, Washington.

Atomic Energy Act of 1954, 42 USC 2011, et seq., as amended.

Bernard, D. and Sobczyk, S., 2010, *Assessment of WMA C Tank Farm Leaks*, ERWM Program, Nez Perce Tribe, Lapwai, Idaho.

BHI-00184, 1995, *Miocene- to Pliocene-Aged Suprabasalt Sediments of the Hanford Site, South-Central Washington*, Rev. 00, Bechtel Hanford, Inc., Richland, Washington.

BHI-01103, 1999, *Clastic Injection Dikes of the Pasco Basin and Vicinity – Geologic Atlas Series*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BPF-73550, 1944, *Specifications for Construction of Composite Storage Tanks Bldg. No. 241 Hanford Engineer Works Project 9536*, Rev. 2, Richland, Washington.

Brown, C.F. and Serne, R.J., *Deep Vadose Zone Characterization at the Hanford Site: Accomplishments from the Last Ten Years*, February 24, 2008, Pacific Northwest Laboratory, Richland, Washington.

CHPRC-00256, 2012, *GoldSim Pro Requirements Traceability Matrix Version 10.50 SP1*, Rev. 2, CH2M HILL Plateau Remediation Company, Richland, Washington.

CHPRC-00269, 2011, *STOMP Requirements Traceability Matrix*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington.

CHPRC-00784, 2014, *Tier 1 Risk-Based Soil Concentrations Protective of Ecological Receptors at the Hanford Site*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601 et seq., as amended.

CP-47631, 2013, *Model Package Report: Central Plateau Groundwater Model Version 3.4*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington.

Dagan, G., 1984, "Solute transport in heterogeneous porous formations," *Journal of Fluid Mechanics*, Vol. 145, pp. 151–177.

DOE G 435.1-1, 1999, *Implementation Guide for Use with DOE M 435.1-1, Radioactive Waste Management Manual*, U.S. Department of Energy, Washington, D.C.

DOE G 435.1-2, DRAFT, *Implementation Guide for use with DOE M 435.1-1, Format and Content Guide for U.S. Department of Energy Low-Level Waste Disposal Facility Performance Assessments and Composite Analyses*, U.S. Department of Energy,

DOE M 435.1-1, 2007, *Radioactive Waste Management Manual*, U.S. Department of Energy, Washington, D.C.

DOE O 435.1, 2001, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C.

DOE P 454.1, 2011, *Use of Institutional Controls*, U.S. Department of Energy, Washington, D.C.

DOE, 2012, "Modeling to Support Regulatory Decision-making at Hanford" (memorandum from A. C. Williams to M. S. McCormick, Richland Operations Office and S. L. Samuelson, Office Of River Protection, October 9), U.S. Department of Energy, Washington, D.C.

DOE/CX-00013, 2010, *Categorical Exclusion for Small Mammal Sampling Near Waste Management Area C, 200 East Area, Hanford Site, Richland, Washington*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/CX-00025, 2011, *Categorical Exclusion for the Tank Farm Interim Surface Barriers, 200 Areas, Hanford Site, Richland, Washington*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/EIS-0189, 1996, *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement*, U.S. Department of Energy, Washington D.C., and Washington State Department of Ecology, Olympia, Washington.

DOE/EIS-0222-F, 1999, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/EIS-0391, 2012, *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*, U.S. Department of Energy, Washington, D.C.

DOE/ORP-2005-01, 2006, *Initial Single-Shell Tank System Performance Assessment for the Hanford Site*, Rev. 0, U.S. Department of Energy Office of River Protection, Richland, Washington.

DOE/ORP-2008-01, 2010, *RCRA Facility Investigation Report for Hanford Single-Shell Tank Waste Management Areas*, Rev. 1, U.S. Department of Energy, Office of River Protection, Richland, Washington.

DOE/RL-88-30, 2014, *Hanford Site Waste Management Units Report*, Rev. 23, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-91-50, 2013, *Hanford Site Environmental Monitoring Plan*, Rev. 6A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-92-04, 1993, *PUREX Source Aggregate Area Management Study Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-92-24, 1992, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analyte,* Volume 1, Rev. 4, U.S. Department of Energy, Richland, Washington.

DOE/RL-93-33, 1996, *Focused Feasibility Study of Engineered Barriers for Waste Management Units in the 200 Areas*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-96-12, 1996, *Hanford Site Background: Part 2, Soil Background for Radionuclides*, Rev. 0, U.S. Department of Energy, Richland, Washington.

DOE/RL-96-16, 1998, *Screening Assessment and Requirements for a Comprehensive Assessment: Columbia River Comprehensive Impact Assessment*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-97-02, 1997, *National Register of Historic Places Multiple Property Documentation Form - Historic, Archaeological and Traditional Cultural Properties of the Hanford Site, Washington*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-99-36, 2000, *Phase 1 RCRA Facility Investigation/Corrective Measures Study Work Plan for Single-Shell Tank Waste Management*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2002-39, 2002, *Standardized Stratigraphic Nomenclature for the Post-Ringold-Formation Sediments within the Central Pasco Basin*, Rev. 0, U.S. Department of Energy, Richland, Washington.

DOE/RL-2002-59, 2004, *Hanford Site Groundwater Strategy Protection, Monitoring, and Remediation*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2008-46, 2010, *Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2009-10, 2013, *Hanford Site Cleanup Completion Framework,* Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2009-127, 2009, *Remedial Investigation/Feasibility Study for the 200-BP-5 Groundwater Operable Unit,* Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2009-77, 2010, *Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area C*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2009-81, 2009, *Central Plateau Cleanup Completion Strategy*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2011-118, 2012, *Hanford Site Groundwater Monitoring for 2011*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2011-50, 2012, *Regulatory Basis and Implementation of a Graded Approach to Evaluation of Groundwater Protection*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2013-18, 2013, *Hanford Site Environmental Report for Calendar Year 2012*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2013-22, 2013, *Hanford Site Groundwater Monitoring Report for 2012*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington .

DOE/RL-2014-32, 2014, *Hanford Site Groundwater Monitoring Report for 2013,* Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RW-0006,1997, *Integrated Data Base Report—1996: U.S. Spent Nuclear Fuel and Radioactive Waste Inventories, Projections, and Characteristics*, Rev. 13, U.S. Department of Energy, Office of Environmental Management, Washington, D.C.

DOE-STD-1153-2002, 2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*, U.S. Department of Energy, Washington, D.C.

DOE-STD-1196-2011, 2011, *DOE Standard Derived Concentration Technical Standard*, U.S. Department of Energy, Washington, D.C.

Driscoll, F.G., 1986, *Groundwater and Wells*, Second Edition, Johnson Division, St. Paul, Minnesota.

ECF-HANFORD-10-0442, 2011, *Calculation of Nonradiological Soil Concentrations Protective of Groundwater Using the Fixed Parameter 3-Phase Equilibrium Partitioning Equation for the 100 Areas and 300 Area,* CH2M HILL Plateau Remediation Company, Richland, Washington

ECF-HANFORD-11-0038, 2012, *Soil Background Data for Interim Use at the Hanford Site,* CH2M HILL Plateau Remediation Company, Richland, Washington.

Ecology 94-06, 1994, *Model Toxics Control Act Regulation and Statue,* Washington State Department of Ecology, Olympia, Washington.

Ecology 94-115, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Washington State Department of Ecology, Olympia, Washington.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order – Tri-Party Agreement*, 2 vols., as amended, State of Washington Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

Endangered Species Act of 1973, 16 U.S.C. 1531-1544, 87 Stat. 884, as amended.

EPA 540-R-01-003, 2002, *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites,* OSWER 9285.7-41, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C.

EPA 910/R-97/005, 1997, *EPA Region 10 Supplemental Ecological Risk Assessment Guidance for Superfund,* U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C.

EPA 540-R-97-006, 1997, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments: Interim Final,* OSWER 9285.7-25, U.S. Environmental Protection Agency, Washington, D.C.

EPA/530-SW-87-017, 1987, *Alternate Concentration Limit Guidance*, OSWER Directive 9481.00-6C, Office of Solid Waste, Waste Management Division, U.S. Environmental Protection Agency, Washington, D.C.

EPA/540/F-95/041, 1996, *Soil Screening Guidance: Fact Sheet*, Publication 9355.4-14FSA, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

EPA/540/R-92/003, 1991, *Guidance for Data Usability in Risk Assessment (Part A) Final*, U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C.

EPA/600/2-91/065, 1991, *The RETC Code for Quantifying the Hydraulic Functions of Unsaturated Soils*, U.S. Environmental Protection Agency, Washington, D.C.

EPA/600/R-93/187, 1993, *Wildlife Exposure Factors Handbook,* U.S. Environmental Protection Agency, Washington, D.C.

EPA/630/P-03/001F, 2005, *Risk Assessment for Carcinogens,* U.S. Environmental Protection Agency, Washington, D.C.

EPA/630/R-95/002F, 1998, *Guidelines for Ecological Risk Assessment,* U.S. Environmental Protection Agency, Washington, D.C.

EPA-402-R-93-081, 1993, *Federal Guidance Report No. 12, External Exposure to Radionuclides in Air, Water, and Soil*, Office of Radiation and Indoor Air, U.S. Environmental Protection Agency, Washington, D.C.

EPA-SAB-RAC-ADV-99-006, 1999, *An SAB Advisory: Modeling of Radionuclide Releases from Disposal of Low Activity Mixed Waste*, U.S. Environmental Protection Agency, Science Advisory Board, Washington, D.C.

ERDA-1538, 1975, *Final Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington*, U.S. Energy Research and Development Administration, Washington D.C.

ERWM, 2009, *Re: Waste Management Area (WMA) C Closure and Hanford Waste Management Area C Soil Contamination Inventory Estimates, RPP-RPT-42294, Rev. 0* (letter from G. Bohee to S.J. Olinger, Office of River Protection, December 17, 2009), Nez Perce Environmental Restoration and Waste Management Program, Nez Perce Tribe, Lapwai, Idaho.

ES/ER/TM-86/R3, 1996, *Toxicological Benchmarks for Wildlife: 1996 Revision,* U.S. Department of Energy, Office of Environmental Management, Oak Ridge, Tennessee.

Fayer, M. J., and G. W. Gee, 2006, "Multiple-Year Water Balance of Soil Covers in a Semiarid Setting," *Journal of Environmental Quality*, Vol. 35, No. 2, pp. 366–377.

Fayer, M. J., G. W. Gee, M. L. Rockhold, M. D. Freshley, and T. B. Walters, 1996, "Estimating Recharge Rates for a Groundwater Model Using a GIS," *Journal of Environmental Quality*, Vol. 25, pp. 510–518.

Federal Water Pollution Control Act, 1972, 33 U.S.C. 1251 et seq., as amended.

FS-NW-LT-5367, 2010, *Submittal of C Farm Geology/Geophysics [sic] Review, Task 26*, Energy*Solutions*, Richland, Washington.

Gee, G. W., M. J. Fayer, M. L. Rockhold, and M. D. Campbell, 1992, "Variations in Recharge at the Hanford Site," *Northwest Science*, Vol. 66, No. 4, pp. 237–250.

Gelhar, L. W. and C. L. Axness, 1983, "Three-dimensional stochastic analysis of macrodispersion in a stratified aquifer," *Water Resources Research*, Vol. 19, pp. 161–180.

GJ-HAN-82, 1997, *Vadose Zone Characterization Project at the Hanford Tank Farms: Tank Summary data Report for Tank C-103,* U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado.

GJ-HAN-83, 1997, *Vadose Zone Characterization Project at the Hanford Tank Farms: Tank Summary data Report for Tank C-105,* U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado.

GJ-HAN-84, 1997, *Vadose Zone Characterization Project at the Hanford Tank Farms: Tank Summary data Report for Tank C-106,* U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado.

GJ-HAN-85, 1997, *Vadose Zone Characterization Project at the Hanford Tank Farms: Tank Summary data Report for Tank C-101,* U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado.

GJ-HAN-86, 1997, *Vadose Zone Characterization Project at the Hanford Tank Farms: Tank Summary data Report for Tank C-102,* U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado.

GJ-HAN-87, 1997, *Vadose Zone Characterization Project at the Hanford Tank Farms: Tank Summary data Report for Tank C-104,* U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado.

GJ-HAN-88, 1997, *Vadose Zone Characterization Project at the Hanford Tank Farms: Tank Summary data Report for Tank C-107,* U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado.

GJ-HAN-90, 1997, *Vadose Zone Characterization Project at the Hanford Tank Farms: Tank Summary data Report for Tank C-108,* U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado.

GJ-HAN-91, 1997, *Vadose Zone Characterization Project at the Hanford Tank Farms: Tank Summary data Report for Tank C-109,* U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado.

GJ-HAN-92, 1997, *Vadose Zone Characterization Project at the Hanford Tank Farms: Tank Summary data Report for Tank C-110,* U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado.

GJO-98-39-TAR/GJO-HAN-18, 1998, *Hanford Tank Farms Vadose Zone: C Tank Farm Report*, U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado.

GJO-98-39-TARA/GJO-HAN-18, 2000, *Vadose Zone Characterization Project at the Hanford Tank Farms, Addendum to the C Tank Farm Report,* U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado.

GoldSim Technology Group, 2009a, *User's Guide GoldSim Contaminant Transport Module*, GoldSim Technology Group, Issaquah, Washington.

GoldSim Technology Group, 2009b, *User's Guide GoldSim Distributed Processing Module*, GoldSim Technology Group, Issaquah, Washington.

GoldSim Technology Group, 2009c, *User's Guide GoldSim Probabilistic Simulation Environment*, GoldSim Technology Group, Issaquah, Washington.

H.R. 1157, 2013, *Rattlesnake Mountain Public Access Act,* House Bill 1157 – 113th Congress, June 11.

H-2-2909, 1955, *Piping Arrangement & Details First Cycle Waste Scavenging 241-C Tank Farm*, Rev. 6, U.S. Atomic Energy Commission, Richland, Washington.

H-2-4573, 1962, *Engineering Flow Diagram*, Rev. 2, Bovay Engineers, Richland, Washington.

H-2-4581, 1963, *Valve Pit Liner Arrangement*, Sheet 1, Rev. 2, Bovay Engineers, Richland, Washington.

H-2-73876, 1983, *Piping Plan 241-C Tank Farm*, Rev. 3, Vitro Engineering Corporation, Richland, Washington.

H-2-830460, 2010, *As-Built Drawings and Construction Report for the Holding Tanks at 241-C Tank Farm,* Engineering Change Notice 10-000467, ARES Corporation, Richland, Washington.

H-2-834062, 2011, *Site Map Raw Water System 200 East Enlarged Plan*, Sheet 10, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Harris, S.H, 2008, *Application of the CTUIR Traditional Lifeways Exposure Scenario in Hanford Risk Assessments*, Confederated Tribes of the Umatilla Indian Reservation, Pendleton, Oregon.

Harris, S.H., and Harper, B.L., 2004, *Exposure Scenario for Confederated Tribes of the Umatilla Indian Reservation (CTUIR) Traditional Subsistence Lifeways,* September 15, 2004, Confederated Tribes of the Umatilla Indian Reservation, Department of Science and Engineering, Pendleton, Oregon.

HGLP-LDR-174, 2008, *299-E27-07 (A4816) Log Data Report*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

HNF-2603, 1998, *A Summary and Evaluation of Hanford Site Tank Farm Subsurface Contamination*, Rev. 0, CH2M Hill Hanford Group, Inc., Richland, Washington.

HNF-5507, 2000, *Subsurface Conditions Description of the B-BX-BY Waste Management Area*, Rev. 0A, CH2M Hill Hanford Group, Inc., Richland, Washington.

HNF-EP-0182, 2007, *Waste Tank Summary Report for Month August 31, 2006*, Rev. 221, CH2M Hill Hanford Group, Inc., Richland, Washington.

HNF-EP-0182, 2013, *Waste Tank Summary Report for Month Ending February 28, 2013*, Rev. 319, Washington River Protection Solutions, LLC, Richland, Washington.

HNF-EP-0182, 2014*, Waste Tank Summary Report for Month Ending August 31, 2014*, Rev. 320,Washington River Protection Solutions, Richland, Washington.

HNF-EP-0182, 2014, *Waste Tank Summary Report for Month Ending June 30, 2014*, Rev. 318, Washington River Protection Solutions, LLC, Richland, Washington.

HNF-SD-RE-TI-178, 2007, *Single-Shell Tank Interim Stabilization Record*, Rev. 9a, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-SD-WM-TI-740, 1999, *Standard Inventories of Chemicals and Radionuclides in Hanford Tank Wastes*, Rev.0C, Lockheed Martin Hanford Corporation, Richland, Washington.

HW-60807, 1999, *Standard Inventories of Chemicals and Radionuclides in Hanford Tank Wastes*, Rev.0C, Lockheed Martin Hanford Corporation, Richland, Washington.

HW-61780, 1959, *Subsurface Geology of the Hanford Separation Areas*, General Electric Company, Richland, Washington.

HW-67459, 1960, *Chemical Processing Department Monthly Report for November, 1960*, Hanford Atomic Products Operation, Richland, Washington.

INDC-356-VOL3, 1945, *Construction Hanford Engineer Works, U.S. Contract Number W-7412-ENG-1 Du Pont Project 9536 History of the Project Volume III,* E.I. du Pont de NeMours & Company, Inc., Wilmington, Delaware.

LA-UR-93-3605, 1993, *Analysis of the 241-C Farm,* October 1993, S.F. Agnew, Los Alamos National Laboratory, Los Alamos, New Mexico.

Millington, R. J. and J. P. Quirk, 1961, "Permeability of Porous Solids," *Transactions of the Faraday Society*, Vol. 57, pp. 1200–1207.

Mualem, Y., 1976, "A New Model for Predicting the Hydraulic Conductivity of Unsaturated Porous Media," *Water Resources Research*, Vol. 12, No. 3, pp. 513–522.

Murphy, E. M., T. R. Ginn, and J. L. Phillips, 1996, "Geochemical Estimates of Paleorecharge in the Pasco Basin: Evaluation of the Chloride Mass Balance Technique," *Water Resources Research*, Vol. 32, No. 9, pp. 2853–2868.

NAGRA NTB 02-20, 2002, *Cementitious Near-Field Sorption Data Base for Performance Assessment of an ILW Repository in Opalinus Clay*, Paul Scherrer Institut, Villigen PSI, Hardstrasse 73, CH-5430 Wettingen/Switzerland.

National Environmental Policy Act of 1969, 42 USC 4321-4347, et seq.

Newcomb, R. C., J. R. Strand, and F. J. Frank, 1972, *Geology and Ground-Water Characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington*, Professional Paper 717, U.S. Geological Survey, Washington, D.C.

NIRAS-MP5-03 DATA LT(NF), 2009, *Review of Sorption Values for the Cementitious Near Field of a Near Surface Radioactive Waste Disposal Facility. Project Near Surface Disposal of Category A Waste at Dessel*, ONDRAF/NIRAS, Brussels, Belgium.

NOAA Manual NOS NGS 5, 1989, *State Plane Coordinate System of 1983*, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Charting and Geodetic Services, Rockville, Maryland.

NUREG-1573, 2000, *A Performance Assessment Methodology for Low-Level Radioactive Waste Disposal Facilities: Recommendations of NRC's Performance Assessment Working Group*, U.S. Nuclear Regulatory Commission, Washington, D.C.

NUREG-1854, 2007, *NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations – Draft Final Report for Interim Use*, U.S. Nuclear Regulatory Commission, Office of Federal and State Materials and Environmental Management Programs, Washington, D.C.

Occurrence Report 79-73, 1979, *Release of Raw Water in 241C Tank Farm*, Rockwell Hanford Operations, Richland, Washington.

Open File Report 4-514, 1995, *Using Chloride and Chlorine-36 as Soil-Water Tracers to Estimate Deep Percolation at Selected Locations on the US Department of Energy Hanford Site, Washington*, U.S. Geological Survey, Tacoma, Washington.

Open File Report 96-8, 1996, *The Miocene to Pliocene Ringgold Formation and Associated Deposits of the Ancestral Columbia River System, South-Central Washington and North-Central Oregon*, Washington State Department of Natural Resources, Olympia, Washington.

ORP-11242, 2011, *River Protection Project System Plan*, Rev. 6, U.S. Department of Energy, Office of River Protection, Richland, Washington.

OSWER 9285.6-10, 2002, *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites,* U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C.

OSWER Directive 9285.7-55, 2003, *Guidance for Developing Ecological Soil Screening Levels*, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

OSWER Directive 9285.7-53, 2003, *Human Health Toxicity Values in Superfund Risk Assessments,* U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

PNL-10285, 1995, *Estimated Recharge Rates at the Hanford Site*, Pacific Northwest National Laboratory, Richland, Washington.

PNL-5428, 1985, *Unsaturated Water Flow at the Hanford Site: A Review of Literature and Annotated Bibliography*, Pacific Northwest Laboratory, Richland, Washington.

PNL-5506, 1986, *Hanford Site Water Table Changes 1950 through 1980 – Data Observations and Evaluation*, Pacific Northwest Laboratory, Richland, Washington.

PNL-6716, 1988, *Interim Characterization Report for the 300 Area Process Trenches*, Pacific Northwest Laboratory, Richland, Washington.

PNL-8935, 1993, *Plant Reestablishment After Soil Disturbance: Effects of Soil, Treatment and Time*, Pacific Northwest Laboratory, Richland, Washington.

PNNL-11216, 1997, *STOMP Subsurface Transport Over Multiple Phases Application Guide*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-11367, 1996, *Hanford Prototype-Barrier Status Report: FY 1996*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-11809, 1998, *Results of Phase I Groundwater Quality Assessment for Single-Shell Tank Waste Management Areas 241-T, 241-TX, 241-TY at Hanford Site,* Pacific Northwest National Laboratory, Richland, Washington.

PNNL-11810, 1998, *Results of Phase I Groundwater Quality Assessment for Single-Shell Tank Waste Management Areas S-SX- at the Hanford Site*, F.N. Hodges, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-11826, 1998, *Results of Phase I Groundwater Quality Assessment for Single-Shell Tank Waste Management Areas B-BX-BY at the Hanford Site*, S. M. Narbutovskih, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-12030, 2000, *STOMP Subsurface Transport Over Multiple Phases Version 2.0 Theory Guide*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13024, as revised, *RCRA Groundwater Monitoring Plan for Single-Shell Tank Waste Management Area C at the Hanford Site*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13033, 1999, *Recharge Data Package for the Immobilized Low-Activity Waste 2001 Performance Assessment*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13645, 2001, *300 Area Process Trenches Groundwater Monitoring Plan*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13895, 2003, *Hanford Contaminant Distribution Coefficient Database and Users Guide*, Rev. 1, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14548, 2004, *Hanford Site Groundwater Monitoring for Fiscal Year 2003*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14656, 2004, *Borehole Data Package for Four CY 2003 RCRA Wells 299-E27-4, 299-E27-21, 299-E27-22, and 299-E27-23 at Single-Shell Tank, Waste Management Area C, Hanford Site, Washington*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14744, 2004, *Recharge Data Package for the 2005 Integrated Disposal Facility Performance Assessment*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14960, 2005, *200-BP-1 Prototype Hanford Barrier Annual Monitoring Report for Fiscal Year 2004*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-15160, 2005, *Hanford Site Climatological Summary 2004 with Historical Data,* Pacific Northwest National Laboratory, Richland, Washington.

PNNL-15503, 2008, *Characterization of Vadose Zone Sediments Below the C Tank Farm: Borehole C4297 and RCRA Borehole 299-E27-22*, Rev. 1, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-15617, 2007, *Characterization of Vadose Zone Sediments from C Waste Management Area: Investigation of the C-152 Transfer Line Leak,* Pacific Northwest National Laboratory, Richland, Washington.

PNNL-15837, 2007, *Data Package for Past and Current Groundwater Flow and Contamination Beneath Single-Shell Tank Waste Management Areas*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-15955, 2007, *Geology Data Package for the Single-Shell Tank Waste Management Areas at the Hanford Site*, Rev. 1, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-16663, 2007, *Geochemical Processes Data Package for the Vadose Zone in the Single-Shell Tank Waste Management Areas at the Hanford Site*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-16688, 2007, *Recharge Data Package for Hanford Single-Shell Tank Waste Management Areas*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-17154, 2008, *Geochemical Characterization Data Package for the Vadose Zone in the Single-Shell Tank Waste Management Areas at the Hanford Site*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-17176, 2007, *200-BP-1 Prototype Hanford Barrier Annual Monitoring Report for Fiscal Years 2005 Through 2007*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-18819, 2010, *Hanford Site Guidelines for Preparation and Presentation of Geologic Information*, Rev. 1, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-6415, 2005, *Hanford Site National Environmental Policy Act (NEPA) Characterization*, Rev. 17, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-6415, 2007, *Hanford Site National Environmental Policy Act (NEPA) Characterization*, Rev. 18, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-SA-60937, 2008, *Geochemical Study of Grab Samples Collected from UPR-200-E-86 Investigative Site*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-SA-61511, 2008, *Geochemical Characterization of Sediments from UPR 200-E-81,* Pacific Northwest National Laboratory, Richland, Washington.

Polmann, D. J., 1990, *Application of Stochastic Methods to Transient Flow and Transport in Heterogeneous Unsaturated Soils*, Ph.D. Thesis, Massachusetts Institute of Technology, Cambridge, Massachusetts.

PSI Bericht Nr. 95-06, 1995, *Sorption Databases for the Cementitious Near-Field of a L/ILW Repository for Performance Assessment*, Paul Scherrer Institute, Wurlingen and Villigen, Switzerland.

RCW 43.21C, "Washington State Environmental Policy," *Revised Code of Washington,* as amended.

RCW 70.105, "Hazardous Waste Management," *Revised Code of Washington*, as amended.

RCW 70.105D, "Hazardous Waste Cleanup — Model Toxics Control Act," *Revised Code of Washington*, as amended.

Resource Conservation and Recovery Act of 1976, 42 U.S. Code, § 6901 et seq.

RHO-BWI-ST-4, 1979, *Compilation Geologic Map of the Pasco Basin, South-Central Washington*, Rockwell Hanford Operations, Richland, Washington.

RHO-CD-673, 1979, *Handbook 200 Areas Waste Sites*, Rockwell Hanford Operations, Richland, Washington.

Ridolfi, Inc., 2007, "Yakama Nation Exposure Scenario for Hanford Site Risk Assessment," *Appendix W.1.1, American Indian Tribal Perspectives and Scenarios*, September 7, 2007, Confederated Tribes and Bands of the Yakama Nation, Toppenish, Washington.

RL-SEP-332, 1965, *Chemical Processing Department Monthly Report for February, 1965*, General Electric Company, Richland, Washington.

RL-WHC-TANK FARM-1993-0047, 1993, *Leakage from a Raw Water Line Used for Maintenance Results in an Approximate 250 Gallon Water Release to 241-C Tank Farm*, Westinghouse Hanford Company, Richland, Washington.

RPP-10098, 2003, *Field Investigation Report for Waste Management Area B-BX-BY,* Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-13707, 2003, *Process Control Plan for 241-C-106 Closure,* Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-14430, 2003, *Subsurface Conditions Description of the C and A-AX Waste Management Area*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-15043, 2003, *Single-Shell Tank System Description*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-16608, 2003, *Review Comments on RPP-16608 Rev 000 Site Specific Single-Shell Tank Phase 1 RCRA Facility Investigation Corrective Measures Study Work Plan Addendum for Waste Management Areas C, A-AX, and U (0061364),* CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-16608, 2004, *Review Comments on RPP-16608 Rev 000 Site Specific Single-Shell Tank Phase 1 RCRA Facility Investigation Corrective Measures Study Work Plan Addendum for Waste Management Areas C, A-AX, and U,* Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-16945, 2006, *Process Control Plan for the 241-C-200 Series Waste Retrieval System*, Rev. 8, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-18290, 2004, *241-C Tank Farm Geologic and Stratigraphic Analysis*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-20577, 2007, *Stage II Retrieval Data Report for Single-Shell Tank 241-C-106*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-21895, 2012, *241-C-103 and 241-C-109 Tanks Waste Retrieval Work Plan*, Rev. 5, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-22393, 2013, *241-C-102, 241-C-104, 241-C-107, 241-C-108 and 241-C-112 Tanks Waste Retrieval Work Plan*, Rev. 7, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-22520, 2014, *241-C-101 and 241-C-105 Tanks Waste Retrieval Work Plan*, Rev. 8, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-23403, 2013, *Single-Shell Tank Component Data Quality Objectives,* Rev. 5, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-23405, 2008, *Tank Farm Vadose Zone Contamination Volume Estimates*, Rev. 3, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-23748, 2006, *Geology, Hydrogeology, Geochemistry, and Mineralogy Data Package for the Single-Shell Tank Waste Management Areas at the Hanford Site,* CH2M Hill Hanford Group, Inc., Richland, Washington.

RPP-23752, 2005, *Field Investigation Report for Waste Management Areas T and TX-TY*, Rev. 0-A, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-25113, 2006, *Residual Waste Inventories in the Plugged and Abandoned Pipelines at the Hanford Site*, Rev. 0-A, Meier Enterprises, Inc., Richland, Washington.

RPP-26744, 2005, *Hanford Soil Inventory Model,* Rev. 1, CH2M Hill Hanford Group, Inc., Richland, Washington.

RPP-32681, 2007, *Process to Assess Tank Farm Leans in Support of Retrieval and Closure Planning,* Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-33116, 2013*, 241-C-110 Tanks Waste Retrieval Work Plan*, Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-34643, 2007, *Small Diameter Slant-Hole Logging at the 241-C-152 Diversion Box,* Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-34644, 2007, *Small Diameter Geophysical Logging at the 241-C-152 Diversion Box,* Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-35169, 2007, *Near Term Data Quality Objectives for Vadose Zone Characterization Waste Management Area C,* Rev. 0, CH2M HILL Hanford Group, Richland, Washington.

RPP-35484, 2007, *Field Investigation Report for Waste Management Areas C and A-A,* Rev. 0, CH2M HILL Hanford Group, Richland, Washington.

RPP-35484, 2008, *Field Investigation Report for Waste Management Areas C and A-A,* Rev. 1, CH2M HILL Hanford Group, Richland, Washington.

RPP-37625, 2008, *Completion Report for UPR-200-E-86 Direct Push Drilling and Sampling,* Rev. 0, CH2M HILL Hanford Group, Richland, Washington.

RPP-37739, 2013, *241-C-111 Tank Waste Retrieval Work Plan*, Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-38406, 2008, *Small Diameter Geophysical Logging for UPR-200-E-81,* Rev. 0, CH2M HILL Hanford Group, Richland, Washington.

RPP-38927, 2011, *Completion Report for the 241-CR-151 Vault (UPR-200-E-81) Direct Push Characterization and Sampling,* Rev. 0, CH2M HILL Hanford Group, Richland, Washington.

RPP-42221, 2009, *Completion Report for the 241-CR-151 Diversion Box Direct Push Phase 2 Characterization,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-48609, 2011, *Completion Report for Small Diameter Geophysical Logging for 241-C Tank Farm (Adjacent to UPR-200-E-82),* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-5002, 2001, *Engineering Report Single-Shell Tank Farms Interim Measures to Limit Infiltration Through the Vadose Zone*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-50233, 2011, *Waste Management Area C Closure Conceptual Design Support Document*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-56935, 2014, *Practicability Evaluation Request to Forego a Third Retrieval Technology for Tank 241-C-112*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-57570, 2014, *Retrieval Completion Certification Report for Tank 241-C-101*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-6637, 2002, *Hazard Evaluation for 241-AX-IX, ITS1, 241-SX-401, 241-SX-402, 241-C-801, 241-A-431*, Rev. 1-A, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-7494, 2001, *Historical Vadose Zone Contamination from A, AX, and C Tank Farm Operations*, Rev. 0, Fluor Federal Services, Richland, Washington.

RPP-7884, 2002, *Field Investigation Report for Waste Management Area S-SX Volume 1 Main Text and Appendices A thru C*, CH2M Hill Hanford Group, Inc., Richland, Washington.

RPP-8321, 2001, *Analysis & Summary Report of Historical Dry Well Gamma Logs for the 241-C-Tank Farm - 200 East Area,* Ch2M Hill Hanford Group, Inc., Richland, Washington.

RPP-ASMT-38219, 2008, *Tank 241-C-110 Leak Assessment Report*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-ASMT-39155, 2008, *Tank 241-C-110 Leak Assessment Report*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-ASMT-46452, 2010, *Tank 241-C-105 Leak Assessment Completion Report*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-CALC-54266, 2013, *Post-Hard Heel Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-108*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-CALC-56856, 2014, *Estimated Waste Volume Remaining in Single Shell Tank 241-C-112 After Hard Heel Retrieval*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-ENV-33418, 2011, *Hanford C-Farm Leak Assessments Report,* Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-ENV-33418, 2012, *Hanford C-Farm Leak Assessments Report*, Rev. 2A, Washington River Protection Solutions, LLC, Richland, Washington

RPP-ENV-33418, 2014, *Hanford C-Farm Leak Inventory Assessments Report*, Rev. 3, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-PLAN-35341, 2007, *Work Plan for Near-Surface Vadose Zone Characterization Utilizing the Hydraulic Hammer / Direct Push Technology For 35 Direct Pushes in FY08*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-PLAN-37243, 2009, *Phase 2 RCRA Facility Investigation/Corrective Measures Study Master Work Plan for Single Shell Tank Waste Management Areas,* Rev. 1, Washington River Protection Solutions LLC, Richland, Washington.

RPP-PLAN-37243, 2010, *Phase 2 RCRA Facility Investigation/Corrective Measures Study Master Work Plan for Single-Shell Tank Waste Management Areas*, Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-PLAN-38777, 2008, *Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-PLAN-39114, 2008, *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-PLAN-39114, 2008, *RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-PLAN-39114, 2010, *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for the Waste Management Area C,* Rev. 1B, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-PLAN-39114, 2012, *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-PLAN-39114, 2012, *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C,* Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-PLAN-47559, 2012, *Single-Shell Tank Waste Management Area C Pipeline Feasibility Evaluation*, Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-24257, 2005, *244-CR Vault Liquid Level Assessment and Video Inspection Completion Report*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-26475, 2006, *Retrieval Data Report for Single-Shell Tank 241-C-203*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-26475, 2007, *Retrieval Data Report for Single-Shell Tank 241-C-203*, Rev. 1-A, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-29095, 2006, *Retrieval Data Report for Single-Shell Tank 241-C-202*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-2919, 2006, *Supplemental Information Hanford Tank Waste Leaks*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-30181, 2006, *Retrieval Data Report for Single-Shell Tank 241-C-201*, Rev. 0-B, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-31558, 2007, *Surface Geophysical Exploration of C Tank Farm at the Hanford Site*, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-33060, 2007, *Retrieval Data Report for Single-Shell Tank 241-C-103*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-34062, 2007, *Retrieval Data Report for Single-Shell Tank 241-C-204*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-38152, 2008, *Data Quality Objectives Report Phase 2 Characterization for Waste Management Area C RCRA Field Investigation/Corrective Measures Study*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-39908, 2009, *Hanford Tank Waste Operations Simulator Model (HTWOS) Version 3.0 Verification and Validation Report*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-41236, 2009, *Surface Geophysical Exploration of UPR 200-E-81 Near the C Tank Farm*, Washington River Protection Solutions, LLC., Richland, Washington.

RPP-RPT-41918, 2010, *Assessment Context for Performance Assessment for Waste in C Tank Farm Facilities after Closure*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-42294, 2010, *Hanford Waste Management Area C Soil Contamination Inventory Estimates*, Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-42323, 2014, *Hanford C-Farm Tank and Ancillary Equipment Residual Waste Inventory Estimates*, Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-42714, 2014, *Completion Report for Single-Shell Tank 241-C-103 Direct Push Soil Investigation,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-43032, 2009, *2009 Auto-TCR for Tank 241-C-105*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-43823, 2010, *Completion Report for Leak Detection Characterization Near Single-Shell Tank 241-C-105,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-44042, 2010, *Recharge and Waste Release within Engineered System in Waste Management Area C*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-45723, 2010, *Catch Tank 241-C-301 Retrieval Feasibility Study*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-46088, Rev. 1, 2010, *Flow and Transport in the Natural System at Waste Management Area C*, Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-46879, 2011, *Corrosion and Structural Degradation within Engineered System in Waste Management Area C*, Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-47461, 2010, *Small Diameter Geophysical Logging for Phase Two, 241-C Tank Farm Characterization, Three Sites,* Rev. 00, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-47479, 2010, *Exposure Scenario for the Waste Management Area C Performance Assessment,* Rev. 1, Washington River Protection Solutions, LLC., Richland, Washington.

RPP-RPT-47486, 2010, *Surface Geophysical Exploration of UPR-200E-86 Near the C Tank Farm*, Rev. 0, Washington River Protection Solutions, LLC., Richland, Washington.

RPP-RPT-48029, 2010, *Small Diameter Geophysical Logging of Four Additional Probeholes for 241-C Tank Farm Characterization Phase 2,* Rev. 0, Washington River Protection Solutions, LLC., Richland, Washington.

RPP-RPT-49288, 2011, *C-Farm Surface Geophysical Exploration – Reprocessing*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-49425, 2011, *Ecological Risk Assessment Approach for Hanford Waste Management Area C*, Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-49956, 2011, *Small Diameter Geophysical Logging for FY2011 C-104 Angle Direct Push, 241 C Farm Characterization,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-50052, 2011, *Surface Geophysical Exploration of UPR-200-E-82 Near the C Tank Farm*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-50581, 2011, *Completion Report for the 241-C Tank Farm, C-101 Angle Direct Push Characterization,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-51384, 2013, *Small Diameter Geophysical Logging in Direct Push Probeholes for Tank 241-C-203 Characterization,* Rev. 1A, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-53367, 2012, *Single-Shell Tank 241-C-104 Hard Heel Retrieval Completion Report*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-54072, 2014, *Retrieval Data Report for Single-Shell Tank 241-C-104*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-55284, 2014, *Retrieval Data Report for Single-Shell Tank 241-C-109*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-55481, 2013, *Geophysical Logging in the 241-C Tank Farm,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-55896, 2013, *Retrieval Data Report for Single-Shell Tank 241-C-108*, Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-56085, 2013, *241-C-104 Tank Waste Retrieval Project Final Report of Drywell Monitoring Data,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-56356, 2014, *Development of Alternative Digital Geologic Models of Waste Management Area C*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-56760, 2014, *Three-Dimensional Surface Geophysical Exploration of the 200-Series Tanks at the 241-C Tank Farm*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-56796, 2014, *Retrieval Data Report for Single-Shell Tank 241-C-109*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-57218, 2014, *Evaluation of Phase 2 Characterization Data at Waste Management Area C,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-58140, 2014, *Retrieval Completion Certification Report for Tank 241-C-112*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-58150, 2014, *Retrieval Completion Certification Report for Tank 241-C-107*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-58297, 2014, *Screening-Level Evaluation of Groundwater Monitoring Data Collected in Vicinity of WMA C,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-58329, 2014, *Baseline Risk Assessment for Waste Management Area C,* Washington River Protection Solutions, LLC, Richland, Washington.

Safe Drinking Water Act of 1974, 42 U.S.C., et seq., as amended.

Sanzenbacher and Haig 2002, *Regional Fidelity and Movement Patterns of Wintering Killdeer in an Agricultural Landscape,* Peter M. Sanzenbacher and Susan M. Hai, Waterbirds 25(1): 16-25.

SGW-54508, 2012, *WMA C September 2012 Quarterly Groundwater Monitoring Report*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington.

SGW-54675, 2012, *WMA C October through December 2012 Quarterly Groundwater Monitoring Report,* Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington.

SGW-55438, 2013, *Hanford Site Groundwater Monitoring for 2012: Supporting Information*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington.

SGW-55572, 2013, *WMA C January through March 2013 Quarterly Groundwater Monitoring Report,* Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington.

SGW-56195, 2013, *WMA C April through June 2013 Quarterly Groundwater Monitoring Report,* Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington.

SGW-56515, 2014, *WMA C July through September 2013 Quarterly Groundwater Monitoring Report*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington.

SKB R-05-75, 2005, *Assessment of uncertainty intervals for sorption coefficients SFR-1 uppföljning av SAFE*, Swedish Nuclear Fuel and Waste Management Company, Stockholm, Sweden.

Soll, J. A., and C. Soper (eds.), 1996, *Biodiversity Inventory and Analysis of the Hanford Site: 1995 Annual Report*, The Nature Conservancy of Washington, Seattle, Washington.

State Environmental Protection Act, RCW 43.21C, Washington State Legislature, Olympia, Washington.

SVF-3009, 2014, *Pu241_Soil_Estimate.xls,* Rev. 00, Washington River Protection Solutions, LLC, Richland, Washington.

TNC, 1998, *Biodiversity Inventory and Analysis of the Hanford Site: 1997 Annual Report*, The Nature Conservancy of Washington, Seattle, Washington.

USDA, 2006, *The Conservation Reserve Program: 33rd Signup, County by County Summary*, U.S. Department of Agriculture Farm Service Agency, Washington, D.C.

USGS 94-514, 1995, Open File Report, *Using Chloride and Chlorine-36 as Soil-Water Tracers to Estimate Deep Percolation at Selected Locations on the US Department of Energy Hanford Site, Washington*, U.S. Geological Survey, Tacoma, Washington.

van Genuchten, M. Th., 1980, "A Closed-form Equation for Predicting the Hydraulic Conductivity of Unsaturated Soils," *Soil Science Society of America Journal*, Vol. 44, pp. 892–989.

W-72903, 1944, *Hanford Engineer Works – Bl'd. #241-TUB 20'-0" Catch Tank Arrangement and Concrete,* Rev. 8, General Electric, Richland, Washington.

WA7890008967, 1988, *Hanford Facility RCRA Permit for Hanford Site for Treatment Storage and Disposal of Dangerous Waste*, Department of Ecology, Olympia, Washington and Environmental Protection Agency, Seattle, Washington.

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

WAC 173-303-400, "Dangerous Waste Regulations," "Interim Status Facility Standards," *Washington Administrative Code*, as amended.

WAC 173-340-747, "Deriving Soil Concentrations for Groundwater Protection," Section 3(a) "Fixed Parameter Three-Phase Partitioning Model," and Section 3(e) "Alternative fate and transport models," *Washington Administrative Code*, as amended.

WAC 197-11, "SEPA Rules," *Washington Administrative Code*, as amended.

WAC-173-303-610*, "*Closure and Post Closure,*" Washington Administrative Code,* as amended.

WAC-173-340-740, "Unrestricted land use soil cleanup standards," *Washington Administrative Codes*, as amended.

WCH-478, 2013, *Exposure and Inadvertent Scenarios for the Environmental Restoration Disposal Facility*, Rev. 1, Washington Closure Hanford, Richland, Washington.

WCH-515, 2013, *Parameter Uncertainty for the ERDF Performance Assessment Uncertainty and Sensitivity Analysis*, Rev. 0, Washington Closure Hanford, Richland, Washington.

WHC-EP-0216, 1989, *Preliminary Operable Units Designation Project*, Environmental Engineering Group, Westinghouse Hanford Company, Richland, Washington.

WHC-EP-0645, 1995, *Performance Assessment for the Disposal of Low-Level Waste in the 200 West Area Burial Grounds*, Westinghouse Hanford Company, Richland, Washington.

WHC-MR-0132, 1990, *A History of the 200 Area Tank Farms*, Westinghouse Hanford Company, Richland, Washington.

WHC-MR-0293, 1992, *Legend and Legacy: Fifty Years of Defense Production at the Hanford Site*, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

WHC-MR-0521, 1996, *The Plutonium Production Story at the Hanford Site: Processes and Facilities History*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC-SA-2680-FP, 1995, *Effect of Moisture-Dependent Anisotropy and Enhanced Recharge Around Underground Storage Tanks*, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-AP-012, 1990, *40 CFR 265 Interim Status Groundwater Monitoring Plan for Single-Shell Tanks*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-AP-012, 1991, *Interim Status Groundwater Monitoring Plan for the Single-Shell Tanks*, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-ES-040, 1994, *Engineering Study of 50 Miscellaneous Inactive Underground Radioactive Waste Tanks*, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-TI-012, 1992, *Geologic Setting of the 200 East Area: An Update*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-TI-185, 1993, *Assessment of Unsaturated Zone Radionuclide Contamination around Single-Shell Tank 241-C-105 and 241-C-106,* Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-ER-TI-003, 1991, *Geology and Hydrology of the Hanford Site: A Standardized Text for Use in Westinghouse Hanford Company Documents and Reports*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-EE-004, 1995, *Performance Assessment of Grouted Double-Shell Tank Waste Disposal at Hanford*, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-ER-349, 1994, *Historical Tank Content Estimate for the Northeast Quadrant of the Hanford 200 East Area*, Westinghouse Hanford Company, Richland, Washington.

WRPS-58405, 2014, *Miscellaneous Laboratory Reports*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

WRPS-56461-VA, 2013, *SGE Comparisons with Other Data Sources*, Washington River Protection Solutions, LLC, Richland, Washington.

WRPS-56991-VA, 2014, *FY13 Electrical Resistivity Results at the C-200s Tanks in C-Farm*, Washington River Protection Solutions, LLC, Richland, Washington.

WSRC-STI-2007-00369, 2007, *Hydraulic and Physical Properties of Tank Grouts and Base Mat Surrogate Concrete for FTF Closure*, Rev. 0, Savannah River National Laboratory, Aiken, South Carolina.

WSRC-TR-2004-00021, 2004, *Stabilizing Grout Compatibility Study*, Rev. 0, Westinghouse Savannah River Company, Aiken, South Carolina.

WSRC-TR-2005-00195, 2005, *Summary of Grout Development and Testing for Single-Shell Tank Closure at Hanford*, Rev. 0, Savannah River National Laboratory, Aiken, South Carolina.

Ye, M., R. Khaleel and T. J. Yeh, 2005, "Stochastic analysis of moisture plume dynamics of a field injection experiment," *Water Resources Research*, Vol. 41, 13 pp.

Yeh, T. J., Ye, M., and Khaleel R., 2005, "Estimation of effective unsaturated hydraulic conductivity tensor using spatial moments of observed moisture plume," *Water Resources Research*, Vol. 41, 12 pp.

APPENDIX A

WASTE MANAGEMENT AREA C CLOSURE MEETING NOTES

This page intentionally left blank.

APPENDIX A
WASTE MANAGEMENT AREA C CLOSURE MEETING NOTES

This appendix contains the meeting notes from three meetings held in fiscal year 2014 to discuss HFFACO milestones related to WMA C closure, SST closure plan content, and RCRA permit modifications. The meeting notes were signed by representatives of DOE and Ecology and are also available in the HFFACO Administrative Record.

Meeting Notes

Discussion of Milestones Related to Waste Management Area C Closure, SST Closure Plan content, and Permit modifications

Meeting Date: October 28, 2013
Location: Ecology Building

Purpose: Discuss HFFACO milestones M-045-61, -62 and -82 to better define the relationships among these milestones and the content of the deliverables.

Attendees: Jeff Lyon (Ecology), Jared Mathey (Ecology), Maria Skorska (Ecology), Jim Alzheimer (Ecology), Brenda Jentzen (Ecology), Mike Barnes (Ecology), Beth Rochette (Ecology), Joni Grindstaff (ORP), Mary Burandt (ORP), Doug Hildebrand (ORP), Jim Lynch (ORP), Tony Miskho (WRPS), Jeff Luke (WRPS), Susan Eberlein (WRPS)

Background:
Hanford Federal Facilities Agreement and Consent Order (HFFACO) milestones M-045-61, M-045-62 and M-045-82 (copied below) have been listed as "to be missed" at the recent monthly project managers meetings. These milestones have been affected by budget constraints and delays in related activities. Today's meeting begins the process of defining what each deliverable under these milestones should comprise, and when these deliverables can be developed, to support progress on closure of Waste Management Area (WMA) C.

M-045-61	Submit to Ecology for review and approval as an Agreement primary document, a Phase 2 RCRA Facility Investigation/Corrective Measures Study Report for WMA C.	12/31/2014
M-045-62	Submit to Ecology for review and approval as an Agreement primary document a Phase 2 Corrective Measures Implementation Work Plan for WMA C.	06/30/2015
M-045-82	Submit complete permit modification requests for Tiers 1, 2, & 3 (see Appendix I) of the SST System, to support final closure requirements for WMA C.	09/30/2015

Appendix I of the HFFACO indicates that the Tier 1 closure plan addresses the Single Shell Tank (SST) system, a Tier 2 addresses each WMA, and a Tier 3 addresses each individual component or group of components (e.g. 100 series tanks, vaults, pipelines).

Topics discussed:

The topics discussed are summarized below. No specific decisions were made. One action was assigned to develop additional information for future discussion.

- Susan Eberlein (WRPS) opened the discussion stating that her current understanding of the requirements associated with closure planning was that:

- Risk Evaluation processes will consider the current and future impacts of the closed system components AND the contamination already in the soil AND the context (i.e. groundwater impacts from other sites)
- Remedial actions for the soil will be selected with an understanding of the closed configuration of the tanks and other components
- The closure configuration for the tanks and other components will be selected with an understanding of the remedial actions for the soil
  [NOTE: iteration may be required to identify a good configuration for both soil and tanks/components]
- Closure actions for the WMA will be selected with an understanding of the other actions being taken for groundwater remediation
- All decisions will consider both radionuclide and non-radionuclide contaminants so that an integrated decision can be made

- Maria Skorska (Ecology) noted that an RFI/CMS traditionally addressed the entire system, but in this case appeared to be one of several integrated parts (closure plans, CMS, groundwater plans)
- Brenda Jentzen (Ecology) recommended that when submitting the closure plans for WMA C, DOE formally request that the groundwater actions be addressed under the BP-5 plans.
  - It may be possible to make that request early, once the performance standards and groundwater contamination are known.
  - The request should include a summary the proposed BP-5 actions to show how they will be protective.
- The above discussions suggested that the Tier 2 (WMA C) closure plan, the CMS for WMA C and the proposed actions for BP-5 were all needed at approximately the same time so that they could be reviewed in an integrated manner.
- It was noted that the Tier 3 (component) closure activity plans for WMA C would likely include:
  - C-100 tanks
  - C-200 tanks
  - CR-vault
  - C-301 catch tank
  - Pipelines/ancillary equipment/diversion boxes
  - Final closure cap

- The group discussed what a Tier 1 (SST System) permit modification request might look like:
  - Jared Mathey (Ecology) indicated that the draft Revision 9 permit had an outline of information that could be in a complete Tier 1 permit modification.
  - There was some discussion about the amount and type of process information that would be appropriate.
  - It was noted that the Tier 1 permit modification request might be very different if it were a modification to a complete permit (e.g., Revision 9 with full operational information such as training, inspections, contingency in place) or a modification for purposes only of supporting WMA C closure (e.g. a modification to Revision 8C, with only the information required for WMA C closure actions)
  - Jeff Lyon (Ecology) noted that the HFFACO milestone did not provide extensive detail about the Tier content, so that it would be good for the group to propose the structure and content most effective in moving closure actions forward.

- The current timing of completing the Revision 9 permit is not clear. Waiting to submit a modification request to Revision 9 could delay the M-045-82 and M-045-61 milestones.
- The Revision 9 permit will address many things outside the scope of WMA C closure, which are not necessarily pre-cursors to closure actions.
- Mary Burandt (ORP) noted that actions taking place under interim status (inspections, training, etc.) would continue, even if a modification focusing strictly on WMA C closure actions were developed.
- Mary Burandt (ORP) asked if the Tier 1 submittal might be considered a compliance schedule for all the other submittals associated with closure.
- Brenda Jentzen (Ecology) expressed concern that EPA is not comfortable with compliance schedules in the permit because in EPA's mind, missing information from a Part B permit application is not appropriate to be used as a basis for a compliance schedule (such as a, inspection schedule or closure plan).
- Tony Miskho (WRPS) indicated knowing the framework of what compliance schedules can be used for in the SST permit chapter is critical to know how to plan the permit modification(s).
- Jared suggested that we consider modifications to Revision 8C that address the WMA C closure related pieces only, and defer the other chapters (including system-wide information not required for WMA C closure) to Revision 9.
- There was some discussion about whether submittal requirements should be in the permit or in the HFFACO milestones. Since HFFACO milestones exist for the WMA C closure elements, some thought they should remain in HFFACO. Other things needed for the Revision 9 permit can be addressed separately.
- Brenda Jentzen paraphrased the preceding discussion into a suggestion that we put whatever is needed for WMA C closure into Permit Revision 8C (in the Tier, 1, 2, 3 permit modification request(s)) and separately deal with the other issues that will need to be resolved for Permit Revision 9.

- The group decided to proceed with the remaining discussion on an assumption that the Tier 1, 2, 3 permit modification requests would be addressed in Revision 8C. Discussion also occurred on splitting up the single permit modification into potentially multiple modifications.
- Brenda Jentzen (Ecology) indicated Ecology had begun development of checklists regarding various regulatory requirements that should be addressed in the permit.
- The group decided to discuss the relevant checklists of regulatory requirements to decide what would need to be included to close WMA C, and where it would be included (Tier 1, Tier 2 or Tier 3).
- It was noted that the first deliverables associated with WMA C closure would be provided some time after the Record of Decision (ROD) for the Tank Closure and Waste Management Environmental Impact Statement (EIS).
- The requirement checklists refer to "Dangerous Waste Management Units" and "Unit Groups". It appeared appropriate that requirements for the Unit Groups would apply to the Tier 1 (SST System) plan, and the Dangerous Waste Management Unit requirements would apply to Tier 2 (WMA C) plan.
- A number of the requirements associated with closure of units and unit groups addressed clean closure. It was recommended that a "Clean Closure Document" be developed. (Note: this is not a regulatory term, but is just used to identify a document for the purposes of these meeting notes.)
  - The Clean Closure Document should be provided prior to the Tier 1, 2, 3 plans.
  - The Clean Closure Document should address the impracticability of clean closure of the SST WMAs.

- The Clean Closure Document should provide a basis for landfill closure for SST WMAs.

- The checklists addressed requirements for both clean closure plans and contingent closure plans [selected requirements from WAC 173-303-610, -640(8), and -665(6)(a)]. When the Clean Closure Document concludes it is impracticable to clean close WMA C, then contingent closure plans for WMA C would be required.
- The Tier 1, 2 and 3 closure plans for M-045-82would be contingent closure plans, addressing closure of WMA C as a landfill. If needed, the CMS for M-045-61 could also be included as part of the contingency closure plans
- Mary Burandt noted that ORP expects to submit a demonstration clean closure is not practicable, and that the document title will be in accordance with the applicable regulations.
- There followed a discussion of the items that could be in each Tier document by discussing the checklists.
- It was noted that the Corrective Measures Implementation Plan (CMIP) may serve a similar function to the Tier 3 component closure plans regarding details of the actions required for the contaminated soil.

- **Clean Closure Plan possible content:**

  - State the clean-up standards for contaminated media, structures, equipment.
  - Describe numeric clean closure levels for the full suite of dangerous constituents generated or managed at the unit.
  - Calculate the clean closure levels using appropriate methods (describe method and include calculations).
  - For units with tank systems, discuss removal or decontamination of all waste residues, contaminated containment system components, soils, structures and equipment OR demonstrate that not all contaminated soil can be removed or decontaminated.

- **Tier 1 Closure Plan possible content:**

  - Describe how final closure of the Unit Group (SST system) will be conducted in accordance with performance standards, including the following items:
    - Minimize the need for further maintenance
    - Minimize post-closure escape dangerous waste/constituents
    - Return land to appearance/use of surrounding land to degree possible
    - Identify the extent of the operation that will remain unclosed
  - Estimate the maximum inventory of dangerous wastes that will be on-site over the active life of the facility.
  - Contain a schedule for closure of each unit (WMA) and for the facility (SST system).
    - It was suggested that this schedule may incorporate or reference HFFACO milestones.
  - Explain if the planned closure schedule will take longer than 90 days for waste removal/treatment and 180 days for closure, and demonstrate why a longer schedule is needed.

- **Tier 2 Closure Plan for WMA C possible content**:

  - Describe how final closure of the Unit (WMA C) will be conducted in accordance with performance standards, including the following items:
    - Minimize the need for further maintenance

        - Minimize post-closure escape dangerous waste/constituents
        - Return land to appearance/use of surrounding land to degree possible
        - Identify the extent of the operation that will remain unclosed
    - Provide detailed description of other activities necessary during closure period to satisfy performance standards, including groundwater monitoring (reference BP-5 plans), run-on and run-off control if applicable
    - Describe how the landfill will be covered with a final cover.
    - Possibly include detailed plans and an engineering report describing the final landfill cover (alternately these items may be in a Tier 3 Component plan)
    - If the closure plan contains alternative requirements:
        - Include the alternative requirements or a reference to them
        - Identify any adjacent units that may have contributed to releases
        - Address how the alternative requirements will be protective of human health and the environment
    - If dangerous waste will be generated during closure, address how it will be handled
    - Provide appropriate language regarding notice to local land authority and notice to deed in property
    - Provide appropriate language regarding certification of closure
    - If the WMA has had releases to the soil, ensure the groundwater monitoring requirements are addressed (through reference to the BP-5 plan)

- **Tier 3 Closure Activity Plans for Components in WMA C (or CMIP for soil actions) possible content:**

    - Provide detailed description of methods to be used during closure (including storing/treating/disposing generated waste)
    - Provide detailed description of steps needed to remove or decontaminate systems, structures, equipment, soil, to include the following:
        - Procedures for dealing with equipment
        - Procedures for dealing with soil
        - Methods for sampling/testing surrounding soil
        - Criteria for determining how to satisfy the closure performance standard (Note: this item would be expected to reference the Appendix I Performance Assessment)
    - Possibly include detailed plans and an engineering report describing the final landfill cover (alternately these items may be part of the Tier 2 WMA C plan)

- It was noted that a contingent Post-Closure Plan would also be required from WAC 173-303-640(8)(c)(ii), but the timing of the Post-Closure Plan was not clear.
- The Post-Closure Plan would include maintaining the integrity and effectiveness of the final cover, groundwater monitoring system maintenance and related topics.

- The Closure Plan requires detailed plans and an engineering report describing the final landfill cover. Those items will most likely be included in the Tier 2 (WMA C) plan or in a specific Tier 3 component plan.

The group concluded that a timeline shows the relationships between the key documents/deliverables, and the timing of deliverables was required as a next step. Once such a timeline is drafted, a follow-on meeting will be set.

Actions:

Develop a timeline showing relationships and estimated timing of development of key deliverables. Include key assumptions. (ORP/WRPS – Hildebrand/Eberlein)

Concurrence:

11/21/13 — J. F. Grindstaff, ORP — Date

11/21/13 — J. J. Lyon, Ecology — Date

Meeting Notes

Discussion of Milestones Related to Waste Management Area C Closure, SST Closure Plan content, and Permit modifications

Meeting Date: November 21, 2013
Location: Ecology Building

Purpose: Discuss HFFACO milestones M-045-61, -62 and -82 to better define the relationships among these milestones and the content of the deliverables.

Attendees: Jeff Lyon (Ecology), Jared Mathey (Ecology), Maria Skorska (Ecology), Mike Barnes (Ecology), Joni Grindstaff (ORP), Lori Huffman (ORP), Mary Burandt (ORP), Doug Hildebrand (ORP), Tony Miskho (WRPS), Jeff Luke (WRPS), Dan Parker (WRPS), Cindy Tabor (WRPS), Susan Eberlein (WRPS)

Background:
Hanford Federal Facilities Agreement and Consent Order (HFFACO) milestones M-045-61, M-045-62 and M-045-82 (copied below) have been listed as "to be missed" at the recent monthly project managers meetings. These milestones have been affected by budget constraints and delays in related activities. Today's meeting continues the process of defining what each deliverable under these milestones should comprise, and when these deliverables can be developed, to support progress on closure of Waste Management Area (WMA) C.

M-045-61	Submit to Ecology for review and approval as an Agreement primary document, a Phase 2 RCRA Facility Investigation/Corrective Measures Study Report for WMA C.	12/31/2014
M-045-62	Submit to Ecology for review and approval as an Agreement primary document a Phase 2 Corrective Measures Implementation Work Plan for WMA C.	06/30/2015
M-045-82	Submit complete permit modification requests for Tiers 1, 2, & 3 (see Appendix I) of the SST System, to support final closure requirements for WMA C.	09/30/2015

Appendix I of the HFFACO indicates that the Tier 1 closure plan addresses the Single Shell Tank (SST) system, a Tier 2 closure plan addresses each WMA, and a Tier 3 closure activity plan addresses each individual component or group of components (e.g. 100 series tanks, vaults, pipelines).

Topics discussed:

The topics discussed are summarized below. No specific decisions were made. One action was assigned to develop additional information for future discussion.

- Mike Barnes (Ecology) reminded the group that any retrieval actions needed for the waste in tank C-301 and the CR-vault tanks might be performed more efficiently if it is done while the other waste retrieval infrastructure is in place.
- Susan Eberlein (WRPS) summarized the logic/schedule ideas that came out of the previous meeting:
    - A "Clean Closure Document" is needed to demonstrate that clean closure is impracticable. This document can be produced after the Tank Closure and Waste Management (TC&WM) Environmental Impact Statement (EIS) Record of Decision (ROD).
    - A Tier 1 (Framework) Closure Plan to address the SST will be provided after the Clean Closure Document. The Tier 1 closure plan can be relatively high level, and will provide a road-map to the subsequent plans.
    - A Tier 2 Closure Plan for WMA C and a Corrective Measures Study (CMS) for WMA C need to be generated in an integrated manner. Soil remediation actions should be recommended with an understanding of what equipment is left in place, and some equipment actions will be affected by planned soil actions. Thus the Tier 2 closure plan and the CMS will probably be developed at the same time.
    - The Tier 3 component closure activity plans and the Corrective Measures Implementation Plan (CMIP) can be developed after the Tier 2 closure plan and CMS.
- Discussion led to the following ideas:
    - The Tier 2 closure plan and CMS will capture WHAT is to be done, while the Tier 3 plans and CMIP will describe HOW it will be done.
    - The plan for the groundwater operable unit is also needed at the same time as the Tier 2 closure plan and CMS.
    - Section 2.2 of HFFACO Appendix I appears to allow the option to address the remedial actions for pipelines in the CMS/CMIP rather than in a separate Tier 3 closure activity plan, if the action for pipelines and soil are closely coupled.
    - Documents used to meet closure plan requirements will have to be incorporated into the permit by some mechanism. It was not clear how the CMIP would be incorporated into the permit. A decision on that process is needed.
    - There is not currently enough information to develop schedules for submittals of all the Tier 3 closure activity plans. For example, the schedule for retrieval of waste from C-301 and CR-vault has not been finalized because the method for retrieval has not been determined. Until more is known about the post-

retrieval configuration for C-301 and CR-vault, the schedule for submittal of the Tier 3 closure activity plan(s) cannot be finalized.

- Maria Skorska noted that usually a CMS identifies the potential alternatives for soil and structures. Without any HFFACO guidance to the contrary, this would include:
  a. SSTs, tank C-301, CR-vault, pipelines and all other auxiliary equipment and structures,
  b. contaminated vadose zone, and
  c. contaminated groundwater.

- Since the HFFACCO specifically identifies the Tier 2 and Tier 3 closure plans for structures, rather than the CMS, the appropriate plans need to be referenced in the CMS.
- Some documents already exist that could be referenced in the CMS, for example, the pipeline feasibility study developed under milestone M-045-80.
- According to HFFACO Appendix I, the combination of Tier 1, 2 and 3 closure plans (plus CMS/CMIP) serve to meet closure plan documentation requirements for components and soil.
- Mary Burandt asked whether the field work implementation would dictate how specific closure actions needed to be grouped. Jared Mathey suggested that a specific sequence or grouping of the Tier 3 closure activity plans may be required to support effective field implementation.
- Options for Tier 3 closure activity plan submittal may include:
  - Submit the Tier 2 closure plan that describes WHAT will be done for each component, along with a compliance schedule for the submittal of the Tier 3 closure activity plans.
  - Submit the Tier 2 closure plan that describes WHAT will be done for each component, along with a HFFACO change package that establishes a milestone for the submittal of the Tier 3 closure activity plans.
  - Submit the Tier 2 closure plan and one of more of the Tier 3 closure activity plans at the same time, along with a compliance schedule or milestone for the remaining plans.
  - Other options to be determined.
  - The decision on what approaches will be acceptable probably needs to be made by senior management.
- Jeff Lyon indicated his interest is seeing what documents can be developed within the framework of the existing milestone dates. He also stated he wanted to see the proposed sequence of submittals, and definition of dates to the extent possible. He was not yet sure that the Tier 2 closure plan and CMS needed to be submitted at the same time.
- There was additional discussion of the relationship between the plans and the permit. There was discussion regarding the ability to submit some of the needed permit information individually, and having it incorporated into the permit, prior to having complete information available.

- Tony Miskho suggested that knowing the outcome of the discussions between Ecology and EPA on what can be submitted under a permit "compliance schedule" is important to finalizing how the permit modification(s) can be conducted..
- Jeff Lyon noted that the Impracticability Request (also called the "Clean Closure Document") needs to address the permit requirements for a clean closure plan.
- Mary Burandt indicated that the intent had been to submit the Clean Closure Document/Impracticability Request once the Record of Decision for the Tank Closure and Waste Management EIS is issued. She expressed concern with the suggestion that we could not submit partial information to modify the permit prior to the time that complete information is available.
- Jared Mathey indicated that the Clean Closure Document/Impracticability Request could be submitted as part of permit revision 8C.
- Jeff Lyon recommended that we craft the language that describes what will be in each of the documents, and also identify any items that could delay development of a specific document.

Actions:

- It was not clear how the CMIP would be incorporated into the permit. A decision on that process is needed. Raise the issue to the appropriate management level. (Mathey/Lyon will raise the issue within Ecology.)

- Determine what approaches will be acceptable for planning submittal of Tier 3 activity closure plans (compliance schedule or establishment of new HFFACO milestones). (Mathey/Lyon will raise the issue within Ecology.)

- Develop a description of what will be included in each document, sequence of submittals, and definition of dates (to the extent that they are known). Include key assumptions and any items that could delay development of the document. (ORP/WRPS – Hildebrand/Eberlein)

Concurrence:

1/7/14 — J. F. Grindstaff, ORP — Date

1-7-14 — J. J. Lyon, Ecology — Date

Meeting Notes

Discussion of Milestones Related to Waste Management Area C Closure, SST Closure Plan content, and Permit modifications

Meeting Date: January 7, 2014
Location: Ecology Building

Purpose: Discuss HFFACO milestones M-045-61, -62 and -82 to better define the relationships among these milestones and the content of the deliverables.

Attendees: Jeff Lyon (Ecology), Jared Mathey (Ecology), Maria Skorska (Ecology), Beth Rochette (Ecology), Joni Grindstaff (ORP), Lori Huffman (ORP), Mary Burandt (ORP), Doug Hildebrand (ORP), Tony Miskho (WRPS), Dan Parker (WRPS), Cindy Tabor (WRPS), Susan Eberlein (WRPS)

Background:
Hanford Federal Facilities Agreement and Consent Order (HFFACO) milestones M-045-61, M-045-62 and M-045-82 (copied below) have been listed as "to be missed" at the recent monthly project managers meetings. These milestones have been affected by budget constraints and delays in related activities. Today's meeting continues the process of defining what each deliverable under these milestones should comprise, and when these deliverables can be developed, to support progress on closure of Waste Management Area (WMA) C.

M-045-61	Submit to Ecology for review and approval as an Agreement primary document, a Phase 2 RCRA Facility Investigation/Corrective Measures Study Report for WMA C.	12/31/2014
M-045-62	Submit to Ecology for review and approval as an Agreement primary document a Phase 2 Corrective Measures Implementation Work Plan for WMA C.	06/30/2015
M-045-82	Submit complete permit modification requests for Tiers 1, 2, & 3 (see Appendix I) of the SST System, to support final closure requirements for WMA C.	09/30/2015

Topics discussed:

Discussion focused on the proposed content for the Tier 1 (Single Shell Tank [SST] System) Closure Permit Modification Request (referred to as the "Tier 1")

- The Tier 1 will address the SST system closure, but not more general information required for the Hanford Site closure.
- The Tier 1 should contain process information for the SST system. The SST system is not an operating unit, and the specific process information should be the information that relates to closure.
- The Tier 1 could contain high level information on equipment and process history, with more detailed information submitted for each WMA in the applicable Tier 2 Permit Modification Request (referred to as the "Tier 2").
- The high level list of SST system equipment is in the Part A, but the Part A is not yet in the Revision 8C permit.

RECEIVED
FEB 13 2014
EDMC

WMA-C

- It was suggested that mapping the list of components currently in the Part A be mapped into either an updated Part A or into Addendum C.
    - The components listed in Part A should be those that "store" waste. Tony Miskho took an action to propose a definition for "storage" as part of this recommendation.
    - The more detailed component lists could be placed into Addendum C on a WMA by WMA basis (e.g. Addendum C1, C2, C3...for the various WMAs). These addenda would be updated with more detail over time for each WMA.
    - All the information currently in the Part would map somewhere.
    - This approach would simplify the modification process when additional detail is developed for each WMA, since an update to Addendum C could occur with a permit modification request.
    - The process for updating the Addendum C information over time needs to be described.
- Lori Huffman noted that the SSTs are going directly to closure and not to final status, so that there will not be a Part B.
- Jared Mathey noted that the Hanford Dangerous Waste Permit is a single final status facility wide permit that requires a complete Part B permit application and that the SSTs are a part of that final status permit.
- Tony Miskho suggested an approach where the Tier 1 becomes Addendum H, with the Tier 2 details becoming Addendum H1, H2, H3...etc. Under this approach all closure related information would be in Addendum H. This approach is similar to that used for some other units on the Hanford site.
- Mary Burandt indicated that the Tier 1 information looked a lot like process information, and so it did not seem like the Tier 1, 2, 3 construct was parallel to the other plans that were completely contained in Addendum H.
- Jeff Lyon indicated that the closure plans that were completely contained in Addendum H were mostly near term closure actions, while the SST system will be closing in steps over a period of about 40 years.
- It did not appear that the Tier 1 for the SST would map well to Addendum H, although possibly the Tier 2s could map to Addendum H.
- There was discussion of how to map schedule related information.
- There is a regulatory requirement for extension requests; the HFFACO milestone structure (M-045-00 series) should be used to address that requirement.
- The document that addresses the practicability of clean closure for the SST WMAs (referred to as the "clean closure document") was discussed next.
- If the conclusion that clean closure is not practicable and is approved, then the remaining permit modification requests are no longer "contingent" closure plans, and therefore become "closure plans".
- The process for submitting the "clean closure document" and getting approval of the practicability conclusion was discussed.
- Lori Huffman indicated that the "clean closure document" provides a description of what clean closure would entail to provide a basis for the practicability decision. It is not intended to represent a "clean closure plan".
- Use of the Administrative Record to document the approval of the impracticability decision makes more sense than attempting to incorporate that approval into the permit. The permit needs to be enforceable.
- Jeff Lyon asked what steps would follow the approval of the practicability determination.

- Mary Burandt suggested that the approval may have conditions associated with it, regarding, for example, the next submittals or how follow-actions will be captured.
- The letter requesting approval, the basis documents, and the approval letter would all be captured in the Administrative Record. Fact sheets could be developed from this information to provide a basis for the permit modification requests to come.
- Jeff Lyon suggested that the submittal of the "clean closure document" reference the HFFACO milestones for future submittals and closure.
- Mary Burandt expressed a concern that until the decision for landfill closure is approved, permit modification requests based on landfill closure cannot be submitted.
- The following recommendations resulted from the discussion:
    - The Practicability Determination for clean closure of the Single Shell Tank waste management areas will be transmitted to Ecology by letter with a request for approval.
    - The anticipated means for approval is for Ecology to transmit a letter back (with any necessary conditions), and the set of documents and correspondence would be entered into the Administrative Record. A permit modification is not associated with this step of the process.
    - After the practicability determination that clean closure is not a practical closure option is approved, the Tier 1 closure permit modification request for landfill closure of the SST system may be submitted.

- There was additional discussion of the Addenda that would need to be submitted with the Tier 1 closure permit modification request. Tony Miskho handed out a sheet with a standard list of addenda for discussion. (attached)
- Jared Mathey suggested that for WMA C, the permit modification requests would be modifications to Revision 8C, and may only require Part A, Addendum C and Addendum H.
- There was a tentative agreement that:
    - The Tier 1 (SST system) closure permit modification request, and the Tier 2 (WMA C) and Tier 3 (component) closure permit modification requests required to close WMA C will be submitted as permit modification requests to Revision 8C of the permit.
- Details of the Tier 1 content need to be discussed at the next meeting.
- Jared Mathey indicated that he would provide an email list of items that he wanted to discuss to determine how they would be addressed in the Tier 1 process. That information will be provided with the next meeting agenda.

Actions:

- Bring a proposed definition of "storage" to the next meeting in order to facilitate discussion of what can be addressed in the Part A and what can be addressed in Addendum C. (Tony Miskho)

Concurrence:

2/4/14 — J. F. Grindstaff, ORP — Date

2/10/14 — J. J. Lyon, Ecology — Date

APPENDIX B

WMA C RFI REPORT DEVELOPMENT MEETING NOTES

This page intentionally left blank.

APPENDIX B
WMA C RFI REPORT DEVELOPMENT MEETING NOTES

This appendix contains the meeting notes from six meetings held in calendar year 2014 to discuss the development of a RCRA facility investigation report for WMA C. The notes incorporate the expectations, agreements, and actions developed during a similar series of meetings held in calendar year 2011. The meeting notes were signed by representatives of the DOE and Ecology and are also available in the HFFACO Administrative Record.

MEETING NOTES

WMA C RCRA Facility Investigation Report Kick-Off

MEETING DATE: January 23, 2014

LOCATION: 2440 Stevens Center, Richland, WA

ATTENDEES:

Mike Barnes (Ecology)
Susan Eberlein (WRPS)
Doug Hildebrand (DOE-ORP)
Naomi Jaschke (DOE-RL)
Jenifer Linville (Freestone)
Jeff Lyon (Ecology)
John Morse (DOE-RL)
Julie Robertson (Freestone)
Cindy Tabor (WRPS)
Greg Thomas (CHPRC)

PURPOSE OF MEETING: The meeting was called to promote discussion among Ecology, DOE-ORP, DOE-RL, CHPRC, and WRPS regarding the renewed effort to develop a RCRA facility investigation (RFI) report for WMA C. As part of the meeting notes, lists of expectations, agreements, and actions will be documented, and the status of these actions will be tracked.

Ms. Tabor stated that the current effort to prepare the WMA C RFI report is driven by a *Hanford Federal Facility Agreement and Consent Order* (TPA) milestone, M-045-61, that calls for the submittal of an RFI/corrective measures study (CMS) by December 31, 2014, and that the RFI report under development will not include information required to be provided in a CMS. She noted that separate meetings are being held to address this disparity.

BACKGROUND INFORMATION:

WMA C Documents Developed to Date: Ms. Robertson acknowledged the extensive amount of work that has been performed to date related to the characterization of WMA C. Ms. Robertson noted that the RFI report under development will reference and draw upon information contained in documents such as the following:

- *Subsurface Condition Description of the C and A-AX Waste Management Area* (RPP-14430)
- *Phase 1 RCRA Facility Investigation/Corrective Measures Study Work Plan for Single-Shell Tank Waste Management Areas* (DOE/RL-99-36; also known as the Phase 1 work plan)
- *Field Investigation Report for Waste Management Areas C and A-AX* (RPP-35484), and
- *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C* (RPP-PLAN-39114).

Ms. Robertson stated that the RFI report will focus on the Phase 2 investigation of WMA C, but that other available data will be integrated into summary evaluations, recommendations, and conclusions.

Recap of 2011 RFI Report Development Activities: Ms. Robertson reviewed activities conducted in 2011 toward drafting a WMA C RFI report. A series of meetings were held among DOE, EPA, Ecology, and WRPS to discuss expectations for and content of a draft RFI report. Meeting notes were prepared to document the discussions and agreements; these notes were signed by the DOE and Ecology Project Managers and placed in the TPA Administrative Record.

PATH FORWARD:

Proposed RFI Report Outline: Ms. Robertson handed out a table cross-walking the currently proposed RFI report outline to the contents of the last outline reviewed by Ecology (dated August 2011). Ms. Robertson noted that the proposed outline may change somewhat as document preparation proceeds, though the contents of the overall document should remain consistent. The contents may also change based on the outcome of future discussions among DOE, Ecology, and EPA. The meeting attendees discussed several concerns and expectations about the RFI report, which are captured in tables below.

Document Schedule: WRPS is working toward the following funding-dependent schedule.

- The draft WMA C RFI report will be ready for WRPS review at the end of July 2014.
- A revised draft will be available for DOE review in the fall of 2014.
- The WMA C RFI report will be issued for Ecology review in December 2014 to meet the stated agency expectations for TPA Milestone M-045-61.

Future Meetings: Future meetings will be held to allow for discussion of the contents of proposed RFI report. The next meeting is scheduled for February 26, 2014, at 10:00 am. Dennis Faulk (EPA) and Beth Rochette (Ecology) are to be invited.

AGREEMENTS, EXPECTATIONS, AND ACTIONS: Refer to the following tables. Individual actions will be removed from the list after DOE and Ecology have agreed to close the action.

ATTACHMENT 1: Crosswalk between Proposed 2014 RFI Report Outline and Outline presented in August 2011.

R Douglas H Hebranck	R A Faulk	2-18-2014
DOE Project Manager (print)	DOE Project Manager (signature)	Date
Michael W Barnes	Michael W Barnes	2-19-2014
Ecology Project Manager (print)	Ecology Project Manager (signature)	Date

EXPECTATIONS.
1. DOE will prepare the WMA C Phase 2 RFI report separate from the CMS. TPA milestone M-045-61, which calls for submittal of an RFI/CMS report, will be renegotiated to align with expectations.
2. The section that addresses regional geology should draw from information presented by Kevin Lindsay and others at a past WMA C Performance Assessment working session and should provide diagrams that reflect the uniqueness of the site.
3. The description of field sampling techniques should describe process improvements made over time and any effects those improvements have made on how the data is interpreted.
4. The document should include information about equipment decontamination activities that occurred in the C Farm over the years as a source of both contamination and water infiltration.
5. The document should include characterization information from dry wells.
6. The document should reflect on information contained in weekly radiological field survey reports ("rounds sheets") regarding surface contamination in C Farm. Mr. Barnes noted that many of the unplanned release sites associated with C Farm are based on airborne or surface contamination events, and many these sites no longer exist (e.g., have been remediated or have dissipated).
7. The document should describe changes made in characterization planning as field work progressed. For example, in the area near the C-200 tanks, initial planning called for direct push investigation. Subsequently, the agencies agreed to investigate that area using surface geophysical exploration (SGE) initially, followed by use of direct push investigation as deemed necessary and feasible based on SGE results and physical limitations in that location.
8. Document sections regarding nature and extent of contamination and human health and risk assessment will be consistent with information being developed for the separate but parallel WMA C performance assessment effort. The RFI report will incorporate whatever information is available on the topics; information gaps will be identified for subsequent resolution.

AGREEMENTS.
1. The RFI report will identify information gaps. Such gaps will be resolved through future efforts prior to submittal of the WMA C CMS. The meeting attendees felt that this process of gap identification and resolution will support future work prioritization agreements.
2. Ecology agrees to the use of the proposed revised RFI report outline shown in Attachment 1.

ACTIONS.

Action Number	Actionee	Description	Status
2014-01-23-1	Hildebrand	Identify funding to complete the RFI report.	New.
2014-01-23-2	Barnes	Ecology expressed concern about how background levels of contamination will be defined. Ecology will forward a link or copy of a PNNL report on a soil boring that purportedly represented background levels yet was contaminated.	New.
2014-01-23-3	Tabor/Robertson	Compile a list of commitments made in the 2011 RFI Report meetings.	New.

ATTACHMENT 1

Crosswalk between Proposed 2014 RFI Report Outline and Outline presented in August 2011

Proposed 2014 Report Section/Subsection Number and Headings	August 2011 Report Section/Subsection Number and Headings
SECTION 1.0 INTRODUCTION	**1.0 <Untitled>**
1.1 PURPOSE AND SCOPE	(above)
1.2 OVERVIEW	(above)
1.2.1 Regulatory Framework	(above)
1.2.2 General Background and History of WMA C	(above)
1.3 REPORT ORGANIZATION	(above)
SECTION 2.0 SITE BACKGROUND AND ENVIRONMENTAL SETTING	**3.0 CHARACTERIZATION OF THE CONTAMINANT SOURCE AND THE ENVIRONMENTAL SETTING**
2.1 SITE DESCRIPTION	
2.2 HANFORD SITE HISTORY AND OPERATIONS	
2.3 HANFORD SITE AND REGIONAL ENVIRONMENTAL SETTING	
2.3.1 Topography	
2.3.2 Climate	3.4.2 Climatology
2.3.3 Soils	
2.3.4 Geology	Text at Hanford Site level of detail: 3.3 Characterization of the Environmental Setting 3.3.1 Geology 3.3.2 Spatial Variability 3.3.3 Spatial and Temporal Fluctuations in Soil Moisture Content 3.3.4 Solid, Liquid, and Gaseous Materials in the Unsaturated Zone
2.3.5 Hydrology	NA
2.3.6 Groundwater	Text at Hanford Site level of detail: 3.4.3 Groundwater 4.2 Groundwater Monitoring Program 4.2.1 Groundwater Monitoring Objectives 4.2.2 Groundwater Monitoring Constituents and Indicator Parameters 4.2.3 Groundwater Monitoring Schedule 4.2.4 Groundwater Monitoring Locations **6.0 FIELD METHODS** 6.5 Monitoring Well installation 6.6 Aquifer Characterization
2.3.7 Surface water	NA
2.3.8 Vegetation and Wildlife	3.4.4 Ecology (Text at Hanford Site level of detail)
2.3.9 Land Use	NA
2.4 WMA C SITE DESCRIPTION	3.4.1 Facility Records and Site Investigations

Proposed 2014 Report Section/Subsection Number and Headings	August 2011 Report Section/Subsection Number and Headings
2.4.1 Location and Site Description	3.1 Waste Characterization 3.2 Unit Characterization 3.2.1 Unit Design and Operating Characteristics 3.2.2 Releases 5.1 Waste and Unit Characterization (data) 5.1.1 Information on Physical and Chemistry Characteristics of Major Waste Types (data) 5.1.2 Physical, Chemical, Radiological Characteristics of Inventories Associated with Major Past Releases (data)
2.4.2 Topography	NA
2.4.3 Geology	Text at WMA C level of detail: 3.3 Characterization of the Environmental Setting 3.3.1 Geology 3.3.2 Spatial Variability 3.3.3 Spatial and Temporal Fluctuations in Soil Moisture Content 3.3.4 Solid, Liquid, and Gaseous Materials in the Unsaturated Zone
2.4.4 Hydrology	NA
2.4.5 Surface Water	NA
2.4.6 Groundwater	Text at WMA C level of detail: 3.4.3 Groundwater 4.2 Groundwater Monitoring Program 4.2.1 Groundwater Monitoring Objectives 4.2.2 Groundwater Monitoring Constituents and Indicator Parameters 4.2.3 Groundwater Monitoring Schedule 4.2.4 Groundwater Monitoring Locations **6.0 FIELD METHODS** 6.5 Monitoring Well installation 6.6 Aquifer Characterization
2.4.7 Vegetation and Wildlife	3.4.4 Ecology (WMA C level of detail)
2.4.8 Land Use	NA
SECTION 3.0 FIELD INVESTIGATION PROGRAM	**2.0 APPROACH FOR CHARACTERIZING RELEASES TO SOIL AND GROUNDWATER** 2.1 General Approach 2.2 Inter-media Transport
3.1 PREVIOUS/OTHER INVESTIGATIONS	
3.2 PHASE 1 RCRA FACILITY INVESTIGATION	NA
3.2.1 Phase 1 Investigative Basis and Approach	NA
3.2.2 Phase 1 Field Activities	NA
3.2.3 Phase 1 Laboratory Analyses	NA
3.2.4 Phase 1 Data Evaluation	NA
3.2.5 Phase 1 Investigation Results	NA

Proposed 2014 Report Section/Subsection Number and Headings	August 2011 Report Section/Subsection Number and Headings
3.2.6 Phase 1 Interim Measures and Interim Corrective Measures	NA
3.2.7 Summary of Phase 1 Findings and Conclusions	NA
3.3 PHASE 2 RCRA FACILITY INVESTIGATION	**4.0 DESIGN OF A MONITORING PROGRAM TO CHARACTERIZE RELEASES**
3.3.1 Phase 2 Investigative Basis and Approach	4.1 Soil Monitoring Program 4.1.1 Soil Monitoring Objectives **6.0 FIELD METHODS** 6.1 Introduction
3.3.2. Phase 2 Surface Characterization and Analysis	4.1.2 Phase 2 Soil Monitoring Constituents and Indicator Parameters 4.1.3 Phase 2 Soil Monitoring Schedule 4.1.4 Phase 2 Soil Monitoring Locations 6.2 Surface Methods 6.2.1 Near Surface Sampling Methods 6.2.2 Surface Radiation Surveys 6.2.3 Surface Geophysics Surveys 6.2.4 Near Surface Gamma Scans
3.3.2.1 Radiological Surveys	(above)
3.3.2.2 Surface Geophysical Exploration	(above)
3.3.2.3 Soil Characterization and Analysis	(above)
3.3.3 Tissue Characterization and Analysis	NA
3.3.4 Subsurface Characterization	4.1.2 Phase 2 Soil Monitoring Constituents and Indicator Parameters 4.1.3 Phase 2 Soil Monitoring Schedule 4.1.4 Phase 2 Soil Monitoring Locations 6.3 Subsurface Methods 6.3.1 Boreholes/Drywells 6.3.2 Direct push 6.3.3 Sampling and Analyses 6.3.4 Surface Geophysical Exploration {SGE)
3.3.4.1 Drywell and Groundwater Well Geophysical Borings	(above)
3.3.4.2 Other Monitoring	(above)
3.3.5 Summary of Deviations from the Sampling Plan	(above)
3.3.6 Summary of data collected	NA
SECTION 4.0 NATURE AND EXTENT OF CONTAMINATION	**5.0 DATA PRESENTATION**

Proposed 2014 Report Section/Subsection Number and Headings	August 2011 Report Section/Subsection Number and Headings
4.1 ENVIRONMENTAL CHARACTERIZATION 4.1.1. Geology 4.1.2 Geochemistry of undisturbed vadose zone soils and porewater 4.1.3 Hydrology 4.1.4 Soil properties affecting fate and transport	5.2 Environmental Setting Characterization
4.2 CONTAMINATION CHARACTERIZATION	5.3 Characterization of the Release
4.2.1 Data Quality	NA
4.2.2 Screening Values	NA
4.2.2.1 Media Based Screening Values	NA
4.2.2.2 Background Threshold Values	NA
4.2.2.3 Remediation Goals	NA
4.2.3 Evaluation of Analytical Results	5.3 Characterization of the Release
4.2.3.1 Soil Analytical Results	5.3.2 Investigations Near 100-Series SSTs 5.3.3 Investigations Near 200-Series SSTs 5.3.4 Investigations Near Unplanned Release Sites 5.3.5 Investigations Near Other Ancillary Facilities
4.2.3.2.1 Soil Results Summary	5.3.1 Overview of Phase 2 Characterization Results
4.2.3.2.2 Comparison of Soil Analytical Results to Screening Values	NA
4.2.3.2 Groundwater Analytical Results	NA
4.2.3.2.1 Groundwater Results Summary	NA
4.2.3.2.3 Comparison of Groundwater Analytical Results to Screening Values	NA
4.2.3.3 Biota Analytical Results	NA
4.2.3.3.1 Biota Results Summary	NA
4.2.3.3.2 Comparison of Biota Analytical Results to Screening Values	NA
4.3 CONTAMINANT FATE AND TRANSPORT	5.3.6 Extent of Contamination at Scale of WMA C 5.3.6.1 Interpreted Extent of Contamination in Vadose Zone 5.3.6.2 Past and Potential Future Impacts to Groundwater
4.3.1 Conceptual Overview of Waste Releases and Subsequent Subsurface Contaminant Migration	(above)
4.3.2 Fate and Transport of Analytes Detected Above Screening Levels	(above)
4.4 NATURE AND EXTENT RECOMMENDATIONS	NA
4.4.1 Soil	NA
4.4.2 Surface Water	NA
4.4.3 Sediment	NA
4.4.4 Groundwater	NA
4.4.5 Biota	NA
4.4.4 Potential Receptors	NA
SECTION 5.0 HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT	**NA**

Proposed 2014 Report Section/Subsection Number and Headings	August 2011 Report Section/Subsection Number and Headings
SECTION 6.0 SUMMARY AND RECOMMENDATIONS	NA
SECTION 7.0 REFERENCES	**9.0 REFERENCES**
APPENDICES (examples)	NA
APPENDIX A Field Logs	NA
APPENDIX B Site Photographs	NA
APPENDIX C Analytical Data and Quality Control Tables	NA
APPENDIX D Laboratory Reports and Chain of Custody Records	NA
APPENDIX E Hydraulic Conductivity Tests	NA
APPENDIX F Soil Boring and Monitoring Well Installation Logs	NA
APPENDIX G Analytical Data Summary	NA
APPENDIX H Human Health Risk Assessment	NA
APPENDIX I Ecological Risk Assessment	NA
APPENDIX J Meeting Minutes	NA
APPENDIX K WIDS Site Descriptions	NA
LIST OF TABLES	NA
TBD	NA
LIST OF FIGURES	NA
TBD	NA

MEETING NOTES

WMA C RCRA Facility Investigation Report

MEETING DATE: February 26, 2014

LOCATION: 2440 Stevens Center, Richland, WA

ATTENDEES:

Mike Barnes (Ecology)
Joe Caggiano (Ecology)
Susan Eberlein (WRPS)
Dennis Faulk (EPA)
Les Fort (WRPS)
Dan Glaser (WRPS)
Doug Hildebrand (DOE-ORP)
Jenifer Linville (Freestone)
Jeff Lyon (Ecology)
Jared Mathey (Ecology)
Julie Robertson (Freestone)
Beth Rochette (Ecology)
Marysia Skorska (Ecology)
Cindy Tabor (WRPS)
Greg Thomas (CHPRC)

PURPOSE OF MEETING: The meeting was called to promote discussion among Ecology, DOE-ORP, DOE-RL, CHPRC, and WRPS regarding the renewed effort to develop a RCRA facility investigation (RFI) report for WMA C. As part of the meeting notes, lists of expectations, agreements, and actions will be documented, and the status of these actions will be tracked.

REVIEW OF EXPECTATIONS AND ACTIONS FROM PRIOR MEETING: The meeting attendees discussed all expectations documented in the January 23, 2014 meeting and reassigned each to either the list of actions or the list of agreements. The attendees also discussed outstanding actions. The results of the discussion are recorded in tables at the end of these meeting notes. Individual actions will be removed from the list after DOE and Ecology have agreed to close the action.

BRIEFING ON SURFACE GEOPHYSICAL EXPLORATION (SGE) INVESTIGATION OF C-200S: Mr. Glaser provided a briefing on the results of the WMA C Phase 2 SGE investigation of the C-200 Tanks. Mr. Glaser noted that the results of the resistivity investigation are final, but the report provided interpretations presented in the context of the resistivity data only. The integrated interpretation, examining the resistivity results in the context of process history, gamma logging, and soil geochemical analyses is preliminary at this time.

REVIEW OF DISCUSSION POINTS FROM 2011 RFI REPORT MEETINGS: In 2011, DOE, EPA, and Ecology participated in a series of meetings to discuss the development of a WMA C RFI report. Ms. Robertson handed out a list of discussion points captured in minutes taken during the 2011 meetings and initiated a review of the discussion points. The outcome of the review is incorporated into the tables at the end of these meeting notes.

NEXT MEETING: March 26, 2014, 9:30 am.

ATTACHMENT 1: Discussion Points from 2011 WMA C RFI Report Meetings.

R Douglas Hildebrand	R D Hildebrand	3-26-2014
DOE Project Manager (print)	DOE Project Manager (signature)	Date
Michael W Barnes	Michael W Barnes	3-26-2014
Ecology Project Manager (print)	Ecology Project Manager (signature)	Date

AGREEMENTS.	
Agreement Date	**Description of the Agreement**
1/23/2014	1. The RFI report will **identify information gaps**. Such gaps will be resolved through future efforts prior to submittal of the WMA C CMS. The meeting attendees felt that this process of gap identification and resolution will support future work prioritization agreements.
	2. Ecology agrees to the **use of the proposed revised RFI report outline** shown in Attachment 1.
2/26/2014	1. The section that addresses regional geology should **use pictures/graphics from the 2010 Natural Systems WMA C Performance Assessment working session** to illustrate the uniqueness of the site (illustrate geology, depict river channeling impacts, etc.).
	2. The description of field sampling techniques should **describe process improvements made over time** and any effects those improvements have made on how the data is interpreted (e.g., surface geophysical exploration, number of samples that can be taken from push borehole).
	3. The RFI report should include, to the extent practicable, information about equipment decontamination activities that occurred in the C Farm over the years and other activities (e.g., fire hydrant testing) that may have been sources of contamination and/or water infiltration. **See DOE/RL-88-30, Hanford Site Waste Management Units Report**.
	4. The RFI report should **include characterization information from dry wells**. This information is currently slated to go into Section 3.3.4.1.
	5. The RFI report should reflect on information contained in weekly radiological field survey reports ("rounds sheets") regarding surface contamination in C Farm. Mr. Barnes noted that many of the unplanned release sites associated with C Farm are based on airborne or surface contamination events, and many of these sites no longer exist (e.g., have been remediated or have dissipated). Such releases are generally documented as "unplanned releases." Convey point that **although the surface may be considered uncontaminated today, shallow subsurface contamination may exist across the farm.**
	6. The RFI report should **describe changes made in characterization planning as field work progressed**. For example, in the area near the C-200 tanks, initial planning called for direct push investigation. Subsequently, the agencies agreed to investigate that area using surface geophysical exploration (SGE) initially, followed by use of direct push investigation as deemed necessary and feasible based on SGE results and physical limitations in that location.
	7. RFI report sections regarding **nature and extent of contamination and human health and risk assessment will be consistent with information being developed for the separate but parallel WMA C Performance Assessment** effort. The RFI report will incorporate whatever information is available on the topics; information gaps will be identified for subsequent resolution.
	8. The RFI report **table of contents should include a section that refers to the conceptual site model**. CSM illustrations in RFI report should be consistent with WMA C Performance Assessment. (This information is currently slated to go into Section 4.3.1.)

ACTIONS.			
Action Number	**Actionee**	**Description**	**Status**
2014-01-23-1	Hildebrand	Identify funding to complete the RFI report.	Closed. Funding identified for soil contamination RFI report.
2014-01-23-2	Barnes	Ecology expressed concern about how background levels of contamination will be defined. Ecology will forward a link or copy of a PNNL report on a soil boring that purportedly represented background levels yet was contaminated.	Closed. Report is PNNL-15503.
2014-01-23-3	Tabor, Robertson	Compile a list of commitments made in the 2011 RFI Report meetings.	Closed. List presented at 2/26/2014 meeting.
2014-02-26-1	Hildebrand	DOE will prepare a TPA change package to address the need to revise TPA milestone M-045-61, which calls for submittal of an RFI/CMS report.	New.
2014-02-26-2	Eberlein	Identify what risk information will be available for inclusion in the RFI report.	New.
2014-02-26-3	Tabor, Robertson	Contact Rebecca Gerhart (EPA) after 3/9/2014 to discuss desired level of detail to include in RFI report. Consider level of detail in recent 100 Area RI/FS reports. Propose inclusion of summary level information in document and hyperlinks to other documents that provide more detail.	New.

ATTACHMENT 1: Discussion Points from 2011 WMA C RFI Report Meetings

General Discussion Points

- RFI Report will include substantial amount of historic information, not overuse cross-references to other documents. (3/24)

New Section 1: Introduction

- Incorporate relevant text from the Work Plan, particularly with regard to regulatory framework and how the document will support regulatory decision-making. (9/8)

New Section 2: Site Background and Environmental Setting

- Include discussion of impacts groundwater, specifically related to Tc-99, iodine, and nitrate information, and include description of the monitoring program. (3/24, 4/21, 6/2, 8/3)
- Include individual tank timelines associated with leaks/losses. (3/24)
- Address surface water (upgradient and downgradient sources of vadose zone contamination). (4/21, 6/2)
- Address facilities that are hydrologically upgradient from WMA C. (6/2)
- Discuss leak loss assessment findings. (8/3)

New Section 3: Field Investigation Program

- In write up of Phase 2 field work, include time frame when work was conducted/samples taken at specific locations. (3/24)
- Discuss conceptual models related to WMA C PA evaluation. (3/24)
- Define terms and use consistently (e.g., surface and sub-surface, in-situ and ex-situ). (4/21)
- Reference weekly operational maps of scanned WMA C surface where hot spots were noted. (These maps are not released, and their only objective is operational safety for workers.) Provide an example map along with discussion of challenges for mapping associated with operational parameters of the farm (e.g., old surface later covered by gravel). (4/21)
- Include dry well, borehole, direct push, and near-surface sampling/characterization. (4/21, 6/2)
- Include characterization of leaks from pipelines and diversion boxes. (8/3)

New Section 4: Nature and Extent of Contamination

- Discuss data validation. (8/3)

Section 5: Human Health and Ecological Risk Assessment (Not discussed in 2011.)

Section 6: Summary and Conclusions (Not discussed in 2011.)

Appendices

- Include UPR descriptions from WIDS. (8/3)
- Include RFI status meeting minutes as an appendix to Rev. 0. (9/8)

***2011 Meeting Dates:** March 14, March 24, April 21, June 2, August 3, September 8, September 22.

MEETING NOTES

WMA C RCRA Facility Investigation Report

MEETING DATE: March 26, 2014

LOCATION: 2440 Stevens Center, Richland, WA

ATTENDEES:

Mike Barnes (Ecology)
Joe Caggiano (Ecology)
Susan Eberlein (WRPS)
Rebecca Gerhart (EPA)
Doug Hildebrand (DOE-ORP)
Jenifer Linville (Freestone)
Jeff Lyon (Ecology)
Jared Mathey (Ecology)
Julie Robertson (Freestone)
Beth Rochette (Ecology)
Maria Skorska (Ecology)
Cindy Tabor (WRPS)
Greg Thomas (CHPRC)
Becky Wiegman (WRPS)

PURPOSE OF MEETING: The meeting was called to promote discussion among Ecology, DOE-ORP, DOE-RL, CHPRC, and WRPS regarding the calendar year 2014 effort to develop a RCRA facility investigation (RFI) report for WMA C. As part of the meeting notes, lists of expectations, agreements, and actions will be documented, and the status of these actions will be tracked.

REVIEW OF EXPECTATIONS AND ACTIONS FROM PRIOR MEETING: There were no expectations from prior meetings to discuss. The results of the discussion of open actions are recorded in tables at the end of these meeting notes. Individual actions will be removed from the list after DOE and Ecology have agreed to close the action.

REVIEW OF DISCUSSION POINTS FROM 2011 RFI REPORT MEETINGS: In 2011, DOE, EPA, and Ecology participated in a series of meetings to discuss the development of a WMA C RFI report. Ms. Robertson handed out a list of discussion points captured in minutes taken during the 2011 meetings and initiated a review of the discussion points. The outcome of the review is incorporated into the tables at the end of these meeting notes. To support the discussion, Ms. Robertson also handed out a revised WMA C RFI report outline showing changes made since January 2014.

NEXT MEETING: Tentatively set for April 22, 2014, 9:30 am.

ATTACHMENTS:

- Discussion Points from 2011 WMA C RFI Report Meetings
- Revised WMA C RFI report outline showing changes made since January 2014.

R Douglas Hildebrand	R Douglas Hildebrand	4-21-2014
DOE Project Manager (print)	DOE Project Manager (signature)	Date
Michael W Barnes	Michael W Barnes	4-21-2014
Ecology Project Manager (print)	Ecology Project Manager (signature)	Date

	EXPECTATIONS.
3/26/2014	Ecology expressed an expectation that characterization information for all equipment in the Part A will be discussed in the RFI report.

AGREEMENTS. (2 pages)	
Agreement Date	**Description of the Agreement**
1/23/2014	1. The RFI report will **identify information gaps**. Such gaps will be resolved through future efforts prior to submittal of the WMA C CMS. The meeting attendees felt that this process of gap identification and resolution will support future work prioritization agreements.
	2. Ecology agrees to the **use of the proposed revised RFI report outline** shown in Attachment 1.
2/26/2014	1. The section that addresses regional geology should **use pictures/graphics from the 2010 Natural Systems WMA C Performance Assessment working session** to illustrate the uniqueness of the site (illustrate geology, depict river channeling impacts, etc.).
	2. The description of field sampling techniques should **describe process improvements made over time** and any effects those improvements have made on how the data is interpreted (e.g., surface geophysical exploration, number of samples that can be taken from push borehole).
	3. The RFI report should **reflect on information contained in weekly radiological field survey reports ("rounds sheets")** regarding surface contamination in C Farm. Mr. Barnes noted that many of the unplanned release sites associated with C Farm are based on airborne or surface contamination events, and many of these sites no longer exist (e.g., have been remediated or have dissipated). Such releases are generally documented as "unplanned releases." Convey point that although the surface may be considered uncontaminated today, shallow subsurface contamination may exist across the farm.
	4. The RFI report should **describe changes made in characterization planning as field work progressed**. For example, in the area near the C-200 tanks, initial planning called for direct push investigation. Subsequently, the agencies agreed to investigate that area using surface geophysical exploration (SGE) initially, followed by use of direct push investigation as deemed necessary and feasible based on SGE results and physical limitations in that location.
	5. RFI report sections regarding **nature and extent of contamination and human health and risk assessment will be consistent with information being developed for the separate but parallel WMA C Performance Assessment** effort. The RFI report will incorporate whatever information is available on the topics; information gaps will be identified for subsequent resolution.
2/26/2014 and 3/26/2014	1. To the extent practicable, the RFI report will **include information about liquid sources near or at the surface** (e.g., equipment decontamination activities within the farm, fire hydrant testing, water lines, snow melt, ponds/cribs/ditches) that may have been sources of contamination and/or water infiltration. **Also include UPR descriptions** from WIDS. DOE/RL-88-30 (*Hanford Site Waste Management Units Report*), tank leak-loss reports, the WMA A-AX/C Field Investigation Report, and GJO-98-39-TAR, GJO-HAN-18 (*Hanford Tank Farms Vadose Zone: C Tank Farm Report*) will be reviewed for relevance.
	2. The RFI report will **include characterization information from dry wells, boreholes,**

AGREEMENTS. (2 pages)	
Agreement Date	**Description of the Agreement**
	direct pushes, and near-surface sampling. It will also include characterization information from leaks associated with ancillary equipment (pipelines, French drains, C-301, etc.).
	3. The RFI report **table of contents should include a section that refers to the conceptual site model**. (This information is currently slated to go into Section 5.3.1.) CSM illustrations in RFI report should be consistent with WMA C Performance Assessment models related to nature and extent of contamination if no action were taken.
3/26/2014	1. The introductory section of the RFI document will **incorporate relevant information from the WMA C Phase 2 work plan** (RPP-PLAN-39114), particularly regarding regulatory framework and the regulatory decision-making process.
	2. The RFI report will **incorporate published information about the groundwater monitoring program and groundwater contamination**, including Tc-99, iodine, and nitrate.
	3. The section of the RFI report describing the tank system will **include individual tank timelines** (the "Caggiano diagrams") associated with leaks/losses as well as findings from tank leak-loss reports.
	4. Using information in published reports, the RFI report will **include information about upgradient facilities that are possible sources of groundwater contamination** at WMA C.
	5. The write up of Phase 2 field work will **include time frame when work was conducted/samples taken** at specific locations.
	6. Terms such as "surface" and "sub-surface" will be defined and used consistently.
	7. **Discuss data validation/quality** (e.g., Tc-99 data quality as it relates to analytical method used) in the RFI report. This information is currently slated to go into Section 5.2.1.
	8. **Notes from routine monthly 2011 and 2014 meetings** regarding the development of the RFI **will be incorporated** into the RFI report.

ACTIONS.			
Action Number	**Actionee**	**Description**	**Status**
2014-02-26-1	Hildebrand	DOE will prepare a TPA change package to address the need to revise TPA milestone M-045-61, which calls for submittal of an RFI/CMS report.	Open. In process.
2014-02-26-2	Eberlein	Identify what risk information will be available for inclusion in the RFI report.	Open. Risk assessment will be a topic of a future RFI meeting.
2014-02-26-3	Tabor, Robertson	Contact Rebecca Gerhart (EPA) after 3/9/2014 to discuss desired level of detail to include in RFI report. Consider level of detail in recent 100 Area RI/FS reports. Propose inclusion of summary level information in document and hyperlinks to other documents that provide more detail.	Open. In process.
2014-03-26-1	Tabor, Robertson	Schedule future meeting to review the conceptual site model and stratigraphy at WMA C.	New.

ATTACHMENT 1: Discussion Points from 2011 WMA C RFI Report Meetings

General Discussion Points

- RFI Report will include substantial amount of historic information, not overuse cross-references to other documents. (3/24)

New Section 1: Introduction

- Incorporate relevant text from the Work Plan, particularly with regard to regulatory framework and how the document will support regulatory decision-making. (9/8)

New Section 2: Site Background and Environmental Setting

- Include discussion of impacts groundwater, specifically related to Tc-99, iodine, and nitrate information, and include description of the monitoring program. (3/24, 4/21, 6/2, 8/3)
- Include individual tank timelines associated with leaks/losses. (3/24)
- Address surface water (upgradient and downgradient sources of vadose zone contamination). (4/21, 6/2)
- Address facilities that are hydrologically upgradient from WMA C. (6/2)
- Discuss leak loss assessment findings. (8/3)

New Section 3: Field Investigation Program

- In write up of Phase 2 field work, include time frame when work was conducted/samples taken at specific locations. (3/24)
- Discuss conceptual models related to WMA C PA evaluation. (3/24)
- Define terms and use consistently (e.g., surface and sub-surface, in-situ and ex-situ). (4/21)
- Reference weekly operational maps of scanned WMA C surface where hot spots were noted. (These maps are not released, and their only objective is operational safety for workers.) Provide an example map along with discussion of challenges for mapping associated with operational parameters of the farm (e.g., old surface later covered by gravel). (4/21)
- Include dry well, borehole, direct push, and near-surface sampling/characterization. (4/21, 6/2)
- Include characterization of leaks from pipelines and diversion boxes. (8/3)

New Section 4: Nature and Extent of Contamination

- Discuss data validation. (8/3)

Section 5: Human Health and Ecological Risk Assessment (Not discussed in 2011.)

Section 6: Summary and Conclusions (Not discussed in 2011.)

Appendices

- Include UPR descriptions from WIDS. (8/3)
- Include RFI status meeting minutes as an appendix to Rev. 0. (9/8)

***2011 Meeting Dates:** March 14, March 24, April 21, June 2, August 3, September 8, September 22.

ATTACHMENT 2: Revised WMA C RFI Report Outline Showing Changes Made Since January 2014

SECTION 1.0 INTRODUCTION
1.1 PURPOSE AND SCOPE
1.2 OVERVIEW
- 1.2.1 Regulatory Framework
- 1.2.2 General Background and History of WMA C

1.3 REPORT ORGANIZATION

SECTION 2.0 SITE BACKGROUND AND ENVIRONMENTAL SETTING
2.1 SITE DESCRIPTION
2.2 ~~HANFORD SITE~~REGIONAL HISTORY AND HANFORD OPERATIONS
- 2.2.1 Historical Overview
- 2.2.2 Operations, Facilities, and Processes
- 2.2.3 Contaminant Sources
- 2.2.4 Waste Management

2.3 HANFORD SITE AND REGIONAL ENVIRONMENTAL SETTING
- 2.3.1 Topography
- 2.3.2 Climate
- 2.3.3 ~~Soils~~Geology
- 2.3.4 ~~Geology~~Surface Water
- 2.3.5 ~~Hydrology~~Vadose Zone Recharge
- 2.3.6 Groundwater
- 2.3.7 ~~Surface Water~~Vegetation and Wildlife
- 2.3.8 ~~Vegetation and Wildlife~~Land Use
- ~~2.3.9 Land Use~~

2.4 WMA C SITE ~~DESCRIPTION~~ENVIRONMENTAL SETTING
- 2.4.1 ~~Location and Site Description~~Topography
- 2.4.2 ~~Topography~~Geology
- 2.4.3 ~~Geology~~Surface Water
- 2.4.4 ~~Hydrology~~Vadose Zone Recharge
- ~~2.4.5 Surface Water~~
- ~~2.4.6~~ 2.4.5 Groundwater
- ~~2.4.7~~ 2.4.6 Vegetation and Wildlife
- ~~2.4.8~~ 2.4.7 Land Use

SECTION 3.0 WMA C SITE DESCRIPTION
3.1 LOCATION AND SITE DESCRIPTION
3.2 UNIT DESIGN AND OPERATING CHARACTERISTICS
- 3.2.1 Single Shell Tanks
- 3.2.2 Ancillary Equipment

3.3 WASTE TYPES AND WASTE PROCESSING HISTORY
- 3.3.1 Waste Streams Transferred Into and Out of 100-Series Tanks
- 3.3.2 Waste Streams Transferred Into and Out of 200-Series Tanks

3.4 INTERIM STABILIZATION
3.5 RETRIEVAL
3.6 RELEASE EVENTS AND LEAK EVALUATIONS

SECTION 4.0 ~~3.0~~ FIELD INVESTIGATION PROGRAM
~~3~~ 4.1 PREVIOUS/OTHER INVESTIGATIONS
~~3~~4.2 PHASE 1 RCRA FACILITY INVESTIGATION
~~3~~4.2.1 Phase 1 Investigative Basis and Approach
~~3~~4.2.2 Phase 1 Field Activities
~~3~~4.2.3 Phase 1 Laboratory Analysis
~~3~~4.2.4 Phase 1 Data Evaluation
~~3~~4.2.5 Phase 1 Investigation Results
~~3~~4.2.6 Phase 1 Interim Measures and Interim Corrective Measures
~~3~~4.2.7 Summary of Phase 1 Findings and Conclusions
~~3~~4.3 PHASE 2 RCRA FACILITY INVESTIGATION
~~3~~4.3.1 Phase 2 Investigative Basis and Approach
~~3~~4.3.2 Phase 2 Surface Characterization and Analysis
~~3~~4.3.2.1 Radiological Surveys
~~3~~4.3.2.2 Surface Geophysical Exploration
~~3~~4.3.2.3 Soil Characterization and Analysis
~~3~~4.3.3 Tissue Characterization and Analysis
~~3~~4.3.4 Subsurface Characterization
~~3~~4.3.4.1 Drywell and Groundwater Well Geophysical Borings
~~3~~4.3.4.2 ~~Other Monitoring~~ Deep Vadose Zone Soil Samples
~~3~~4.3.5 Summary of Deviations from the Sampling Plan
~~3~~4.3.6 Summary of Data Collected

SECTION ~~4~~5.0 NATURE AND EXTENT OF CONTAMINATION
~~4~~5.1 ENVIRONMENTAL CHARACTERIZATION
~~4~~5.1.1 Geology
~~4~~5.1.2 Geochemistry of Undisturbed Vadose Zone Soils and Porewater
~~4~~5.1.3 Hydrology
~~4~~5.1.4 Soil properties affecting fate and transport
~~4~~5.2 CONTAMINATION CHARACTERIZATION
~~4~~5.2.1 Data Quality
~~4~~5.2.2 Screening Values
~~4~~5.4.4.1 Media Based Screening Values
~~4~~5.2.2.2 Background Threshold Values
~~4~~5.2.2.3 Remediation Goals
~~4~~5.2.3 Evaluation of Analytical Results
~~4~~5.2.3.1 Soil Analytical Results
~~4~~5.2.3.1.1 Soil Results Summary
~~4~~5.2.3.1.2 Comparison of Soil Analytical Results to Screening Values
~~4~~5.2.3.2 Groundwater Analytical Results
~~4~~5.2.3.2.1 Groundwater Results Summary
~~4~~5.2.3.2.2 Comparison of Groundwater Analytical Results to Screening Values
~~4~~5.2.3.3 Biota Analytical Results
~~4~~5.2.3.3.1 Biota Results Summary
~~4~~5.2.3.3.2 Comparison of Biota Analytical Results to Screening Values
~~4~~5.3 CONTAMINANT FATE AND TRANSPORT

~~4~~5.3.1 Conceptual Site Model ~~Overview of Waste Releases and Subsequent Subsurface Contaminant Migration~~
~~4~~5.3.2 Fate and Transport of Analytes Detected Above Screening Levels
~~4~~5.4 NATURE AND EXTENT RECOMMENDATIONS
~~4~~5.4.1 Soil
~~4~~5.4.2 Surface Water
4.4.3 Sediment
4.4.4 Groundwater
4.4.5 Biota
4.4.6 Potential Receptors

SECTION ~~5~~6.0 HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT

SECTION ~~6~~7.0 SUMMARY AND RECOMMENDATIONS

SECTION ~~7~~8.0 REFERENCES

APPENDICES (examples)
APPENDIX A Field Logs
APPENDIX B Site Photographs
APPENDIX C Analytical Data and Quality Control Tables
APPENDIX D Laboratory Reports and Chain of Custody Records
APPENDIX E Hydraulic Conductivity Tests
APPENDIX F Soil Boring and Monitoring Well Installation Logs
APPENDIX G Analytical Data Summary
APPENDIX H Human Health Risk Assessment
APPENDIX I Ecological Risk Assessment
APPENDIX J Meeting Minutes
APPENDIX K WIDS Site Descriptions

LIST OF TABLES
TBD
LIST OF FIGURES
TBD

MEETING NOTES

WMA C RCRA Facility Investigation Report

MEETING DATE: April 30, 2014

LOCATION: Washington State Department of Ecology Office, Richland, WA

ATTENDEES:

Marcel Bergeron (WRPS)
Mike Barnes (Ecology)
Kathy Davis (Freestone)
Susan Eberlein (WRPS)
Dan Glaser (WRPS)
Doug Hildebrand (DOE-ORP)
Julie Robertson (Freestone)
Beth Rochette (Ecology)
Cindy Tabor (WRPS)
Greg Thomas (CHPRC)
Becky Wiegman (WRPS)

PURPOSE OF MEETING: The meeting was called to promote discussion among Ecology, DOE-ORP, DOE-RL, CHPRC, and WRPS regarding the calendar year 2014 effort to develop a RCRA facility investigation (RFI) report for WMA C. As part of the meeting notes, lists of expectations, agreements, and actions will be documented, and the status of these actions will be tracked.

REVIEW OF EXPECTATIONS AND ACTIONS FROM PRIOR MEETING: The attendees discussed an expectation expressed by Joe Caggiano (Ecology) in March 2014 that characterization information for all equipment in the Part A will be discussed in the RFI report. Ms. Robertson stated that a section of the RFI report will contain a description of WMA C, including a table detailing system components and equipment. The table will look much like Table 2-6 in *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C* (RPP-PLAN-39114, Rev. 2). Available documents containing information about residual equipment inventory will be referenced in the table. The attendees deferred further discussion of the expectation until Mr. Caggiano could be present at a future meeting.

The results of the discussion of open actions are recorded in tables at the end of these meeting notes. Individual actions will be removed from the list after DOE and Ecology have agreed to close the action.

PHASE 2 INVESTIGATION DATA (OVERVIEW OF DATA QUALITY ASSESSMENT): Ms. Tabor provided a brief presentation reviewing the required components of a complete data quality assessment. She noted that the DQA for the Phase 2 WMA C investigation is in progress.

UPCOMING MEETINGS: Tentatively set for May 28 and June 25, 2014, 9:30 am.

R Douglas Hildebrand	RDHildebrand	5-20-2014
DOE Project Manager (print)	DOE Project Manager (signature)	Date
Michael W Barnes	Michael W Barnes	5-21-2014
Ecology Project Manager (print)	Ecology Project Manager (signature)	Date

EXPECTATIONS.	
3/26/2014	Ecology expressed an expectation that characterization information for all equipment in the Part A will be discussed in the RFI report.

ACTIONS.			
Action Number	**Actionee**	**Description**	**Status**
2014-02-26-1	Hildebrand	DOE will prepare a TPA change package to address the need to revise TPA milestone M-045-61, which calls for submittal of an RFI/CMS report.	Open. In process.
2014-02-26-2	Eberlein	Identify what risk information will be available for inclusion in the RFI report.	Open. Risk assessment will be a topic of a future RFI meeting.
2014-02-26-3	Tabor, Robertson	Contact Rebecca Gerhart (EPA) after 3/9/2014 to discuss desired level of detail to include in RFI report. Consider level of detail in recent 100 Area RI/FS reports. Propose inclusion of summary level information in document and hyperlinks to other documents that provide more detail.	Open. Initial meeting held 4/28/2014. Anticipate additional meetings.
2014-03-26-1	Tabor, Robertson	Schedule future meeting to review the conceptual site model and stratigraphy at WMA C.	Tentatively scheduled for June 2014 meeting.

AGREEMENTS. (2 pages)	
Agreement Date	**Description of the Agreement**
1/23/2014	1. The RFI report will **identify information gaps**. Such gaps will be resolved through future efforts prior to submittal of the WMA C CMS. The meeting attendees felt that this process of gap identification and resolution will support future work prioritization agreements.
	2. Ecology agrees to the **use of the proposed revised RFI report outline** shown in Attachment 1.
2/26/2014	1. The section that addresses regional geology should **use pictures/graphics from the 2010 Natural Systems WMA C Performance Assessment working session** to illustrate the uniqueness of the site (illustrate geology, depict river channeling impacts, etc.).
	2. The description of field sampling techniques should **describe process improvements made over time** and any effects those improvements have made on how the data is interpreted (e.g., surface geophysical exploration, number of samples that can be taken from push borehole).
	3. The RFI report should **reflect on information contained in weekly radiological field survey reports ("rounds sheets")** regarding surface contamination in C Farm. Mr. Barnes noted that many of the unplanned release sites associated with C Farm are based on airborne or surface contamination events, and many of these sites no longer exist (e.g., have been remediated or have dissipated). Such releases are generally documented as "unplanned releases." Convey point that although the surface may be considered uncontaminated today, shallow subsurface contamination may exist across the farm.

AGREEMENTS. (2 pages)	
Agreement Date	**Description of the Agreement**
	4. The RFI report should **describe changes made in characterization planning as field work progressed**. For example, in the area near the C-200 tanks, initial planning called for direct push investigation. Subsequently, the agencies agreed to investigate that area using surface geophysical exploration (SGE) initially, followed by use of direct push investigation as deemed necessary and feasible based on SGE results and physical limitations in that location.
	5. RFI report sections regarding **nature and extent of contamination and human health and risk assessment will be consistent with information being developed for the separate but parallel WMA C Performance Assessment** effort. The RFI report will incorporate whatever information is available on the topics; information gaps will be identified for subsequent resolution.
2/26/2014 and 3/26/2014	1. To the extent practicable, the RFI report will **include information about liquid sources near or at the surface** (e.g., equipment decontamination activities within the farm, fire hydrant testing, water lines, snow melt, ponds/cribs/ditches) that may have been sources of contamination and/or water infiltration. **Also include UPR descriptions** from WIDS. DOE/RL-88-30 (*Hanford Site Waste Management Units Report*), tank leak-loss reports, the WMA A-AX/C Field Investigation Report, and GJO-98-39-TAR, GJO-HAN-18 (*Hanford Tank Farms Vadose Zone: C Tank Farm Report*) will be reviewed for relevance.
	2. The RFI report will **include characterization information from dry wells, boreholes, direct pushes, and near-surface sampling**. It will also include characterization information from leaks associated with ancillary equipment (pipelines, French drains, C-301, etc.).
	3. The RFI report **table of contents should include a section that refers to the conceptual site model**. (This information is currently slated to go into Section 5.3.1.) CSM illustrations in RFI report should be consistent with WMA C Performance Assessment models related to nature and extent of contamination if no action were taken.
3/26/2014	1. The introductory section of the RFI document will **incorporate relevant information from the WMA C Phase 2 work plan** (RPP-PLAN-39114), particularly regarding regulatory framework and the regulatory decision-making process.
	2. The RFI report will **incorporate published information about the groundwater monitoring program and groundwater contamination**, including Tc-99, iodine, and nitrate.
	3. The section of the RFI report describing the tank system will **include individual tank timelines** (the "Caggiano diagrams") associated with leaks/losses as well as findings from tank leak-loss reports.
	4. Using information in published reports, the RFI report will **include information about upgradient facilities that are possible sources of groundwater contamination** at WMA C.
	5. The write up of Phase 2 field work will **include time frame when work was conducted/samples taken** at specific locations.
	6. Terms such as "surface" and "sub-surface" will be defined and used consistently.
	7. **Discuss data validation/quality** (e.g., Tc-99 data quality as it relates to analytical method used) in the RFI report. This information is currently slated to go into Section 5.2.1.
	8. **Notes from routine monthly 2011 and 2014 meetings** regarding the development of the RFI **will be incorporated** into the RFI report.

MEETING NOTES

Waste Management Area C RCRA Facility Investigation Report

MEETING DATE: August 14, 2014
LOCATION: 2425 Stevens Center, Richland, WA
ATTENDEES:

Alaa Aly (CHPRC)
Marcel Bergeron (WRPS)
Mike Barnes (Ecology)
Joe Caggiano (Ecology)
Ryan Childress (WRPS)
Dan Glaser (WRPS)
Doug Hildebrand (DOE-ORP)
Jenifer Linville (Freestone)
Julie Robertson (Freestone)
Beth Rochette (Ecology)
Kristin Singleton (WRPS)
Cindy Tabor (WRPS)
Greg Thomas (CHPRC)

PURPOSE OF MEETING: The meeting was called to promote discussion among Ecology, EPA, DOE-ORP, DOE-RL, CHPRC, and WRPS regarding the calendar year 2014 effort to develop a RCRA facility investigation (RFI) report for Waste Management Area C (WMA C). As part of the meeting notes, lists of expectations, agreements, and actions will be documented, and the status of these actions will be tracked.

PRIOR MEETING NOTES: Ms. Robertson reported that notes from prior related meetings are in the *Hanford Federal Facility Agreement and Consent Order* Administrative Record. The attendees reviewed a list of expectations and open action items remaining from the prior meeting (April 30, 2014). The results of the discussion are recorded in tables at the end of these meeting notes. Individual actions will be removed from the list after DOE and Ecology have agreed to close the action.

DRAFT RFI REPORT OUTLINE: Ms. Robertson handed out copies of the current draft report outline (Attachment 1). Ms. Tabor reported that the current outline modifies where information will be placed in the report or allows for additional information to be put into the report.

WMA C RISK ASSESSMENT: Mr. Bergeron reported that four separate technical reports are in production as a part of the baseline risk assessment effort. One of the reports will detail the calculation of exposure point concentrations (EPCs) based on WMA C Phase 2 soil characterization data. A second document will describe the baseline risk assessment developed from calculated EPCs. A third report will summarize a screening level evaluation of groundwater monitoring data collected in the vicinity of WMA C over a 10-year period. A fourth report will provide a summary of polychlorinated biphenyl (PCB) congener data from analysis of selected soil samples collected at WMA C. The latter two reports are being prepared as supporting information to the baseline risk assessment and the RFI report.
A summary of the technical report documenting the baseline risk assessment will be provided in Section 7 of the RFI report.

A summary of spectral gamma data collected at selected locations in the vicinity of WMA C is also being prepared as a supporting appendix to the RFI report. This logging data summary is based on spectral gamma data currently available in the Hanford Environmental Information System Geophysical Logging (HEIS-GPL) database.

Mr. Bergeron also handed out a draft outline for the baseline risk assessment technical report (Attachment 2). Mr. Bergeron indicated that the baseline risk assessment will include a detailed human

health risk assessment and a screening level ecological risk assessment. He also indicated that parts of the baseline risk assessment related to the groundwater pathway will be deferred until the WMA C Performance Assessment effort has been completed.

The planned technical reports outlined above will be issued with the draft RFI report when it is provided to the regulatory agencies. Mr. Aly reported that a risk assessment for the associated groundwater operable unit (200-BP-5) is in the process of being completed and will be issued at a later date.

UPCOMING MEETING: September 2014, specific date and time to be determined.

ATTACHMENTS:

- Draft WMA C RFI Report Outline - August 2014 (4 pages)
- Draft Baseline Risk Assessment Technical Report Outline - August 2014 (2 pages)

R Douglas Hildebrand	R Douglas Hildebrand	9-8-2014
DOE Project Manager (print)	DOE Project Manager (signature)	Date
Michael W Barnes	Michael W Barnes	9-8-2014
Ecology Project Manager (print)	Ecology Project Manager (signature)	Date

EXPECTATIONS.	
3/26/2014	1. Ecology expressed an expectation that characterization information for all equipment in the Part A will be discussed in the RFI report.
8/14/2014	2. The WMA C baseline risk assessment will include evaluation of unrestricted, Native American, and other scenarios. WRPS and CHPRC will evaluate recently-released EPA guidance on soil screening levels for protection of groundwater for radionuclides.
	3. RFI report and/or risk assessment documentation should address the relationship between polychlorinated biphenyls in tanks (such as the C-200s) and the vadose zone material.
	4. Both the RFI report and the WMA C risk assessment will identify data/information gaps that may require future revisions of those documents.
	5. Gamma logs will be included in the RFI report (electronic link or appendix).

ACTIONS.			
Action Number	**Actionee**	**Description**	**Status**
2014-02-26-1	Hildebrand	DOE will prepare a TPA change package to address the need to revise TPA milestone M-045-61, which calls for submittal of an RFI/CMS report.	Open. In process.
2014-02-26-2	Eberlein	Identify what risk information will be available for inclusion in the RFI report.	Closed. Risk assessment discussed 08-14-2014.
2014-02-26-3	Tabor, Robertson	Contact Rebecca Gerhart (EPA) after 3/9/2014 to discuss desired level of detail to include in RFI report. Consider level of detail in recent 100 Area RI/FS reports. Propose inclusion of summary level information in document and hyperlinks to other documents that provide more detail.	Open. Initial meeting held 4/28/2014. Anticipate future discussions.
2014-03-26-1	Tabor, Robertson	Schedule future meeting to review the conceptual site model and stratigraphy at WMA C.	Tentatively scheduled for next meeting.
2014-08-01	Tabor	Identify whether any new unplanned releases have been identified as a part of the most recent leak loss assessment update effort.	New.

AGREEMENTS. (2 pages)	
Agreement Date	**Description of the Agreement**
1/23/2014	1. The RFI report will **identify information gaps**. Such gaps will be resolved through future efforts prior to submittal of the WMA C CMS. The meeting attendees felt that this process of gap identification and resolution will support future work prioritization agreements.
	2. Ecology agrees to the **use of the proposed revised RFI report outline** shown in Attachment 1.
2/26/2014	1. The section that addresses regional geology should **use pictures/graphics from the 2010 Natural Systems WMA C Performance Assessment working session** to illustrate the uniqueness of the site (illustrate geology, depict river channeling impacts, etc.).
	2. The description of field sampling techniques should **describe process improvements made over time** and any effects those improvements have made on how the data is interpreted (e.g., surface geophysical exploration, number of samples that can be taken from push borehole).
	3. The RFI report should **reflect on information contained in weekly radiological field survey reports ("rounds sheets")** regarding surface contamination in C Farm. Mr. Barnes noted that many of the unplanned release sites associated with C Farm are based on airborne or surface contamination events, and many of these sites no longer exist (e.g., have been remediated or have dissipated). Such releases are generally documented as "unplanned releases." Convey point that although the surface may be considered uncontaminated today, shallow subsurface contamination may exist across the farm.
	4. The RFI report should **describe changes made in characterization planning as field work progressed**. For example, in the area near the C-200 tanks, initial planning called for direct push investigation. Subsequently, the agencies agreed to investigate that area using surface geophysical exploration (SGE) initially, followed by use of direct push investigation as deemed necessary and feasible based on SGE results and physical limitations in that location.
	5. RFI report sections regarding **nature and extent of contamination and human health and risk assessment will be consistent with information being developed for the separate but parallel WMA C Performance Assessment** effort. The RFI report will incorporate whatever information is available on the topics; information gaps will be identified for subsequent resolution.
2/26/2014 and 3/26/2014	1. To the extent practicable, the RFI report will **include information about liquid sources near or at the surface** (e.g., equipment decontamination activities within the farm, fire hydrant testing, water lines, snow melt, ponds/cribs/ditches) that may have been sources of contamination and/or water infiltration. **Also include UPR descriptions** from WIDS. DOE/RL-88-30 (*Hanford Site Waste Management Units Report*), tank leak-loss reports, the WMA A-AX/C Field Investigation Report, and GJO-98-39-TAR, GJO-HAN-18 (*Hanford Tank Farms Vadose Zone: C Tank Farm Report*) will be reviewed for relevance.
	2. The RFI report will **include characterization information from dry wells, boreholes, direct pushes, and near-surface sampling**. It will also include characterization information from leaks associated with ancillary equipment (pipelines, French drains, C-301, etc.).
	3. The RFI report **table of contents should include a section that refers to the**

AGREEMENTS. (2 pages)	
Agreement Date	**Description of the Agreement**
	conceptual site model. (This information is currently slated to go into Section 5.3.1.) CSM illustrations in RFI report should be consistent with WMA C Performance Assessment models related to nature and extent of contamination if no action were taken.
3/26/2014	1. The introductory section of the RFI document will **incorporate relevant information from the WMA C Phase 2 work plan** (RPP-PLAN-39114), particularly regarding regulatory framework and the regulatory decision-making process.
	2. The RFI report will **incorporate published information about the groundwater monitoring program and groundwater contamination**, including Tc-99, iodine, and nitrate.
	3. The section of the RFI report describing the tank system will **include individual tank timelines** (the "Caggiano diagrams") associated with leaks/losses as well as findings from tank leak-loss reports.
	4. Using information in published reports, the RFI report will **include information about upgradient facilities that are possible sources of groundwater contamination** at WMA C.
	5. The write up of Phase 2 field work will **include time frame when work was conducted/samples taken** at specific locations.
	6. Terms such as "surface" and "sub-surface" will be defined and used consistently.
	7. **Discuss data validation/quality** (e.g., Tc-99 data quality as it relates to analytical method used) in the RFI report. This information is currently slated to go into Section 5.2.1.
	8. **Notes from routine monthly 2011 and 2014 meetings** regarding the development of the RFI **will be incorporated** into the RFI report.

ATTACHMENT 1: Draft WMA C RFI Report Outline
August 2014

SECTION 1.0 INTRODUCTION
1.1 PURPOSE AND SCOPE
1.2 WMA C Site Description
1.3 Summary of Previous and Ongoing Investigations
1.4 Regulatory Framework for Closure of WMA C
- 1.4.1 Hanford Federal Facility Agreement and Consent Order
- 1.4.2 Closure Under Resource Conservation and Recovery Act of 1976
- 1.4.3 AEA Requirements
  - 1.4.3.1 Risk and Performance Assessments
- 1.4.4 National Environmental Policy Act of 1969 and State Environmental Policy Act of 1971
- 1.4.5 The Comprehensive Environmental Response, Compensation, and Liability Act and Other Cleanup Activities Affecting WMA C

SECTION 2.0 SITE BACKGROUND AND ENVIRONMENTAL SETTING
2.1 SITE DESCRIPTION
2.2 REGIONAL HISTORY AND HANFORD OPERATIONS
- 2.2.1 Historical Overview
- 2.2.2 Operations, Facilities, and Processes
- 2.2.3 Contaminant Sources
- 2.2.4 Waste Management

2.3 HANFORD SITE AND REGIONAL ENVIRONMENTAL SETTING
- 2.3.1 Topography
- 2.3.2 Climate
- 2.3.3 Geology
  - 2.3.3.1 100 Areas
  - 2.3.3.2 200 Areas
  - 2.3.3.3 300 Area
- 2.3.4 Surface Water
- 2.3.5 Vadose Zone Recharge
- 2.3.6 Groundwater
- 2.3.7 Vegetation and Wildlife
- 2.3.8 Land Use

2.4 WMA C SITE ENVIRONMENTAL SETTING
- 2.4.1 Topography
- 2.4.2 Geology
  - 2.4.2.1 Vadose Zone Soils
- 2.4.3 Surface Water
- 2.4.4 Vadose Zone Recharge
- 2.4.5 Enhanced Recharge and Preferential Pathways
  - 2.4.5.1 Meteorological Events
  - 2.4.5.2 Water Lines
  - 2.4.5.3 Fire Hydrants
  - 2.4.5.4 Cribs/Ponds/Ditches/Trenches in the Vicinity of WMA C
  - 2.4.5.5 Unplanned Releases (UPRs) and Waste Pipeline Leaks
  - 2.4.5.6 Miscellaneous Structures
  - 2.4.5.7 Decontamination Activities

2.4.5.8 Drywells
2.4.5.9 Clastic Dikes
2.4.6 Groundwater
2.4.6.1 Aquifer Thickness
2.4.6.2 Groundwater Flow rate and Direction
2.4.6.3 Groundwater Monitoring Program
2.4.7 Vegetation and Wildlife
2.4.8 Land Use

SECTION 3.0 WMA C SITE DESCRIPTION
3.1 LOCATION AND SITE DESCRIPTION
3.2 UNIT DESIGN AND OPERATING CHARACTERISTICS
3.2.1 Single Shell Tanks
3.2.2 Ancillary Equipment
3.2.2.1 Transfer Lines
3.2.2.2 Diversion Boxes
3.2.2.3 Catch Tank 241-C-301
3.2.2.4 244-CR Vault
3.2.2.5 Valve Boxes/Pits
3.2.2.6 241-C-801 Cesium Loadout Facility
3.2.2.7 French Drains
3.2.2.8 2607-EG Septic Tank
3.3 WASTE TYPES AND WASTE PROCESSING HISTORY
3.3.1 Waste Streams Transferred Into and Out of 100-Series Tanks
3.3.2 Waste Streams Transferred Into and Out of 200-Series Tanks
3.3.1.1 Bismuth Phosphate Process Wastes
3.3.1.2 Tri-Butyl Phosphate Waste
3.3.1.3 Plutonium Uranium Extraction, B Plan, Reduction-Oxidation, and Miscellaneous Wastes
3.4 INTERIM STABILIZATION
3.5 RETRIEVAL
3.5.1 Modified Sluicing Technology
3.5.2 Mobile Arm Retrieval System
3.5.3 Vacuum Retrieval Technology
3.6 UNPLANNED RELEASE EVENTS AND LEAK EVALUATIONS
3.6.1 Unplanned Releases
3.6.2 Tank Leak Evaluation

SECTION 4.0 FIELD INVESTIGATION PROGRAM
4.1 PREVIOUS/OTHER INVESTIGATIONS
4.2 PHASE 1 RCRA FACILITY INVESTIGATION
4.2.1 Installation of C4297
4.2.2 Characterizing UPR-200-E-82
4.2.3 Collection of Samples from RCRA Monitoring Well 299-E-27-22
4.2.4 Surface Geophysical Exploration
4.2.5 Testing Direct Push Technology
4.2.6 Interim Measures
4.2.7 Results
4.3 PHASE 1 NEAR-TERM CHACTERIZATION
4.3.1 UPR-200-E-86
4.3.2 UPR-200-E-81

4.4 PHASE 2 RCRA FACILITY INVESTIGATION
4.4.1 Phase 2 Investigative Basis and Approach
4.4.1.1 Establishment of Data Quality Objectives
4.4.1.2 Overview of Phase 2 RFI Characterization Activities
4.4.2 Phase 2 Soil Characterization and Analysis
4.4.2.1 Phase 2 Soil Sampling Methodology
4.4.2.2 Phase 2 Soil Sampling Summary
4.4.2.3 Deep Vadose Zone Soil Samples
4.4.3 Relogging Dry Wells and Logging Groundwater Monitoring Wells
4.4.4 Surface Geophysical Exploration
4.4.5 Tissue Characterization and Analysis

SECTION 5.0 Nature and Extent
5.1 Data Review and Evaluation Process
5.1.1 Data Quality Assessment
5.1.2 Screening Levels
5.1.3 Evaluation Process
5.2 Vadose Zone Contamination
5.2.1 Analytical Data
5.2.2 Logging Data
5.2.3 Surface Geophysical Exploration
5.3 Summary of Groundwater Contamination
5.3.1 Annual Report Summaries (Constituents of Concern)
5.3.2 Summary of Above Background
5.4 Biota Contamination
5.4.1 Analytical Data
5.5 Nature and Extent Summary and Data Gaps
5.5.1 Nature and Extent Summary
5.5.2 Nature and Extent Data Gaps

SECTION 6.0 Contaminant Fate and Transport
6.1 Overview of Conceptual Site Models
6.2 Vadose Zone Flow and Transport
Subsections: Hydrogeologic units and conditions, Extent of known contamination, Factors affecting moisture movement, Flow and transport properties
6.3 Groundwater Flow and Transport System
6.4 Primary and Secondary Sources
6.5 Potential Route Mechanisms
6.6 Contaminant Persistence
6.7 Uncertainties in Modeling: CSM, Contaminant Distribution, Transport Parameters, Specific to Vadose and GW Modeling
6.8 Contaminant Fate and Transport Summary and Data Gaps
6.8.1 Summary
6.8.2 Data Gaps

SECTION 7.0 HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT
7.1 HUMAN HEALTH RISK ASSESSMENT
7.1.1 Analytical Data Processing
7.1.2 Exposure Assessment
7.1.3 Toxicity Assessment

7.1.4 Risk Characterization
7.1.5 Uncertainties Analysis
7.2 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
7.2.1 Identification of Ecological Contaminants of Potential Concern
7.2.2 Problem Formulation
7.2.3 Ecological Exposure Assessment
7.2.4 Screening Level Ecological Effects Assessment
7.2.5 Risk Characterization
7.2.5.1 Radionuclides
7.2.5.2 Chemicals
7.2.6 Uncertainty Analysis
7.3 SOIL-TO-GROUNDWATER PATHWAY EVALUATION
7.4 CONCLUSIONS OF THE RISK ASSESSMENTS

SECTION 8.0 SUMMARY AND RECOMMENDATIONS

SECTION 9.0 REFERENCES

APPENDICES (examples)
APPENDIX A Field Logs
APPENDIX B Site Photographs
APPENDIX C Analytical Data and Quality Control Tables
APPENDIX D Laboratory Reports and Chain of Custody Records
APPENDIX E Hydraulic Conductivity Tests
APPENDIX F Soil Boring and Monitoring Well Installation Logs
APPENDIX G Analytical Data Summary
APPENDIX H Human Health Risk Assessment
APPENDIX I Ecological Risk Assessment
APPENDIX J Meeting Minutes
APPENDIX K WIDS Site Descriptions

LIST OF TABLES
TBD
LIST OF FIGURES
TBD

ATTACHMENT 2: Draft Baseline Risk Assessment Technical Report Outline
August 2014

OUTLINES FOR HUMAN HEALTH RISK ASSESSMENT (HHRA)

1. Human Health Risk Assessment
    a. Exposure Assessment
        i. Land Use
        ii. Potential Exposed Populations
        iii. Exposure Pathways (Conceptual Site Model)
        iv. Identification of Contaminants of Potential Concerns
            1. Data Reduction
            2. Weight of Evidence Screen
            3. Risk Screen
            4. Background Screen
            5. Data Qualifiers
        v. Quantifying Exposure Point Concentrations
        vi. Quantifying Chemical Intake/ Adsorption
            1. Radiological COPCs
            2. Non-Radiological COPCs
2. Toxicity Assessment
    a. Radiological COPCs
    b. Non-Radiological COPCs
        i. Carcinogenic Evaluation Methodologies
        ii. Non-carcinogenic Evaluation Methodologies
3. Risk Characterization
    a. Radiological COPCs
    b. Non-Radiological COPCs
        i. Carcinogenic Risk Characterization
        ii. Non-carcinogenic Risk Characterization
4. Uncertainties Assessment
    a. Uncertainty Associated with Analytical Data
    b. Uncertainty Associated with Exposure Assessment
    c. Uncertainty Associated with Toxicity Assessment
    d. Uncertainty Associated with Risk Characterization
5. HHRA Summary

OUTLINE FOR SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT (SLERA)

1. Evaluation of Ecological Exclusion Criteria and Ecological Assessment
2. Characterization of the Ecological Setting
    a. Terrestrial Setting
    b. Aquatic Setting
    c. Threatened and Endangered Species
3. Selection of Stressor (Identification of chemicals of potential ecological concern; COPECs)
4. Screening-Level Problem Formulation
    a. Tiered Assessment Approach
    b. Ecological Conceptual Site Model
5. Screening-Level Ecological Exposure Assessment
    a. Receptors and their Exposure
    b. Quantification of Exposure
6. Screening Level Ecological Effects Assessment
    a. Effects Evaluation for Radionuclides
    b. Chemical Toxicity
7. Screening Level Risk Characterization
    a. Risk Characterization for Radionuclides
    b. Current Chemical Preliminary Risk to Ecological Receptors
8. Uncertainty Analysis
    a. Uncertainty Associated with Problem Formulation
    b. Uncertainty Associated with Exposure Assessment
    c. Uncertainty Associated with Effect Assessment
    d. Uncertainty Associated with Risk Characterization
9. Summary and Evaluation of SLERA Results

MEETING NOTES

Waste Management Area C RCRA Facility Investigation Report

MEETING DATE: October 1, 2014
LOCATION: Washington State Department of Ecology Office, Richland, WA
ATTENDEES:

Ryan Beach (DOE-ORP)
Marcel Bergeron (WRPS)
Mike Barnes (Ecology)
Joe Caggiano (Ecology)
Neil Davis (WRPS)
Susan Eberlein (WRPS)
Les Fort (WRPS)
Rebecca Gerhart (EPA)*
Doug Hildebrand (DOE-ORP)
Chris Kemp (DOE-ORP)
Julie Robertson (Freestone)
Cindy Tabor (WRPS)
Greg Thomas (CHPRC)
Becky Wiegman (WRPS)

*by telephone

PURPOSE OF MEETING: The meeting was called to promote discussion among Ecology, EPA, DOE-ORP, DOE-RL, CHPRC, and WRPS on the RCRA facility investigation (RFI) report being developed for Waste Management Area C (WMA C). Lists of expectations, agreements, and actions (including the status of any actions) will be documented in the meeting notes.

PRIOR MEETING NOTES: Ms. Robertson reported that notes from previous meetings about the WMA C RFI report are in the *Hanford Federal Facility Agreement and Consent Order* Administrative Record. The attendees reviewed a list of expectations and open action items remaining from the prior meeting (August 14, 2014). The results of the discussion are recorded in tables at the end of these meeting notes. Closed actions will be removed from the list after DOE and Ecology have agreed to close the action.

DRAFT RFI REPORT OUTLINE: Ms. Robertson distributed copies of the current draft report outline (Attachment A), noting changes made since August 2014 as document preparation continues.

NATURE AND EXTENT: Ms. Tabor presented several draft tables and figures that provided information about WMA C vadose zone soil sample locations, analytical data, and geophysical studies (Attachment B). The RFI report will include separate tables containing analytical data sorted by either location/investigation group or by constituent to support data evaluation. The report will also contain figures to illustrate stratigraphy at borehole sites together with borehole logging information and vadose zone analytical results with depth. Ecology and EPA complimented the effort being put into clearly presenting the large amount of vadose zone characterization information gathered at WMA C.

UPCOMING MEETING: The attendees tentatively agreed to meet in November 2014, with a specific date and time to be determined.

ATTACHMENTS:

- Attachment A: Draft WMA C RFI Report Outline – September 30, 2014 (4 pages)
- Attachment B: Nature and Extent of Contamination – Draft Figure and Table Hand-Outs, October 1, 2014 (10 pages)

R Douglas Hildebrand		10-24-2014
DOE Project Manager (print)	DOE Project Manager (signature)	Date
Michael W Barnes		10-24-2014
Ecology Project Manager (print)	Ecology Project Manager (signature)	Date

EXPECTATIONS.	
3/26/2014	1. Ecology expressed an expectation that characterization information for all equipment in the Part A will be discussed in the RFI report. On 10/1/2014, DOE reported that this expectation is being addressed in TPA change package M-45-14-03.
10/1/2014	1. Ecology expects that WRPS/DOE will review vadose zone PCB results and evaluate whether contamination can be attributed to C-200 tanks (specifically, C-203) vs. pipelines connecting the C-200s to Strontium Semi-Works (where pumps contained PCBs that may have leaked).

ACTIONS.

Action Number	Actionee	Description	Status
2014-02-26-1	Hildebrand	DOE will prepare a TPA change package to address the need to revise TPA milestone M-045-61, which calls for submittal of an RFI/CMS report.	Closed. DOE submitted signed change package M-45-14-03 on 9/30/2014.
2014-02-26-3	Tabor, Robertson	Contact Rebecca Gerhart (EPA) after 3/9/2014 to discuss desired level of detail to include in RFI report. Consider level of detail in recent 100 Area RI/FS reports. Propose inclusion of summary level information in document and hyperlinks to other documents that provide more detail.	Open. Initial meeting held 4/28/2014. Discussions are ongoing.
2014-03-26-1	Tabor, Robertson	Schedule future meeting to review the conceptual site model and stratigraphy at WMA C.	Open. WRPS and DOE will seek clarification from Ecology on the desired discussion topic and schedule a meeting as necessary.
2014-08-01	Tabor	Identify whether any new unplanned releases have been identified as a part of the most recent leak loss assessment update effort.	Closed. WRPS reported no new UPRs were identified.

AGREEMENTS. (2 pages)	
Agreement Date	**Description of the Agreement**
1/23/2014	1. The RFI report will **identify information gaps**. Such gaps will be resolved through future efforts prior to submittal of the WMA C CMS. The meeting attendees felt that this process of gap identification and resolution will support future work prioritization agreements.
	2. Ecology agrees to the **use of the proposed revised RFI report outline** shown in Attachment 1.
2/26/2014	1. The section that addresses regional geology should **use pictures/graphics from the 2010 Natural Systems WMA C Performance Assessment working session** to illustrate the uniqueness of the site (illustrate geology, depict river channeling impacts, etc.).
	2. The description of field sampling techniques should **describe process improvements made over time** and any effects those improvements have made on how the data is interpreted (e.g., surface geophysical exploration, number of samples that can be taken from push borehole).
	3. The RFI report should **reflect on information contained in weekly radiological field survey reports ("rounds sheets")** regarding surface contamination in C Farm. Mr. Barnes noted that many of the unplanned release sites associated with C Farm are based on airborne or surface contamination events, and many of these sites no longer exist (e.g., have been remediated or have dissipated). Such releases are generally documented as "unplanned releases." Convey point that although the surface may be considered uncontaminated today, shallow subsurface contamination may exist across the farm.
	4. The RFI report should **describe changes made in characterization planning as field work progressed**. For example, in the area near the C-200 tanks, initial planning called for direct push investigation. Subsequently, the agencies agreed to investigate that area using surface geophysical exploration (SGE) initially, followed by use of direct push investigation as deemed necessary and feasible based on SGE results and physical limitations in that location.
	5. RFI report sections regarding **nature and extent of contamination and human health and risk assessment will be consistent with information being developed for the separate but parallel WMA C Performance Assessment** effort. The RFI report will incorporate whatever information is available on the topics; information gaps will be identified for subsequent resolution.
2/26/2014 and 3/26/2014	1. To the extent practicable, the RFI report will **include information about liquid sources near or at the surface** (e.g., equipment decontamination activities within the farm, fire hydrant testing, water lines, snow melt, ponds/cribs/ditches) that may have been sources of contamination and/or water infiltration. **Also include UPR descriptions** from WIDS. DOE/RL-88-30 (*Hanford Site Waste Management Units Report*), tank leak-loss reports, the WMA A-AX/C Field Investigation Report, and GJO-98-39-TAR, GJO-HAN-18 (*Hanford Tank Farms Vadose Zone: C Tank Farm Report*) will be reviewed for relevance.
	2. The RFI report will **include characterization information from dry wells, boreholes, direct pushes, and near-surface sampling**. It will also include characterization information from leaks associated with ancillary equipment (pipelines, French drains, C-301, etc.).
	3. The RFI report **table of contents should include a section that refers to the conceptual site model**. (This information is currently slated to go into Section 5.3.1.) CSM illustrations in RFI report should be consistent with WMA C Performance Assessment

AGREEMENTS. (2 pages)	
Agreement Date	**Description of the Agreement**
	models related to nature and extent of contamination if no action were taken.
3/26/2014	1. The introductory section of the RFI document will **incorporate relevant information from the WMA C Phase 2 work plan** (RPP-PLAN-39114), particularly regarding regulatory framework and the regulatory decision-making process.
	2. The RFI report will **incorporate published information about the groundwater monitoring program and groundwater contamination**, including Tc-99, iodine, and nitrate.
	3. The section of the RFI report describing the tank system will **include individual tank timelines** (the "Caggiano diagrams") associated with leaks/losses as well as findings from tank leak-loss reports.
	4. Using information in published reports, the RFI report will **include information about upgradient facilities that are possible sources of groundwater contamination** at WMA C.
	5. The write up of Phase 2 field work will **include time frame when work was conducted/samples taken** at specific locations.
	6. Terms such as "surface" and "sub-surface" will be defined and used consistently.
	7. **Discuss data validation/quality** (e.g., Tc-99 data quality as it relates to analytical method used) in the RFI report. This information is currently slated to go into Section 5.2.1.
	8. **Notes from routine monthly 2011 and 2014 meetings** regarding the development of the RFI **will be incorporated** into the RFI report.
8/14/2014	1. The WMA C baseline risk assessment will include evaluation of unrestricted, Native American, and other scenarios.
	2. WRPS and CHPRC will evaluate recently-released EPA guidance on soil screening levels for protection of groundwater for radionuclides.
	3. RFI report and/or risk assessment documentation will review vadose zone PCB data to support evaluation of possible sources (i.e., C-200 tanks/241-C-203 and leaks from pipelines from Strontium Semi-Works/PCB-containing pumps).
	4. Both the RFI report and the WMA C risk assessment will identify data/information gaps that may require future revisions of those documents.
	5. Gamma logs will be included in the RFI report (electronic link or appendix). A summary of spectral gamma data collected at selected locations in the vicinity of WMA C is also being prepared as a supporting appendix to the RFI report.

ATTACHMENT A: Draft WMA C RFI Report Outline
September 30, 2014

SECTION 1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE
- 1.1.1 Definitions
- 1.1.2 Single-Shell Tank System Closure
  - 1.1.2.1 *National Environmental Policy Act of 1969* and *State Environmental Policy Act of 1971* Decisions
  - 1.1.2.2 Closure Under the *Resource Conservation and Recovery Act of 1976*
  - 1.1.2.3 Closure Under the *Atomic Energy Act of 1954*
  - 1.1.2.4 Waste Management Area C Performance Assessment
- 1.1.3 Groundwater Remediation

1.2 DOCUMENT STRUCTURE

1.3 WMA C SITE DESCRIPTION

1.4 SUMMARY OF *RESOURCE CONSERVATION AND RECOVERY ACT* FACILITY INVESTIGATIONS
- 1.4.1 Phase 1 Investigation
- 1.4.2 Phase 1 Near-Term Characterization
- 1.4.3 Phase 2 Investigation

SECTION 2.0 SITE BACKGROUND AND ENVIRONMENTAL SETTING

2.1 SITE DESCRIPTION

2.2 REGIONAL HISTORY AND HANFORD OPERATIONS
- 2.2.1 Historical Overview
- 2.2.2 Operations, Facilities, and Processes
- 2.2.3 Contaminant Sources
- 2.2.4 Waste Management

2.3 HANFORD SITE AND REGIONAL ENVIRONMENTAL SETTING
- 2.3.1 Topography
- 2.3.2 Climate
- 2.3.3 Geology
  - 2.3.3.1 100 Areas
  - 2.3.3.2 200 Areas
  - 2.3.3.3 300 Area
- 2.3.4 Surface Water
- 2.3.5 Vadose Zone Recharge
- 2.3.6 Groundwater
- 2.3.7 Vegetation and Wildlife
- 2.3.8 Land Use

2.4 WMA C SITE ENVIRONMENTAL SETTING
- 2.4.1 Topography
- 2.4.2 Geology
  - 2.4.2.1 Vadose Zone Soils
- 2.4.3 Surface Water
- 2.4.4 Vadose Zone Recharge
- 2.4.5 Enhanced Recharge and Preferential Pathways
  - 2.4.5.1 Meteorological Events
  - 2.4.5.2 Water Lines
  - 2.4.5.3 Fire Hydrants

2.4.5.4 Cribs/Ponds/Ditches/Trenches in the Vicinity of WMA C
2.4.5.5 Unplanned Releases (UPRs) and Waste Pipeline Leaks
2.4.5.6 Miscellaneous Structures
2.4.5.7 Decontamination Activities
2.4.5.8 Drywells
2.4.5.9 Clastic Dikes
2.4.6 Groundwater
2.4.6.1 Aquifer Thickness
2.4.6.2 Groundwater Flow rate and Direction
2.4.6.3 Groundwater Monitoring Program
2.4.7 Vegetation and Wildlife
2.4.8 Land Use

SECTION 3.0 WMA C SITE DESCRIPTION
3.1 LOCATION AND SITE DESCRIPTION
3.2 UNIT DESIGN AND OPERATING CHARACTERISTICS
3.2.1 Single Shell Tanks
3.2.2 Ancillary Equipment
3.2.2.1 Transfer Lines
3.2.2.2 Diversion Boxes
3.2.2.3 Catch Tank 241-C-301
3.2.2.4 244-CR Vault
3.2.2.5 Valve Boxes/Pits
3.2.2.6 241-C-801 Cesium Loadout Facility
3.2.2.7 French Drains
3.2.2.8 2607-EG Septic Tank
3.3 WASTE TYPES AND WASTE PROCESSING HISTORY
3.3.1 100-Series Tanks Waste Streams
3.3.1.1 Bismuth Phosphate Process Wastes
3.3.1.2 Tri-Butyl Phosphate Waste
3.3.1.3 Plutonium Uranium Extraction, B Plan, Reduction-Oxidation, and Miscellaneous Wastes
3.3.2 200-Series Tanks Waste Streams
3.4 INTERIM STABILIZATION
3.5 WASTE RETRIEVAL TECHNOLOGY
3.5.1 Modified Sluicing Technology
3.5.2 Mobile Arm Retrieval System
3.5.3 Vacuum Retrieval Technology
3.6 RESIDUAL WASTE INVENTORY
3.6.1 Retrieved Tanks
3.6.2 Not-Yet Retrieved Tanks
3.6.3 Ancillary Equipment
3.7 ASSESSMENT OF KNOWN OR SUSPECTED UNPLANNED RELEASES AT WMA C
3.7.1 Releases from Single-Shell Tanks
3.7.1.1 Tank 241-C-101 Tank Leak Investigation
3.7.1.2 Tank 241-C-105 Tank Leak Investigation
3.7.1.3 Tank 241-C-110 Tank Leak Investigation
3.7.1.4 Tank 241-C-111 Tank Leak Investigation
3.7.1.5 C-200 Series Single-Shell Tank Leak Investigation
3.7.2 Possible Releases from Single-Shell Tanks Not Included in the DQO
3.7.3 Unplanned Releases

3.7.4 Waste Losses From Spare Inlet Nozzles and Cascade Lines
3.7.5 Suspected Pipeline Waste Loss Events

SECTION 4.0 FIELD INVESTIGATION PROGRAM
4.1 PREVIOUS/OTHER INVESTIGATIONS
4.2 PHASE 1 RCRA FACILITY INVESTIGATION
4.2.1 Characterizing Soil Around Tank 241-C-105 (Installation of C4297)
4.2.2 Characterizing UPR-200-E-82
4.2.3 Collecting Samples from RCRA Monitoring Well 299-E-27-22
4.2.4 Surface Geophysical Exploration
4.2.5 Testing Direct Push Technology
4.2.6 Phase 1 Conclusions and Recommendations
4.3 PHASE 1 NEAR-TERM CHACTERIZATION
4.3.1 UPR-200-E-86
4.3.2 UPR-200-E-81
4.4 PHASE 2 RCRA FACILITY INVESTIGATION
4.4.1 Phase 2 Investigative Basis and Approach
4.4.2 Phase 2 Direct Push Characterization and Analysis
4.4.3 Relogging Dry Wells and Logging Groundwater Monitoring Wells
4.4.4 Surface Geophysical Exploration
4.4.5 Tissue Characterization and Analysis
4.4.6 Soil Samples from Groundwater Wells

SECTION 5.0 NATURE AND EXTENT OF CONTAMINATION
5.1 DATA REVIEW AND EVALUATION PROCESS
5.1.1 Data Quality Assessment
5.1.2 Screening Levels
5.1.3 Evaluation Process
5.2 VADOSE ZONE CHARACTERIZATION
5.2.1 Analytical Data
5.2.2 Direct Push and Drywell Logging Data 5.2.3 Surface Geophysical Exploration
5.3 SUMMARY OF GROUNDWATER CONTAMINATION
5.3.1 Summary of Groundwater Data Collected at WMA C
5.3.2 Summary of Groundwater Contamination at WMA C
5.4 BIOTA CONTAMINATION
5.4.1 Analytical Data
5.4.2 Recommendations
5.5 NATURE AND EXTENT OF VADOSE ZONE CONTAMINATION
5.5.1 Nature and Extent Conclusions
5.5.2 Nature and Extent Data Gaps

SECTION 6.0 CONTAMINANT FATE AND TRANSPORT
6.1 OVERVIEW OF APPROACH FOR ASSESSMENT OF CONTAMINANT FATE AND TRANSPORT
6.2 CONCEPTUAL MODEL(S) OF CONTAMINANT FATE AND TRANSPORT
6.3 CURRENT IMPLEMENTATION OF NUMERICAL MODELS FOR EVALUATING CONTAMINANT FATE AND TRANSPORT
6.4 APPROACH FOR ASSESSING SYSTEM SENSITIVITY AND UNCERTAINTY
6.5 CONTAMINANT FATE AND TRANSPORT SUMMARY AND DATA GAPS

SECTION 7.0 HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT

7.1 HUMAN HEALTH RISK ASSESSMENT
- 7.1.1 Analytical Data Processing
- 7.1.2 Exposure Assessment
- 7.1.3 Toxicity Assessment
- 7.1.4 Risk Characterization
- 7.1.5 Uncertainties Analysis

7.2 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
- 7.2.1 Identification of Ecological Contaminants of Potential Concern
- 7.2.2 Problem Formulation
- 7.2.3 Ecological Exposure Assessment
- 7.2.4 Screening Level Ecological Effects Assessment
- 7.2.5 Risk Characterization
  - 7.2.5.1 Radionuclides
  - 7.2.5.2 Chemicals
- 7.2.6 Uncertainty Analysis

7.3 SOIL-TO-GROUNDWATER PATHWAY EVALUATION

7.4 CONCLUSIONS OF THE RISK ASSESSMENTS

SECTION 8.0 SUMMARY AND RECOMMENDATIONS

SECTION 9.0 REFERENCES

APPENDICES (preliminary)

APPENDIX A (Goes with Section 1.0)
- A.1 2014 WMA C Closure Meeting Notes
- A.2 2014 WMA C RCRA Facility Investigation Report Development Meeting Notes

APPENDIX B (Goes with Section 3.0)
- B.1 241-C Farm Tank Waste Receipt and Transfer Timeline Diagrams
- B.2 WMA C Waste Information Database System Table
- B.3 241-C Tank Farm Construction Photos

APPENDIX C (Goes with Section 4.0; specific order not yet determined)
- C.1 WMA C Phase 2 Investigation Field Methods Information
- C.2 WMA C Phase 2 Investigation Direct Push Sample Depth Meeting Notes
- C.3 WMA C Phase 2 Investigation Work Plan Development Meeting Notes
- C.4 WMA C Phase 2 Investigation Work Plan, Sampling and Analysis Plan, and Field Sampling and Analysis Plan Change Control Documentation
  - C.4.1 TPA Change Notices and Document Approval Letters (detailed information on changes for document revisions)
  - C.4.2 FSAP Change Notices
- C.5 WMA C Phase 2 Investigation Borehole Completion Reports

APPENDIX D (Goes with Section 5.0)
- D.1 Data Quality Assessment
- D.2 Previous investigation backup information (as needed)
- D.3 Graphics and Tables – possibly several different appendices)
- D.4 Lab Reports
- D.5 Summary of Spectral Gamma Logging Data
- D.6 Spectral Gamma Logging System Data Reports

APPENDIX E (Goes with Section 6.0)

Appendix X Additional site photos (if needed)

ATTACHMENT B: Nature and Extent of Contamination
Draft Figure and Table Hand-Outs
October 1, 2014

October 1 – RFI Meeting

Walk Thru Section 5 outline (overview)...different components:

- Vadose Zone Analytical (Direct Push and Samples from GW Wells)
- SGE
- Logging Data (Drywell and Direct Push)
- Tissue (Mouse Data)
- Summary of Groundwater Contamination

Focus of this discussion is on Vadose Analytical Data

Report will include:

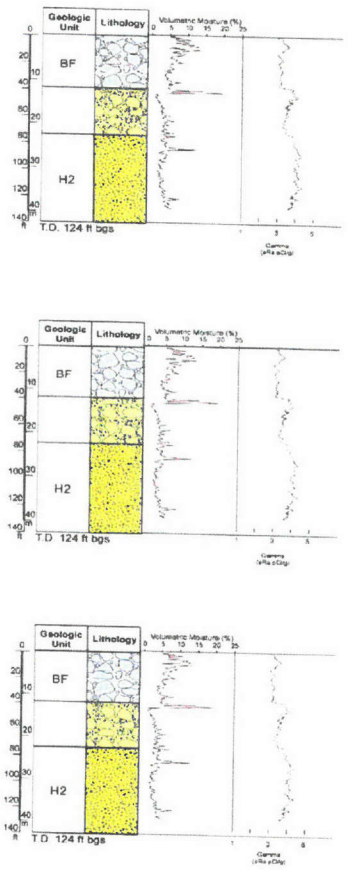
- Pre-Phase 1 RFI data: Tanaka [UPR-82] Cesium-137, 2 locations and Approximately 70 Drywell Logging Locations
- Phase 1 RFI data: UPR-82 (26 pushes, 20/40 vertical and 6 angle), C4297 (C-105), and Well 299-E27-22 (was hoped to be a background location)
- Near-term (Phase 1.5): UPR-86 (3 sample locations) and UPR-81 (part of P location in Phase 2)

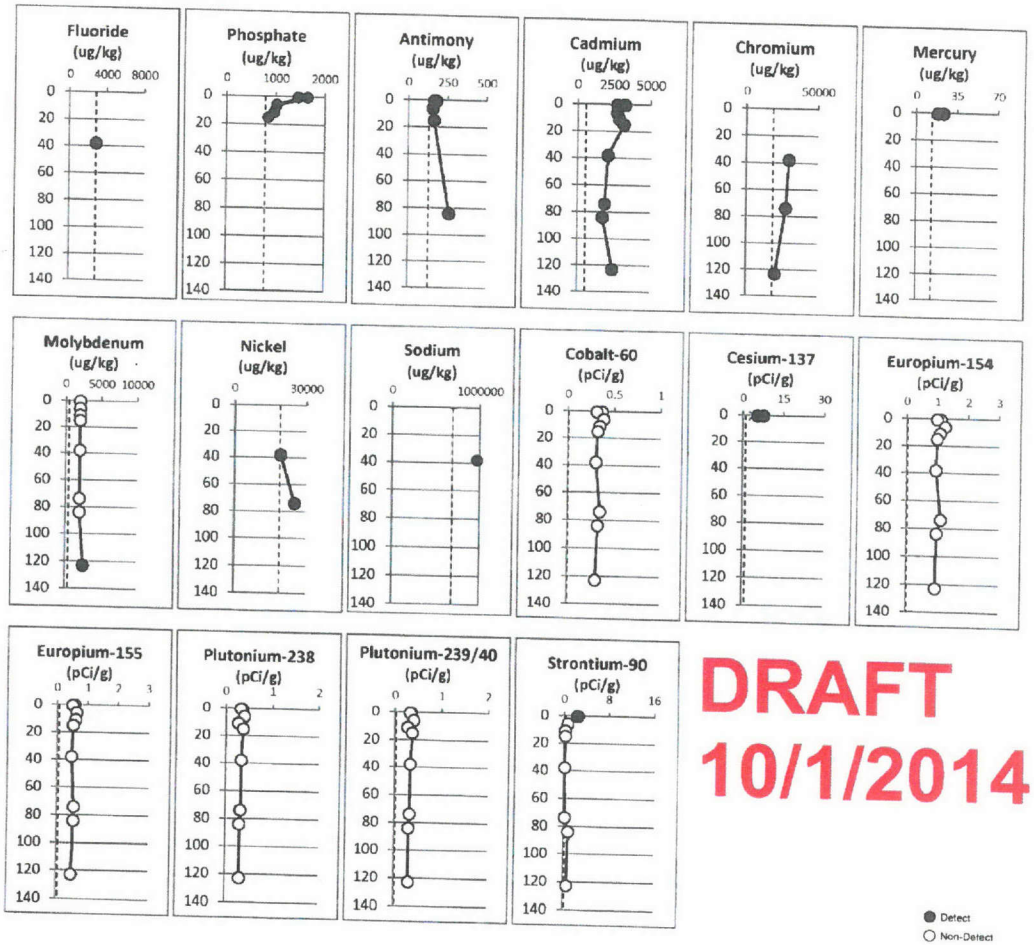
Note: Phases 1 and Near-Term analyzed by PNNL

Phase 2 RFI Analytical Data/Sampling Locations

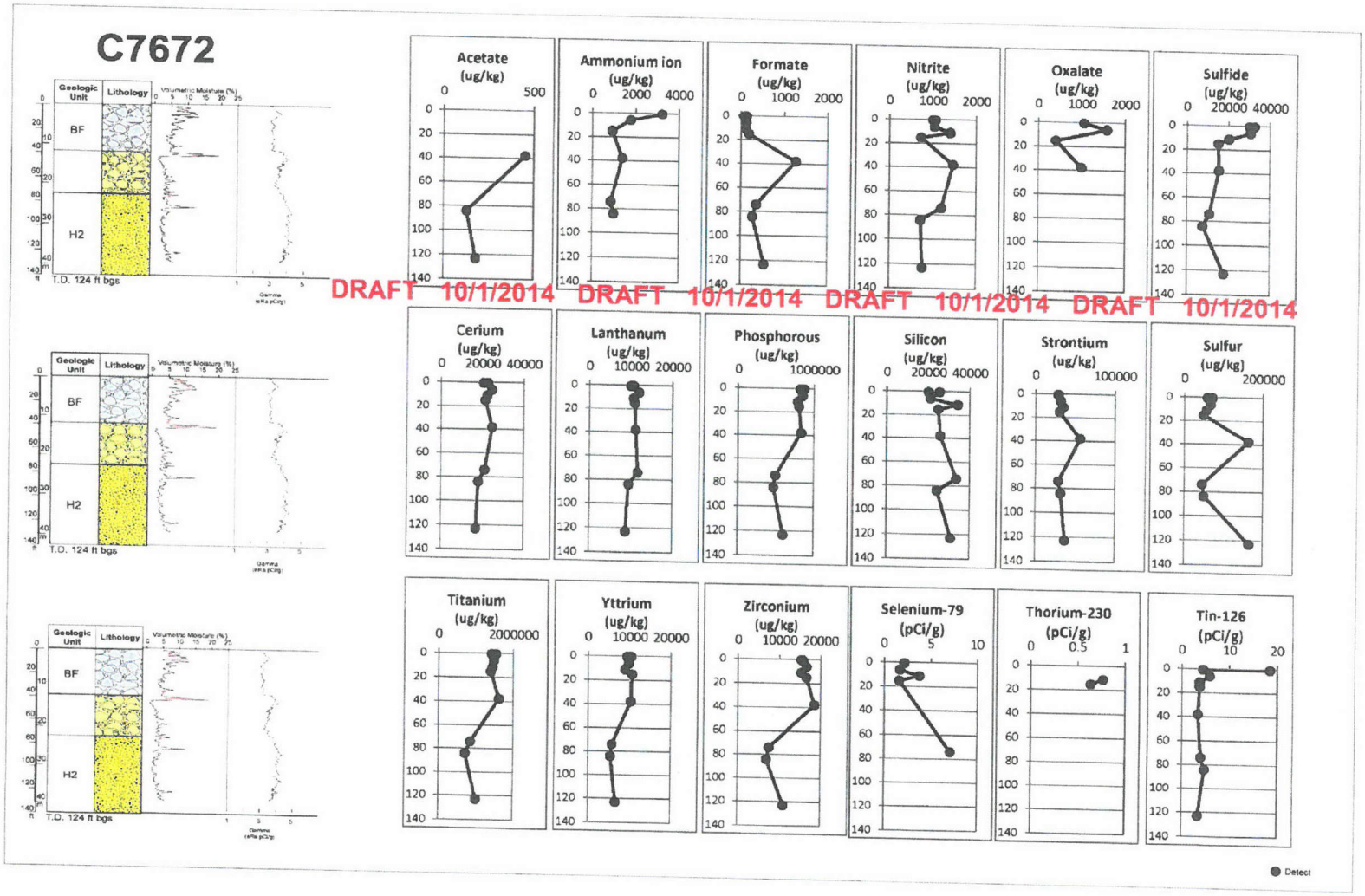
Investigation Group/Site	Area	Reason
A+B	C-101	Characterize C-101 release
C	C200s (C-203)	Determine if C-200s actually leaked
E	Area between C-106 and C-109	Assess transfer line release between C-106 and C-109 including ^{60}Co distribution
F+G	C-103 and Building C-801 and the building's chemical drain	Assess release of PUREX waste to building C-801 chemical drain and assess suspected transfer line release between C-103 and C-801 Building
H+I	UPR-91 and UPR-115	Evaluate surface release area NE of UPR-91 and evaluate surface release NE of UPR-115
J	C-104	Characterize potential C-104 release
L1+L2	Area between C-103 and C-106	Assess potential release from C-103 and C-106 transfer line
P	UPR-81	Evaluate UPR-81
R	Area near C-301 catch tank	Asses potential release from catch tank C-301
U	C-110	Characterize potential C-110 release
299-E27-20 (Z)	Adjacent to 299-E27-23	
299-E27-24 (Y)	Due east of 291-CR	

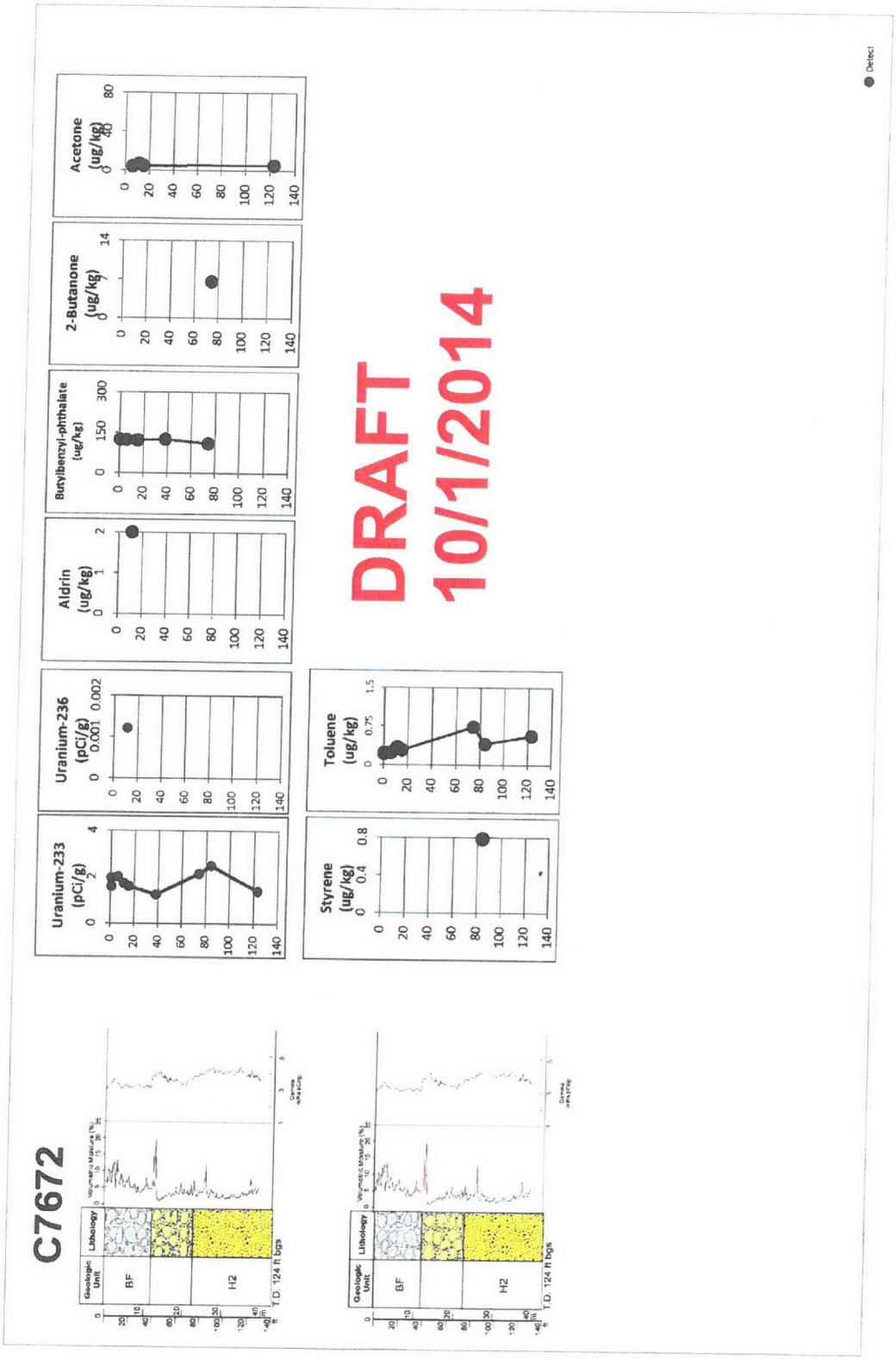
C7672

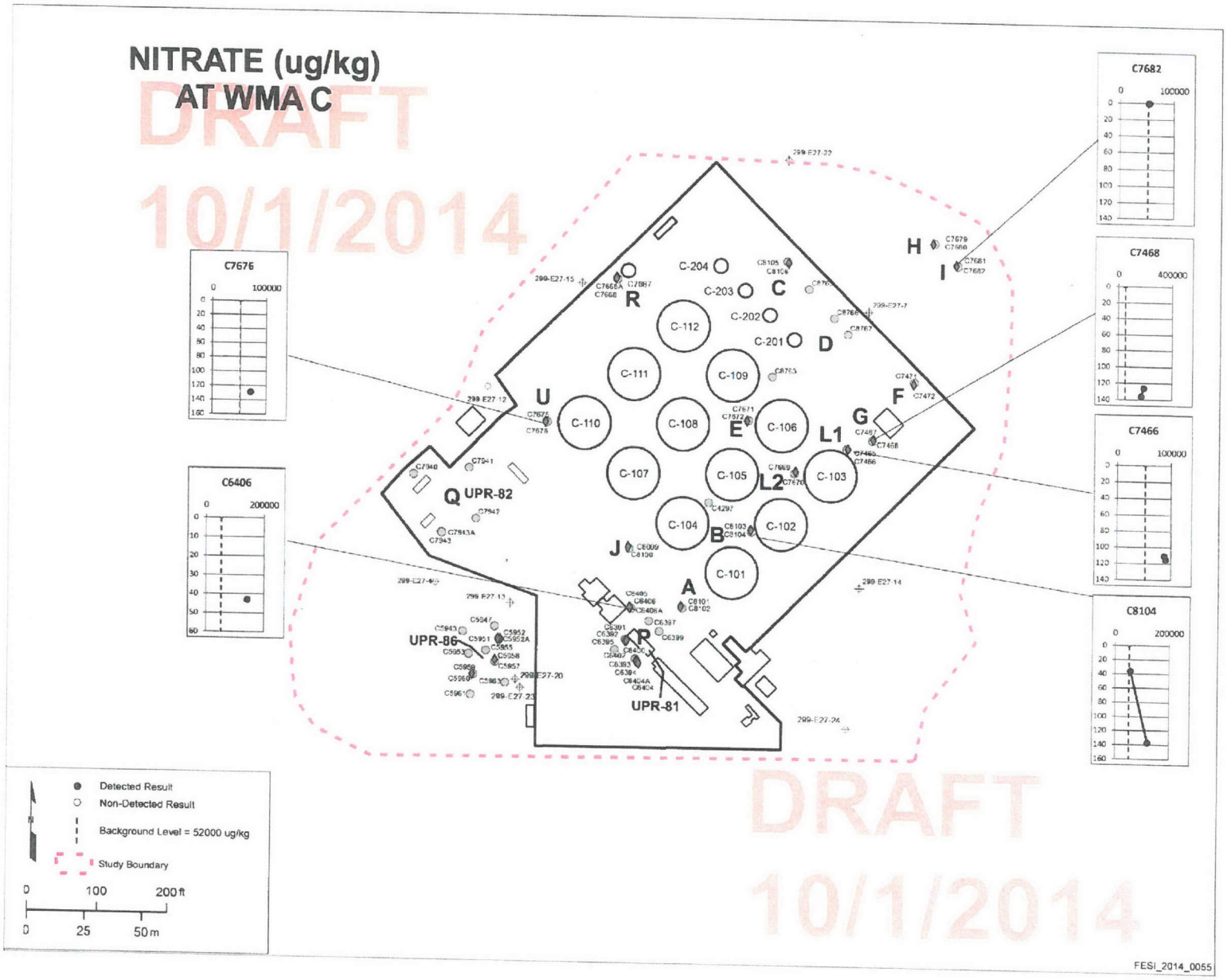


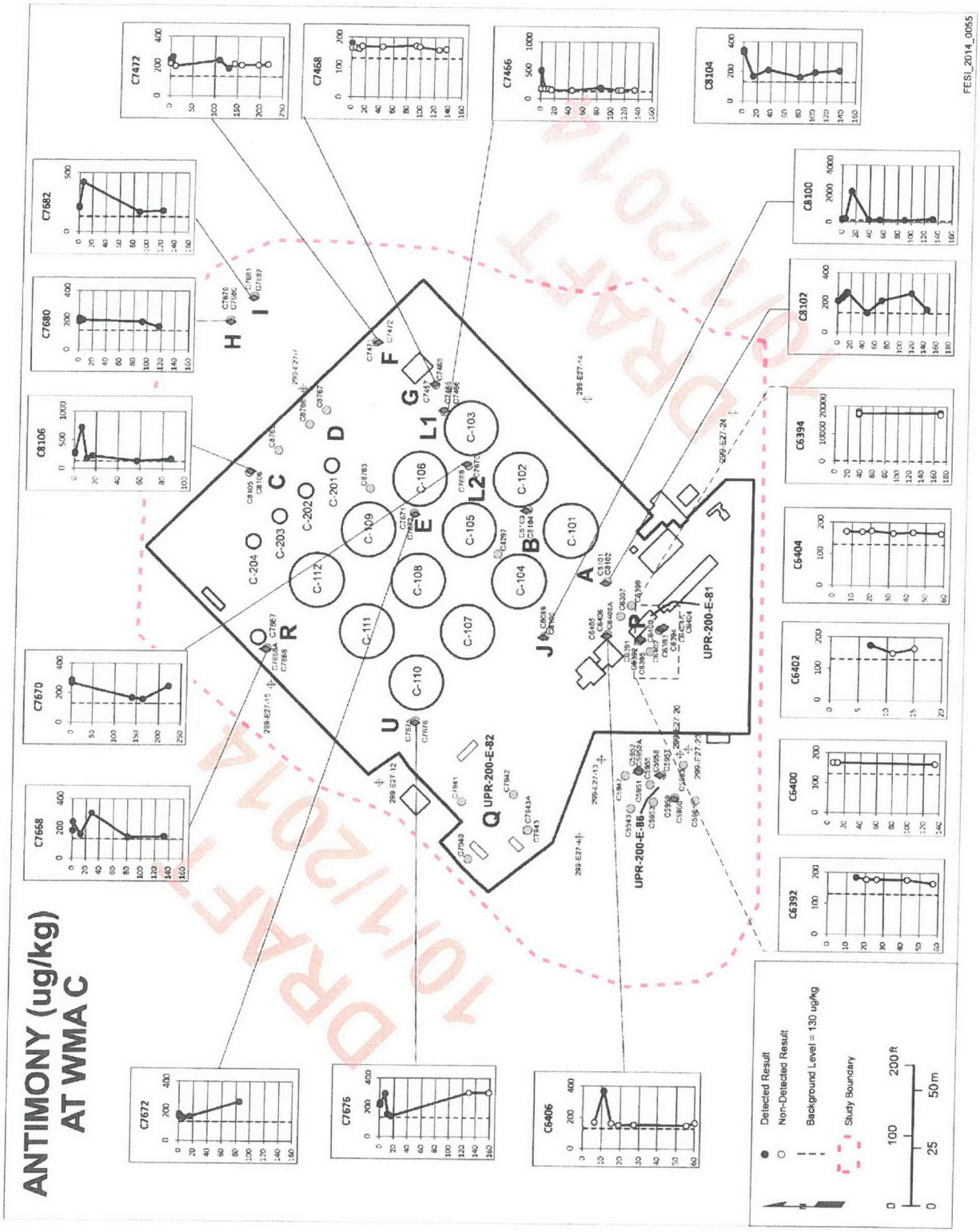


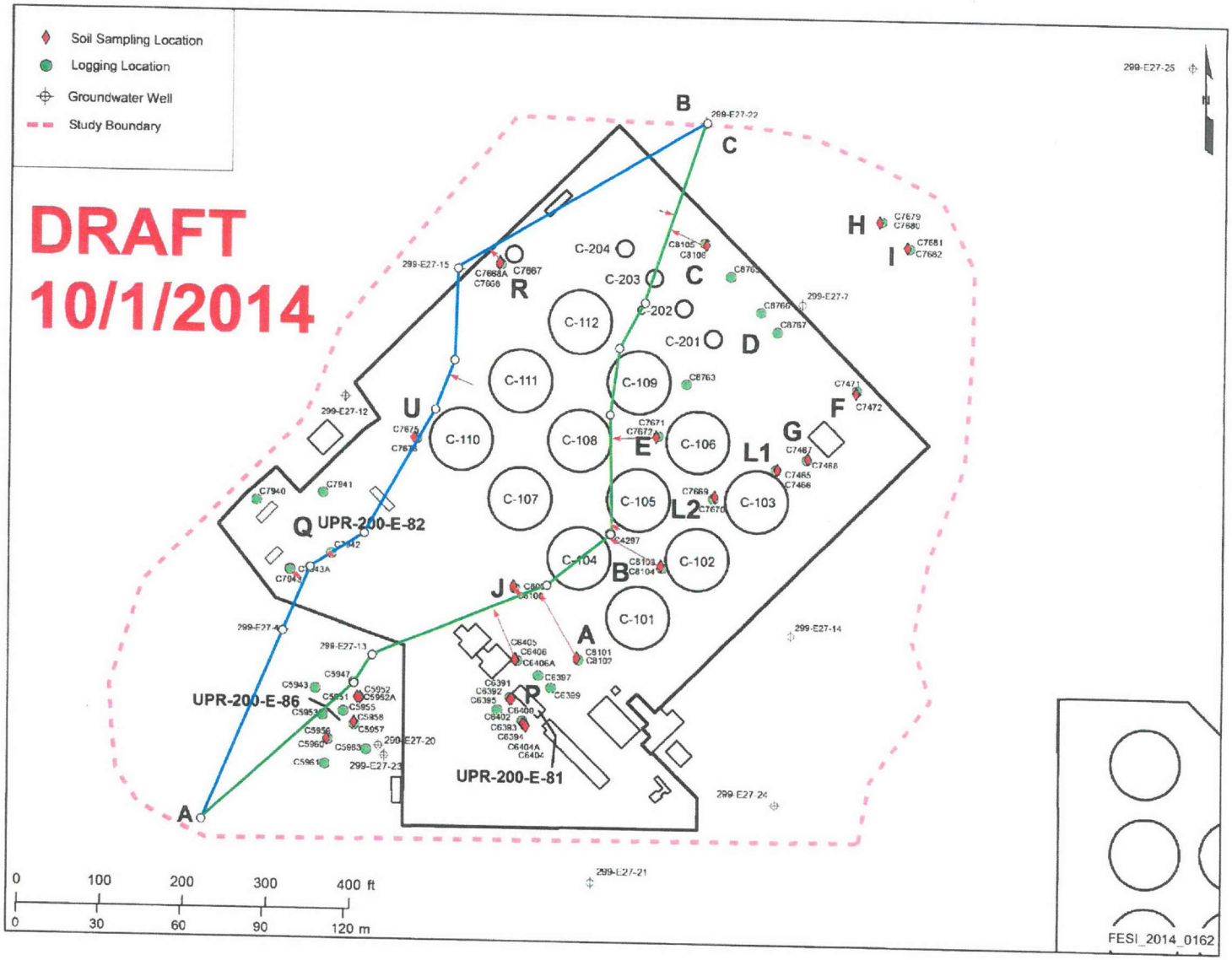
DRAFT
10/1/2014

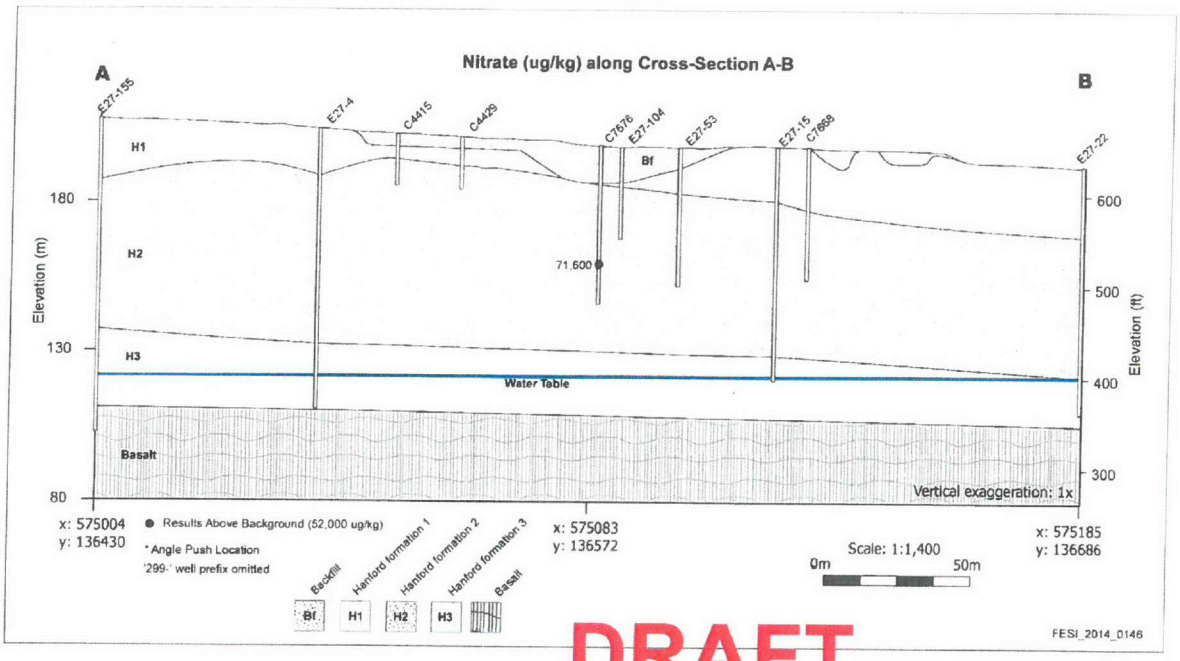

C7672
Geologic Unit
Lithology
BF
H2
T.D. 124 ft bgs
Acetate (ug/kg)
Ammonium ion (ug/kg)
Formate (ug/kg)
Nitrite (ug/kg)
Oxalate (ug/kg)
Sulfide (ug/kg)
Cerium (ug/kg)
Lanthanum (ug/kg)
Phosphorous (ug/kg)
Silicon (ug/kg)
Strontium (ug/kg)
Sulfur (ug/kg)
Titanium (ug/kg)
Yttrium (ug/kg)
Zirconium (ug/kg)
Selenium-79 (pCi/g)
Thorium-230 (pCi/g)
Tin-126 (pCi/g)
Detect
DRAFT 10/1/2014


C7672
Geologic Unit
Lithology
BF
H2
T.D. 124 ft bgs
Uranium-233 (pCi/g)
Uranium-236 (pCi/g)
Aldrin (ug/kg)
Butylbenzyl-phthalate (ug/kg)
2-Butanone (ug/kg)
Acetone (ug/kg)
Styrene (ug/kg)
Toluene (ug/kg)
DRAFT
10/1/2014
Detect

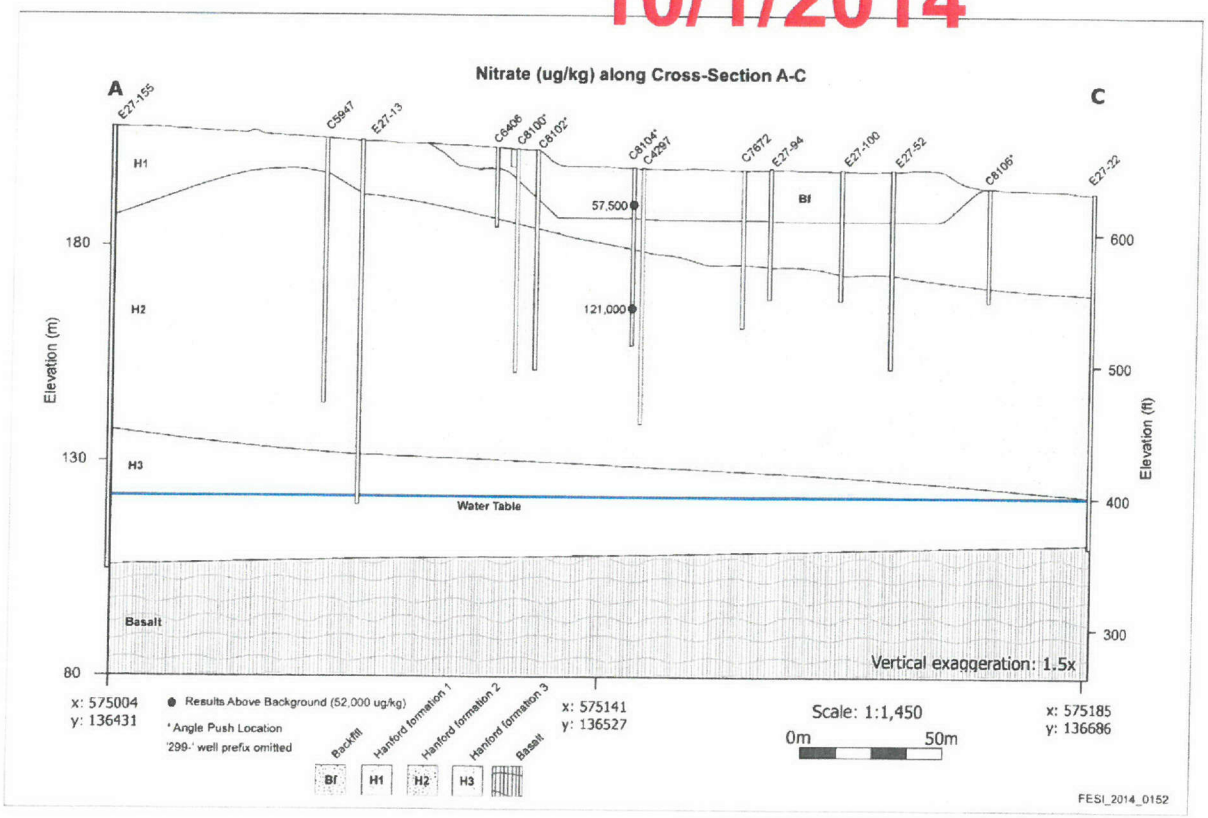

NITRATE (ug/kg)
AT WMA C
DRAFT
10/1/2014
C7676
C6406
C7682
C7468
C7466
C8104
C-204
C-203
C-202
C-201
C-112
C-111
C-110
C-109
C-108
C-107
C-106
C-105
C-104
C-103
C-102
C-101
R
C
D
U
E
F
G
L1
L2
Q
UPR-82
B
J
A
H
I
UPR-86
UPR-81
Detected Result
Non-Detected Result
Background Level = 52000 ug/kg
Study Boundary
0 100 200 ft
0 25 50 m
FESI_2014_0055

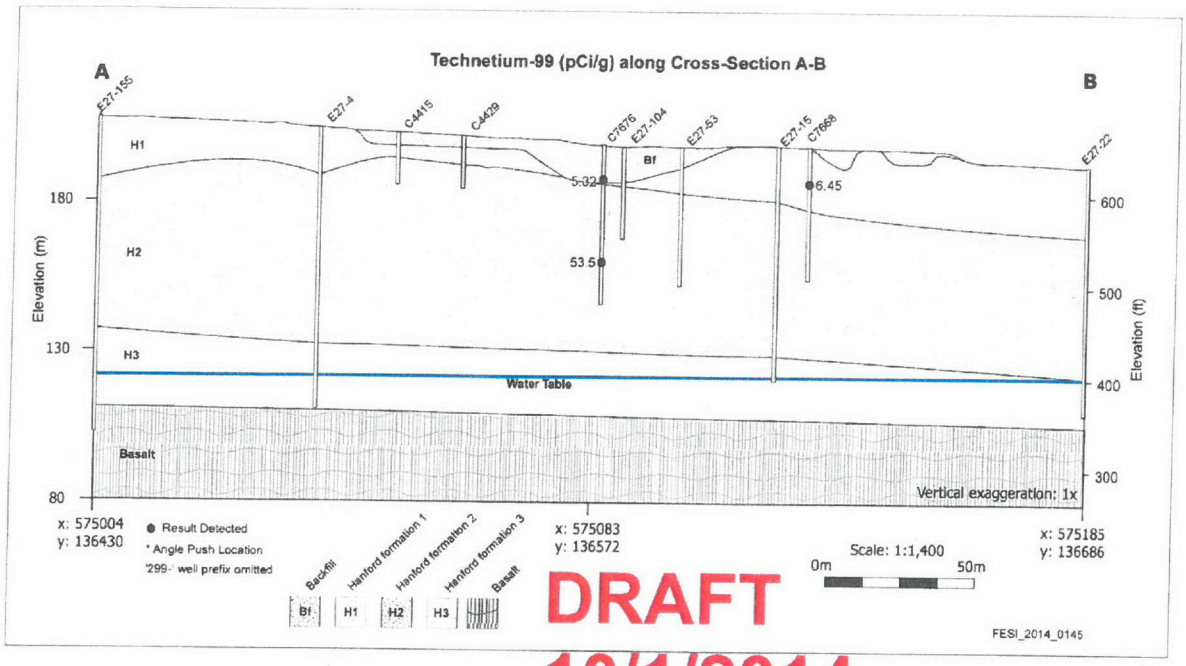

ANTIMONY (ug/kg)
AT WMA C
FESI_2014_0055
C7472
C7468
C7466
C8104
C7682
C7680
C8106
C8100
C8102
C6394
C6404
C6402
C6400
C6392
C7670
C7658
C7672
C7676
C6406
UPR-200-E-81
UPR-200-E-82
UPR-200-E-86
C-101
C-102
C-103
C-104
C-105
C-106
C-107
C-108
C-109
C-110
C-111
C-112
C-201
C-202
C-203
C-204
Detected Result
Non-Detected Result
Background Level = 130 ug/kg
Study Boundary
0 100 200ft
0 25 50m


Soil Sampling Location
Logging Location
Groundwater Well
Study Boundary
DRAFT
10/1/2014
UPR-200-E-82
UPR-200-E-86
UPR-200-E-81
C-204
C-203
C-202
C-201
C-112
C-111
C-110
C-109
C-108
C-107
C-106
C-105
C-104
C-103
C-102
C-101
A
B
C
D
E
F
G
H
I
J
L1
L2
P
Q
R
U
0 100 200 300 400 ft
0 30 60 90 120 m
FESI_2014_0162

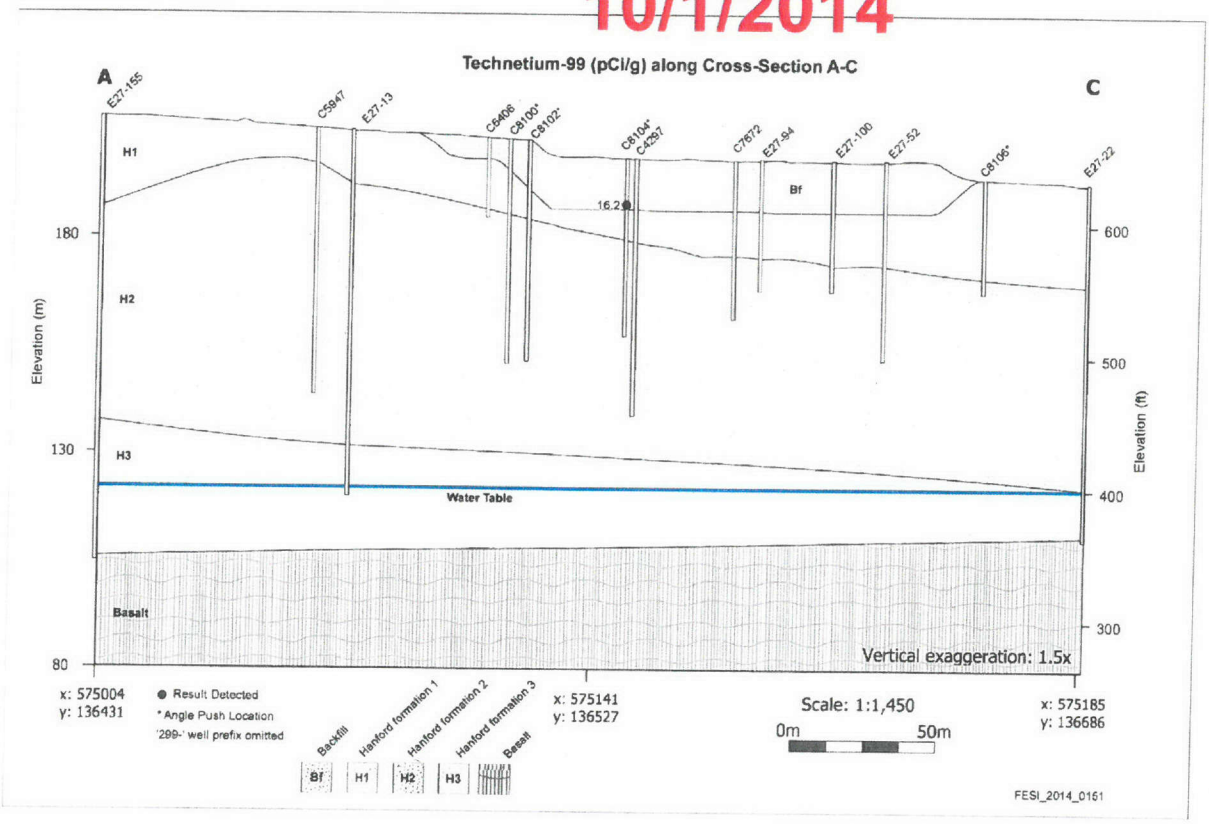


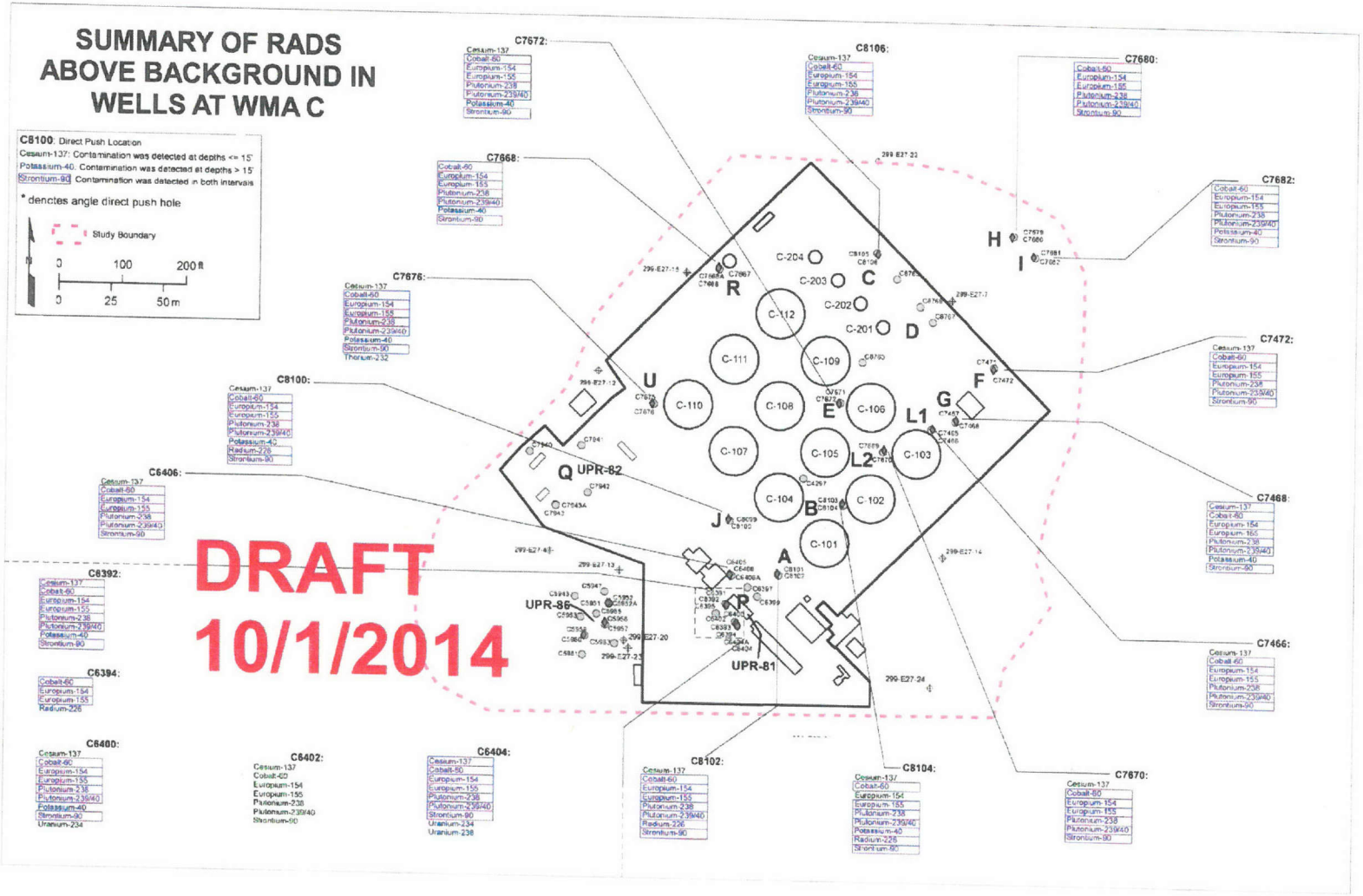
DRAFT
10/1/2014





DRAFT
10/1/2014




SUMMARY OF RADS ABOVE BACKGROUND IN WELLS AT WMA C
C8100: Direct Push Location
Cesium-137: Contamination was detected at depths <= 15'
Potassium-40: Contamination was detected at depths > 15'
Strontium-90: Contamination was detected in both intervals
* denotes angle direct push hole
Study Boundary
0 100 200 ft
0 25 50 m
DRAFT
10/1/2014
C7672:
C8106:
C7680:
C7668:
C7682:
C7676:
C7472:
C8100:
C6406:
C7468:
C8392:
C7466:
C6394:
C6400:
C6402:
C6404:
C8102:
C8104:
C7670:
C-204
C-203
C-202
C-201
C-112
C-111
C-110
C-109
C-108
C-107
C-106
C-105
C-104
C-103
C-102
C-101
R
C
D
U
E
F
G
L1
L2
Q
UPR-82
J
B
A
P
UPR-86
UPR-81
H
I

APPENDIX C

AGENCY AGREEMENTS ON RFI REPORT CONTENTS

This page intentionally left blank.

APPENDIX C
AGENCY AGREEMENTS ON RFI REPORT CONTENTS

In January 2014 DOE, Ecology, and EPA initiated detailed discussions to align agency expectations for the content of this Phase 2 WMA C RFI report. Signed notes from these meetings were entered into the HFFACO Administrative Record and are contained in Appendix B of this report. Included in the meeting notes are a list of agreements reached by DOE, Ecology, and EPA regarding document contents. Agreements recorded as of October 1, 2014 are included in this appendix (Table C-1), along with the RFI report section and/or appendix number that addresses each agreement.

Appendix C. Agency Agreements Regarding RFI Report Contents.

Agreement Date	Description of the Agreement	Location in Draft A RFI Report
1/23/2014	1. The RFI report will identify information gaps. Such gaps will be resolved through future efforts prior to submittal of the WMA C CMS. The meeting attendees felt that this process of gap identification and resolution will support future work prioritization agreements.	Sections 5, 6, 7, as applicable, with summary in Section 8.
	2. Ecology agrees to the use of the proposed revised RFI report outline shown in Attachment 1.	Throughout document. Proposed outline revisions were shared and discussed at subsequent meetings.
2/26/2014	1. The section that addresses regional geology should use pictures/graphics from the 2010 Natural Systems WMA C Performance Assessment working session to illustrate the uniqueness of the site (illustrate geology, depict river channeling impacts, etc.).	Section 2.
	2. The description of field sampling techniques should describe process improvements made over time and any effects those improvements have made on how the data is interpreted (e.g., surface geophysical exploration, number of samples that can be taken from push borehole).	Section 4/Appendix G.
	3. The RFI report should reflect on information contained in weekly radiological field survey reports ("rounds sheets") regarding surface contamination in C Farm. Mr. Barnes noted that many of the unplanned release sites associated with C Farm are based on airborne or surface contamination events, and many of these sites no longer exist (e.g., have been remediated or have dissipated). Such releases are generally documented as "unplanned releases." Convey point that although the surface may be considered uncontaminated today, shallow subsurface contamination may exist across the farm.	Section 5.
	4. The RFI report should describe changes made in characterization planning as field work progressed. For example, in the area near the C-200 tanks, initial planning called for direct push investigation. Subsequently, the agencies agreed to investigate that area using surface geophysical exploration (SGE) initially, followed by use of direct push investigation as deemed necessary and feasible based on SGE results and physical limitations in that location.	Section 4.
	5. RFI report sections regarding nature and extent of contamination and human health and risk assessment will be consistent with information being developed for the	Sections 6 and 7.

Appendix C. Agency Agreements Regarding RFI Report Contents.

Agreement Date	Description of the Agreement	Location in Draft A RFI Report
	separate but parallel WMA C Performance Assessment effort. The RFI report will incorporate whatever information is available on the topics; information gaps will be identified for subsequent resolution.	
2/26/2014 and 3/26/2014	1. To the extent practicable, the RFI report will include information about liquid sources near or at the surface (e.g., equipment decontamination activities within the farm, fire hydrant testing, water lines, snow melt, ponds/cribs/ditches) that may have been sources of contamination and/or water infiltration. Also include UPR descriptions from WIDS. DOE/RL-88-30 (*Hanford Site Waste Management Units Report*), tank leak-loss reports, the WMA A-AX/C Field Investigation Report, and GJO-98-39-TAR, GJO-HAN-18 (*Hanford Tank Farms Vadose Zone: C Tank Farm Report*) will be reviewed for relevance.	Sections 2 and 3.
	2. The RFI report will include characterization information from dry wells, boreholes, direct pushes, and near-surface sampling. It will also include characterization information from leaks associated with ancillary equipment (pipelines, French drains, C-301, etc.).	Section 5.
	3. The RFI report table of contents should include a section that refers to the conceptual site model. CSM illustrations in RFI report should be consistent with WMA C Performance Assessment models related to nature and extent of contamination if no action were taken.	Section 6.
3/26/2014	1. The introductory section of the RFI document will incorporate relevant information from the WMA C Phase 2 work plan (RPP-PLAN-39114), particularly regarding regulatory framework and the regulatory decision-making process.	Section 1.
	2. The RFI report will incorporate published information about the groundwater monitoring program and groundwater contamination, including Tc-99, iodine, and nitrate.	Sections 1, 2, and 5.
	3. The section of the RFI report describing the tank system will include individual tank timelines (the "Caggiano diagrams") associated with leaks/losses as well as findings from tank leak-loss reports.	Section 3/Appendix E.
	4. Using information in published reports, the RFI report will include information about upgradient facilities that are possible sources of groundwater contamination at WMA C.	Sections 2 and 5.

Appendix C. Agency Agreements Regarding RFI Report Contents.

Agreement Date	Description of the Agreement	Location in Draft A RFI Report
	5. The write up of Phase 2 field work will include time frame when work was conducted/samples taken at specific locations.	Section 4.
	6. Terms such as "surface" and "sub-surface" will be defined and used consistently.	A definitions section has been incorporated as Section 1.1.1 of the document. Three key terms are defined and used consistently throughout the document.
	7. Discuss data validation/quality (e.g., Tc-99 data quality as it relates to analytical method used) in the RFI report. This information is currently slated to go into Section 5.2.1.	Section 4/Appendix M
	8. Notes from routine monthly 2011 and 2014 meetings regarding the development of the RFI will be incorporated into the RFI report.	Section 1/Appendix B contains approved notes from the 2014 RFI Report development meetings, which incorporate discussion points from the 2011 meeting notes.
8/14/2014	1. The WMA C baseline risk assessment will include evaluation of unrestricted, Native American, and other scenarios.	Section 7.
	2. WRPS and CHPRC will evaluate recently-released EPA guidance on soil screening levels for protection of groundwater for radionuclides.	Section 7.
	3. RFI report and/or risk assessment documentation will review vadose zone PCB data to support evaluation of possible sources (i.e., C-200 tanks/241-C-203 and leaks from pipelines from Strontium Semi-Works/PCB-containing pumps).	Section 5.
	4. Both the RFI report and the WMA C risk assessment will identify data/information gaps that may require future revisions of those documents.	Sections 5, 6, 7, as applicable, with summary in Section 8.
	5. Gamma logs will be included in the RFI report (electronic link or appendix). A summary of spectral gamma data collected at selected locations in the vicinity of WMA C is also being prepared as a supporting appendix to the RFI report.	Section 5/Appendix T.

APPENDIX D

C FARM CONSTRUCTION PHOTOGRAPHS

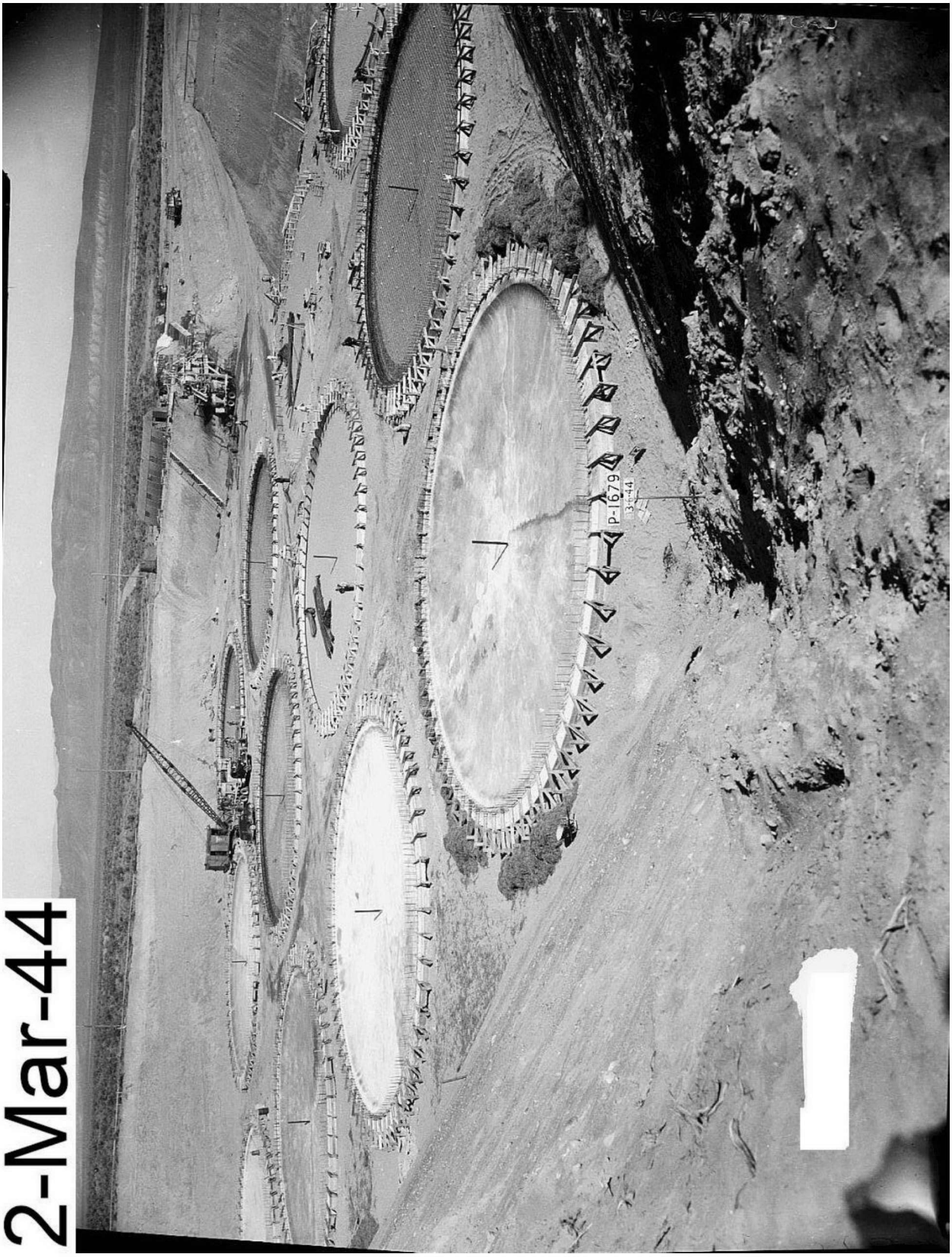
This page intentionally left blank.

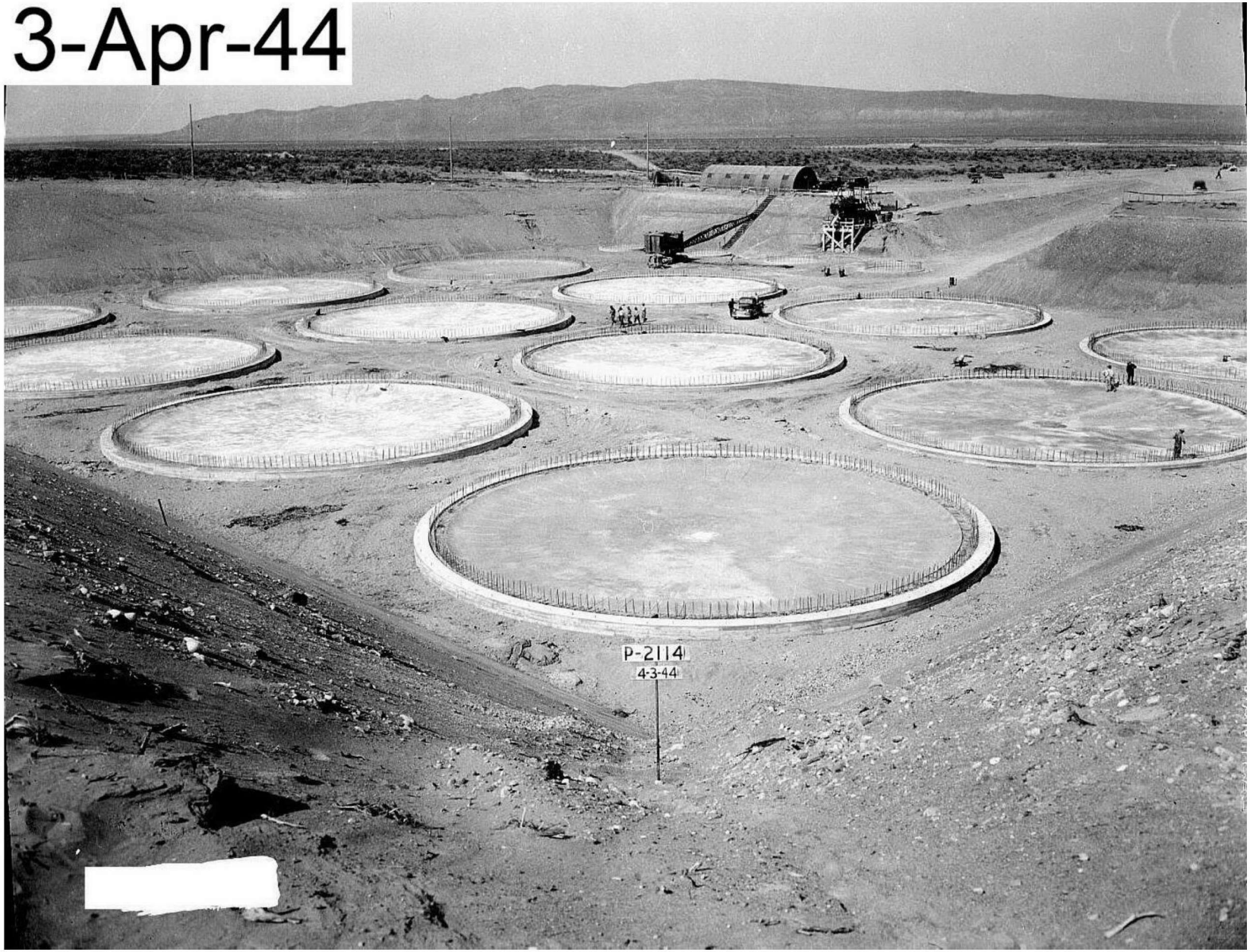
APPENDIX D
C FARM CONSTRUCTION PHOTOGRAPHS

This appendix contains the following C Farm construction photographs:

- Ten taken during the initial construction of C Farm, from February 1944 through January 1945
- Two showing construction activities in the 1950s
- A series of eight taken during retrieval processes in 2008 through 2011.

1

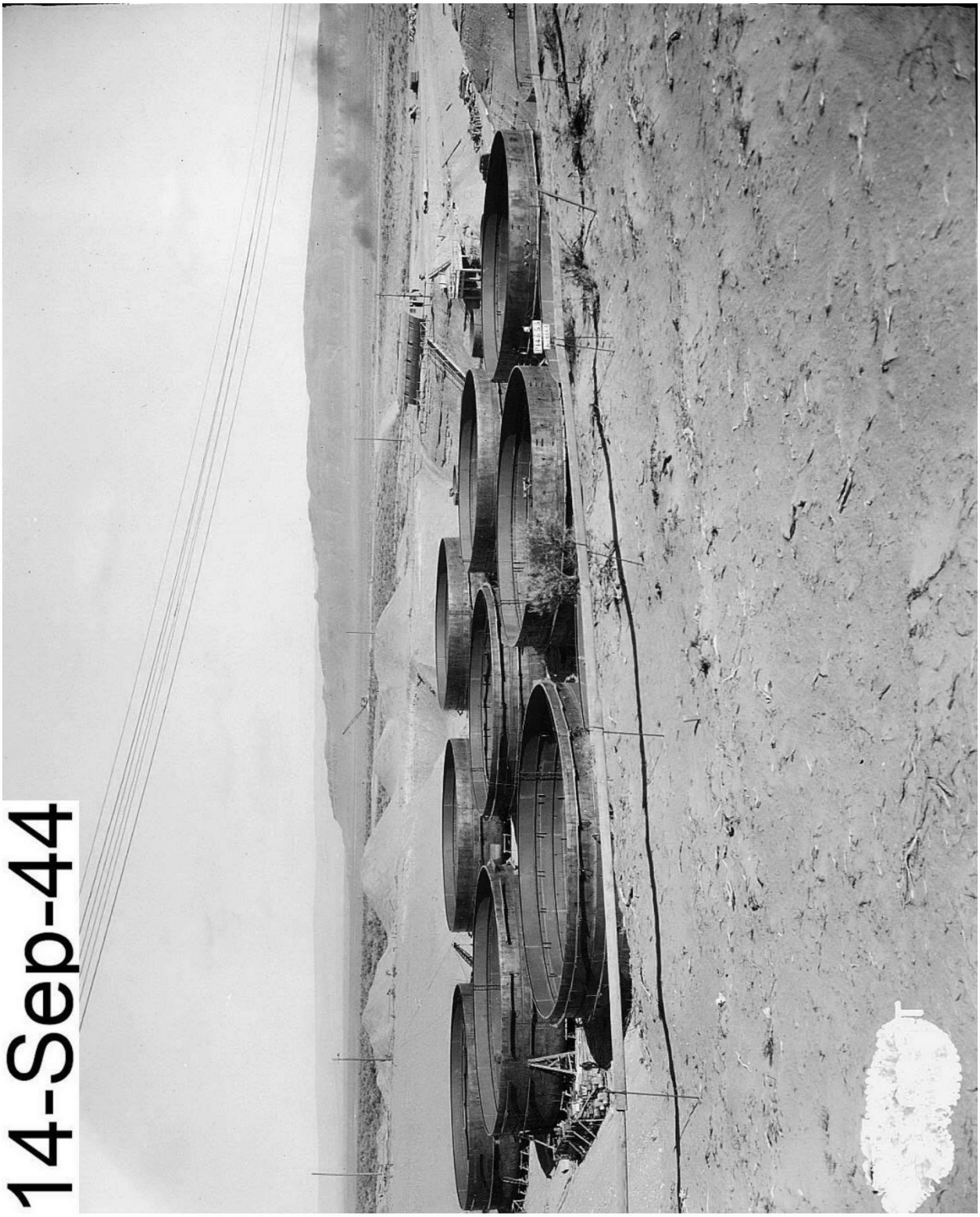

2-Mar-44
P-1679
3-44

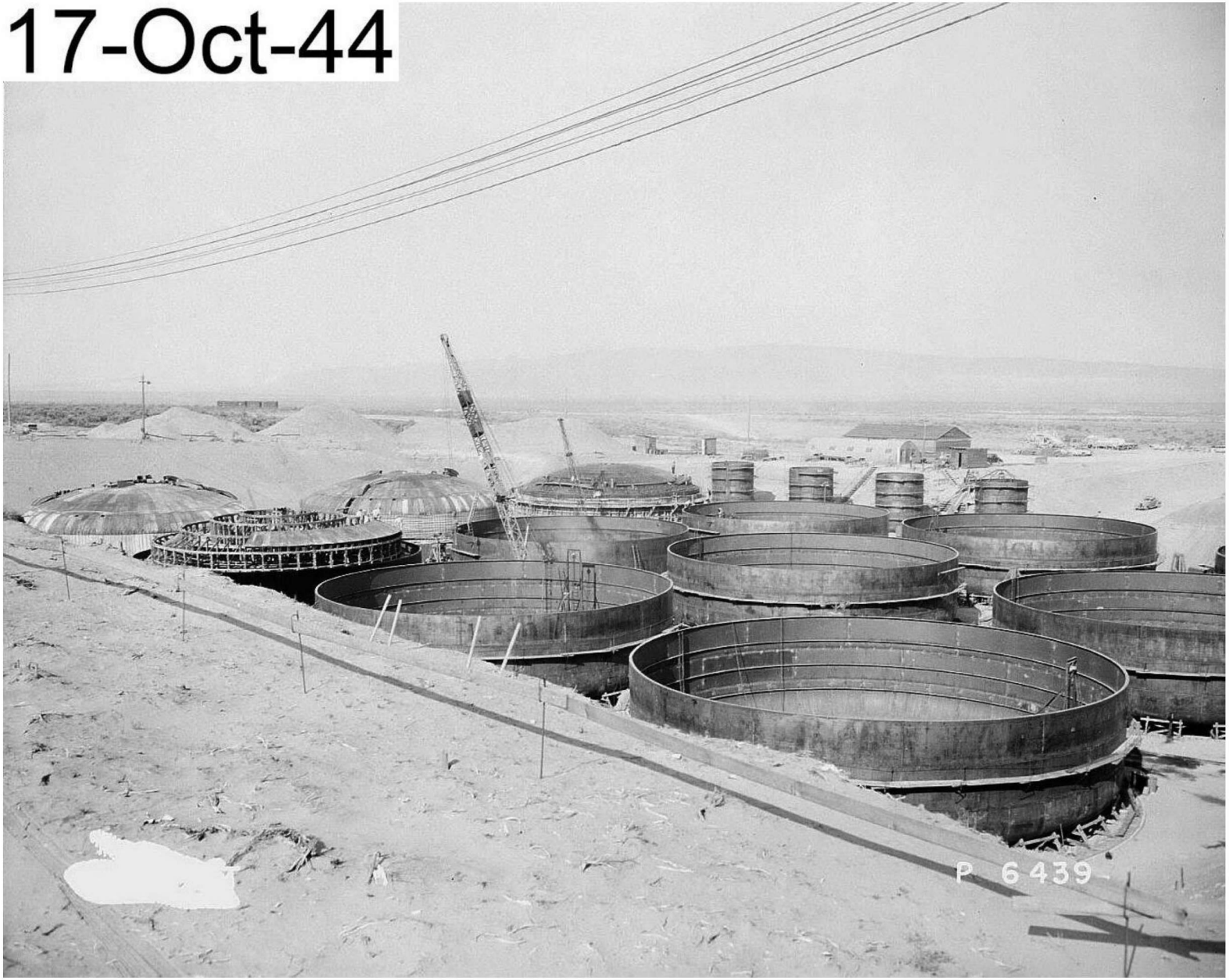


1

1

1-Aug-44
P15241

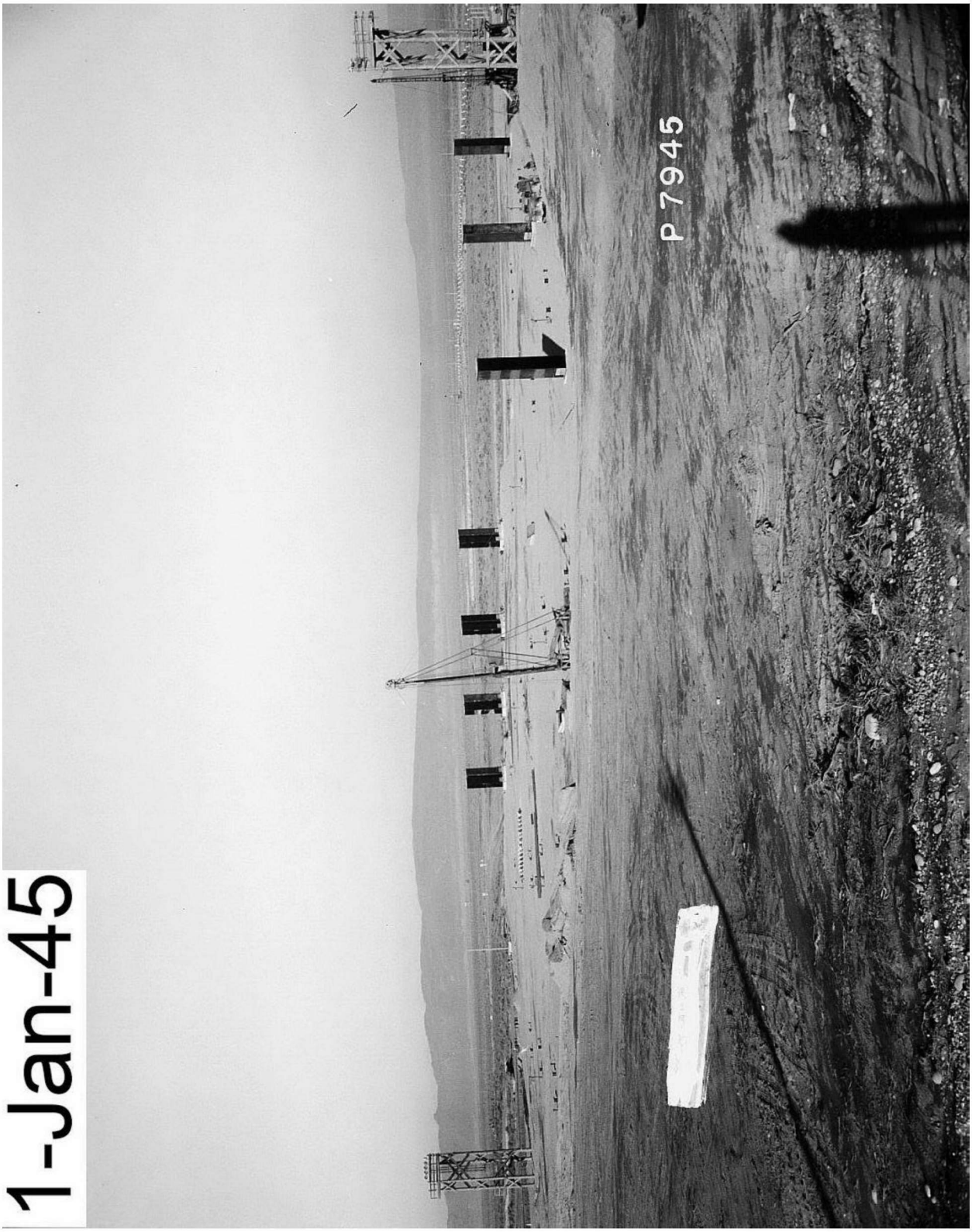

14-Sep-44

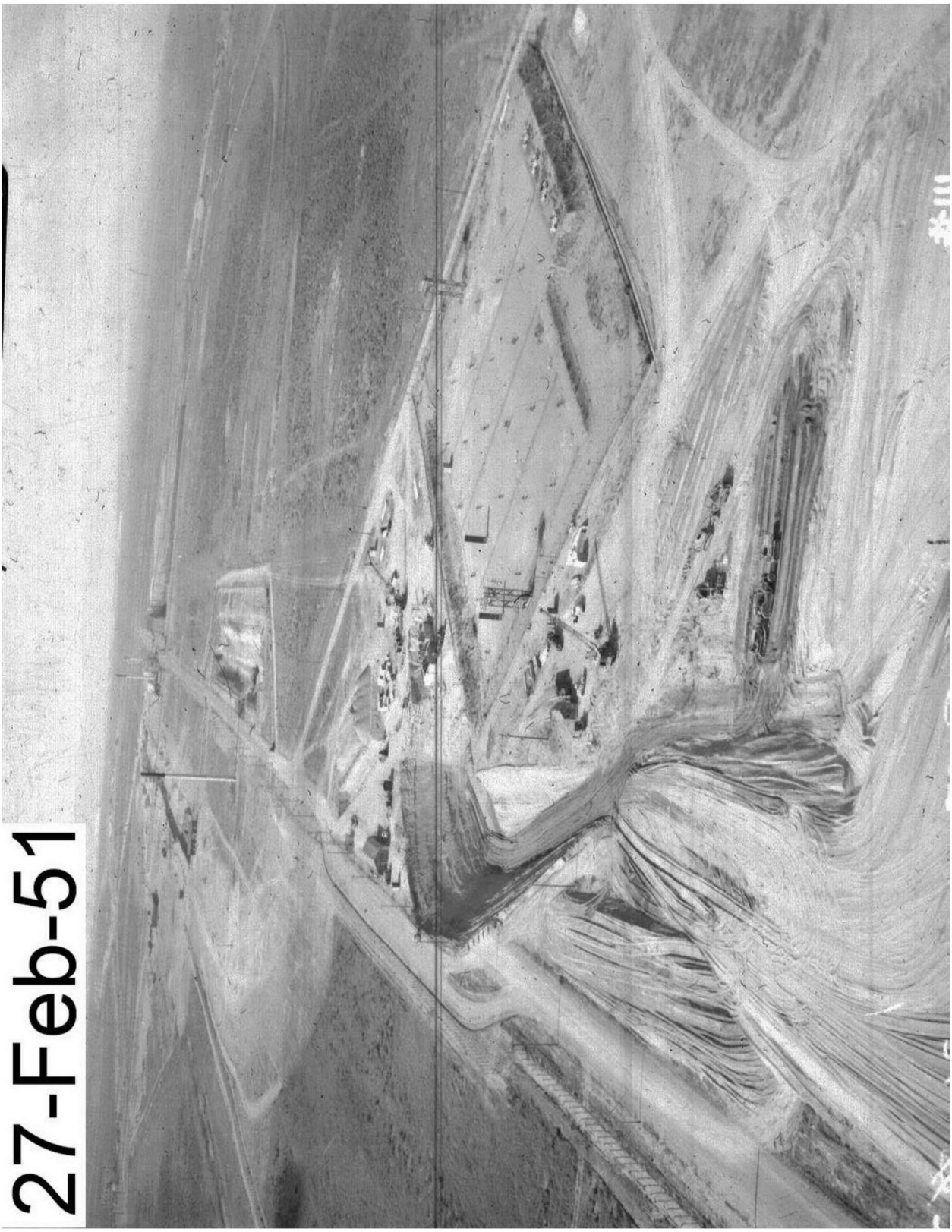


1

4-Nov-44
P 6885

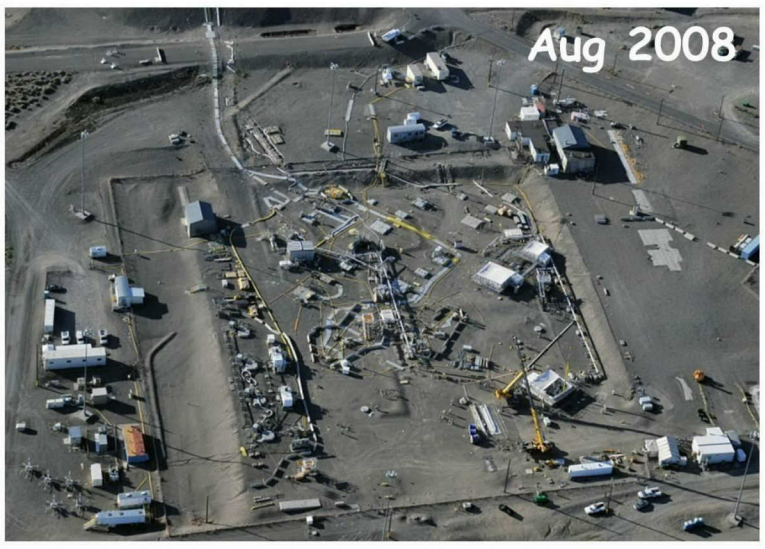
7-Dec-44
P 7470


1-Jan-45
P 7945


27-Feb-51

5-Feb-53

Surface Infrastructure Changes due to Retrieval Operations during the Phase 2 RFI



APPENDIX E

C FARM OPERATIONAL TIMELINE GRAPHS

This page intentionally left blank.

APPENDIX E
C FARM OPERATIONAL TIMELINE GRAPHS

This appendix details the operating history of each of the C Farm 100-series and 200-series tanks. The table and figures in this appendix identify the types of process wastes that were introduced to and removed from each tank over time. The figures also identify when significant operational actions occurred in the vicinity of each tank (e.g., installation of dry wells, application of active ventilation).

C Farm was originally designated to receive waste from the planned 221-C Bismuth Phosphate Plant, which was canceled shortly after the plant foundation was excavated. Instead, the tanks were used through connections from the 221-B Bismuth Phosphate Plant. C Farm was not used until March 17, 1946, starting with receipt of waste into the 100-series tanks, and receipt of waste in the 200-series tanks in September 1947. The tanks were used through two major fuel reprocessing actions, B Plant Wastes, Tributyl Phosphate Plant Waste, and wide variety of waste types as indicated in Table E-1 comprised of PUREX, B Plant, REDOX, and miscellaneous wastes. Tank-specific waste operations timelines and summaries for the 100-series tanks are presented in Figures E-1 through E-12.

Tanks C-201 through C-204 sat unused until November 1947 when they were activated to store MW (HLW) from operation of the bismuth phosphate process in the 221-B Separations building. These tanks were filled with metal waste by January 1948. The metal waste was sluiced from these tanks from March 1953 through January 1955. Tanks C-203 and C-204 received cold uranium (i.e., uranium that had not been irradiated in a reactor) waste from PUREX startup testing in November 1955. The cold uranium waste was removed from tanks C-203 and C-204 in December 1955. Tanks C-201 through C-204 were then used from May 1955 through October 1956 to receive and store waste originating from research and development activities conducted at the Strontium Semiworks Facility in the 200 East Area. Tank C-201 through C-204 were retrieved in 2005 and 2006. Tank-specific waste operations timelines and summaries for the 200-series tanks are presented in Figure E-13.

Table E-1. Waste Types Received into 241-C 100-Series Tanks (1956–1978)

Year	C-101	C-102	C-103	C-104	C-105	C-106	C-107	C-108	C-109	C-110	C-111	C-112
1956	TFeCN			CW	CW					OWW	OWW	TFeCN
1957			PSN	CW	CW	PSN		TFeCN	TFeCN		TFeCN	TFeCN
1958				CW	CW							
1959					CW				CW		CW	
1960	CW	CW	CW		CW			CW			CW	CW
1961		CW					CW	CW			CW	HS
1962		CW					CW		HS		HS	HS
1963	PSN	CW	PSN		PSN	PSN					HS	
1964	PSN	CW					HS		HS		HS	
1965		CW	PSN				HS	HS	HS			
1966		CW	PSN				HS		HS			
1967		CW					HS					
1968		OWW			PSN							
1969		OWW		OWW	PSN	PSS						
1970			IX	OWW	PSN	PSS	IX	IX	IX	IX		IX
1971			IX	OWW	PSS	PSS						
1972			OWW	OWW	PSS					IX		
1973			Misc.	Misc.	PSS		Misc.	Misc.				
1974			Misc.	Misc.	PSS	BL						
1975			Misc.	Misc.	PSS	BL						
1976			Misc.	Misc.	PSS	BL						
1977						BL						
1978						BL						

BL = B Plant strontium processing wastes and misc. wastes
CW = coating waste from PUREX or REDOX Plants
HS = Strontium Semiworks Facility waste
IX = cesium denuded waste from ion exchange process in B Plant
Misc. = Sources may include research waste from Battelle Northwest (i.e., BNW) which is now PNNL, reactor decontamination waste, etc.
OWW = Organic Wash Waste from PUREX Plant
PSN = PUREX HLW supernatant
PSS = PUREX Sludge Supernatant derived from washing PUREX HLW sludge in 244-AR Vault or 241-A and 241-AX tanks
RSN = REDOX HLW Supernatant
TFeCN = Ferrocyanide waste from 244-CR vault treatment of TBP waste

1

Figure E-1. C-101 Waste Receipt and Transfer Timeline

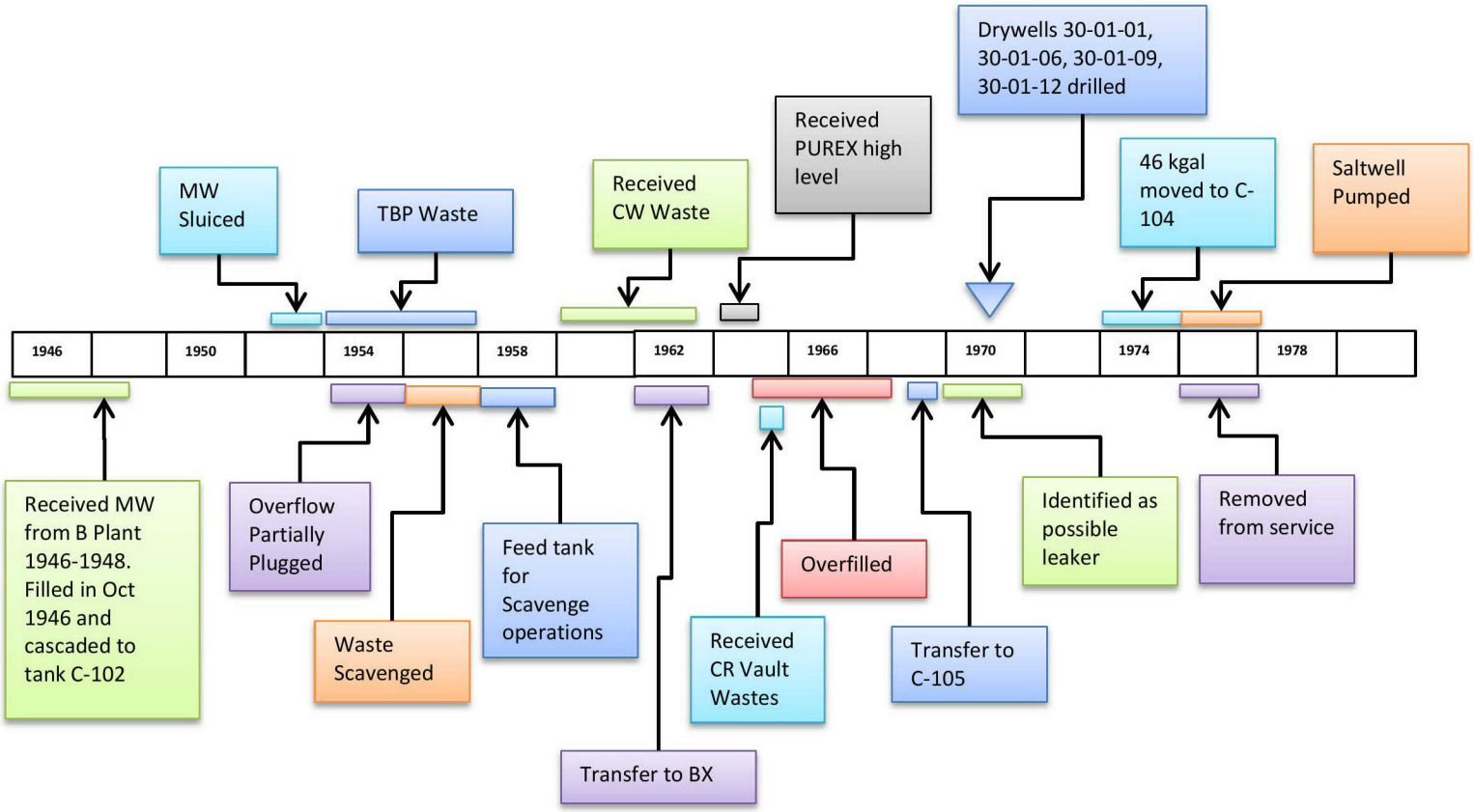


Figure E-2. C-102 Waste Receipt and Transfer Timeline

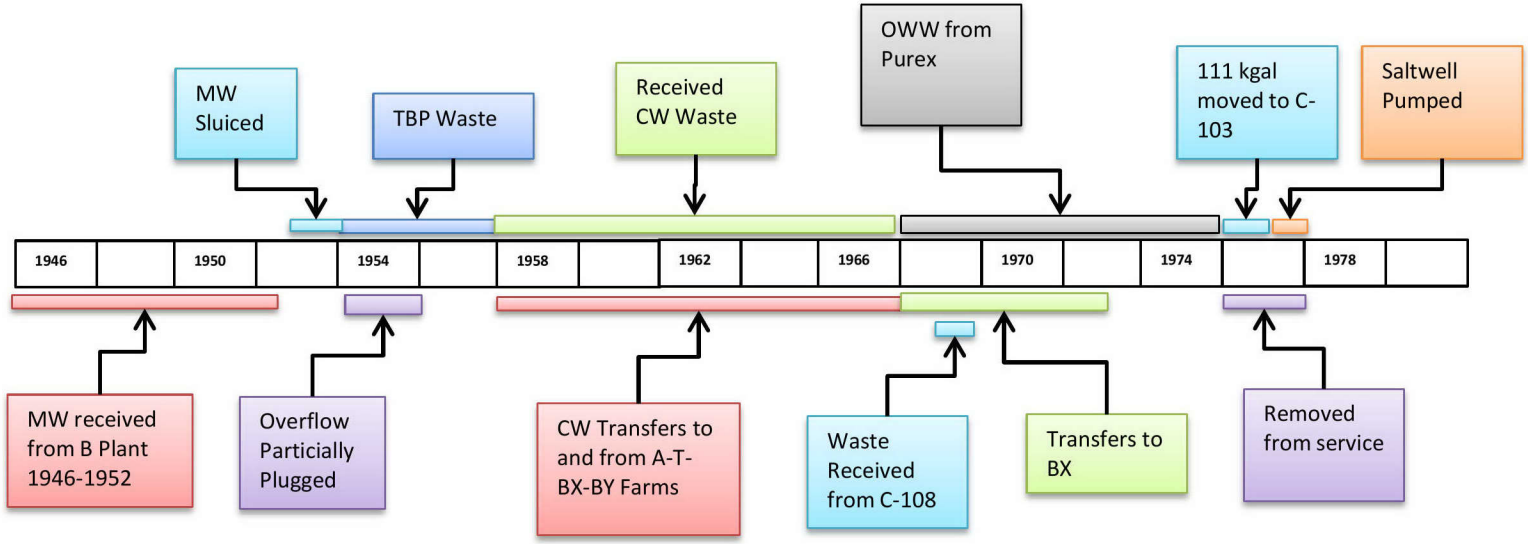


Figure E-3. C-103 Waste Receipt and Transfer Timeline

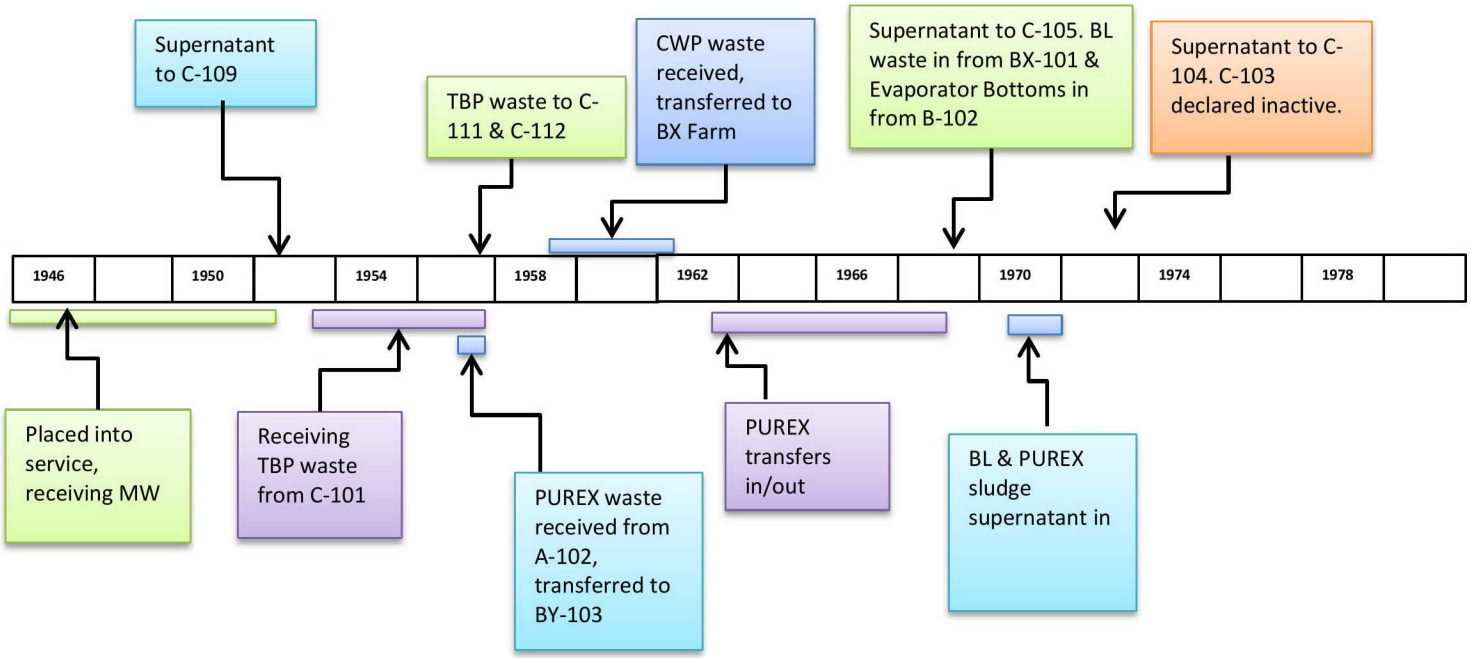


Figure E-4. C-104 Waste Receipt and Transfer Timeline

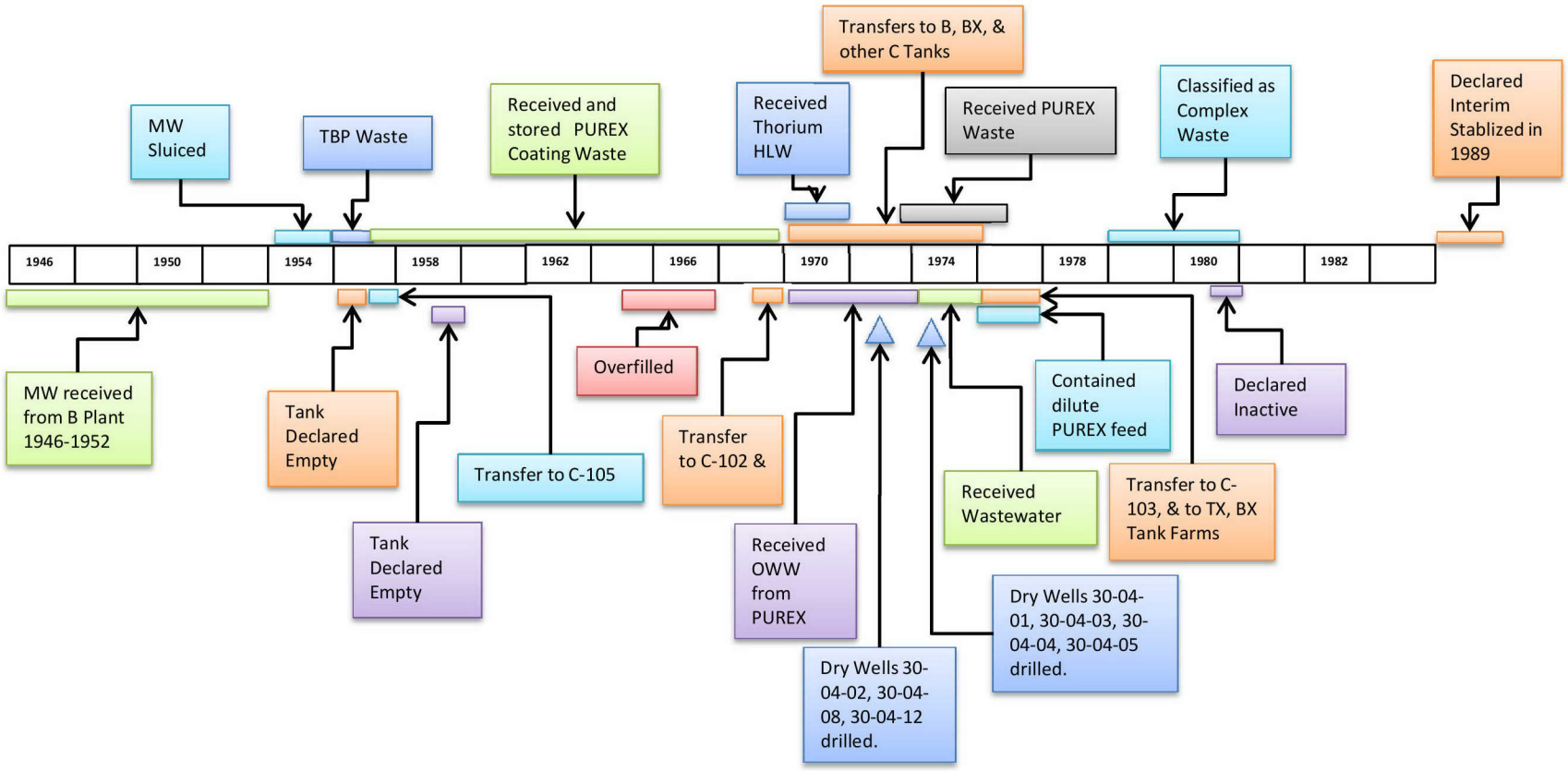


Figure E-5. C-105 Waste Receipt and Transfer Timeline

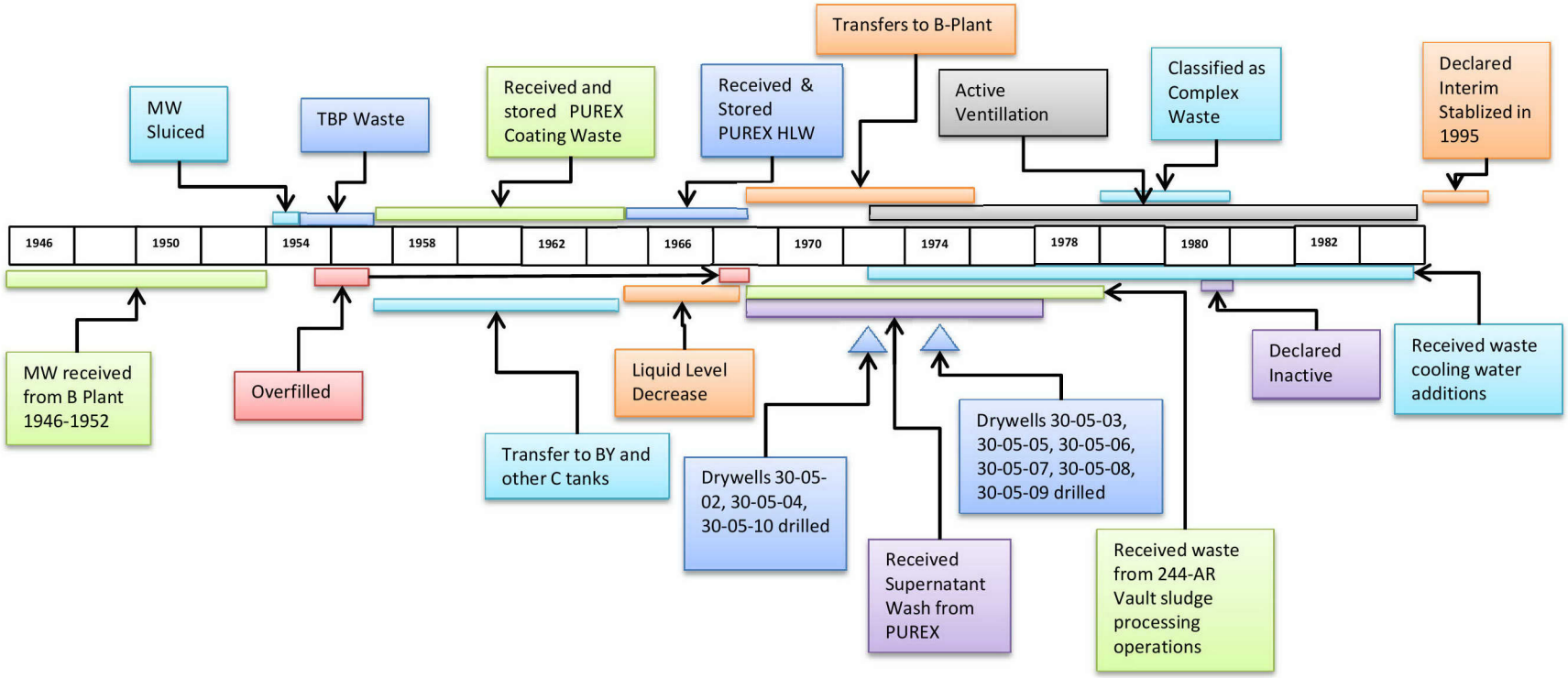


Figure E-6. C-106 Waste Receipt and Transfer Timeline

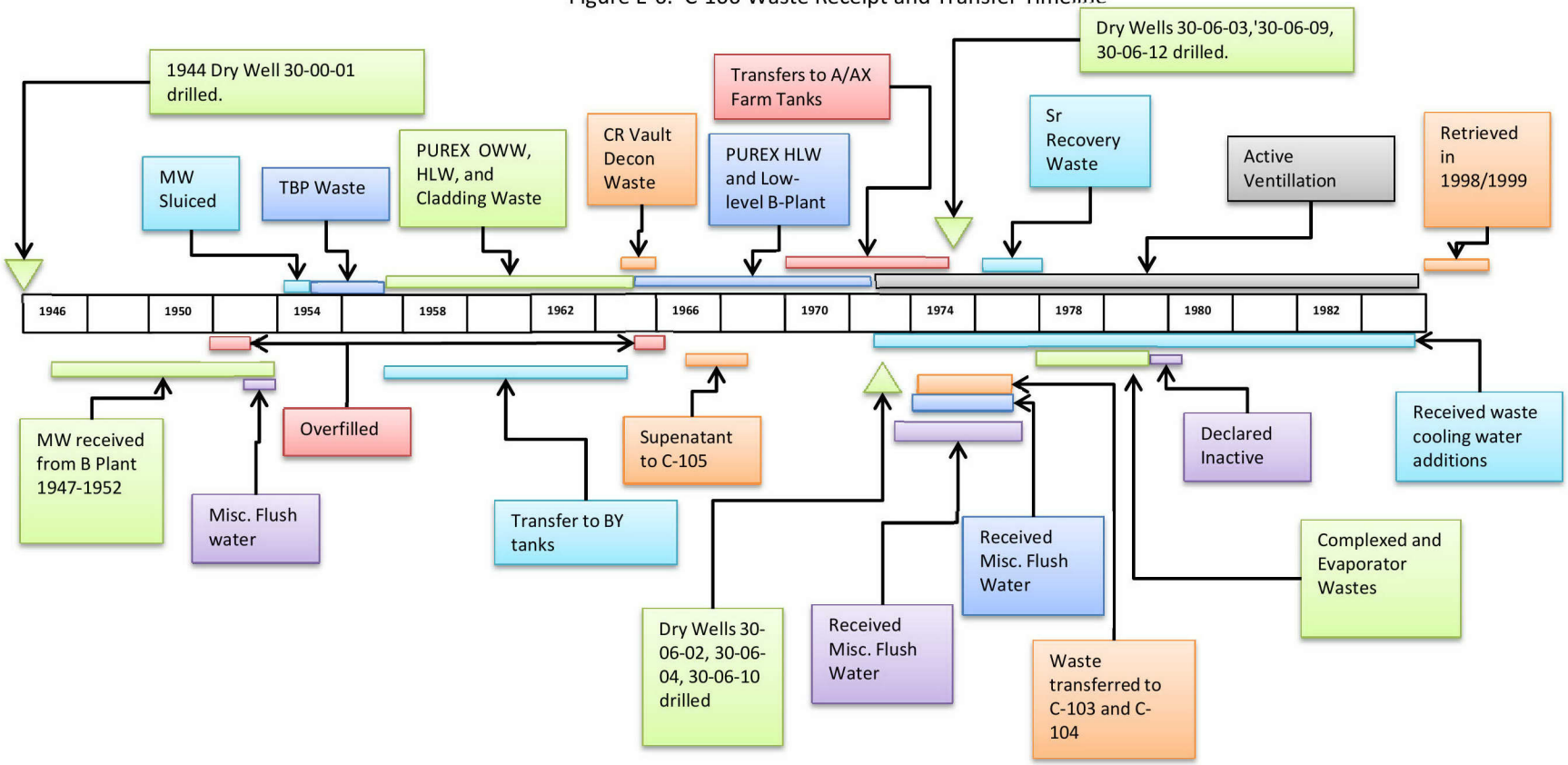


Figure E-7. C-107 Waste Receipt and Transfer Timeline

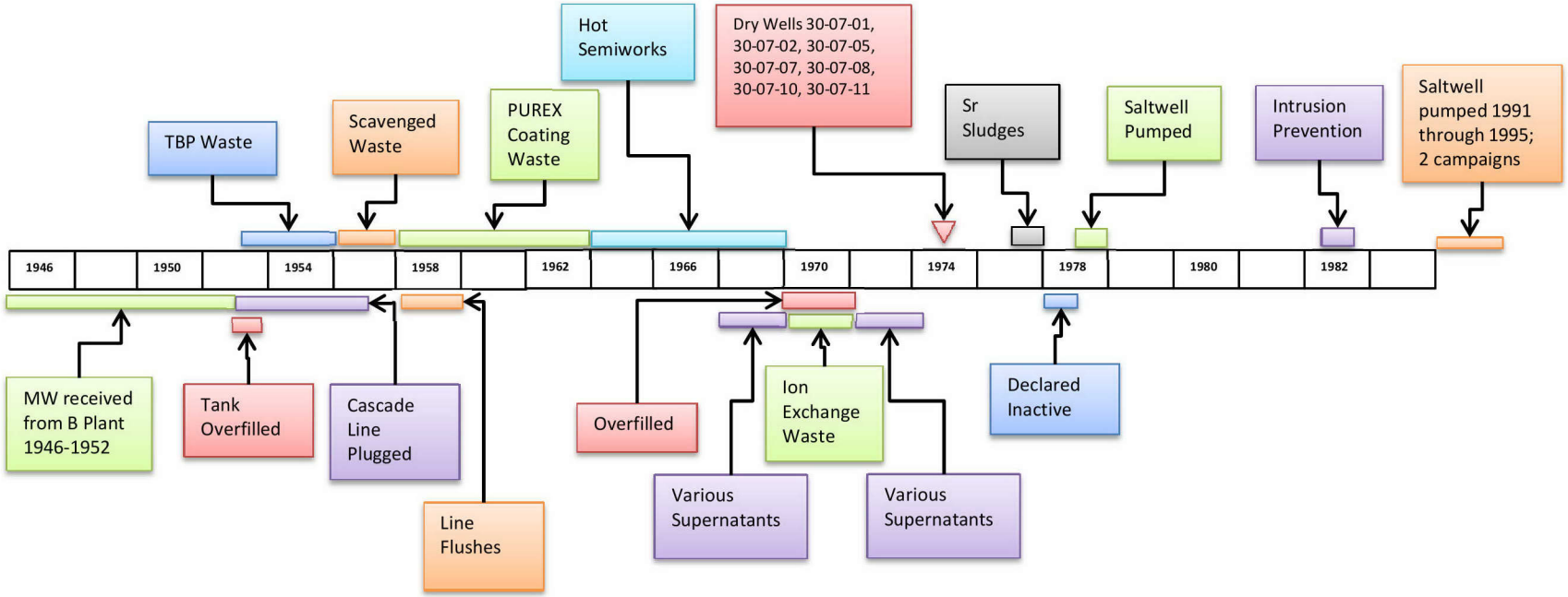


Figure E-8. C-108 Waste Receipt and Transfer Timeline

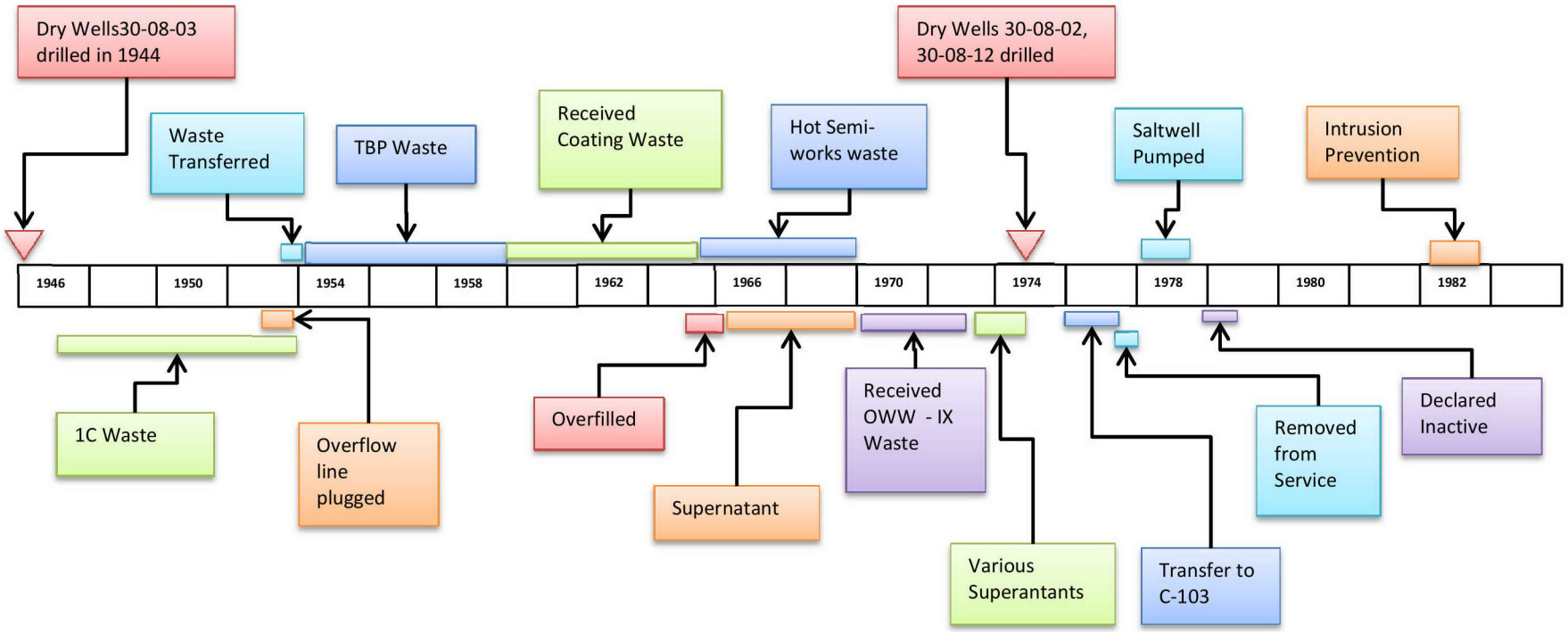


Figure E-9. C-109 Waste Receipt and Transfer Timeline

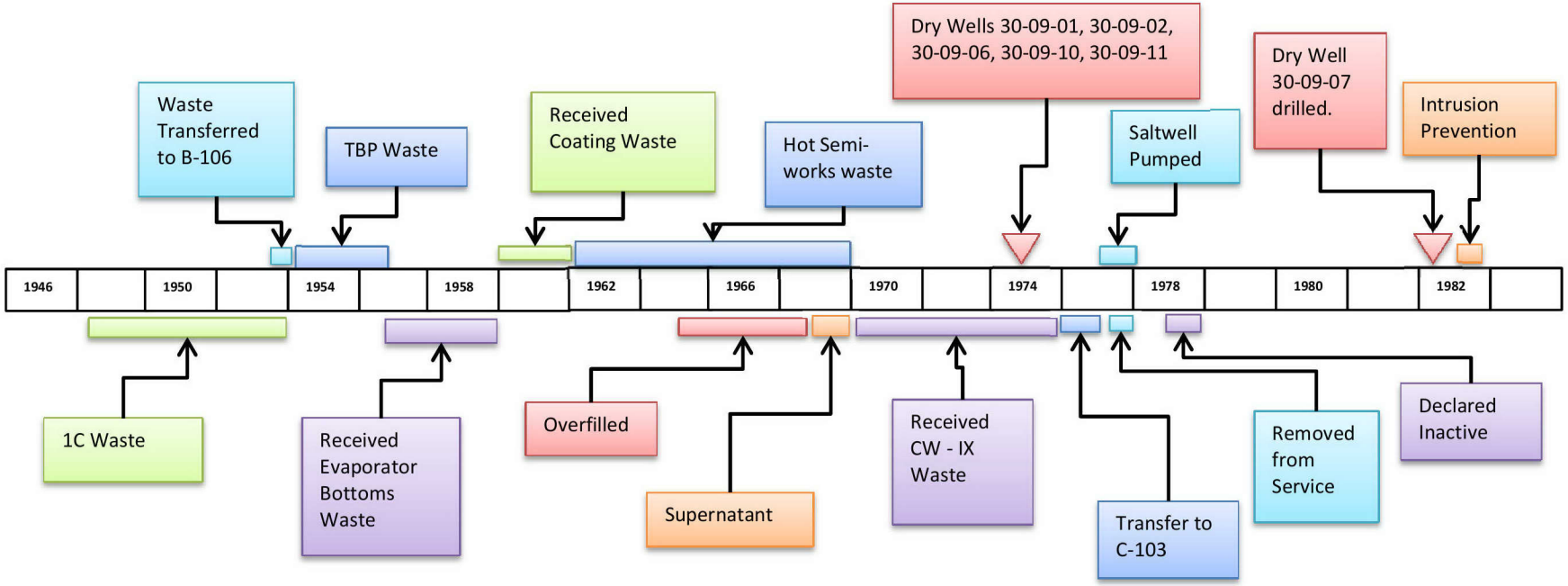


Figure E-10. C-110 Waste Receipt and Transfer Timeline

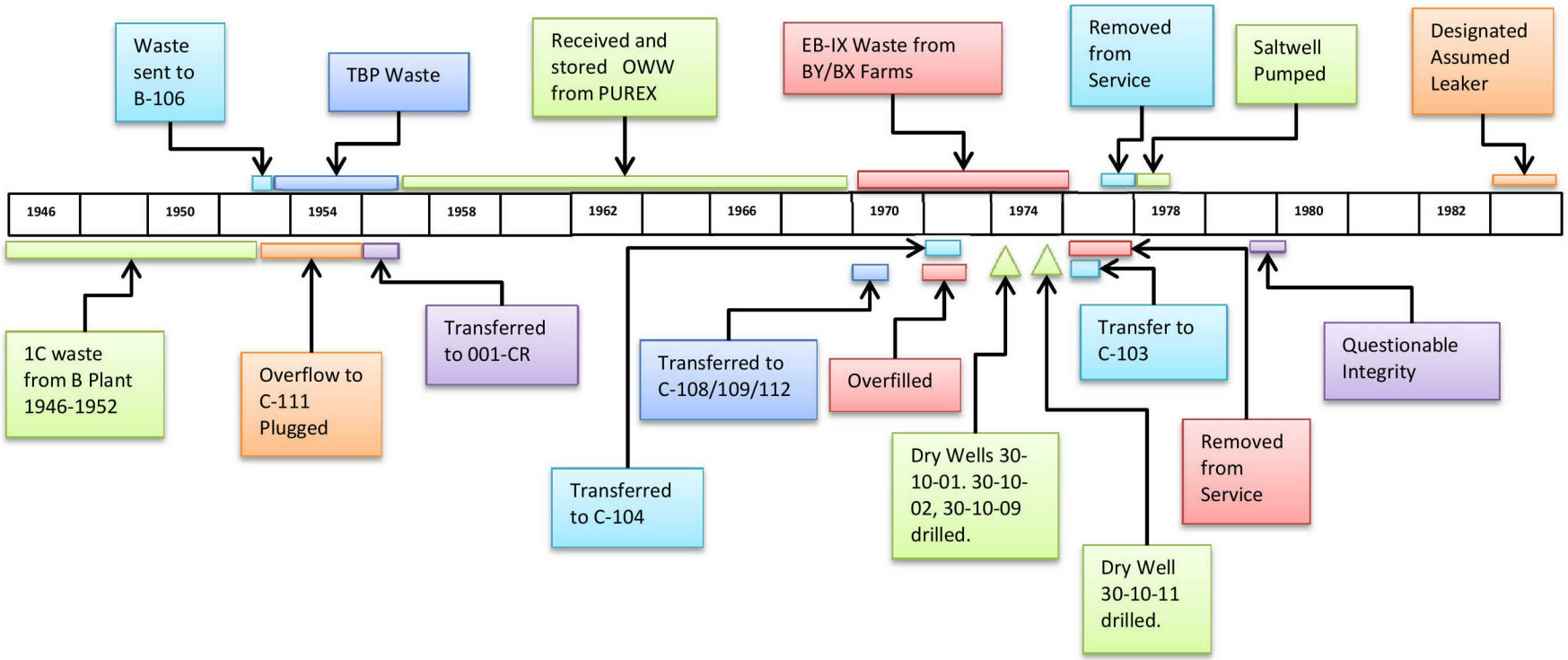


Figure E-11. C-111 Waste Receipt and Transfer Timeline

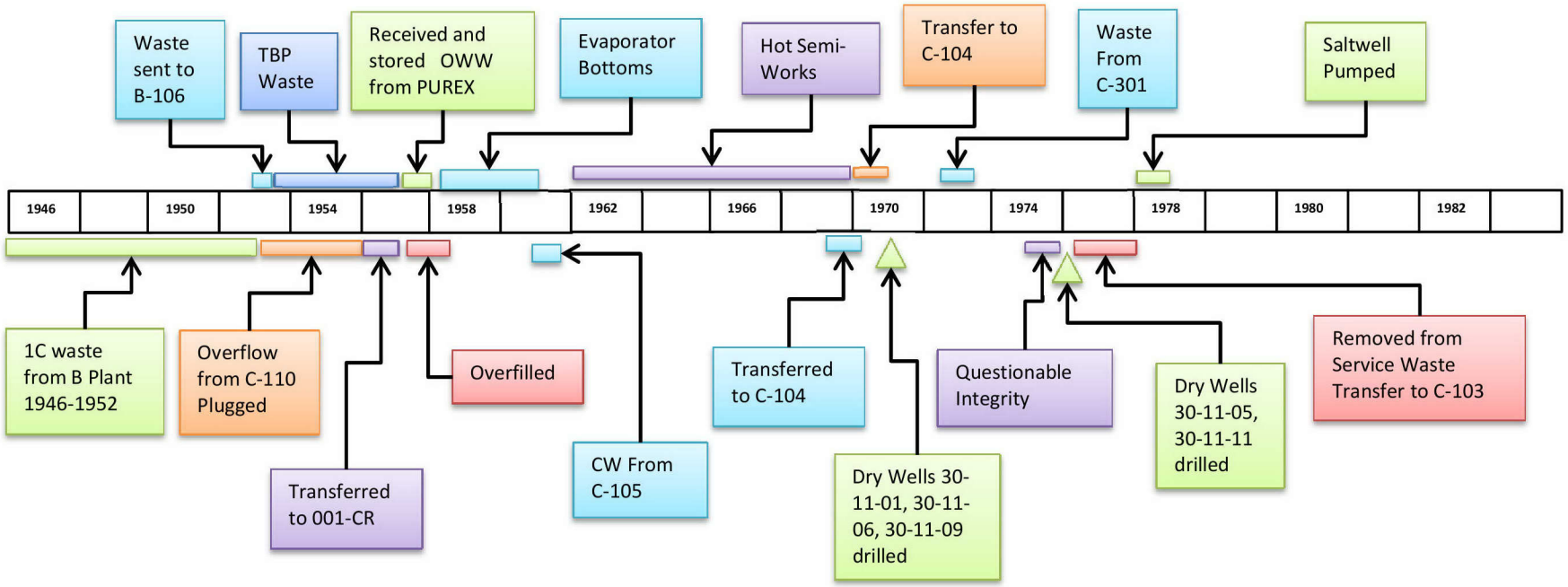


Figure E-12. C-112 Waste Receipt and Transfer Timeline

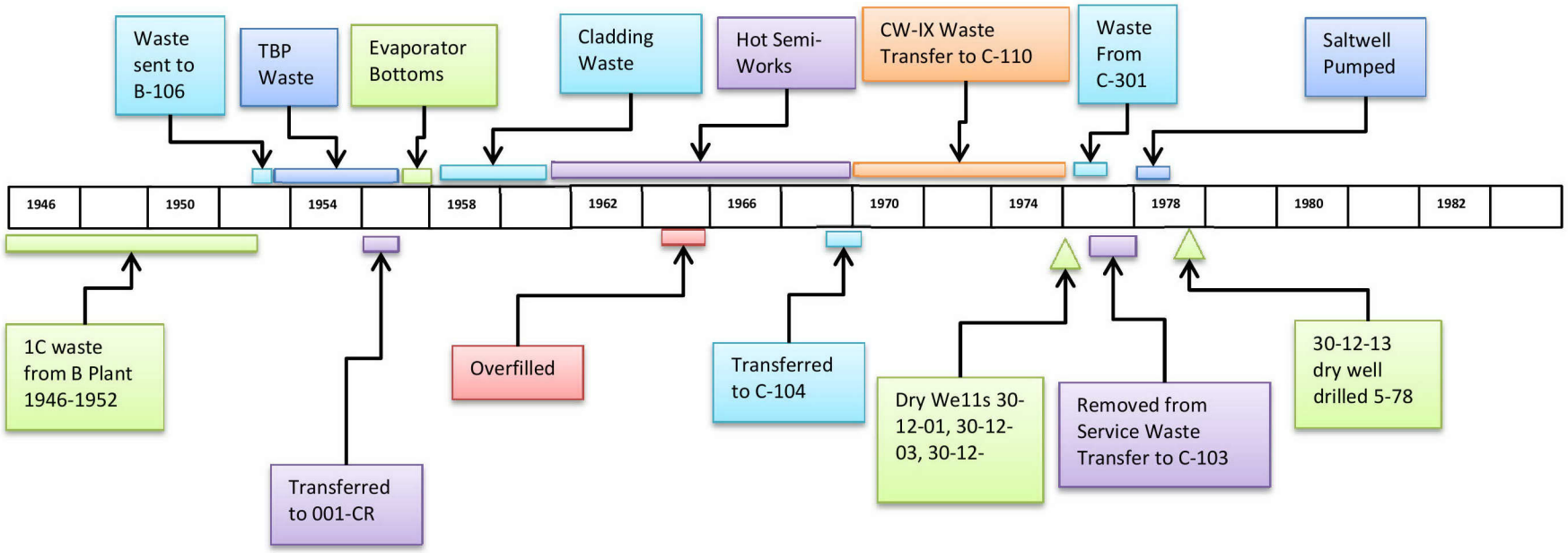
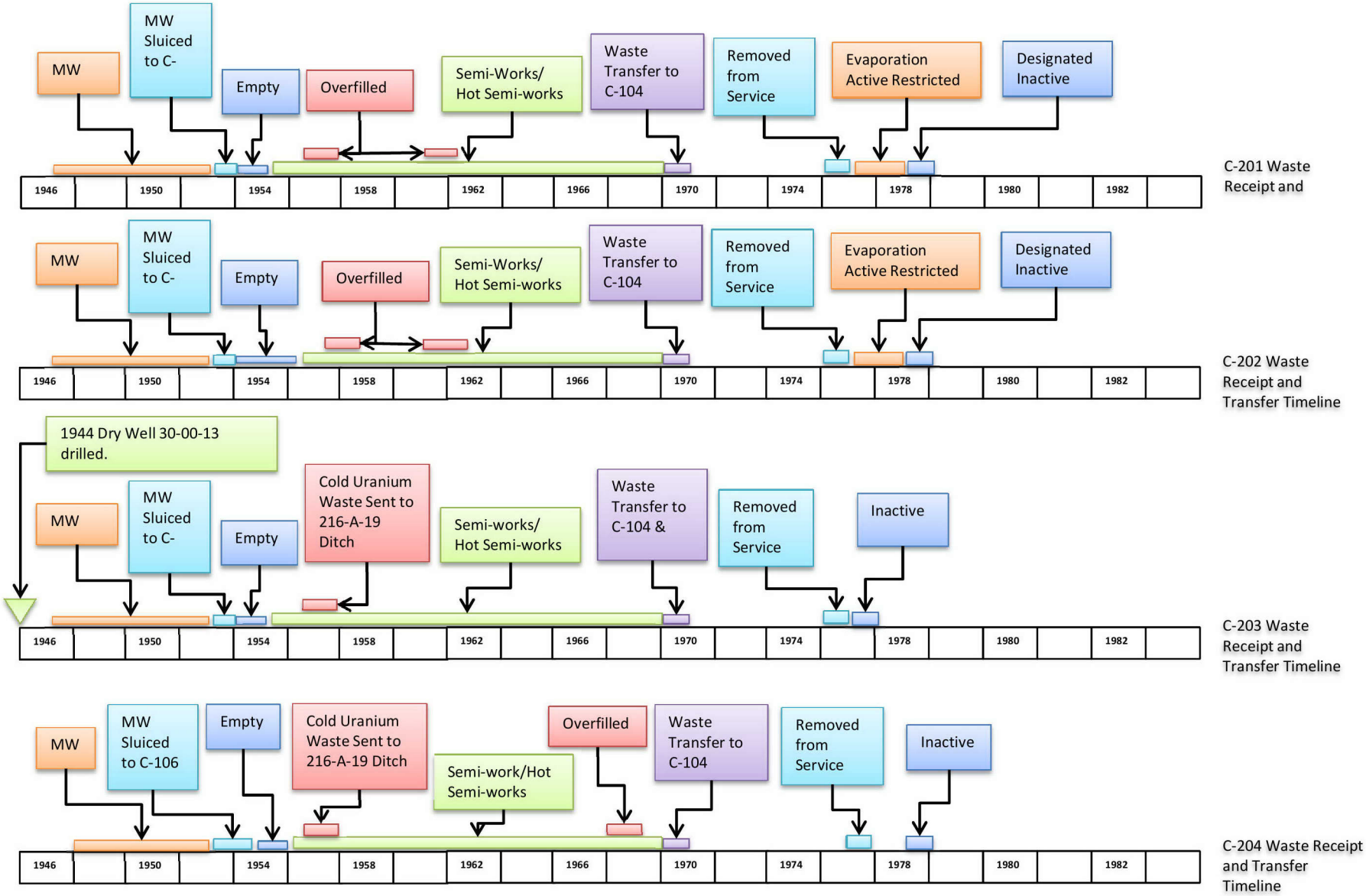


Figure E-13. C-200 Tanks Waste Receipt and Transfer Timeline



APPENDIX F

WASTE INFORMATION DATABASE SYSTEM ENTRIES IN AND NEAR WMA C

This page intentionally left blank.

APPENDIX F
WASTE INFORMATION DATABASE SYSTEM ENTRIES IN AND NEAR WMA C

The DOE maintains a comprehensive inventory of Hanford Site waste management units. Information about these units is maintained in the Waste Information Database System (WIDS) and is summarized on an annual basis in DOE/RL-88-30, *Hanford Site Waste Management Units Report* in accordance with the requirements of HFFACO Action Plan Section 3.5. This appendix lists WIDS sites in and near WMA C and provides a summary of information about each of the listed sites.

The information in the WIDS reports represents the best available information on the nature and extent of releases. Substantial uncertainty exists in the volume and content of releases from components within the WMA C.

Site Code	Site Type	Site Dimensions (m)	Dates of Operation	Site History	Subsite	Responsible Contractor	Site Classification /Reclassification
200-E-133	Contamination Migration	Undetermined	1946-unknown	This Waste Information Data System (WIDS) site was created in an effort to consolidate and simplify the management of multiple separate Unplanned Release (UPR) entries. Several poorly defined UPRs have occurred at the 241-C Tank Farm over the years. This site encompasses all the individual UPRs and otherwise contaminated soil inside and adjacent to the chain link fence surrounding the 241-C Tank Farm. The following nine UPR sites were consolidated with this site because the UPR boundaries are within the footprint of this WIDS site: UPR-200-E-16, UPR-200-E-27, UPR-200-E-68, UPR-200-E-81, UPR-200-E-82, UPR-200-E-107, UPR-200-E-118, UPR-200-E-136, and UPR-200-E-137. The individual UPRs associated with the 241-C Tank Farms are not separately marked or posted. The exact extent (horizontal and vertical) of the soil contaminated by UPRs that occurred within this farm complex over the years are not known. Occasionally, radioactive contamination is found adjacent to the outside of the tank farm fence, resulting in a contamination zone extension around the tank farm perimeter. These areas are also part of this site. Varied levels of remediation were done on individual surface releases at the time they occurred. In September 2011, an effort was made to surface stabilize contaminated areas outside the north and west sides of 241-C Tank Farm. Approximately 5,500 square feet of previously posted Soil Contamination Areas were covered with clean gravel and downposted to Underground Radioactive Material Area status (per RC-1100517).	*UPR-200-E-16; 241-C Overground Transfer Line Leak; UN-200-E-16*. The 241-C-105 to 241-C-108 overground transfer line broke and contaminated the soil northeast of the 241-C-105 tank pit. Both the spill and the buried pipe fall within the 241-C Tank Farm fence. *UPR-200-E-27; 244-CR Contamination Spread; UN-200-E-27*. On November 1, 1960, during work in the 244-CR Vault, winds spread contaminated particles eastward. Contamination levels around the vault, inside the fence, ranged between 50 and 100 millirads/hour. Particles reading as high as 40,000 counts per minute were found outside the fence. The original incident report says work was being done in a diversion box when the release occurred. *UPR-200-E-68; Radioactive Contamination Spread; UN-200-E-68; UN-216-E-68*. On January 11, 1985, a Radiation Protection Technologist reported finding 2,000 counts per minute removable contamination in the vicinity of the 244-AR Vault. Environmental samples and roadway and surface surveys indicated the 241-C-151 Diversion Box was the source of the contamination spread. Dose rates of 5 rad per hour were found on the cover blocks. *UPR-200-E-81; 241-CR-151 Line Break; UN-200-E-81; UN-216-E-9*. The release occurred on October 15, 1969. A puddle of contaminated liquid, measuring approximately 1.8 meters by 12.2 meters (6 feet by 40 feet), was discovered a few feet west of the 241-CR-151 Diversion Box. The source was determined to be a leak in an underground transfer line from the 202-A Building to the 241-C-102 Waste Storage Tank, via the 241-CR-151 Diversion Box. When it was stopped, most of the liquid seeped into the soil. The contaminated area was covered with about 0.5 meters (18 inches) of backfill and clean gravel. A maximum dose rate of 5 rad per hour at distance of 6.1 meters (20 feet) was recorded. As of 1991, the diversion box had been covered with weather-proofing foam and no separate barriers indicated the release site. *UPR-200-E-82; 241-C-152 Line Break; B Plant Ion Exchange Feed Line Leak; UN-200-E-82; UN-216-E-10*. On December 19, 1968, an underground waste line leak was discovered near the 241-C-152 Diversion Box. The source was determined to be the feed line that ran from tank 241-C-105 to the 221-B Building. Approximately 3,800 liters (1,000 gallons) of the total liquid release collected on the surface and was visually noticed by a Radiation Monitor. The liquid traveled downgrade, in a northeast direction, until it pooled into an area measuring approximately 0.46 square meters (5 square feet), outside the tank farm fence. The precise location of this area is not provided in the references.	WRPS	Accepted

Site Code	Site Type	Site Dimensions (m)	Dates of Operation	Site History	Subsite	Responsible Contractor	Site Classification /Reclassification
200-E-133 (continued)					*UPR-200-E-107, UN-200-E-107, Contamination Spread in 241-C Tank Farm*. The exact location of this release is unclear. Some reference documents (for example, Stenner et al 1988, Deford and Carpenter 1995) state the release occurred at the 241-CR-100 tank. However, there is no tank with this number. The original 1953 incident report states it occurred at the 241-CR-110 tank, in the 241-CR tank farm. It is believed that the location should be described as the 241-C-110 tank in the 241-C Tank Farm. Process waste was being directed to the first tank in a three-tank cascade series. The waste failed to cascade to the second tank, indicating the overflow line was plugged. Since there was an urgent need to discharge the waste to these tanks, an overground transfer was attempted. The foreman wanted to check the pump operation. He believed the pump was not yet submerged into the waste and opened the air valve. Since the pump leg was already in the liquid, it discharged waste with sufficient force to be propelled 6 meters (20 feet) away. Approximately 19 liters (5 gallons) of waste was discharged to the ground with a dose rate of 4 rad per hour. *UPR-200-E-118, UN-200-E-118, Airborne Release from 241-C-107*. On April 20, 1957, an airborne particle release caused contamination to spread inside the 241-C Tank Farm fence and extended 91 meters (300 feet) to the south of the badge house and an additional 270 meters (900 feet) to the north of the badge house. The contamination also spread outside of the fence, affecting the south bank of the parking lot. The highest dose rate at the surface was estimated at 50 millirad per hour, with one particle deposited per square foot. *UPR-200-E-136, UN-200-E-136, 241-C-101 Tank Leak*. UPR-200-E-136 occurred over a period of time, due to a liquid level decrease in tank 241-C-101. The tank was categorized as having "questionable integrity" in 1970. The tank was recategorized as a "confirmed leaker" in January 1980. *UPR-200-E-137, UN-200-E-137, 241-C-203 Leak*. Tank 241-C-203 began to operate in 1947. In the first quarter of 1976, the tank was removed from service and not intended for reuse. Over a period of two to three years, precipitation apparently entered the tank, migrated through the salt cake, and either became entrained in the salt cake or leaked out. Interim stabilization was completed in March 1982. The tank was declared a "leaker" in 1984 with a leak volume of 400 gallons (1,500 liters).		
216-C-8	French Drain	Culver: Diameter: 1.8 m (6 ft) Depth: 2.4 m (8 ft) Crib: Diameter: 2.4 m (8 ft) Depth: 4.9 m (16 ft) Overburden: 1.2 m	1962-1965	The site received radioactively contaminated ion exchange waste from the 271-CR Building. The waste volume is unknown. The waste site is composed of a 1.8-meter (6-foot) diameter, 2.4-meter (8-foot) long concrete culvert, placed vertically into the ground. The top of the structure is 1.2 meters (4 feet) below grade. It was placed into a 2.4-meter (8-foot) diameter by 4.9-meter (16-foot) deep excavation. A 5-centimeter (2-inch) diameter steel vent pipe was placed vertically through the center of the culvert and extended 1 meter (3 feet) above the surface. The culvert is filled with gravel. The above grade portion of the pipe has been	None	CHPRC	Accepted

Site Code	Site Type	Site Dimensions (m)	Dates of Operation	Site History	Subsite	Responsible Contractor	Site Classification /Reclassification
		(4 ft)		removed. An underground feed pipe entered near the top of the culvert. The crib surface was stabilized in April 1991. It was surveyed and posted as an Underground Radioactive Material Area in 1992.			
241-C-101	Single-Shell Tank	Diameter: 22.86 m (75 ft) Depth: 11.73 m (38.5 ft) Overburden: 2.21 m (7.25 ft)	1946-1970	The 241-C-101 tank received bismuth phosphate metal waste, tributyl phosphate process waste, and Plutonium Uranium Extraction Plant (PUREX) process coating waste from tank 241-C-106, which had high levels of strontium in the waste. Because this tank was the first tank in a cascading series, most of the solids precipitated out of the solutions into this tank. From 1952 to 1955 the tank was sluiced to recover uranium that had been discharged as waste. Interstitial pumping of tank waste was completed in 1979, ending a saltwell pumping program initiated in 1976. Primary tank stabilization was completed in 1978. This unit was categorized as a "confirmed leaker" in 1980, an upgrade from the 1973 status of "suspected leaker." In 1970, the tank was categorized as a "possible leaker," after it was pumped to a minimum heel of 1.12 meters (3.67 feet) when a decrease in the waste level of the tank was noted. UPR-200-E-136 is associated with this tank. See Subsite UPR-200-E-136 in Site 200-E-133.	None	WRPS	Accepted
241-C-102	Single-Shell Tank	Diameter: 22.86 m (75 ft) Depth: 11.73 m (38.5 ft) Overburden: 2.21 m (7.25 ft)	1946-1976	Tank 241-C-102 is the second tank in the 241-C-101, 241-C-102, and 241-C-103 cascade line. These tanks received 221-B Building bismuth phosphate process waste. Later, this tank received small amounts from Semiworks (201-C) and the Critical Mass Laboratory, as well as Uranium Recovery and PUREX process wastes. Tank 241-C-102 was partially isolated in 1982, with level adjustments in 1982, and a final saltwell pumping in1991. After removal from service in 1976, a saltwell pump was installed in 1977 and pumped until 1978. In 1978 the tank was declared inactive. The last documented waste transfer for this site was in May 1946.	None	WRPS	Accepted
241-C-103	Single-Shell Tank	Diameter: 22.86 m (75 ft) Depth: 11.73 m (38.5 ft) Overburden: 2.21 m (7.25 ft)	1946-1979	Tank 241-C-103 is the third tank in the 241-C-101, 241-C-102, 241-C-103 cascade line. This tank has waste from the following process: PUREX coating waste, tributyl phosphate waste, coating waste, PUREX high-level waste, 221-B Plant high-level waste, 221-B Plant waste fractionization low-level waste, PUREX sludge supernate, PUREX low-level waste, waste fractionization PUREX sludge, PUREX organic wash waste, laboratory waste, decontamination waste, Reduction-Oxidation (S Plant) (REDOX) ion exchange waste, REDOX high-level waste, noncomplexed waste, waste fractionization ion exchange waste, N Reactor waste, Pacific Northwest Laboratory waste, and evaporator bottoms from 241-A, 241-B, 241-BX, and 241-C Tank Farms. This unit was used as the receiver for operating P-10 saltwell systems within the 241-C Tank Farm. An additional source of waste is PUREX and insoluble strontium-rich sluicing solids from the operation of 244-CR Vault. Partial isolation of this tank was achieved in 1982. However, this tank is classified as non-stabilized. In 1988, an unusual occurrence report was issued documenting a decrease in the surface level of the waste. This decrease in surface level continued until 1993. The loss of liquid is attributed to evaporation. According toWHC-SD-WM-ER-349, this tank is on the organic salts watch list. The last documented waste transfer for this site was in 1979.	None	WRPS	Accepted

Site Code	Site Type	Site Dimensions (m)	Dates of Operation	Site History	Subsite	Responsible Contractor	Site Classification /Reclassification
241-C-103 VP	Valve Pit	Depth: 2.90 m (9.50 ft)	1979-unknown	The waste site is an underground corrugated metal structure. The valve pit was installed as part of the 241-C Farm tank waste interim stabilization saltwell system.	None	WRPS	Accepted
241-C-104	Single-Shell Tank	Diameter: 22.86 m (75 ft) Depth: 11.73 m (38.5 ft) Overburden: 2.21 m (7.25 ft)	1946-1980	Tank 241-C-104 is the first tank in the 241-C-104, 241-C-105, and 241-C-106 cascade line. This tank received bismuth phosphate metal waste starting in 1946, strontium-leached sluicing solids in 1977, and fissile material (including uranium-223) from PUREX thorium campaigns. This tank was sluiced during the 1952 to 1955 uranium recovery sluicing operation. During 1954, this tank was used as a tank-to-tank sluicing receiver. This waste was later sent to the 244-CR process vault. The last documented waste transfer for this site was in 1980.	None	WRPS	Accepted
241-C-105	Single-Shell Tank	Diameter: 22.86 m (75 ft) Depth: 11.73 m (38.5 ft) Overburden: 2.21 m (7.25 ft)	1946-1979	As part of the 241-C-104, 241-C-105, 241-C-106 cascade line, this tank received bismuth phosphate metal waste from 1947 until 1953. The tank was used as a receiver for PUREX sludge supernate enroute to 221-B Plant for cesium ion exchange processing. During 1952 and 1953, this tank was sluiced for the uranium recovery program. The last documented waste transfer for this site was in 1979. This tank is considered sound and partially isolated, through it is non-stabilized. Water additions for evaporative cooling were stopped in 1988, and the last level adjustment was made in 1985. After a level adjustment in 1979, partial isolation was achieved in 1983. The tank was declared inactive in 1980, when all single-shell tanks were declared inactive. Tank 241-C-105 has been removed from the high-heat load watch list.	None	WRPS	Accepted
241-C-106	Single-Shell Tank	Diameter: 22.86 m (75 ft) Depth: 11.73 m (38.5 ft) Overburden: 2.21 m (7.25 ft)	1947-1979	This tank is the last tank in the 241-C-104, 241-C-105 and 241-C-106 cascade. As the first generation tanks, this tank was designed to receive non-boiling waste. Tank 241-C-106 received bismuth phosphate metal waste in 1947. The tank was sluiced from 1952 to 1955 for uranium recovery efforts. The tank was on the high-heat load watch list for critical monitoring of temperature. A level adjustment was made in 1984. Other fluctuations in level throughout the 1980s can be explained by evaporative cooling/water additions. The tank was partially isolated in 1983, and declared inactive in 1979. In 2004, 33,000 gallons of waste were transferred out of tank 241-C-106 and placed in double shell tank 241-AN-106. At completion of the tank 241-C-106 retrieval operations in 2004, 2,770 gallons or 370 cubic feet of residual waste remained in the tank. Approximately 11 cubic feet was liquid and 359 cubic feet was solid sludge.	None	WRPS	Accepted
241-C-107	Single-Shell Tank	Diameter: 22.86 m (75 ft) Depth: 11.73 m (38.5 ft) Overburden: 2.21 m (7.25 ft)	1946-1978	This is the first tank in the 241-C-107, 241-C-108, 241-C-109 cascade line, designed to receive non-boiling waste. Tank 241-C-107 received first cycle waste and process decontamination wastes from 221-B Plant in 1946. This tank also received insoluble, strontium-leached sluicing solids in 1977. The last documented waste transfer for this site was in 1978. This tank was partially isolated in 1982, though levels were adjusted in 1992, and prior to isolation in 1978. The tank was declared inactive in 1978 and it is currently awaiting stabilization. P-10 saltwell pumping to remove interstitial liquids had been completed.	None	WRPS	Accepted

Site Code	Site Type	Site Dimensions (m)	Dates of Operation	Site History	Subsite	Responsible Contractor	Site Classification /Reclassification
241-C-108	Single-Shell Tank	Diameter: 22.86 m (75 ft) Depth: 11.73 m (38.5 ft) Overburden: 2.21 m (7.25 ft)	1947-1977	Tank 241-C-108 was designed as the second tank of the 241-C-107, 241-C-108, 241-C-109 cascade series. It received non-boiling, cascade overflow from tank 241-C-107. Wastes received by this tank include first cycle waste, and process decontamination waste from 221-B Plant. The tank also acted as a primary settling tank for "In-Farm" waste scavenging for the Uranium Recovery process. The last documented waste transfer for this site was in 1977. This tank was interim stabilized in 1984 after a level adjustment. Intrusion prevention was achieved in 1982. Saltwell pumping was initiated in 1976 and finished in 1978. The tank was declared inactive in 1977.	None	WRPS	Accepted
241-C-109	Single-Shell Tank	Diameter: 22.86 m (75 ft) Depth: 11.73 m (38.5 ft) Overburden: 2.21 m (7.25 ft)	1948-1978	Tank 241-C-109 is the third tank of the cascade series. It received non-boiling cascade overflow from tank 241-C-108. Wastes received by this tank include bismuth phosphate first cycle waste and process decontamination waste from 221-B Plant. The tank acted as a primary settling tank for "In-Farm" scavenging for the Uranium Recovery process. The last documented waste transfer for this site was in 1978. Interim stabilization and a level adjustment were completed in 1983 after intrusion prevention succeeded in 1982. The tank was removed from service in 1976 and declared inactive in 1978. Saltwell pumping was performed from 1976 to 1979.	None	WRPS	Accepted
241-C-110	Single-Shell Tank	Diameter: 22.86 m (75 ft) Depth: 11.73 m (38.5 ft) Overburden: 2.21 m (7.25 ft)	1946-1976	This tank is the first tank in the 241-C-110, 241-C-111, 241-C-112 cascade line. It was designed to receive non-boiling waste. The tank received bismuth phosphate first cycle waste from 1946 to 1967. Tanks 241-C-108, 241-C-109, 241-C-110, 241-C-111, and 241-C-112 were also used as primary settling tanks for "In-Farm" scavenging for the Uranium Recovery process. The last documented waste transfer for this site was in 1978. Partial isolation was achieved in 1982 after primary stabilization was completed in 1979. Saltwell pumping was performed from 1976 to 1979. Level adjustments were made in 1984 and 1985. The tank classification was revised from an "assumed leaker" with a volume loss of 2,000 gallons (7,600 liters) to "sound," based on a formal leak assessment completed in 2008.	None	WRPS	Accepted
241-C-111	Single-Shell Tank	Diameter: 22.86 m (75 ft) Depth: 11.73 m (38.5 ft) Overburden: 2.21 m (7.25 ft)	1946-1978	This tank is the second tank in the 241-C-110, 241-C-111, 241-C-112 cascade line. It was designed to receive non-boiling waste. The tank received bismuth phosphate first cycle waste beginning in 1946. Tanks 241-C-108, 241-C-109, 241-C-110, 241-C-111, and 241-C-112 were also used as primary settling tanks for "In-Farm" scavenging for the Uranium Recovery process. This tank was declared an "assumed leaker" in 1968 with a volume loss of 5,500 gallons (20,818 liters). The last documented waste transfer for this site was in May 1978. Saltwell pumping was initiated in 1976 and completed in 1978. A level adjustment was made in 1982 and intrusion prevention was completed in 1982. Partial isolation was achieved in 1982 with interim stabilization completed in 1984.	None	WRPS	Accepted

Site Code	Site Type	Site Dimensions (m)	Dates of Operation	Site History	Subsite	Responsible Contractor	Site Classification /Reclassification
241-C-112	Single-Shell Tank	Diameter: 22.86 m (75 ft) Depth: 11.73 m (38.5 ft) Overburden: 2.21 m (7.25 ft)	1946-1976	This tank is the third tank in the 241-C-110, 241-C-111, 241-C-112 cascade line, and was designed to receive non-boiling waste. The tank received bismuth phosphate first cycle waste starting in 1976. Tanks 241-C-108, 241-C-109, 241-C-110, and 241-C-112 were also used as primary settling tanks for "In-Farm Scavenged Uranium." The tank was saltwell pumped from 1976 to 1979. It was removed from service in 1976 and declared inactive in 1979. This tank is on the ferrocyanide watch list. This tank is "sound," and has been interim stabilized. A level adjustment was made in 1990.	None	WRPS	Accepted
241-C-151	Diversion Box	Length: 6.10 m (20.00 ft) Width: 2.74 m (9.00 ft) Depth: 3.54 m (11.60 ft)	1946-1985	The diversion box is an underground, reinforced concrete structure. It is designed to contain leaks and spills from waste transfers and drainage during jumper operations within the unit. Surface features include concrete cover blocks with lifting bails. It is estimated that approximately 23 kilograms (50 pounds) of lead shielding may be stored in each diversion box. The last documented waste transfer for this site was in July 1985. This unit has been isolated and weather-covered. The diversion box has been stabilized with weather-proofing foam.	None	WRPS	Accepted
241-C-152	Diversion Box	Length: 8.53 m (28.00 ft) Width: 2.74 m (9.00 ft) Depth: 3.54 m (11.60 ft)	1946-1985	Diversion boxes and receiving vaults drain to catch tanks. They are designed to contain leaks or spills from waste transfers and drainage during jumper operations within the unit. The 241-C-152 Diversion Box is associated with the 241-C-301 Catch Tank. This diversion box interconnects the 241-B-154 and 241-B-153 Diversion Boxes with the 241-C Tank Farm. The last documented waste transfer for this site was in July 1985. The diversion box has been isolated and stabilized with weather-proofing foam. It is estimated that approximately 23 kilograms (50 pounds) of lead shielding may be stored in each diversion box.	None	WRPS	Accepted
241-C-153	Diversion Box	Length: 10.36 m (34.00 ft) Width: 2.74 m (9.00 ft) Depth: 3.20 m (10.50 ft)	1946-1985	This diversion box is associated with the 241-C-301 Catch Tank and 241-C Tank Farm. This unit interconnects the 241-C-151 and 241-C-152 Diversion Boxes. It transferred liquid waste from the processing plants to the tank farms. The Part A Permit assumed that 50 pounds (23 kilograms) of lead shielding bricks may also be stored in this diversion box.	None	WRPS	Accepted
241-C-201	Single-Shell Tank	Diameter: 6.10 m (20 ft) Depth: 11.55 m (37.88 ft) Overburden: 3.96 m (13 ft)	1947-1977	This tank is a 200-series single-shell tank, designed to receive non-boiling waste. Tanks 241-C-201, 241-C-202, 241-C-203, and 241-C-204 have tie lines between each tank to equalize the waste volumes in each tank. This tank received metal waste, and is plumbed to the 241-C-252 Diversion Box. Tank 241-C-201 began to operate in 1947 by receiving bismuth phosphate metal waste. This tank was sluiced during the uranium recovery process. No pumpable liquid remains in the tank. This tank is an "assumed leaker," with a loss of 550 gallons (2,080 liters). The tank was removed from service in 1976 and declared inactive in 1977. Intrusion prevention and interim stabilization were completed in 1982. Level adjustments were made in 1982 and 1990.	None	WRPS	Accepted

Site Code	Site Type	Site Dimensions (m)	Dates of Operation	Site History	Subsite	Responsible Contractor	Site Classification /Reclassification
241-C-202	Single-Shell Tank	Diameter: 6.10 m (20 ft) Depth: 11.55 m (37.88 ft) Overburden: 3.96 m (13 ft)	1947-1977	Tank 241-C-202 began to operate in 1947 by receiving metal waste. Tanks 241-C-201, 241-C-202, 241-C-203, and 241-C-204 were used to settle waste while supernate was sent to a crib. This tank was sluiced for uranium recovery. No pumpable liquid remains in the tank. Metal waste in the tank was removed in 1954 and the tank received waste from Hot Semiworks in 1955 and 1956. Most of the Hot Semiworks waste was removed in 1970. The last documented waste transfer for this site was in 1977. This tank is an "assumed leaker," with a loss of 450 gallons (1,700 liters). Intrusion prevention was completed in 1982, while interim stabilization was completed in 1981. The tank was removed from service in 1976 and declared inactive in 1977. The tank was interim stabilized in 1982. Waste retrieval was completed in August 2005 with the retrieval of 1,032 gallons of waste, resulting in an ending volume in the tank of 147 gallons. Retrieval was accomplished using a vacuum retrieval system. Waste was transported to tank 241-AN-106 through a hose-in-hose transfer line.	None	WRPS	Accepted
241-C-203	Single-Shell Tank	Diameter: 6.10 m (20 ft) Depth: 11.55 m (37.88 ft) Overburden: 3.96 m (13 ft)	1947-1976	Tank 241-C-203 began to operate in 1947 by receiving metal waste. This tank is an "assumed leaker," with a loss of 1,500 liters (400 gallons). The tank was removed from service in 1976 and declared inactive in 1977. In 1986, a cracked sludge surface was observed with no visible liquids. Intrusion leak prevention and interim stabilization were completed in 1982. From June 2004 through March 2005, approximately 9,504 liters (2,501 gallons) of waste was removed from this tank and transferred to double-shell tank 241-AN-106.	None	WRPS	Accepted
241-C-204	Single-Shell Tank	Diameter: 6.10 m (20 ft) Depth: 11.55 m (37.88 ft) Overburden: 3.96 m (13 ft)	1948-1977	Tank 241-C-204 began to operate in 1948 by receiving metal waste. Tanks 241-C-201, 241-C-202, 241-C-203, and 241-C-204 were used to settle waste while supernate was sent to a crib. This tank was sluiced for uranium recovery. No pumpable liquid remains in the tank. This tank is an "assumed leaker," with a loss of 1,320 liters (350 gallons). The tank was not intended for reuse in 1976, and declared inactive in 1977. A level adjustment, intrusion prevention and interim stabilization were completed in 1982.	None	WRPS	Accepted
241-C-252	Diversion Box	Length: 10.97 m (36.00 ft) Width: 2.74 m (9.00 ft) Depth 4.57 m (15.00 ft)	1946-1985	The diversion box is an underground, reinforced concrete structure. Surface features include concrete cover blocks and lifting bails. It is estimated that approximately 23 kilograms (50 pounds) of lead shielding may be stored in this diversion box. The last documented waste transfer for this site was in July 1985. This unit has been sealed with weather-proofing foam.	None	WRPS	Accepted

Site Code	Site Type	Site Dimensions (m)	Dates of Operation	Site History	Subsite	Responsible Contractor	Site Classification /Reclassification
241-C-301	Catch Tank	Length: 5.79 m (19.00 ft) Diameter: 6.10 m (20 ft)	1946-1985	Tank 241-C-301C received drainage from the 241-C-151, 241-C-152, 241-C-153, and 241-C-252 Diversion Boxes. The wastes received in the catch tank include waste from 221-B Plant, PUREX and Hot Semiworks operations. In 1994, the tank contained 5,586 liters (1,470 gallons) of liquid supernate and 34,260 liters (9,016 gallons) of sludge. The tank may also have received ferrocyanide waste. Catch tanks are components of tank farms that collect spills and/or leaks during waste transfers between processing facilities and tank farms. Catch tanks also received any water from rainfall, snowmelt, or dust that entered the diversion boxes (the diversion boxes were later weather-proofed.) The tanks were coal-coated for corrosion protection, and later underwent two cathodic protection upgrades. The catch tank was constructed with 15.2-centimeter (6-inch) thick walls, coated with Amercoat to obtain a non-porous surface.	None	WRPS	Accepted
241-C-801	Process Unit/Plant	Length: 9.75 m (32 ft) Width: 7.92 m (26 ft) Depth/Height: 7.62 m (25 ft)	1962-1976	The site is a single-story building located inside the 241-C Tank Farm. The upper portion of the building is constructed of prefabricated metal. The bottom 2.9 meters (9.5 feet) of the building is constructed of concrete walls and foundations, approximately 0.3 meters (1 foot) thick. This part of the structure is covered with earth. The main building sections include the loadout room, which is 9.8 by 4.3 by 6.1 meters (32 by 14 by 20 feet), and the operating room, which is 4.3 by 3.7 by 6.1 meters (14 by 12 by 20 feet). A valve pit measuring 2.4 by 2.1 by 2.4 meters (8 by 7 by 8 feet) is located in the southwest portion of the building. A rollup door allowed truck access to the High Bay portion of the building. The High Bay occupies approximately half of the building and has a 5-ton capacity crane bridge. Two underground storage tanks are associated with this facility. Tank 241-C-103 was used for cesium feed storage. Waste from this tank was pumped into the 801-C Loadout facility, then into a truck-mounted demineralizer. The demineralizer removed the cesium from the liquid waste and retained it inside the shielded container. The cesium depleted waste was transferred to tank 241-C-102. The truck containing the cesium was transported offsite. The 241-C Valve pit was installed in the upper level of the 241-C-801 Cesium Loadout Facility, which received cesium-rich waste from tank 241-C-103. The waste was pumped through an ion exchanger before being transferred to tank 241-C-102. The Cesium Loadout Facility was declared inactive and isolated in September 2002.	None	WRPS	Accepted
241-CR-151	Diversion Box	Length: 13.11 m (43.00 ft) Width: 7.92 m (26.00 ft) Depth: 4.88 m (16 ft)	1946-unknown	The diversion box is an underground, reinforced concrete structure. Surface features include concrete cover blocks and lifting bails. This covered diversion box is designed to contain leaks from transfers and drainage from operations within the unit. This unit acts as a secondary containment for the transfer line jumper connections. The date of the last waste receipt to the 241-C Tank Farm was 1979. This unit may have been used after 1979 to transfer waste to the double-shell units.	None	WRPS	Accepted
241-CR-152	Diversion Box	Length: 3.96 m (13 ft) Width: 10.06 m (33 ft) Depth: 3.66 m (12 ft)	1946-1985	The diversion box is an underground, reinforced concrete structure. Surface features include concrete cover blocks and lifting bails. This diversion box is designed to contain leaks from transfers and drainage from operations within the unit. This unit acts as a secondary containment for transfer line jumper connections. The last documented waste transfer	None	WRPS	Accepted

Site Code	Site Type	Site Dimensions (m)	Dates of Operation	Site History	Subsite	Responsible Contractor	Site Classification /Reclassification
				for this site was in July 1985.			
241-CR-153	Diversion Box	Length: 11.28 m (37 ft) Width: 3.96 m (13 ft) Depth: 3.35 m (11 ft)	1946-1985	The 241-CR-153 Diversion Box is located in the southern portion of the 241-C Tank Farm, northwest of the 244-CR Vault. It is attached to the 241-CR-152 Diversion Box. The diversion box is an underground, reinforced concrete structure. Surface features include concrete cover blocks and lifting bails. This diversion box is designed to contain leaks from transfers and drainage from operations within the unit. This unit acts as a secondary containment for transfer line jumper connections. The last documented waste transfer for this site was in July 1985.	None	WRPS	Accepted
244-CR Vault Subsites: 244-CR Vault: 1 244-CR Vault: 2 244-CR Vault: 3 244-CR Vault: 4	Receiving Vault Subsites: 244-CR-001 Tank and Sump 244-CR-002 Tank and Sump 244-CR-003 Tank and Sump 244-CR-004 Tank and Sump	Length: 31.09 m (102 ft) Width: 7.92 m (26 ft) Depth: 17.07 m (56 ft)	1946-1988	This vault is an underground, reinforced concrete structure. It is a two-level, multi-cell structure (cells 1, 2, 3 and 11). The lower cell contains the process vessels. Upper cells contain piping and equipment. The structure is constructed with concrete cover blocks which, when removed, allow access to the upper cells. The lower cells contain four process vessels: TK-CR-001, TK-CR-011, TK-CR-002, and TK-CR-003 (see subsites). The receiving vault had the capacity to add chemicals, mix solutions and cool the tank contents. Waste was also received from the Hot Semiworks Facility. The 244-CR-003 Tank in the 244-CR Vault is used for the interim storage of saltwell waste from the 241-C Tank Farm. The *Hanford C-Farm Leak Assessments Report* (RPP-ENV-33418) documented the failed pipelines and unplanned releases associated with 241-C Tank Farm activities. On February 18, 1965, the 244-CR Vault was found flooded up to approximately the level of the tank tops. Immediate steps were taken to reduce the liquid level by jetting the solution to the 244-CR-011 Tank. Partial cause of the flooding is attributed to a failure in the coating waste line which enters the 241-CR-151 Diversion Box. Drainage from this diversion box collects in the 244-CR-002 Vault Sump. Water from a sampler flush line and drainage from rain and snow contributed to the liquid level in the vault. To date, the 244-CR-001, 244-CR-002, and 244-CR-003 Sumps have been emptied, and the 244-CR-011 Sump is being emptied, to the 244-CR-011 Tank. This liquid is being pumped from the 244-CR-011 Tank to tank 241-A-103 in the 241-A Tank Farm. In May 1966, a leak in the PUREX coating waste route (via 241-CR-152 Diversion Box) was detected by an abnormal liquid level increase of the 244-CR-002 Vault Sump. The leaking flexible jumper in the 241-CR-152 Diversion Box was replaced. The 241-CR-152 Diversion Box and 244-CR Vault Sump are concrete structures with painted surfaces. It is uncertain whether leaked waste was contained inside the 241-CR-152 Diversion Box and 244-CR Vault Sump.	*Receiving Vault 244-CR-001 Tank and Sump*. 244-CR-001 is a 189,250-liter (50,000-gallon) tank located in a 6.7-meter (22-foot) by 7.9-meter (26-foot) by 8.8-meter (29-foot) cell (cell 1) within the 244-CR Vault. The concrete cell has a 170-liter (45-gallon) capacity sump. The 244-CR Vault and associated tanks and cells were used as the uranium sludge recovery and distribution vault for the 241-C Tank Farm. The 244-CR Vault was also used for the interim storage and transfer of waste from 221-B Plant, PUREX and Hot Semiworks. Tank 244-CR-001 was the slurry accumulator, receiving waste from the 241-C Farm tanks. The slurry was processed with nitric acid. In 2002, the tank was estimated to contain 7,570 liters (2,000 gallons) of waste solids from the Uranium Recovery Program. In 2005, the tank contained 5,197 liters (1,375 gallons) of liquid and sludge. Cell #1 contained 291 liters (77 gallons) of liquid. *Receiving Vault 244-CR-002 Tank and Sump*. 244-CR-002 is a 56,775-liter (15,000-gallon) tank located in a 4.9-meter (16-foot) by 6.0-meter (20-foot) by 5.79-meter (19-foot) cell (cell 2) within the 244-CR Vault. The concrete cell has a 170-liter (45-gallon) capacity sump. The 244-CR Vault and associated tanks and cells were used as the uranium sludge recovery and distribution vault for the 241-C Tank Farm. The 244-CR Vault was also used for the interim storage and transfer of waste from 221-B Plant, PUREX and Hot Semiworks. Tank 244-CR-002 was the blending tank, mixing waste from the 244-CR-001 with nitric acid. In 2002, the tank was estimated to contain 5,678 liters (1,500 gallons) of waste solids from the Uranium Recovery Program. In 2005, the tank contained 2,846 liters (753 gallons) of liquid and sludge. Cell 2 contained 5,579 liters (1,476 gallons) of liquid and sludge. *Receiving Vault 244-CR-003 Tank and Sump*. 244-CR-003 is a 56,775-liter (15,000-gallon) tank located in a 4.9-meter (16-foot) by 6.0-meter (20-foot) by 5.79-meter (19-foot) cell (cell 3) within the 244-CR Vault. The concrete cell has a 170-liter (45-gallon) capacity sump. The 244-CR Vault and associated tanks and cells were used as the uranium sludge recovery and distribution vault for the 241-C Tank Farm. The 244-CR Vault was also used for the interim storage and transfer of waste from 221-B Plant, PUREX and Hot Semiworks. Tank 244-CR-003 was a blending tank, mixing waste from the 244-CR-001 with nitric acid. In 2002, the tank was estimated to contain 15,973 liters (4,200 gallons) of saltwell waste with an unknown amount of solids. In 2005, the tank contained	WRPS	Accepted

Site Code	Site Type	Site Dimensions (m)	Dates of Operation	Site History	Subsite	Responsible Contractor	Site Classification /Reclassification
					8,112 liters (2,146 gallons) of liquid and sludge. Cell 3 contained 6,709 liters (1,775 gallons) of liquid and sludge. 244-CR-003 was the last active tank in the 244-CR Vault. The tank had been available to be used for saltwell pumping of the 241-C Tank Farm.		
244-CR Vault Subsites: 244-CR Vault: 1 244-CR Vault: 2 244-CR Vault: 3 244-CR Vault: 4 (continued)					*Receiving Vault 244-CR-011 Tank and Sump*. 244-CR-011 is a 189,250-liter (50,000-gallon) tank located in a 6.7-meter (22-foot) by 7.9-meter (26-foot) by 8.8-meter (29-foot) cell (cell 11) within the 244-CR Vault. The concrete cell has a 170-liter (45-gallon) capacity sump. The 244-CR Vault and associated tanks and cells were used as the uranium sludge recovery and distribution vault for the 241-C Tank Farm. The 244-CR Vault was also used for the interim storage and transfer of waste from 221-B Plant, PUREX and Hot Semiworks. Initially, tank 244-CR-011 acted as a process pump tank for the transfer of processed waste from the 244-CR Vault to the diversion station for transfer to the Uranium Recovery facility or other operations. In 2002, the tank was estimated to contain 132,475 liters (35,000 gallons) of supernate and rainwater. In 2005, 15,082 liters (3,990 gallons) of sludge was reported. No liquid volume was remaining in the tank. Cell 11 contained 27,639 liters (7,312 gallons) of liquid and sludge.		
244-CR-WS-1 244-CR French Drain	French Drain	Diameter: 0.61 m (2 ft)	Unknown	The waste site is a 24-inch diameter french drain. It is covered and partially filled with gravel. The drain is located on the south side of the 291-CR Ventilation Building stack, inside the 241-C Tank Farm fence. The structure is associated with the 291-CR Ventilation Building. This unit received condensate from the 291-CR Stack, the plenum chamber exhaust fans and the plenum inlet. The depth is not obvious on the drawing references.	None	WRPS	Accepted
2607-EG	Septic Tank	Diameter: Not Specified	1951-unknown	There were two 2607-EG septic tanks. The first tank failed and was replaced in 1972. A large diameter, vertical concrete pipe extends above the ground surface. It received sanitary wastewater and sewage from the 271-CR Building. The associated drain field had a capacity of 619 gallons (2,350 liters) per day. The original unit failed and was replaced in 1972. This original septic system was isolated and properly abandoned as documented in HNF-SD-LL-SP-001. The second unit was also called 2607-EG. There is conflicting information as to whether the replacement 2607-EG tank was abandoned in 1998. HNF-6612 (section 4) indicated it had not been abandoned in 2003. But a 2010 email states the septic tank was filled with a sand slurry and abandoned in place, probably in 1998.	None	WRPS	Accepted
UPR-200-E-72 Radioactive Contamination from Uncovered Buried Waste	Unplanned Release	Undetermined	Unknown	The site is located south of the 241-C Tank Farm, near the 216-C-8 Crib. In 1985, radiological surveys were being performed outside the 241-C Tank Farm fence following a contamination incident at the 241-C-151 Diversion Box. A contaminated area was found south of the 241-C Tank Farm that indicated the burial of previously undocumented contaminated material. The area contained specks of contamination reading up to 7 rad per hour. The source of the contamination is assumed	None	WRPS	Accepted

Site Code	Site Type	Site Dimensions (m)	Dates of Operation	Site History	Subsite	Responsible Contractor	Site Classification /Reclassification
				to be the buried material. In 1985, the contamination was physically fixed in place with Turco Fabri-Film. The area was surrounded with a chain and posted as a Surface Contamination Area. Further investigation included collecting samples and submitting them to the laboratory for analysis. The occurrence report states that decontamination will be performed when the weather (wind) permits.			
UPR-200-E-86	Unplanned Release	Length: 6.1 m (20 ft) Width: 6.1 m (20 ft) Depth: 6.1 m (20 ft)	2/25/1971	UPR-200-E-86 is the leak of transfer line V812. The line was being used to transfer process waste from the 244-AR Vault to 241-C-106 in 241-C Tank Farm. The leak occurred at the welded junction of a carbon steel segment and a stainless steel segment of the pipeline. Approximately 65,802 liters (17,385 gallons) of process waste, containing 25,000 curies of cesium-137 was released. The Unplanned Release has been consolidated with the V812 pipeline WIDS sitecode 200-E-153-PL. In 1971, eight wells were drilled around the leak to define the release area. Wells 1,2,3,6 and 7 found no subsurface contamination to a depth of 6 meters (20 feet). Well number 4 encountered contaminated soil reading 5 rad per hour between the depth of 1 and 2 meters (3 to 6 feet) below ground surface. Wells 5 and 8 found contaminated soil at depths of 16 and 19 feet. No contamination was found below 6 meters (20 feet) in any of the wells. In 1972, three wells were drilled through the contaminated area to determine the depth of the contamination. Contamination was not found below the 6.1 meter (20-foot) level on any of the wells.	None	None[a]	Consolidated
UPR-200-E-91	Unplanned Release	Undetermined	Unknown	This site was a large area of contaminated soil, located north and east of the 241-C Tank Farm. The release occurred over time, due to radioactive particles migrating out of the adjacent 241-C Tank Farm. At one time, water from an equipment decontamination station, located inside the tank farm, seeped downhill into this area. Vapor emissions and windblown particulates from the contaminated surfaces of the tank farm contributed to the buildup of ground contamination at the site. The posted area of contamination was given a UPR number in September 1980. A hand-drawn sketch of the contaminated area is included with the 1981 memo from Boyd Shannon to Bill Osborne, titled “Status Change of Unplanned Release Sites” (RHO 1981). Scraping activities began in January 1981. Contaminated soil from the area north and east of the 241-C Tank Farm and also a 9.1-meter (30-foot) strip of soil located inside the northeast portion of the 241-C Tank Farm perimeter fence was removed. Most documentation states that the scraped area was 2.8 hectares (7 acres). The vegetation control records state that the area was 1.2 hectares (3 acres). The contaminated soil was placed in the excavation adjacent to the north side of the 216-A-24 Crib (see UPR-200-E-56). The scraped area outside the tank farm was seeded with a variety of drought-resistant grasses. The area was released from radiation zone status in February 1981.	None	WRPS	Accepted

Site Code	Site Type	Site Dimensions (m)	Dates of Operation	Site History	Subsite	Responsible Contractor	Site Classification /Reclassification
UPR-200-E-99	Unplanned Release	Undetermined	1980	UPR-200-E-99 was established as a WIDS site in September 1980. The actual date of occurrence is unknown. An event on November 1, 1960 was documented in HW-84619 that described wind blown contamination from the 244-CR Vault with contamination levels of 40,000 counts per minute being found several hundred feet beyond the tank farm fence. This event could have contributed to this area of contamination. In 1981, while preparing the area south of 7th Street for herbicide application, tumbleweeds were being removed. Radiological surveys inside the posted Surface Contamination Area found no detectable contamination. The Surface Contamination postings were removed on March 5, 1981, and the area was released from radiation zone status based on the radiation survey results.	None	WRPS	Accepted
UPR-200-E-100	Unplanned Release	Undetermined	1985	UPR-200-E-100 consisted of radioactive rodent feces and contamination specks located south Seventh Street and west of Buffalo Street, adjacent to the 244-A Lift Station. Due to rodent movement and some contamination migration from wind, the size and the shape of the contaminated area was redefined several times. The release area was determined to be due to windblown particulates and biological transport (rodent feces) from the tank farms and the 244-A Lift Station. Another source of the contamination may be an underground pipeline leak near the 244-A lift station. A waste site number (UN-216-E-29) was assigned to this area on August 18, 1985.	None	CHPRC	Accepted
UPR-200-E-115	Unplanned Release	Undetermined	2/12/1974	UPR-200-E-115 was the release of liquid waste occurred on the ground adjacent to the 241-AX-103 Pump Pit, inside the 241-AX Tank Farm fence. During bleeding of air from a line, air flowed up (instead of down) causing contaminated liquid to spray onto two employees and the ground adjacent to the 241-AX-103 Pump Pit. The employees were wearing coveralls and assault masks. The 241-AX-103 pump pit was contaminated with levels up to5 rad per hour. The ground around the pump pit had maximum contamination levels of 2 rad per hour.	None	None[a]	Consolidated
UPR-200-E-135	Unplanned Release	Undetermined	Unknown	UPR-200-E-135 is the release of the 241-BY-108 Tank Leak. The release from the tank occurred over time. The tank was active from 1955 to 1972. The release consisted of approximately 19,000 liters (5,000 gallons) of tributyl phosphate waste and evaporator bottoms from 241-BY and 241-C Tank Farms. 241-BY-108 was classified as a "Confirmed Leaker" in 1972 and removed from service. In 1976, Occurrence Report 76-142 revealed the liquid level gauge plummet was tangled in some old tape and was leaning at an angle that could distort the readings. The tape was removed and a new gauge plummet was installed. In January 1980, Occurrence Report 80-5 documented approximately 9880 liters (2600 gallons) of precipitation intrusion occurred due to a rapid snow melt. A saltwell system has been installed to remove interstitial liquid.	None	None[a]	Consolidated

[a] The Responsible Contractor column reflects the most recent information available from the Waste Information Data System (WIDS). Per TPA-MP-14, a site given a reclassification status of "consolidated" is a duplicate of, physically located within, or adjacent to another WIDS site and will be

Site Code	Site Type	Site Dimensions (m)	Dates of Operation	Site History	Subsite	Responsible Contractor	Site Classification /Reclassification

dispositioned as part of that other WIDS site. The responsible contractor for a consolidated site is that of the WIDS site with which it was consolidated.

References:

HNF-6612, 2012, *Hanford Site Sewer System Master Plan*, Rev. 3, Mission Support Alliance, LLC, Richland, Washington.
HNF-SD-LL-SP-001, 1998, *200 and 600 Areas Sanitary Wastewater Master Plan*, Rev. 1, Fluor Daniel Northwest, Inc., Richland, Washington.
RHO, 1981, "Status Change of Unplanned Release Sites" (memo from J. B. Shannon to W. L. Osborne, July 27), Rockwell Hanford Operations, Richland, Washington.
RPP-ENV-33418, 2012, *Hanford C-Farm Leak Assessments Report*, Rev. 2A, Washington River Protection Solutions, LLC, Richland, Washington.
TPA-MP-14, 2011, *Maintenance of the Waste Information Data System (WIDS)*, Rev. 32, U.S. Departement of Energy, Richland Operations Office, Washington State Department of Ecology, and U.S. Environmental Protection Agency, Richland, Washington.
WHC-SD-WM-ER-349, 1997, *Historical Tank Content Estimate for the Northeast Quadrant of the Hanford 200 East Area*, Rev. 1b, Fluor Daniel Northwest, Inc., Richland, Washington.

APPENDIX G

OVERVIEW OF FIELD TECHNOLOGIES

This page intentionally left blank.

APPENDIX G
OVERVIEW OF FIELD TECHNOLOGIES

INTRODUCTION

Multiple field methods were used to characterize the subsurface in and around WMA C. The approaches were often cutting edge and technical in nature. This appendix begins with a discussion of the technology used to install boreholes for logging and sampling of the vadose zone. It continues with the geophysical measurements: both surface geophysical exploration (i.e., 3D resistivity and well to well) and logging (i.e., spectral gamma and neutron). References are made to documents that provide more information should the reader be interested.

INSTALLATION OF BOREHOLES

Boreholes are holes created by pushing or drilling into the vadose zone, groundwater, and bedrock. The geologic conditions of much of the vadose zone (Hanford Formation) is unconsolidated sands and gravels and requires the installation of casing (steel, fiberglass, PVC) to be installed in the boreholes to prevent them from collapse. Often, multiple strings of casing are required to be installed in the same borehole to allow target depths to be reached, or properly isolate zones of contamination. The completed diameters of the boreholes vary from about 2.5 to 14 in.

Boreholes are constructed as either temporary or permanent structures. Temporary boreholes are usually installed to obtain soil, vapor or groundwater samples for laboratory analysis or as access for geophysical logging tools, and are then decommissioned. Permanent boreholes are completed as wells for long term monitoring of the vadose or groundwater zones or for remedial purposes such as extraction of contaminant vapors and groundwater for treatment.

Because of the different type of soils and levels of contamination, different types of drilling technologies have been used at the Hanford Site. They can be divided into two major categories:

- Conventional drilling which brings soils to the surface while advancing the borehole, and
- Direct push which displaces the soils to advance the borehole bringing no soils to the surface.

In both categories, metal pipe is either rotated and drilled or driven into the ground to advance the borehole.

Conventional drilling techniques consist of air/mud rotary, cable tool, auger, and sonic. These methods use a rotary drill bit, hammering action, or sonic vibration to advance the drill pipe and bring drilled cuttings to the surface through circulating air, water or a drilling mud, or by mechanical means through drive barrels, tubing, or auger flights. This method is best used in locations where contamination is not present to avoid the generation of large volumes of waste

material removed through the drilling actions and to minimize the spread of contamination. Typically only the cable tool method is used in areas of contamination; however, this method still generates a considerable volume of waste.

Soil samples can be obtained in a variety of methods and result in either a disturbed or undisturbed sample. The disturbed sample is normally considered a grab sample and is fairly quick, easy and less expensive to collect. This sample is collected from the drilled cuttings brought to the surface through the air/water circulation method, drive barrel method from cable tool drilling, or off the auger flights from auger drilling. These samples are disturbed. The soils are mixed and homogenized from the drilling action and actual depth of the sample is not known, only a general depth range. Additionally, ability to determine soil structure and moisture content has been impacted. However, geochemistry is not affected.

The undisturbed soil samples are obtained by a soil core method. In conventional drilling, undisturbed samples can be collected by using split spoon samplers. These are devices that are driven ahead of the advanced borehole into the undisturbed soils, driving the sample up into the sampler device. These usually measure approximately 2 to 5 ft in length and 2 to 6 in. in diameter. The split spoon sampler is driven its length then removed from the borehole and the samples extracted. The samples are generally collected into liners that are removed from the sampler, capped, and shipped to a lab. Because such sampling interrupts the drilling, it is relatively expensive. However, this sampling method provides a known depth from which the sample is collected and results in a relatively undisturbed sample leaving the soil structure intact to allow more accurate analysis.

Direct Push Technology

A different method of installing a borehole is using direct push technology. In this method a pipe is advanced in the soils by pushing, driving or a combination of both. No cuttings are brought to the surface; the soil around the borehole is displaced as the pipe is pushed. Various systems for direct push technology exist. The cone penetrometer system uses hydraulic rams to push pipe into the soils. The system is mounted in a large weighted truck to provide the force or weight to allow the pipe to be pushed. This method has limitations for advancing the pipe due to soil friction. Another method involves the use of a drive hammer to drive the pipe into the soils. Both of these methods have been used at the Hanford Site with mixed results. The composition of the vadose zone, gravels and sand, and the presence of cemented zones limit penetration depths. Also, the weight and size of the cone penetrometer units restrict its use in the tank farms due to infrastructure interferences.

In response to a need for a method to conduct investigations and characterizations of the vadose zone beneath the underground single shell radioactive storage tanks at the Hanford Site, unique direct push rigs and tooling were developed to meet the site specific challenges presented by drilling in the tank farms. This method combines the hydraulic push and hammer driving method. The hydraulic hammer unit (HHU) has high-energy impact (450 to 650 ft/lbs per cycle at 2,000 cycles per minute) and rotates the pipe while driving. This allows the pipe to be driven and rotated at the same time, allowing for deeper target depths. The hydraulic hammers used to drive the pipe provide larger driving forces than the conventional direct push hammers utilized

on commercially available direct push rigs. A 2.5 in. closed end probe is driven for borehole installation and log data collection. The direct push drill casing is heavy wall and small diameter, ranging from 2.5-in. to 2.62-in. outside diameter and 1.12 to 1.75-in. inside diameter. This system is capable of reaching depths greater than 200 ft in soils capable of being displaced.

The initial version of the HHU used a single point sampler which allowed only one sample per borehole. The sampler was driven to top of the sample interval, a locking key was unlatched, the sampler was driven through the interval, and the drive rods and sampler were removed from the borehole. This method collected an 18 in. by 1.5 in. soil core plus approximately 5 in. of soil in the drive shoe. The major limitation with this method was that only one sample could be collected per borehole. Soils containing high gamma-emitting contamination could not be sampled, because there was not a safe way to isolate the sample for worker safety.

A dual-wall percussion system now provides for multiple sampling opportunities in each borehole. Driving is conducted with an outer push tubing is 2.625 in. outside diameter by 1.875 in. inside diameter and inner tubing is 1.25 in. outside diameter by 1.08 in. inside diameter. The dual-wall system with a "dummy" tip is advanced to the predetermined sample depth. The tubing is then back-pulled approximately 2 in. to 5 in. to relieve pressure and materials from the drive shoe and tip. When sampling depth is achieved and the rods have been back-pulled for sampling, the removable tip is removed by extracting the inner rods. On removal of the inner string of tubing, a sampler is attached to the inner string and returned to the bottom of the outer casing/push tubing and positioned against the inner receiver face of the drive shoe. The inner and outer tubing strings are "locked" together by use of a proprietary method, and the entire assembly is advanced through the targeted sample interval.

The sampler body holds three stainless steel liners that are 1.25 in. outside diameter by 1.08 in. inside diameter. After the sampler is advanced approximately 2 ft., the inner string is released and retrieved to the surface. The liners are removed from the sampler body and surveyed. Trained sample-handling technicians document the sample condition, and the volume percent recovery, and then package and transport the sample to the laboratory for analysis. The dummy tip is reattached to the inner string and returned to the bottom and placed in the casing shoe. The entire assembly is advanced to the next designated sample depth, and the process is repeated until all samples are collected. Soil below a high gamma emitting contamination can also be collected, since the outer drive casing is not extracted with the sampler. However, soils containing high gamma-emitting contamination still cannot be sampled, as a method to isolate the sample for worker safety has not yet been developed.

Some of the benefits of using direct push technology are that it is mobile and capable of being deployed in difficult to access locations. This allows many more locations in a tank farm to be investigated as compared to conventional drilling. Direct push technology is less expensive and much easier to deploy in multiple locations inside a tank farm. Unlike a drill rig, a direct push unit can sit on top of an underground storage tank. The direct push technology does not require the use of circulating medium (air, water, drilling fluids) for advancement, therefore does not generate waste by bringing contaminated materials to surface during the drilling process, and is fairly rapid in advancing tubing and collecting samples. In suitable materials the units are capable of advancing tubing at a rate of much less than 1 ft per minute. This rate of

advancement varies depending upon soil consistency and density. This technology can only be deployed in materials that can be displaced. It will not penetrate cemented materials. The drive point has been specifically designed to take advantage of the unique ability of the hydraulic hammer to drive and rotate simultaneously. It is the combination of the tooling design and this hammer that makes this technology so successful in driving tubing rapidly and to depths exceeding the capabilities of similar technologies.

Experience within WMA C

A cable tool drilling method was used during Phase 1 to drill one borehole at Tank C-105 (C4297). Grab samples as well as soil core samples using the split-spoon were collected from this borehole. Four single point depth electrodes were placed in the borehole during decommissioning.

Also during Phase 1, a cone penetrometer was used for the first borehole at UPR-200-E-82. The HHU was first deployed and used to push the remaining 19 exploratory and 20 sampling boreholes for this project. The HHU was used and refined to drive and sample all the rest of the boreholes during Phases 1.5 and 2 of the WMA C characterization effort.

SURFACE GEOPHYSICAL EXPLORATION: ELECTRICAL RESISTIVITY

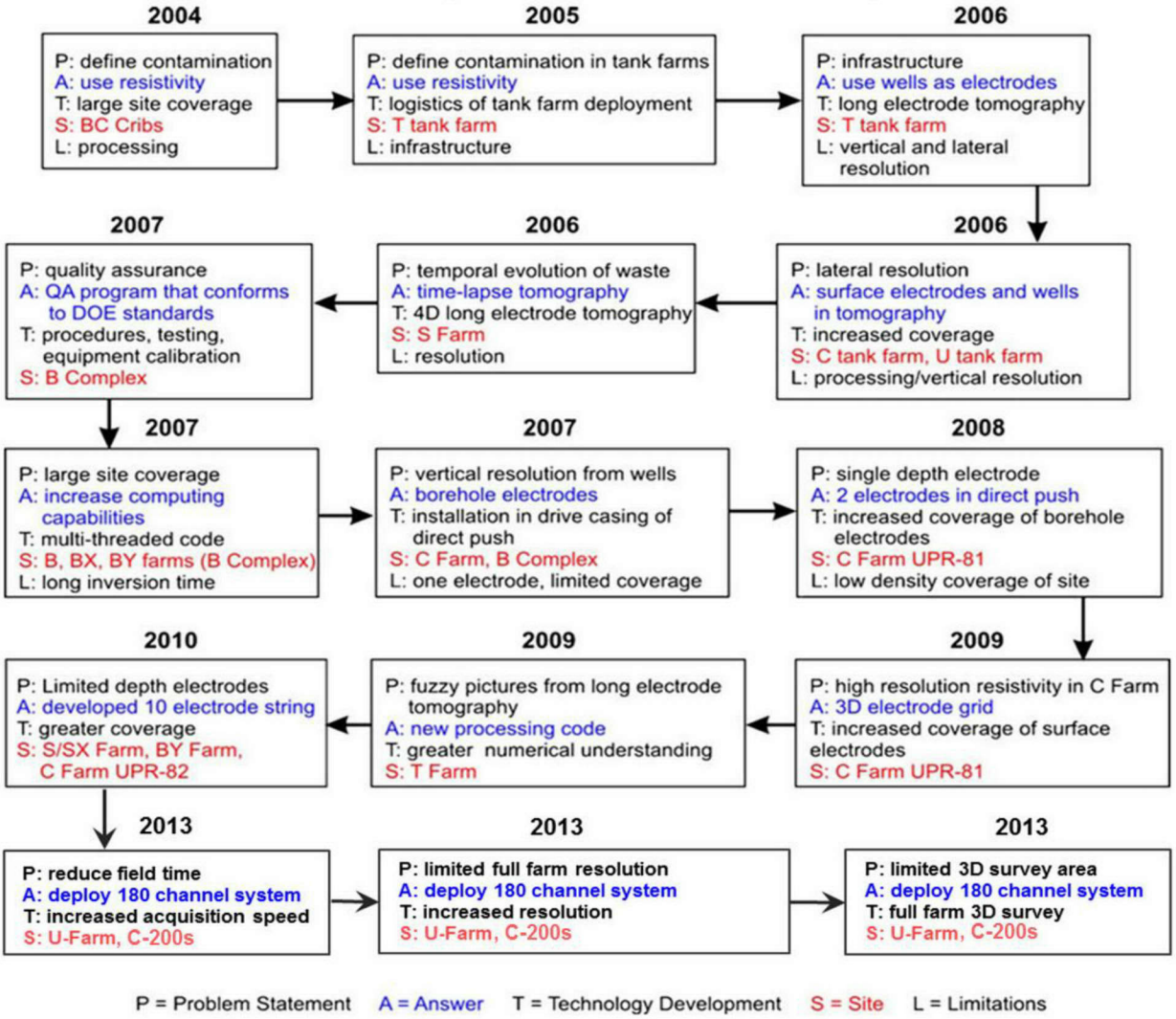
Geophysics is a science where physical earth properties are measured, with the goal of using these properties to help explain geologically or hydrologically-related phenomena. Geophysics, for example, can be used to remotely observe changes in hydrogeological properties or to extend or "ground-truth" information about geochemical conditions based on borehole data. One of the earth's physical properties commonly exploited in geophysical deployments at the Hanford Site is the ability for electrical current to flow in the subsurface. This is the basis for electrical resistivity measurements (SGE), where a volumetric measurement of the resistance to electrical current flow within a medium is acquired (Rucker, et al., 2011, *Electrical Resistivity in Support of Geological Mapping Along the Panama Canal*). Soil free from past discharges can be expected to have high resistivity values, given the relative low natural saturation and low ionic strength of the porewater. Near contaminant discharge points, the measured resistivity will decrease depending on the transport mechanisms of the various ionic constituents.

The SGE program started in 2004 through 2011. Several improvements have been made since this time. The most notable improvements are the implementation of a 180 channel resistivity system, and the improved data processing power associated with computational software and hardware advancements. All resistivity surveys completed between 2004 and 2013 at the Hanford site used systems that were limited to 8 or 12 channels. The 180 channel system provides a greater coverage area, resulting in considerably more data, with less field effort, and resulting in a greatly reduced cost of deployment. The increase in computing capability allows these much larger data sets to be compiled and processed in a single effort rather than parsing into smaller datasets. Additionally, *apriori* information such as the relative location of infrastructure and approximation of infrastructure properties can be included in the resulting models.

Data processing methodologies as outlined in RPP-RPT-50452 have remained largely the same.

As the use of electrical resistivity was advanced into areas originally considered too complex for the technology, changes were made to acquisition methodology, logistics, computer hardware, software, and interpretation that allowed robust images of electrolytic plumes in tank farms to be constructed. The evolution of the technology can be seen graphically in Figure G-1.

Figure G-1. Resistivity Technology Advancements and Applications at the Hanford Site since 2004 (Modified from RPP-RPT-50452).



RPP-RPT-50452, *Surface Geophysical Exploration – Compendium Document* discusses the evolution of the SGE program and highlights some of the most recent successes in imaging conductive targets related to past leaks within and around the Hanford Site's tank farms. Since the first deployment, the focus of the SGE program at the Hanford Site has been to acquire and model the best electrical resistivity data that minimizes the influence of buried metal objects. Toward that goal, two significant advances have occurred: (1) using the infrastructure directly in the acquisition campaign and (2) placement of electrodes beneath the infrastructure. The direct

use of infrastructure was successfully demonstrated at T Farm by using wells as long electrodes (Rucker et al., 2010, *Electrical-Resistivity Characterization of an Industrial Site Using Long Electrodes*). While the method was capable of finding targets related to past releases, a loss of vertical resolution was the trade-off. The burying of electrodes below the infrastructure helped to increase the vertical resolution, as long as a sufficient number of electrodes are available for the acquisition campaign.

GEOPHYSICAL LOGGING

Geophysical logging, as with most technologies, has evolved since the first deployments at WMA C. Geophysical logging includes drywell logging and slim-hole logging in the direct push boreholes. Since the 1950's, gross gamma logging has been used as a secondary tank leak monitoring system. Strategically placed shallow boreholes, called drywells, were routinely monitored for changes in total gamma activity. In 1997, a spectral gamma logging system was used to assess the nature and extent of gamma-emitting radionuclides in the vadose zone. For WMA C Phase 2 characterization, drywells were re-logged to identify changes in drywell measurements since 1997. Drywell logging included measurements using a spectral gamma logging system, neutron moisture logging systems, radionuclide assessment system, and handheld neutron moisture logging.

Geophysical logging for direct push is comprised of gross gamma and spectral gamma logging, neutron moisture logging, and gyroscope logging. These logging tools are specifically calibrated to the probe hole tubing conditions under which they are deployed. Gross gamma logging provides a measure of the concentration of gamma emitting radionuclides in the direct vicinity of the borehole location. Spectral gamma logging allows for better determination of individual gamma-emitting radionuclides. Neutron moisture logging provides an estimate of moisture content in the soil directly adjacent to the borehole. A passive neutron tool was also used to identify the presence of fissionable isotopes.

From 2005 to mid-2008, two or three different detectors provided overlapping gross gamma detection ranges. A sodium iodide (NaI) scintillator was deployed to detect gross gamma at concentrations as low as 10 pCi/g and as high as approximately 90,000 pCi/g. High count rate Geiger-Mueller detectors were used for determination of total gamma flux in zones with greater than $10^{5\text{ to }8}$ equivalent ^{137}Cs concentrations of gamma emitting nuclides. Accurate count rates in excess of 10^8 equivalent could be obtained. Neutron-neutron detectors accurately detected moisture concentrations from saturation (17 to 25%) to less than 2 to 5% by volume.

In mid-2008, a Bismuth-Germanium Oxide (BGO) tool provided a total count gross gamma log and was processed for KUT ratios (naturally occurring potassium, uranium and thorium) to determine if man-made gamma radio-nuclides were present. The BGO tool provided detection of ^{137}Cs as low as approximately 2 pCi/g.

In October 2011, a combination gamma tool with dual detectors (LaBr and BGO) tools was introduced. This increased the efficiency for log data collection and improved data quality, resolution and detection limits (^{137}Cs detection down to 1 to 1.5 piC/g and ^{60}Co detection to 0.5

to 1 piC/g). The new system operates with a state-of-the-art digital interface signal. This standard logging suite also includes an infrared casing temperature detector.

In addition, a dual gyroscope logging tool provides x, y, and z coordinates of the probe path to within 0.001 m accuracy. The gyroscope logging tool was used when angle pushes were being driven to ensure the borehole was still on target.

APPENDIX H

DOCUMENTATION SUPPORTING DEVELOPMENT AND REVISION OF THE WMA C PHASE 2 WORK PLAN AND SAP

This page intentionally left blank.

APPENDIX H
DOCUMENTATION SUPPORTING DEVELOPMENT AND REVISION OF THE WMA C PHASE 2 WORK PLAN AND SAP

This appendix contains a series of documents (letters, HFFACO document change notices, and review comment records) prepared by DOE, Ecology, and EPA related to the development and revisions of RPP-PLAN-39114, *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, and RPP-PLAN-38777, *Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C*. Table H-1 summarizes the content of each of the documents in this appendix.

Table H-1. Summary of Document Contents

Document Date	Document Number	Document Type	Preparer	Recipient	Subject	Attachment(s)	Content Summary
9/5/2008		Letter	Nez Perce	DOE/Ecology	Data Quality Objectives Report, Phase 2 Characterization for Waste Management Area C Corrective Measures Study, RPP-RPT-38152, Draft Rev. 0		Nez Perce Environmental Restoration & Waste Management concerns about the WMA C Phase 2 draft Rev. 0 DQO report.
12/18/2008	08-TPD-090	Letter	DOE	Ecology	TRANSMITTAL OF THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) FACILITY INVESTIGATION/CORRECTIVE MEASURES STUDY (RFI/CMS) WORK PLAN FOR WASTE MANAGEMENT AREA (WMA) C AS REQUIRED BY HANFORD FEDERAL FACILITIES AGREEMENT AND CONSENT ORDER (AKA TRI-PARTY AGREEMENT) MILESTONE M-045-60	RFI/CMS Work Plan for WMA C, RPP-PLAN-391 14, and the associated Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C, RPP-PLAN-38777	Transmits WP Rev. 0 and SAP Rev. 0.
2/4/2009	0080278; 0900451	Letter	Ecology	DOE	Extension of Review Period for the RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, RPP-PLAN-39114, Revision 0	n/a	Ecology conditional approval to proceed and request for extension of Ecology WP review period.
3/11/2009	09-TPD-006	Letter	DOE	Nez Perce	DATA QUALITY OBJECTIVES (DQO) REPORT, PHASE 2 CHARACTERIZATION FOR WASTE MANAGEMENT AREA (WMA) C CORRECTIVE MEASURES STUDY, RPP-RPT-38152, DRAFT REV.0	Review Comment Record (Response to Comments)	DOE response to Nez Perce comments on the DQO, Rev. 0.
4/10/2009		Letter	Nez Perce	DOE/Ecology	RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, RPP-PLAN-39114, Revision 0		Nez Perce Environmental Restoration & Waste Management comments on WP Rev. 0.
4/23/2009	0080878; 0900955	Letter	Ecology	DOE	Department of Ecology Review of the Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C, RPP-PLAN-3877, Revision 0, Associated with the RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, RPP-PLAN-39114, Revision 0	Review Comment Record	Ecology comments on SAP Rev. 0.
4/24/2009	0080875; 0900973	Letter	Ecology	DOE	Department of Ecology Review of the RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, RPP-PLAN-39114, Revision 0	Review Comment Record	Ecology comments on WP Rev. 0.
6/24/2009	09-TPD-050	Letter	DOE	Ecology	The Washington State Department of Ecology (Ecology) Comments on the Resource Conservation and Recovery Act (RCRA) Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area (WMA) C, RPP-PLAN-39114, Revision 0.	n/a	DOE request for concurrence on proposed changes based on Ecology's comments. Commitment to revise WP and SAP to a Rev. 1 within 120 days.
8/10/2009	n/a	Review Comment Record	Ecology/DOE	Ecology/DOE	Ecology Comments on WMA C Sampling and Analysis Plan RPP-PLAN-38777, Rev. 0 and DOE responses	n/a	Ecology comments on SAP and DOE responses.

Table H-1. Summary of Document Contents

Document Date	Document Number	Document Type	Preparer	Recipient	Subject	Attachment(s)	Content Summary
8/10/2009	n/a	Review Comment Record	Ecology/DOE	Ecology/DOE	Ecology Comments on WMA C Work Plan RPP-PLAN-39114, Rev. 0 and DOE responses	n/a	Ecology comments on WP and DOE responses.
9/28/2009	0085243	Letter	Ecology	Admin Record	Waste Management Area-C (WMA-C) 1996 Memorandum of Understanding (Section II., D, and E) briefing provided to the Environmental Protection Agency (EPA) on August 26, 2009	Presentation and meeting notes for 8/26/2009 Ecology briefing to EPA regarding WMA C RFI/CMS Work Plan	Ecology briefing to EPA on WP. Lists workshops and meetings held with Native Americans and State of Oregon to discuss Phase 2 DQO.
11/2/2009	09-TPD-118	Letter	DOE	Ecology	Transmittal of the RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) FACILITY INVESTIGATION/CORRECTIVE MEASURES STUDY (RFI/CMS) WORK PLAN FOR WASTE MANAGEMENT AREA (WMA) C Revision 1	RFI/CMS Work Plan for WMA C, RPP-PLAN-39114, Revision 1, and the associated Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C, RPP-PLAN-38777, Revision 1, and associated RCRs showing comment resolution.	Submits Revision 1 of the WP and SAP. Also references change package undergoing public comment for new dates for PA, RFI/CMS Report, and implementation plan.
11/12/2009	n/a	Letter	Ecology	EPA	Waste Management Area-C (WMA-C) Soil Characterization for Corrective Action and Closure	n/a	Documents the provision of an Ecology briefing to USEPA on the WP Rev. 0.
12/22/2009	09-TPD-075	Letter	DOE/Ecology	Nez Perce	The state of Washington Department of Ecology (Ecology) and the US Department of Energy (DOE), Office of River Protection (ORP) Technical Response to Nez Perce Comments on Waste Management Area (WMA) C Workplan	Review Comment Record	Response to Nez Perce comments on the WP Rev. 0.
3/29/2010	0085502; 1000425	Letter	Ecology	DOE	Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, RPP-PLAN-39114, Revision 1 (Work Plan)	n/a	Ecology's approval of WP Rev 1 and a request to start meetings prior to 4/25/10 to discuss Ecology concerns with WMA C progress.
2/25/2011	TPA-CN-422	HFFACO Change Notice Form	DOE/Ecology	EDMC	HFFACO Change Notice for SAP RPP-PLAN-38777 Rev. 2 Signed by DOE and Ecology	n/a	Ecology approval of TPA CN creating SAP Rev. 2A.
2/25/2011	TPA-CN-382	HFFACO Change Notice Form	DOE/Ecology	EDMC	HFFACO Change Notice modifying WP RPP-PLAN-39114 Rev. 1 to revise Appendix B Signed by DOE and Ecology	n/a	Ecology approval of TPA CN creating WP Rev. 1B.
3/23/2011	11-TPD-020	Letter	DOE	Ecology	Organic Analyses Optimization for Waste Management Area (WMA) C	n/a	DOE Request to Ecology to approve Organic Optimization and omit sulfide.

Table H-1. Summary of Document Contents

Document Date	Document Number	Document Type	Preparer	Recipient	Subject	Attachment(s)	Content Summary
6/1/2011	11-NWP-053	Letter	Ecology	DOE	Organic Analyses Optimization for Waste Management Area (WMA) C		Ecology approval of Organic Optimization and removal of sulfide, and request for further discussion of optimization.
1/5/2012	11-TF-153	Letter	DOE	Ecology	SUBMITTAL OF PROPOSED CHANGE NOTICE FOR THE WASTE MANAGEMENT AREA (WMA) C PHASE 2 RESOURCE CONSERVATION AND RECOVERY ACT OF 1976 (RCRA) FIELD INVESTIGATION WORK PLAN AND SAMPLING AND ANALYSIS PLAN	DOE-signed HFFACO CN 2011-7 for Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, RPP-PLAN 39114, Rev 1B and DOE-signed HFFACO CN 2011-6 for Sampling and Analysis Plan For Phase 2 Characterization of Vadose Zone Soil In Waste Management Area C, RPP-PLAN 3877 Rev.2A	Transmits proposed change notices for the creation of WP Rev. 2 and SAP Rev. 3.
5/8/2012	12-NWP-071	Letter	Ecology	DOE	Proposed Changes to RPP-PLAN-39114 and RPP-PLAN-38777	n/a	Ecology approval of proposed changes and request for continued collaboration on the development of the RFI/CMS Report. Does not have Ecology-signed CNs attached.
6/6/2012	TPA CN 2011-6	HFFACO Change Notice Form	DOE/Ecology	EDMC	HFFACO Change Notice for SAP RPP-PLAN-38777 Rev. 2A Signed by DOE and Ecology	n/a	Ecology approval of TPA CN creating SAP Rev. 3.
6/6/2012	TPA CN 2011-7	HFFACO Change Notice Form	DOE/Ecology	EDMC	HFFACO Change Notice for WP RPP-PLAN-39114 Rev. 1B Signed by DOE and Ecology	n/a	Ecology approval of TPA CN creating WP Rev. 2.

Table H-1. Summary of Document Contents

Document Date	Document Number	Document Type	Preparer	Recipient	Subject	Attachment(s)	Content Summary
9/7/2012	12-TF-0035	Letter	DOE	Ecology	TRANSMITTAL OF DOCUMENT REVISIONS FOR WASTE MANAGEMENT AREA (WMA) C CLOSURE ACTIVITIES AND ONGOING SOIL MEDIA WORK	RPP-ENW-33418 - REV-02A; RPP-PLAN-38777 - REV-03; RPP-PLAN-39114 - REV-02; RPP-RPT-49050 - REV-00 SITE C7472; RPP-RPT-49185 - REV-00 SITE C7670; RPP-RPT-49238 - REV-00 SITE C7668; RPP-RPT-49902 - REV-00 SITE C7672; RPP-RPT-50378 - REV-00 SITE C7676; RPP-RPT-50443 - REV-00 SITE C7682; RPP-RPT-50615 - REV-00 SITE C8100; RPP-RPT-51759 - REV-00; SGW-52 194 - REV-00 GW ORGANIC REPORT; VSR 11-015 C7472; VSR 11-035 C7670; VSR 11-044 C7668; VSR 11-045 C7672; VSR 11-046 C7680; VSR 11-047 C7682; VSR 11-048 C7676	Transmits WP Rev. 2, SAP Rev. 3, and multiple supporting documents.

ORP / H6-60

OFFICE OF RIVER PROTECTION

DOCUMENT / LETTER #:	ACTION:	ACTION DUE DATE:
NA-NPT	No [ ] Yes [X]	10/1/2008

DATA QUALITY OBJECTIVES REPORT, PHASE 2 CHARACTERIZATION FOR WASTE MANAGEMENT AREA C CORRECTIVE MEASURES STUDY, RPP-RPT-38152, DRAFT REV. 0

OFFICE OF RIVER PROTECTION	I	A		I	A
			AMD MK Barrett - Director		
			Arlene Hanson - Program Asst.		
S.J. Olinger Manager		XX	ENS JH Wicks - Act. Asst. Mgr. S. Licht		
Kelly Brazil Prog. Asst./Mgr Rdg File	XX		ESD - WB Scott -Act. Dir. S. Licht, Sec.		
H.N. Taylor Deputy Manager			NSD - RW Griffith -Act. Dir. " "		
Kimberly Reynolds Secretary	X		ESQ WJ [Bill] Taylor - Asst. Manager		
Manager's Office Staff			Becky Gano - Secretary		
[Sr. Tech. Advisor]			ECD - LA Huffman Director		
			VCD - KA Hoar Director		
Chief of Staff [Rotating]			OPA LA Copeland-Dir. D. Serrano-Sec.		
Karen E. Lutz			TF SL Charboneau-Asst. Mgr. -S. Mendoza		
Kelly Brazil Secretary			BJ Harp - Deputy Manager		
Legal Services			SH Pfaff - FPD Waste Retrieval		
Richard V. Gonzales Advisor/Contracts			TOD - BA Harkins Shannon Tobias Sec.		
Cathy D. Poynor Secretary			TPD - GD Trenchard Director - "		
Scott D. Stubblebine Attorney			WTP JR ESCHENBERG - Asst. Mgr.		
Stella Mendoza Secretary			DL Noyes - Acting Deputy Mgr.		
Public Affairs/Communications:			Anez Perez- Program Asst. / Sarah Licht-Sec.		
Erik Olds Public Affairs Specialist			WCD - KG Wade - Director "		
Lori M. Gamache Public Affairs Specialist			WED - GE Brunson - Director "		
Secretary			WPD - PT Furlong - Director "		
HR / EEO / Diversity			- OTHERS -		
CM Fetto Kelly Brazil - Sec.			CB Reid		
DNFSB			MJ Royack		
Lori J. Croy			Stella Mendoza	X	
FTCP					
Stella Mendoza - Secretary			DA Brockman- ^RL Correspondence		

I = Information Copy A = Action Party	Notes:	Date Rec'd
Scan: Yes [X] No [ ] Sensitive: Yes [ ] No [X] Sensitive Att: Yes [ ] No [X]		RECEIVED SEP 24 2008 DOE-ORP/RPCC
ORPCC Contacts: Patricia Deaton - 376-2145 Judy Corder - 376-2143		

Nez Perce

ENVIRONMENTAL RESTORATION & WASTE MANAGEMENT
P.O. BOX 365 · LAPWAI, IDAHO 83540-0365 · (208) 843-7375 / FAX: 843-7378

September 5, 2008

Shirley Olinger, Site Manager
Office of River Protection
P.O. Box 450, MS: H6-60
Richland, WA 99352

Re: *Data Quality Objectives Report, Phase 2 Characterization for Waste Management Area C Corrective Measures Study*, **RPP-RPT-38152, Draft Rev. 0**

Dear Ms. Olinger:

The Nez Perce Tribe retains reserved treaty rights in the Mid-Columbia region under the Treaty of 1855 with the United States Government. These rights have been recognized and affirmed through subsequent Federal and State actions. These actions protect Nez Perce rights to utilize our usual and accustomed resources and resource areas, including those in the Hanford Reach of the Columbia River. Accordingly, the Nez Perce Tribe Environmental Restoration and Waste Management program (ERWM) has support from the Department of Energy (DOE) to participate in and monitor relevant DOE activities. Degradation of groundwater is relevant to reserved treaty rights, and therefore we maintain involvement in waste management/vadose zone/groundwater issues.

The Nez Perce ERWM appreciates the opportunity to review *Data Quality Objectives Report, Phase 2 Characterization for Waste Management Area C Corrective Measures Study*, **RPP-RPT-38152, Draft Rev. 0. However, our review of this document is crippled** by our lack of access to the data and documents available through the Hanford Local Area Network (HLAN).

In our prior communications, we have established that many of the assertions in the precursor documents are poorly supported and lack technical rigor. For example, the vadose zone contamination resulting from the C-101 tank leak is described as "either fictitious or of insufficient contamination levels to be of concern" (Wood et al. 2003, page 5-4). Our comments on these documents remain unresolved.

We consider the closure of the 241-C tank farm as a template for future closures of additional single shell tank farms. We are concerned that schedule and budget will limit the amount of characterization that can be performed in the tank farm. Therefore, it is important that the planned characterization is well thought out and as thorough as the

RECEIVED
SEP 24 2008
DOE-ORP/ORPCC

budget constraints will allow. Our review of the *Data Quality Objective* has identified concerns in the following areas.

1. The DQO fails to recognize that the C tank farm has and continues to contaminate groundwater (Attachment 1). Identifying the vadose zone sources of the ongoing degradation of groundwater underneath WMA C should be explicitly stated as a DQO objective.
2. An integrated conceptual model for WMA C has yet to be constructed by DOE. Conceptual models on the current distribution of contaminants in the vadose zone and groundwater and migration from the vadose zone to the aquifer are not clearly presented and are not supported by field data.
   - An integrated conceptual model consists of an interpretation of geophysical logs, drillers logs and geologic sample descriptions, which depict stratigraphy and vadose and groundwater contamination.
   - The use of geophysical logs to correlate stratigraphy is well established and has been used in tank farms in the past. Within the C tank farm, DOE's most recent use of geophysical dry well logging to correlate stratigraphy and contamination was documented in DOE (1992).
   - The influence of stratigraphy upon the subsurface distribution of radionuclides in Hanford's subsurface should be acknowledged. This influence was recognized at least as early as 1948 (Brown and Rupert 1948). The purpose of correlating the stratigraphic units is to evaluate and account for their effect on lateral transport. "Stratification tends to increase spreading of liquids along bedding planes and along contacts between sedimentary units" (Fecht et al. 1977). Within the C WMA, previous investigators have recognized the influence of stratigraphy on waste migration in the vadose zone (Brodeur 1993 and Kos 1995).
   - The conceptual model proposed by prior Hanford investigators (e.g. Brown and Ruppert 1948, Fecht et al. 1977, DOE 1992, Brodeur 1993, Kos 1995) and resurrected by the Nez Perce ERWM has been misrepresented. The conceptual model proposed by the Nez Perce ERWM is described in Attachment 2 and should be the preferred conceptual model since it honors data collected in the field.
3. The proposed characterization methods consist of direct pushes and high resolution resistivity (HRR). The gross gamma logging system used in conjunction with the direct push has a detection limit of approximately ten pCi/g of ^{137}Cs equivalent. This detection limit is greater than the soil cleanup criteria of 6.2 pCi/g for ^{137}Cs that has been applied in Interim Action Record of Decisions for the 100 Area. It is inappropriate to propose the use of a tool that has detection limit that is higher than a potential cleanup standard and for contamination levels which may threaten remediation workers health. Attachment 3 further details our concerns with direct push technology. High resolution resistivity surveys have not proved very reliable in the tank farms in the past. For example, the HRR survey of the B-BX-BY area failed to identify the area known to be contaminated by the BX-102 tank leak. The collection of high resolution resistivity data at C tank farm has resulted in a two-dimensional interpretation of questionable value since these HRR results are unable

to predict the depth of contamination, expected concentration or the thickness of the contaminated interval.

4. The proposed locations for additional characterization are not focused on determining the source of current groundwater contamination. Rationales for the locations and reasons for drilling proposed boreholes are not well supported. Tanks leaks are assumed to have occurred through spare inlet ports. Depending upon the temperature and the specific gravity of the tank waste, the overfilling of a tank threatened the structural integrity of the tank (Smith 1955). The issues raised by Smith (1955) are not discussed or addressed in Field and Jones (2006) and Johnson and Field (2007).
5. DOE and its contractors should be open to recommendations from the Tribes, regulators, expert panels, and stakeholders. While we have participated in numerous meetings on C tank farm, the proposed characterization only marginally addresses one of our concerns (i.e. the ongoing migration of ^{60}Co near tank C-108). The direct push locations proposed to evaluate tank C-101 are not properly positioned to identify if this tank leak is the source of radionuclides observed at well 299-E27-14 (Figure 1). The DQO doesn't propose any sampling to determine the origin of the radionuclides detected at well 299-E27-7 (Figure 1).

At the present time, ERWM recommends the following:

1. Development of drilling locations to characterize tank leaks: determine the origin of the radionuclides detected (wells 299-E27-7 and 299-E27-14) outside of the C tank farm; and verification of the leak assessment (Johnson and Field 2008) for tank C-111 by drilling a slant hole similar to the slant hole drilled at tank SX-108. This slant hole would start at location "K" as shown on Figure 1 and terminate under tank C-111.
2. Every proposed characterization borehole should be supported by a strike and dip geological cross section, which shows all vadose zone and aquifer field data on contamination, and similar data from geophysical logs.
3. Implement the recommendations for characterization made by the SX Expert Panel (DOE 1997) over a decade ago.
4. The nearby groundwater wells should be logged with the HPGe spectral gamma and neutron-moisture. Groundwater wells that need immediate logging are:
   - 299-E27-2 (may have been decommissioned)
   - 299-E27-12
   - 299-E27-13
   - 299-E27-15
   - 299-E26-8
5. Integrate the vadose/groundwater investigations both inside and outside the tank farms by having only one contractor interpreting the existing data and writing DQOs and associated documents.
6. Use a pile driver and a cone point and simply pound the casing down with a large diameter casing that supports the use of a variety of logging tools including the high-purity germanium (HPGe) detector as recommended by Brodeur (2006).
7. When using the direct-push method to collect soil samples, soil samples should be collected as each additional length of pipe is added to the drill string. We understand that this interval is approximately every four feet. If the presence of gamma-emitting

radionuclides is used as criteria for the collection of soil samples using the "direct-push technology", intervals for sampling should be based on gamma spectra collected with a high-purity germanium detector.

8. Install drywell monitoring boreholes around tank C-102 as recommended by Brodeur (1993).

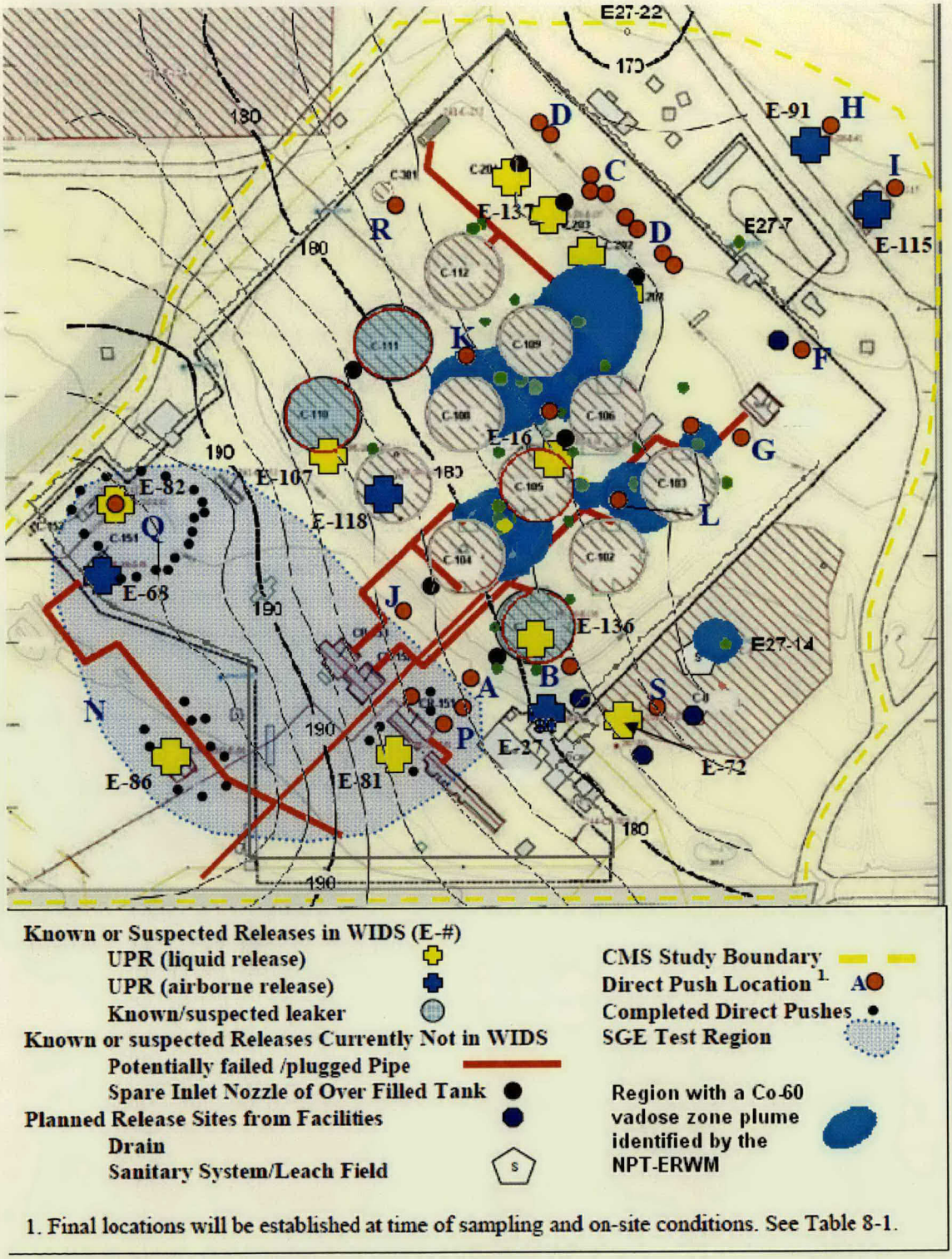


Figure 1. DQO's Figure 8-6. Candidate Sample Locations and SGE Interrogation Areas modified to show regions with ^{60}Co in the vadose zone

9. All extraneous references to work and unsupported conclusions for other tank farms should be removed from the DQO.

Since we have had a limited amount of time to review the DQO, ERWM's anticipates the development of additional recommendations as time permits.

ERWM would appreciate timely participation in the further development of the DQO for WMA C. Please contact Stan Sobczyk of our staff, at (208) 843-7375, ext. 3751 for inclusion into an open decision-making process and close coordination to expedite the work needed to close WMA C in a manner that protects human health and the Nez Perce Tribe's retained treaty rights and the Columbia River.

Sincerely,

Gabriel Bohnee
ERWM Director

Cc: Dave Brockman, DOE/RL
Stuart Harris, CTUIR
Russell Jim, YIN
Ken Niles, Oregon
Nick Ceto, EPA
Jane Hedges, Ecology
Francis SiJohn, DOE/RL

Attachment 1
C Tank Farm Has Contaminated Groundwater

The 241-C tank farm has contaminated groundwater.High level radioactive wastes from the tanks that leaked at C tank farm have been migrating in the vadose zone vertically and laterally to the east-northeast, which is down stratigraphic dip. The movement of ^{60}Co in the subsurface has been observed for decades, and it is reasonable to assume that ^{60}Co is moving along with other radionuclides (i.e. ^{99}Tc). Figures A1-1 and A1-2 demonstrate that the Tc-99 groundwater contamination underneath C tank farm is from vadose zone sources within the farm. As shown on Figure A1-2, significant upgradient gross beta activity in groundwater has not been observed over the last 16 years to the north, northeast, or east of 241-C Tank Farm, while significant gross beta activity is observed in groundwater underneath the tank farm (Figure A1-1). Therefore, C tank farm is the source of the gross beta activity that exceeds the drinking water standard that has been observed in the groundwater wells that surround the tank farm.

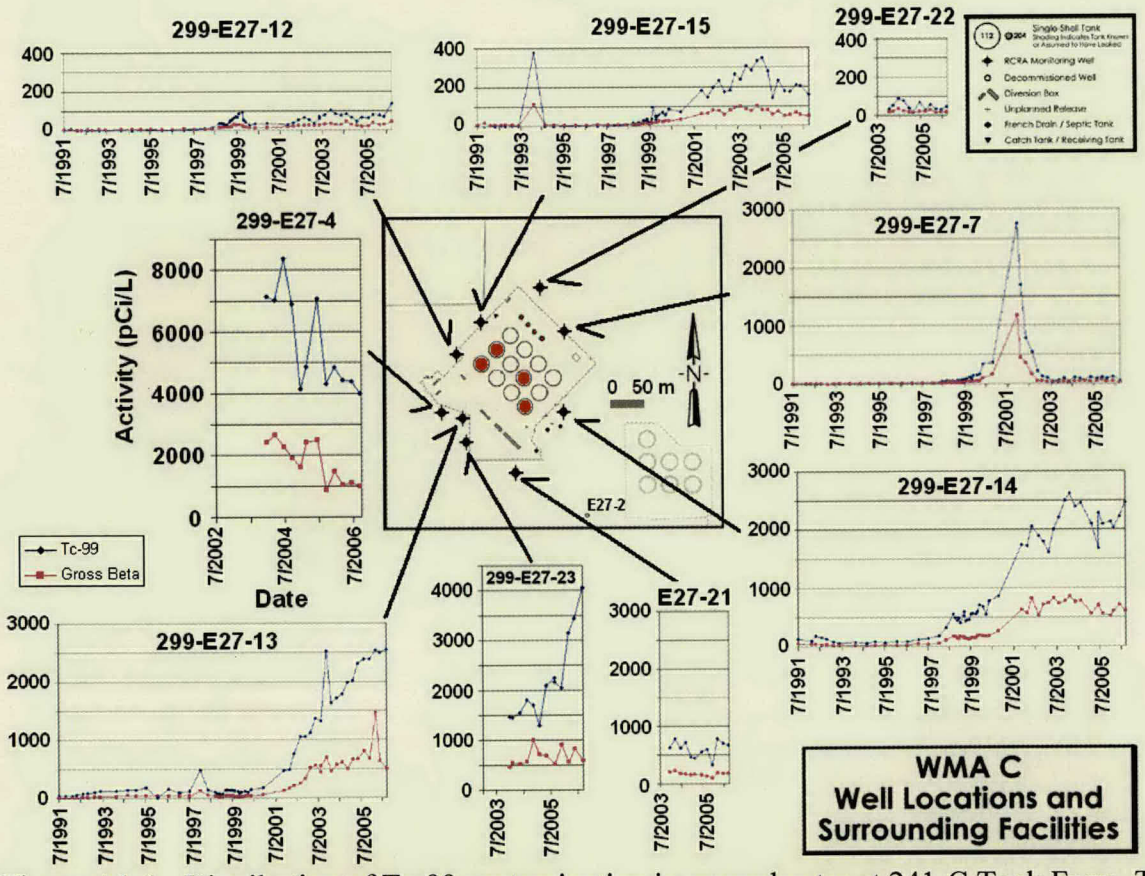


Figure A1-1. Distribution of Tc-99 contamination in groundwater at 241-C Tank Farm. The groundwater flow direction is to the southwest.

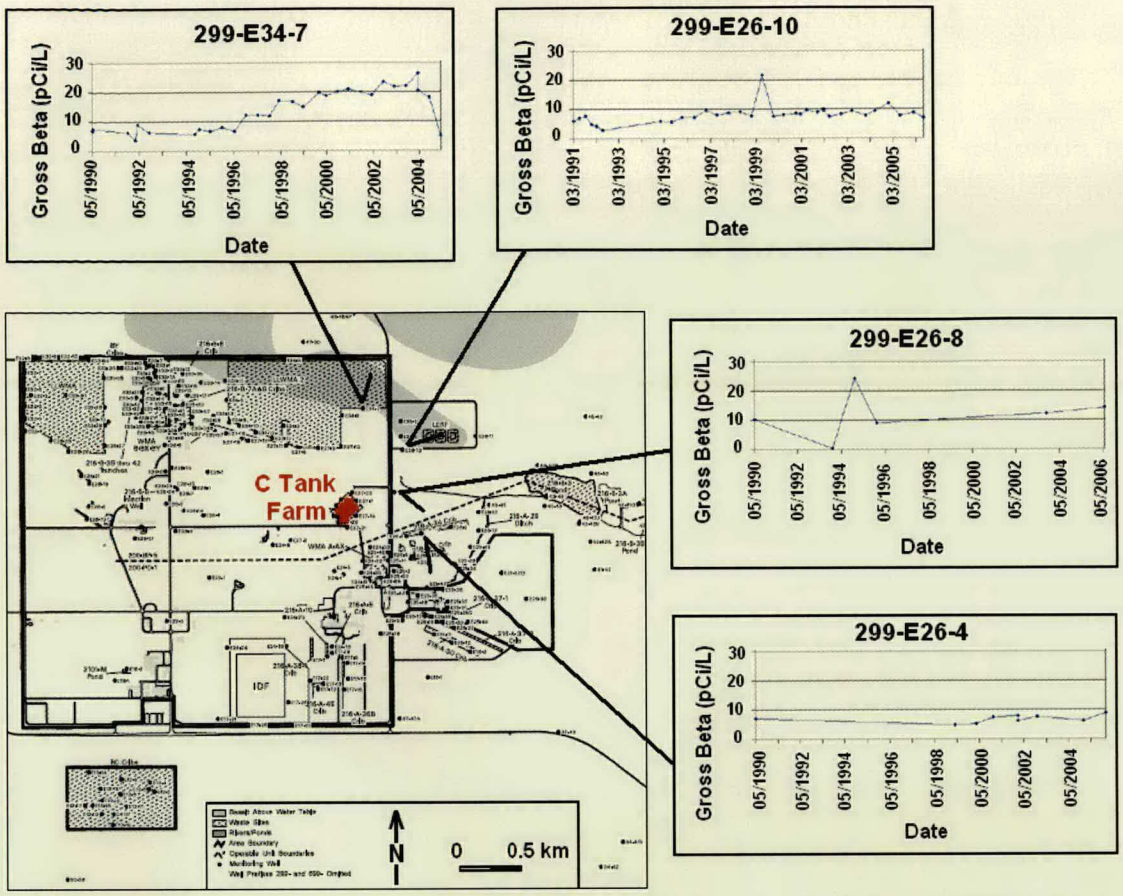
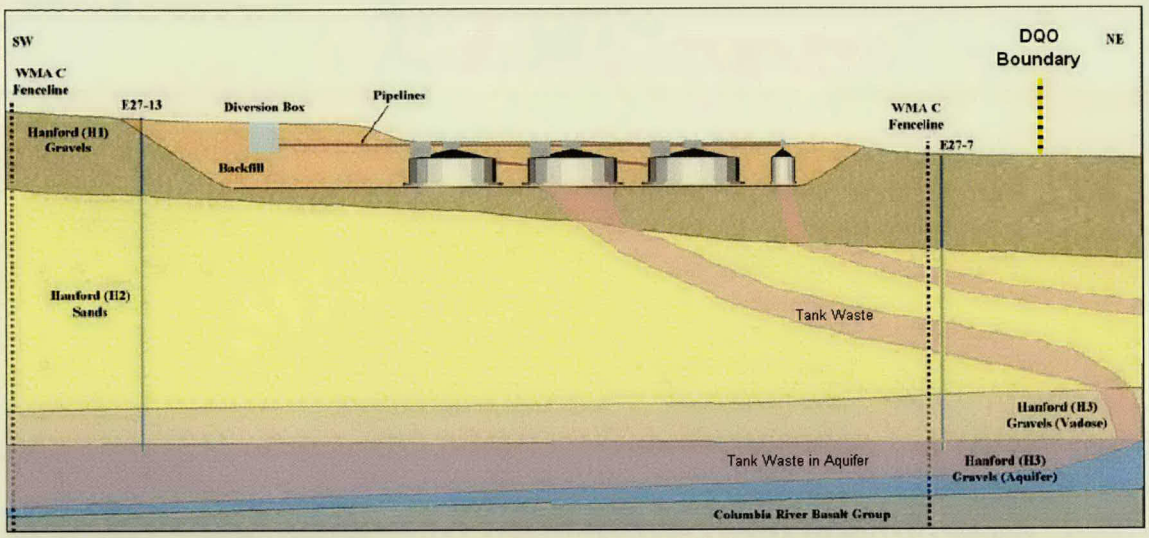


Figure A1-2. Gross beta activity in groundwater wells that are upgradient of 241-C Tank Farm.

Attachment 2

A corrected version of the DQO's "Figure 8-3. Alternative Conceptual Model 1: Movement of Contaminants down Stratigraphic Dip" that more accurately represents the Nez Perce Tribe ERWM's conceptual model for groundwater contamination at C tank farm is shown below as Figure A2-1.



1) **Tank and/or pipeline leaks**
2) **Tank waste migrates primarily vertically through backfill and H1 gravels**
3) **Tank waste and moisture migrates primarily laterally through the H2 sands following stratigraphic dip.**
4) **Tank waste migrates primarily vertically through the coarser material in the lower H2 and H3 gravels until it reaches groundwater**
5) **Tank waste is denser than groundwater and sinks in the aquifer as it is transported to the southwest under the tank farm**

Figure A2-1. Modifed version of the DQO's "Figure 8-3. Alternative Conceptual Model 1: Movement of Contaminants down Stratigraphic Dip"

The Nez Perce ERWM conceptual model is based upon a series of cross sections and visualizations that are derived from spectral gamma ray logging of 71 drywells and five groundwater monitoring wells (Figure A2-2). Figure A2-3 is an example log with corresponding sediment description and stratigraphic nomenclature. The cross sections (Figures A2-4 through A2-9) document the structure and stratigraphy of the sediments and extent of gamma ray emitting contamination underlying the 241-C tank farm. Table A2-1 lists the interpreted stratigraphic contacts for Waste Management Area C.

High level radioactive wastes from the leaking tanks have been migrating vertically and laterally to the northeast, which is down stratigraphic dip in the Hanford H2 (Figure A2-10). Figure A2-10 shows at least two regions where ^{60}Co contamination in the vadose zones appears to emanate from the tanks. These tanks are C-105 and C-108.). The movement of radionuclides at borehole

30-08-02 (Figure A2-6) has been observed since 1978 (Rockwell International Internal Letter No. 7210-82-257). The movement of ^{60}Co in the subsurface has been further documented in a recent report (DOE 2003), and it is reasonable to assume that ^{60}Co is moving along with other radionuclides (i.e. ^{99}Tc).

^{60}Co contamination in the vadose zone has been detected outside the C tank farm fence at wells 299-E27-7 and 299-E27-14 (Figures A2-2, A2-4 & A2-10). Anthropogenic uranium has been detected at 299-E27-7. ^{60}Co detected at well 299-E27-14 can be projected back to tank C-101 (Figures A2-2, A2-4 & A2-10). A possible source for the uranium detected in the vadose zone at well 299-E27-7 (Figure A2-10) is tank C201.

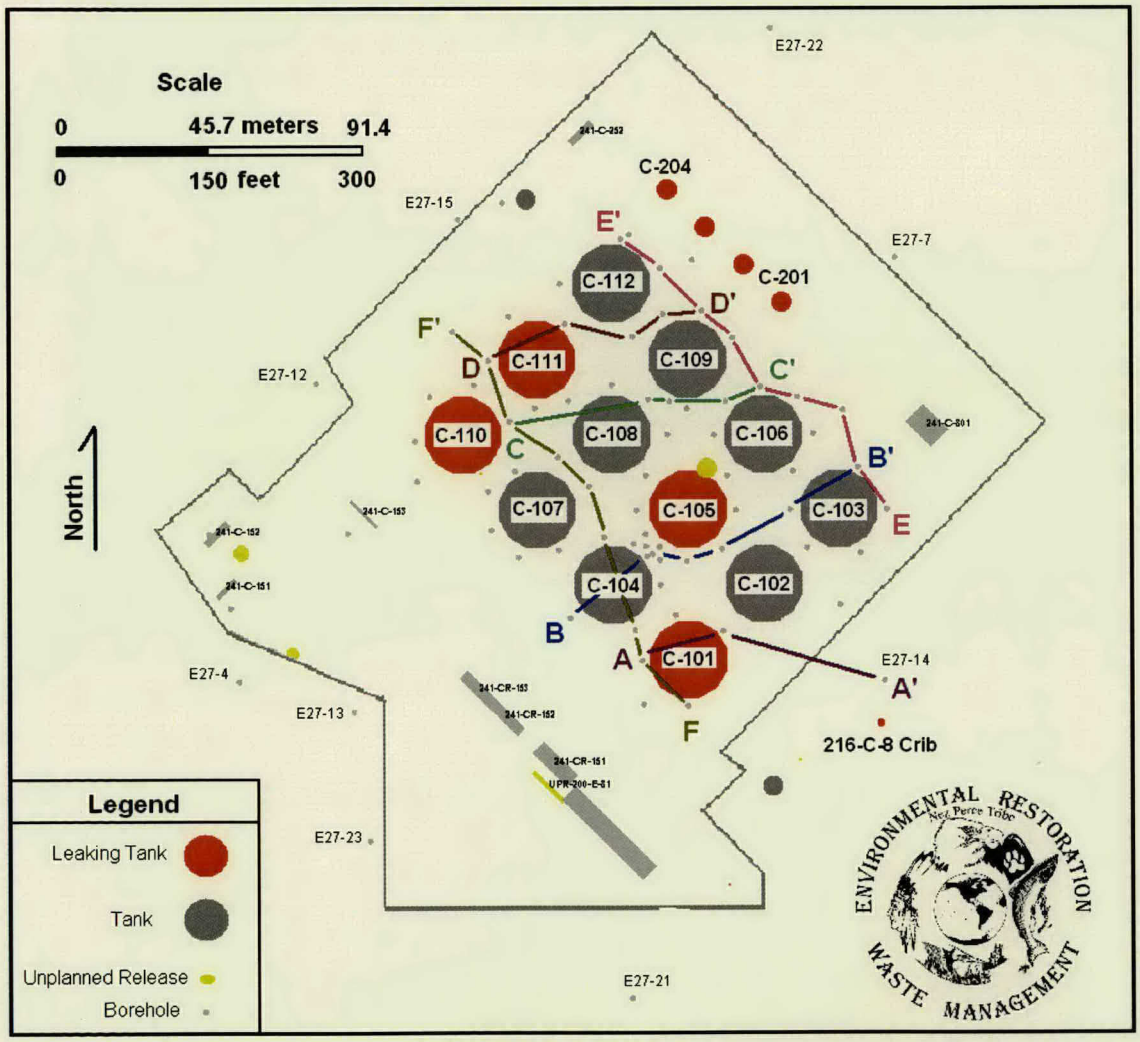


Figure A2-2. Index map and cross section location map for Waste Management Area C.

Figure A2-11 is a visualization that includes vadose zone contamination (^{60}Co) geology (H2 stratigrapic dip), groundwater contamination (^{99}Tc) and the only nearby waste site (216-C-8 crib). The visualization shows that ^{60}Co from the tank leaks have reached the deep vadose zone (~150 ft below ground surface). Most importantly, the visualization demonstrates that

radionuclides are present in the deep vadose zone at two of the "upgradient" RCRA groundwater monitoring wells (299-E27-7 and 299-E27-14) and that these two wells should not be considered upgradient groundwater monitoring wells. The ^{99}Tc groundwater plume originates from at C tank farm (refer to Attachment 1) and extends to the southwest underneath the farm.

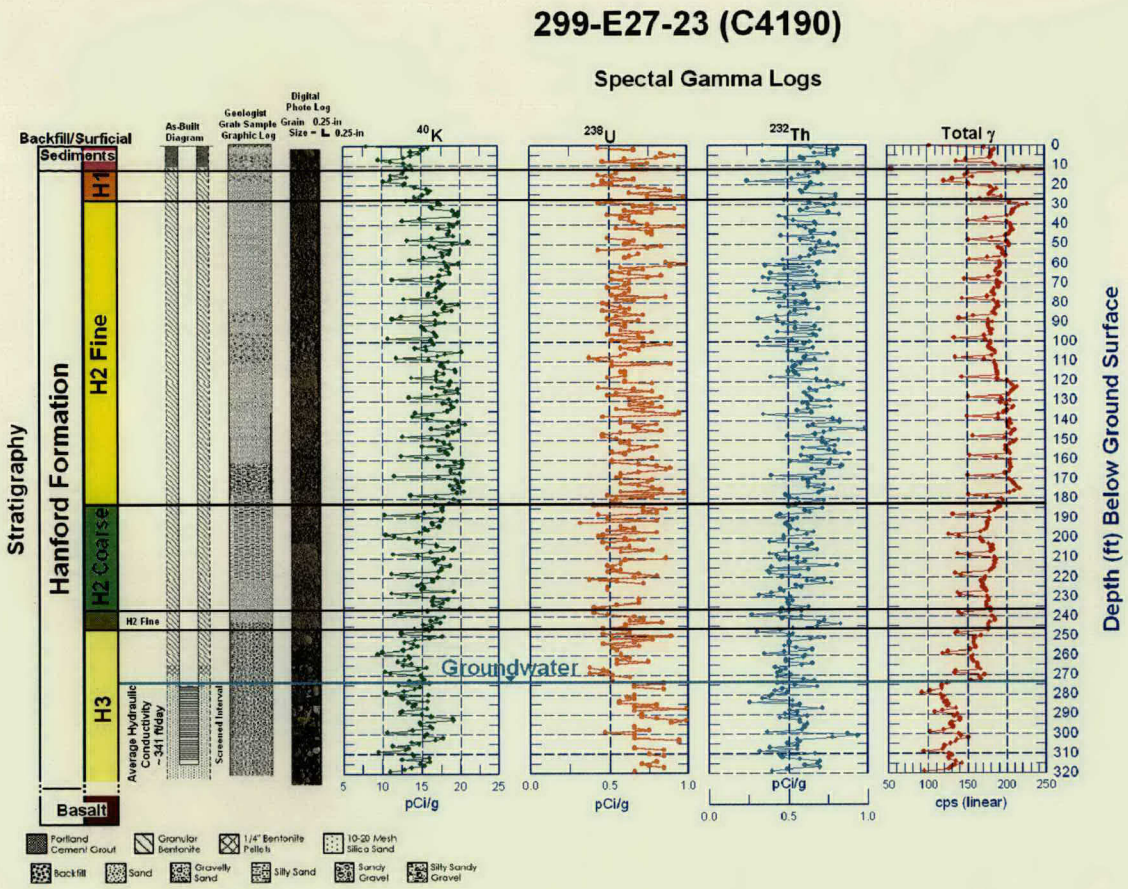


Figure A2-3. Example log (groundwater well 299-E27-23) for Waste Management Area C modified from (Williams and Narbutovskih 2004.

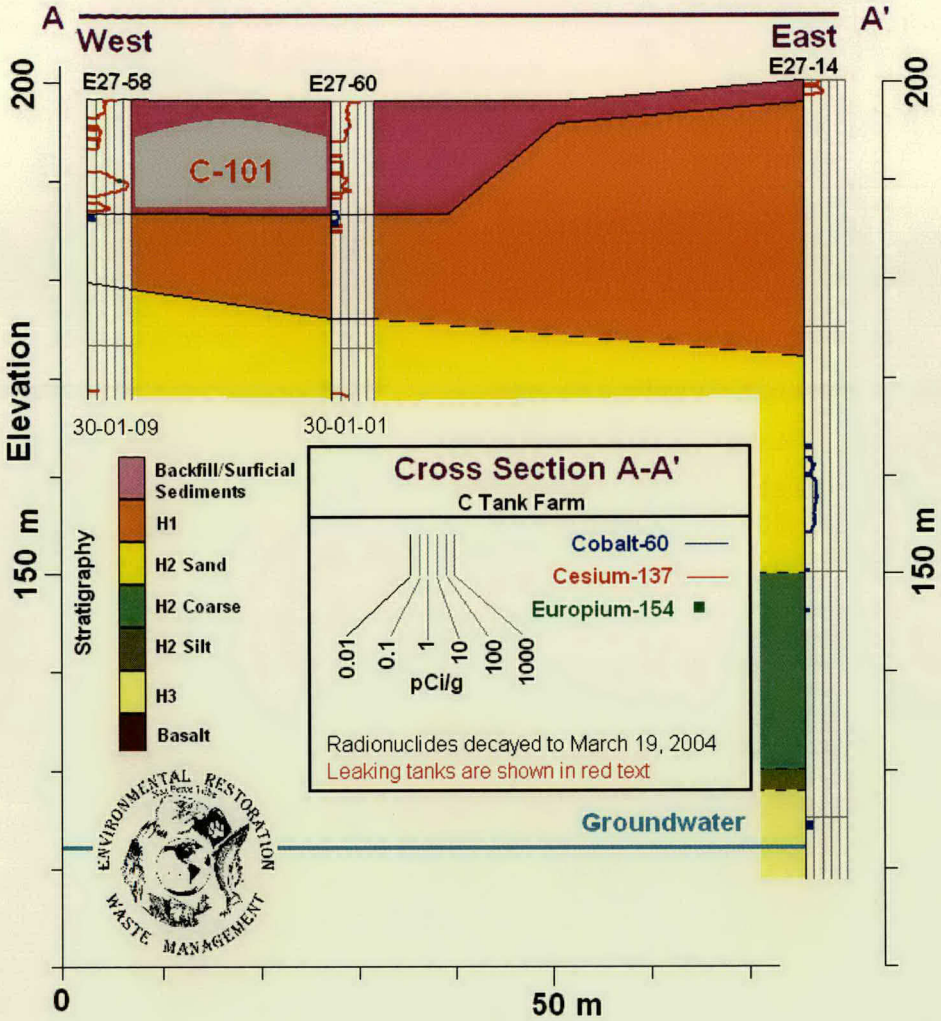


Figure A2-4. Dip cross section A-A' through Waste Management Area C.

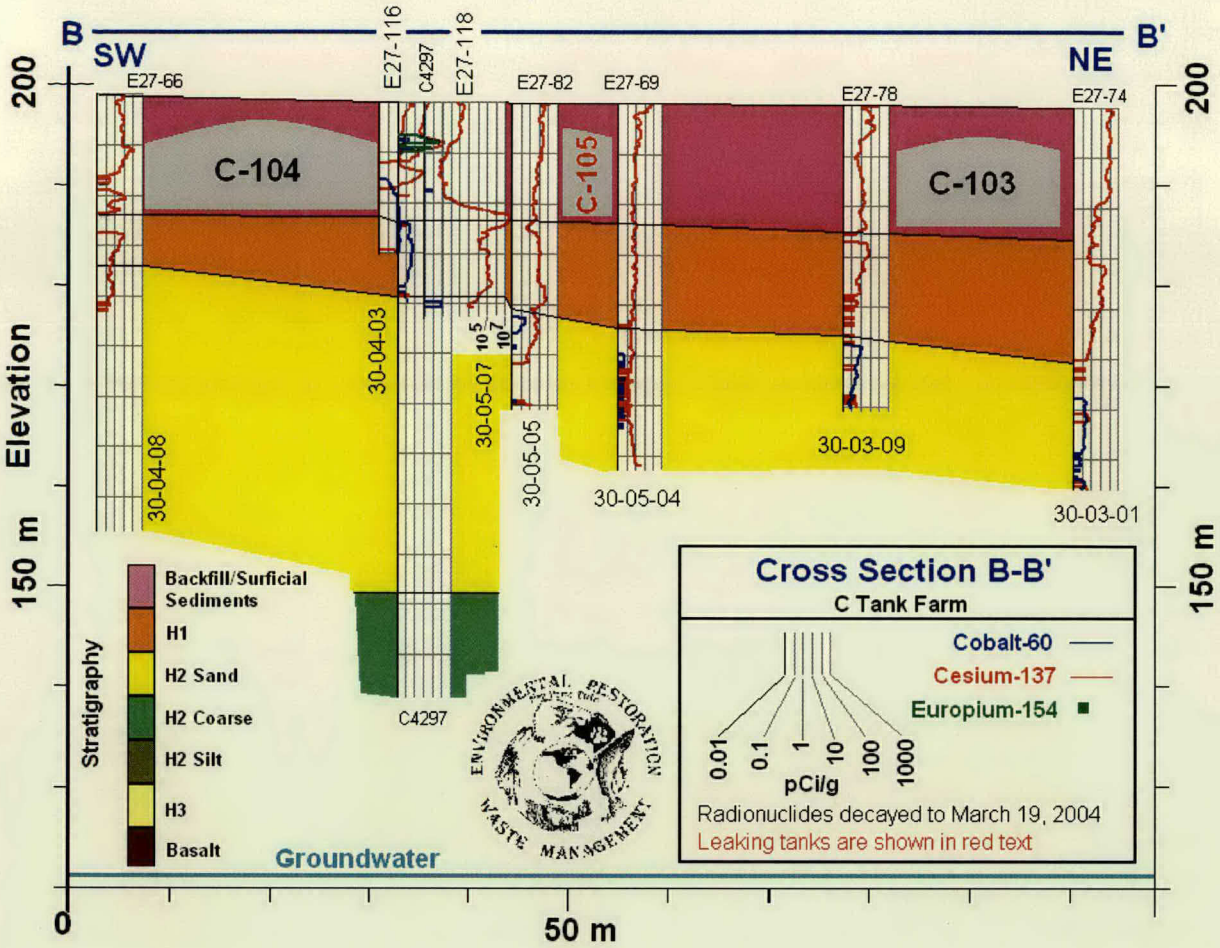


Figure A2-5. Dip cross section B-B' through Waste Management Area C.

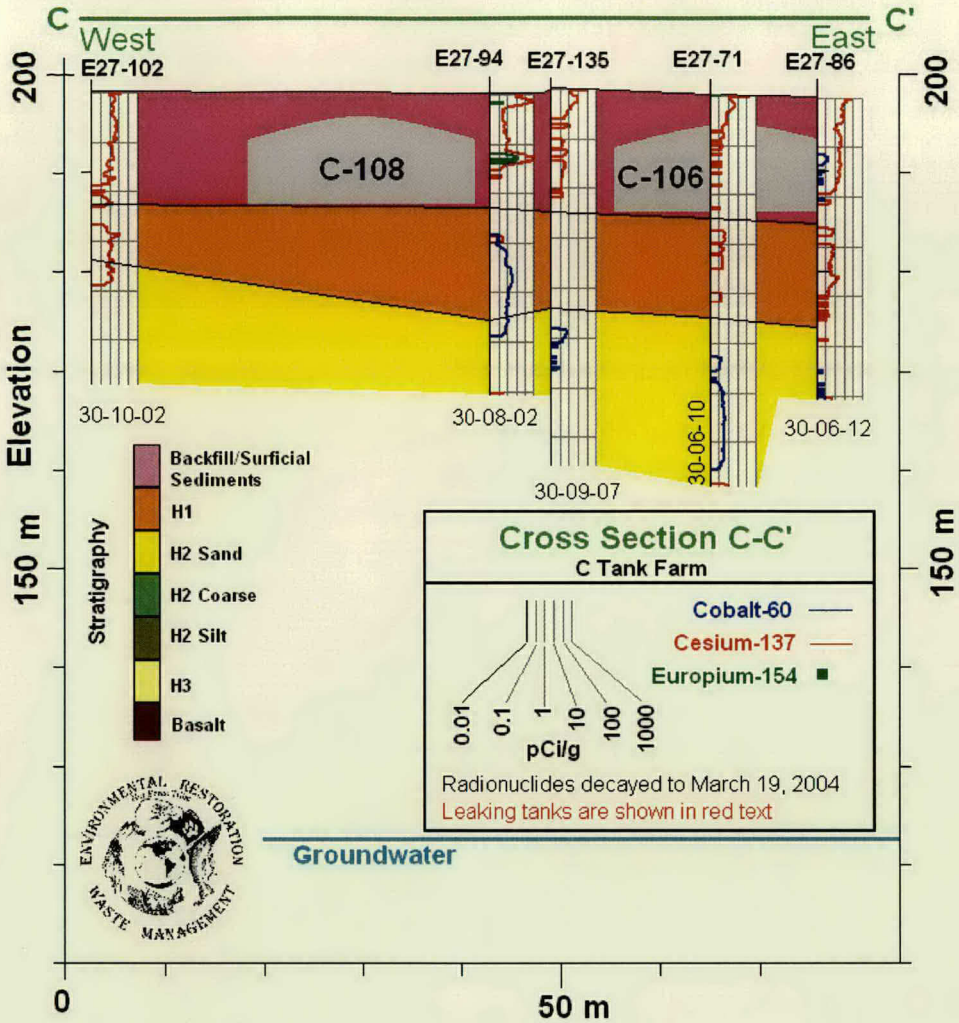


Figure A2-6. Dip cross section C-C' through Waste Management Area C.

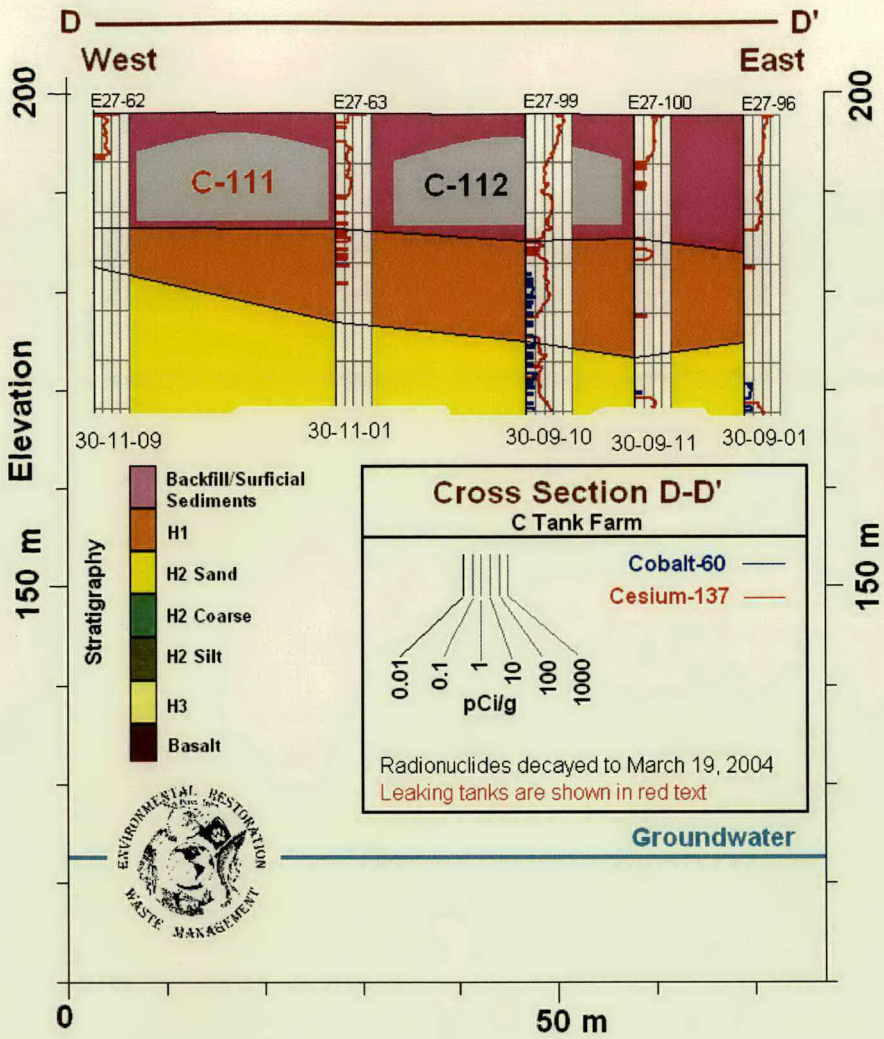


Figure A2-7. Dip cross section D-D' through Waste Management Area C.

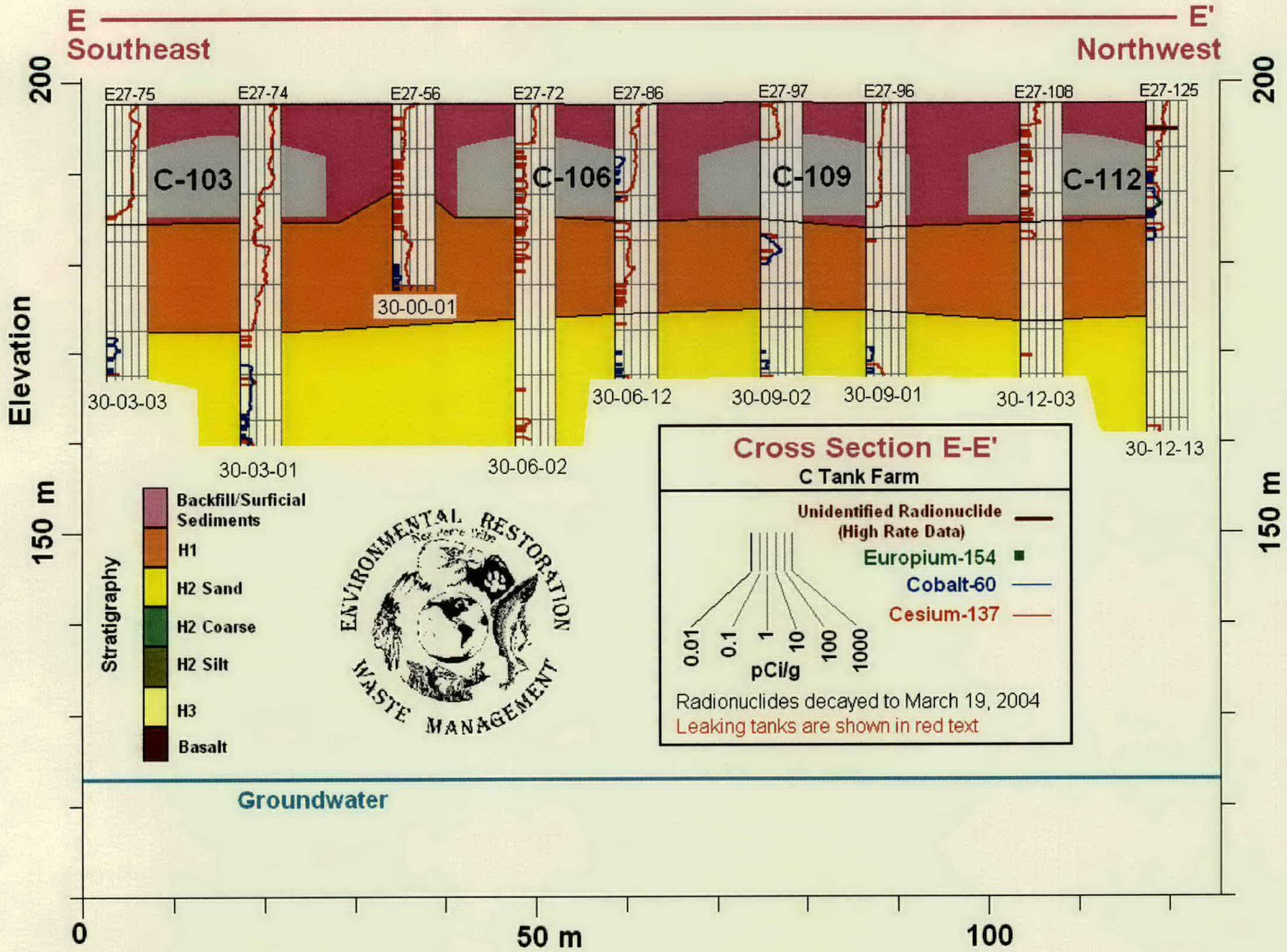


Figure A2-8. Strike cross section E-E' through Waste Management Area C.

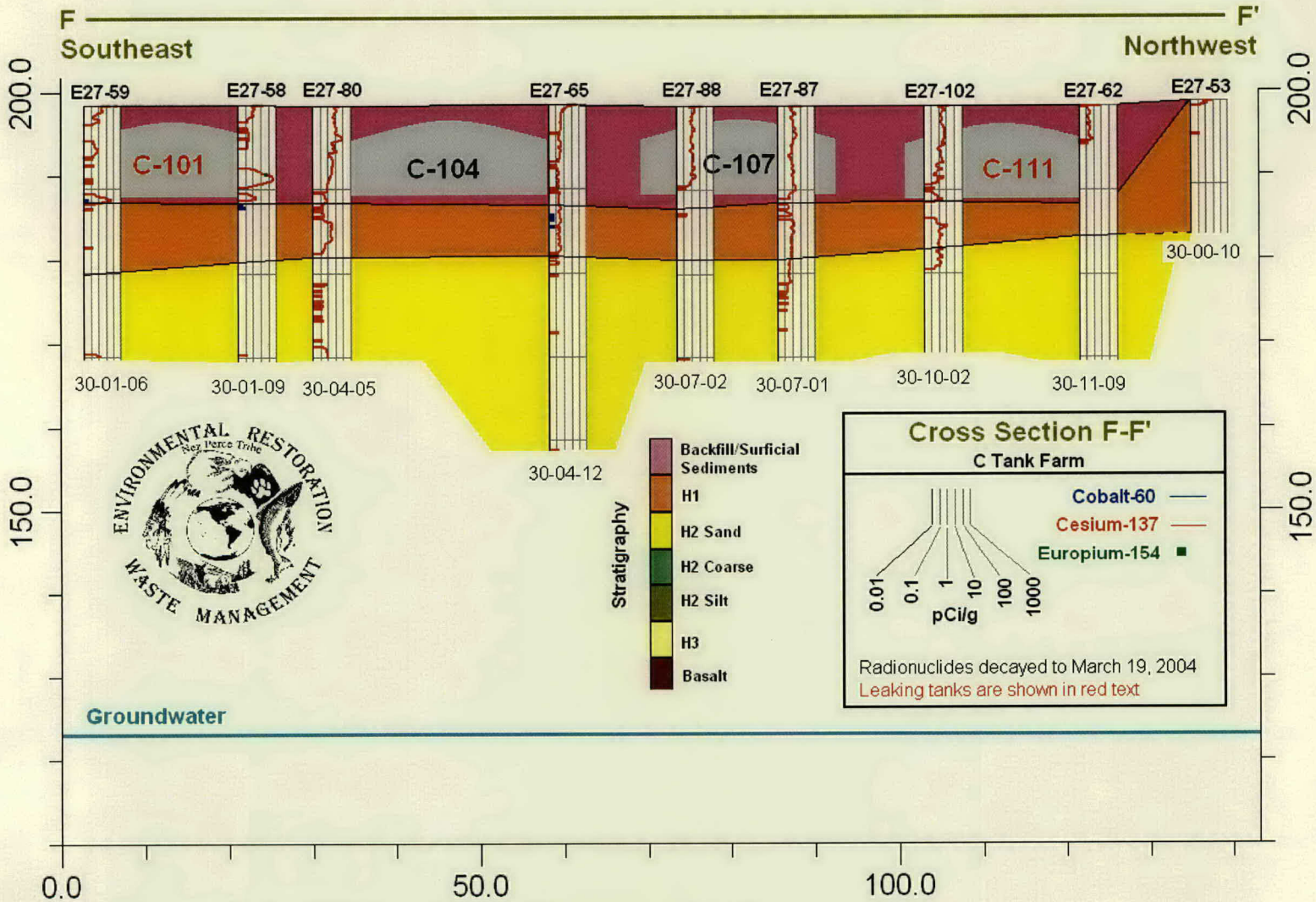


Figure A2-9. Strike cross section F-F' through Waste Management Area C.

Table A2-1. Summary of the geologic interpretation for Waste Management Area C. Stratigraphic contacts are reported as log depth (feet) for the respective spectral gamma log.

WELL NAME	Tank Farm Well Number	H1	H2	H2 Coarse	H2_silt	H3	Basalt
299-E26-8	299-E26-8						250
299-E27-12	299-E27-12	0	35	172	?	234	nr
299-E27-13	299-E27-13	0	32	183	?	238	nr
299-E27-14	299-E27-14	10	92	165	229	236	nr
299-E27-15	299-E27-15	0	70	158	?	245	nr
299-E27-2	299-E27-2						
299-E27-21	299-E27-21	0	61	180	240	243	nr
299-E27-22	299-E27-22	6	80	153	np	227	268
299-E27-23	299-E27-23	12	28	182	236	246	nr
299-E27-4	299-E27-4	?	31	183	230	238	nr
299-E27-7	299-E27-7						
299-E27-56	30-00-01	32	nr				
299-E27-54	30-00-03	0	88	nr			
299-E27-55	30-00-06	38	58	nr			
299-E27-57	30-00-09						
299-E27-53	30-00-10	0	52	nr			
299-E27-121	30-00-11	12	23	Nr			
299-E27-52	30-00-12	?	?	?			
299-E27-124	30-00-13	5	nr				
299-E27-120	30-00-22	0	23	nr			
299-E27-122	30-00-24	0	19	nr			
299-E27-60	30-01-01	37.5	72	nr			
299-E27-59	30-01-06	38	66	nr			
299-E27-58	30-01-09	38	61	nr			
299-E27-61	30-01-12	38	67	nr			
299-E27-74	30-03-01	43	83	nr			
299-E27-75	30-03-03	43	?	nr			
299-E27-76	30-03-05	42	84	nr			
299-E27-77	30-03-07	40	76	nr			
299-E27-78	30-03-09	41	75	nr			
299-E27-115	30-04-01	38	nr	nr			
299-E27-67	30-04-02	39	64	nr			
299-E27-116	30-04-03	37.5	nr	nr			
299-E27-79	30-04-04	37.5	62	nr			
299-E27-80	30-04-05	38	59	nr			
299-E27-66	30-04-08	39	53	nr			
299-E27-65	30-04-12	39	59	nr			
299-E27-70	30-05-02	38	73	nr			
299-E27-81	30-05-03	38	74	nr			
299-E27-69	30-05-04	39	73	nr			
299-E27-82	30-05-05	38	67	nr			

299-E27-119	30-05-06	39	nr	nr			
299-E27-118	30-05-07	?	?	?			
299-E27-117	30-05-08	38	nr	nr			
299-E27-83	30-05-09	38	65	nr			
299-E27-68	30-05-10	40	72	nr			
299-E27-72	30-06-02	40	78	nr			
299-E27-84	30-06-03	40	80	nr			
299-E27-73	30-06-04	43	80	nr			
299-E27-85	30-06-09	39	74	nr			
299-E27-71	30-06-10	41	74	nr			
299-E27-86	30-06-12	42	76	nr			
299-E27-87	30-07-01	38	60	nr			
299-E27-88	30-07-02	40	60	nr			
299-E27-89	30-07-05	40	52	nr			
299-E27-90	30-07-07	38	47	nr			
299-E27-91	30-07-08	38	45	nr			
299-E27-92	30-07-10	38	45	nr			
299-E27-93	30-07-11	38	50	nr			
299-E27-94	30-08-02	38	75	nr			
299-E27-51	30-08-03	38	nr	nr			
299-E27-95	30-08-12	38	72	nr			
299-E27-96	30-09-01	45	75	nr			
299-E27-97	30-09-02	42	75	nr			
299-E27-98	30-09-06	38	72	nr			
299-E27-135	30-09-07	41	73	nr			
299-E27-99	30-09-10	42	75	nr			
299-E27-100	30-09-11	41	80	nr			
299-E27-101	30-10-01	38	50	nr			
299-E27-102	30-10-02	37.5	56	nr			
299-E27-103	30-10-09	38	43	nr			
299-E27-104	30-10-11	37.5	43	nr			
299-E27-63	30-11-01	38	69	nr			
299-E27-105	30-11-05	39	67	nr			
299-E27-64	30-11-06	41.5	62	nr			
299-E27-62	30-11-09	38	51	nr			
299-E27-106	30-11-11	38	60	nr			
299-E27-107	30-12-01	43	79	nr			
299-E27-108	30-12-03	43	79	nr			
299-E27-109	30-12-09	40	68	nr			
299-E27-125	30-12-13	42	78	nr			
C4297	C4297	39	64	160	nr		
? = Top not picked. nr = Stratigraphic bed not reached							

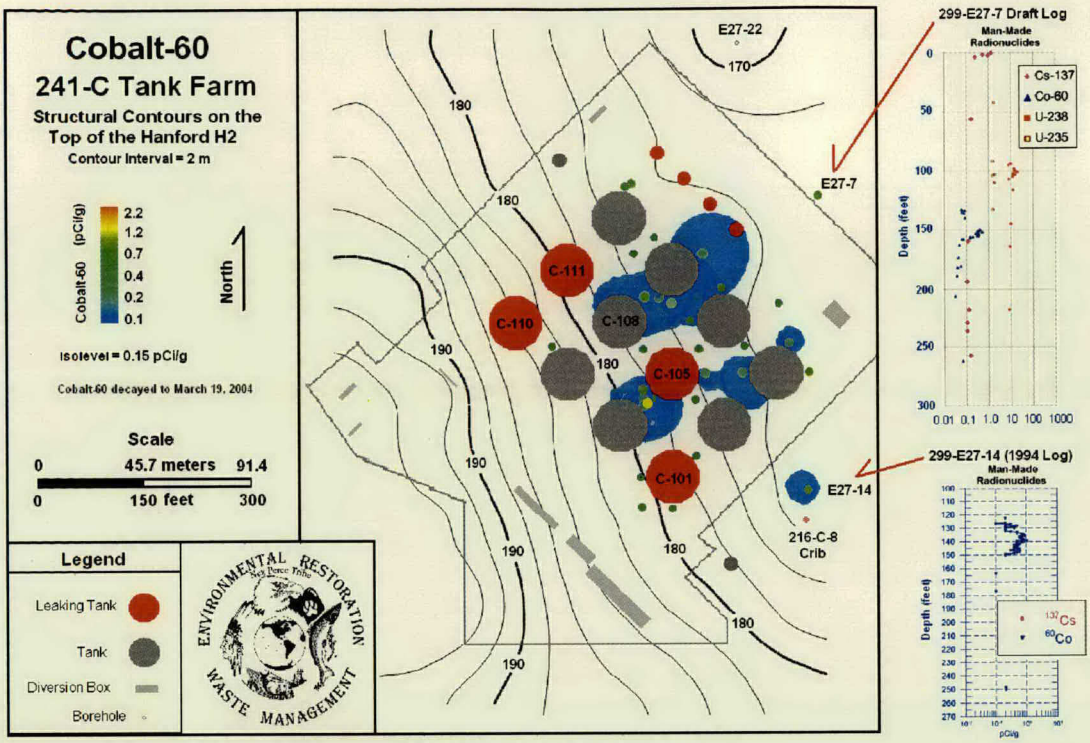


Figure A2-10. Plan view of the distribution ^{60}Co in the subsurface based on spectral gamma logging at 241-C tank farm.

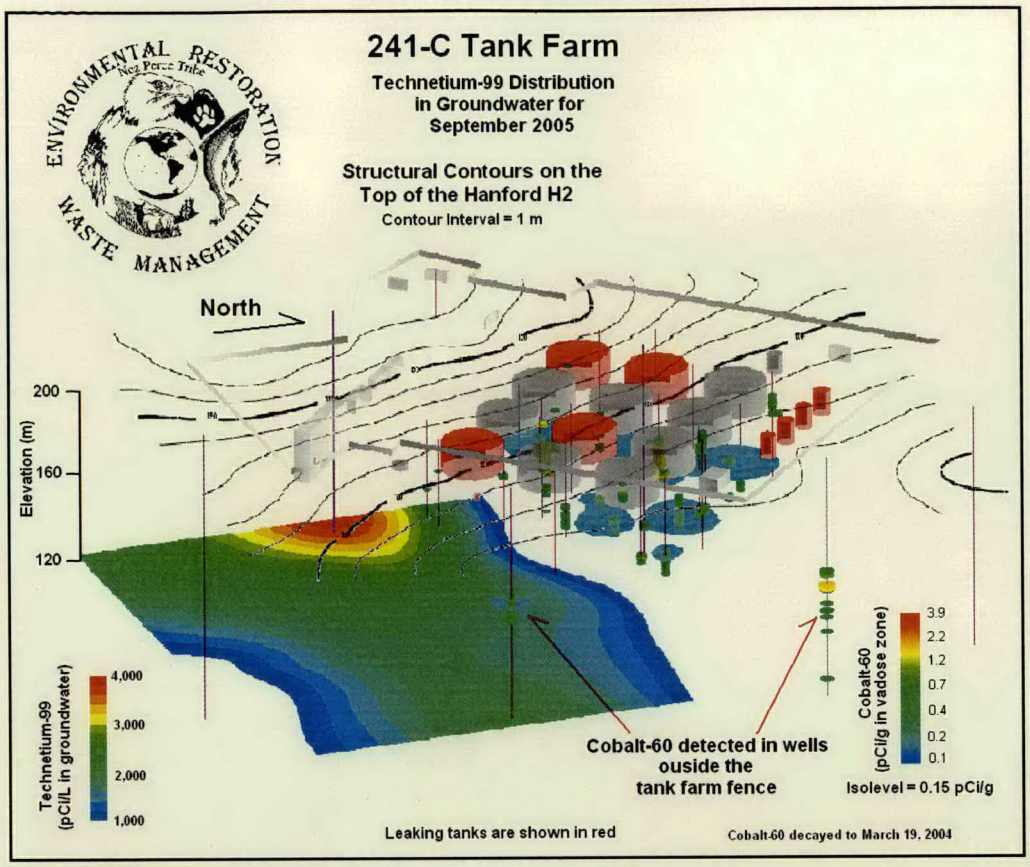


Figure A2-11. Visualization of the distribution ^{60}Co in the subsurface based on spectral gamma logging at 241-C tank farm and C tank farm's ^{99}Tc groundwater plume as observed in September 2005.

Attachment 3
Direct Push Concerns

The *Data Quality Objectives Report, Phase 2 Characterization for Waste Management Area C Corrective Measures Study*, RPP-RPT-38152, Draft Rev. 0 proposes the use of direct push to collect soil samples and obtain geophysical logs to access the distribution of wastes in the vadose zone to a depth of 200 ft or "refusal". It is proposed that the characterization goal can be accomplished by using gross gamma, neutron-moisture and passive neutron logging of direct-push holes to determine optimum sampling depths for the collection of soil samples. These pushes are limited to depths of 200 ft or less, which leaves the deepest 40 to 80 ft of the vadose zone uncharacterized. Since Tc-99 is not a gamma emitter, the implicit assumption is that Tc-99 may be present in the intervals of relatively high moisture in the absence of a gamma anomaly.

There are pitfalls in using gross gamma and moisture logging to select soil sample intervals as indicated in this DQO. The detection limit of the geophysical logging tools being used in conjunction with the push method is approximately ten pCi/g of Cs-137 equivalent. In is the case, then the 20-ft thick zone of Co-60 (Figure A3-1) detected in borehole C4297 would not be detected by the geophysical sonde employed in the direct-push holes. Note: The Eu-154 and Co-60 at approximately 14 ft would not be known, resulting in a gross over-estimation of the Cs-137 content. Also, the DQO indicates that soil samples will be collected from zones identified by moisture logging.

Using the criteria of either a ten pCi/g eq Cs-137 anomaly or a moisture anomaly, the zone of Co-60 contamination between 40 and 63 (Figure A3-1) would not be detected by the gamma logging method employed. Since the zone is also relatively low in moisture, this zone would not be selected for collection of a soil sample by either diagnostic method (gamma or neutron logging). Since the zone with relatively high moisture is thin at 65 ft, the results of a soil sample collected at 65 ft would be attributed to a few feet of contamination rather than a 20-foot zone.

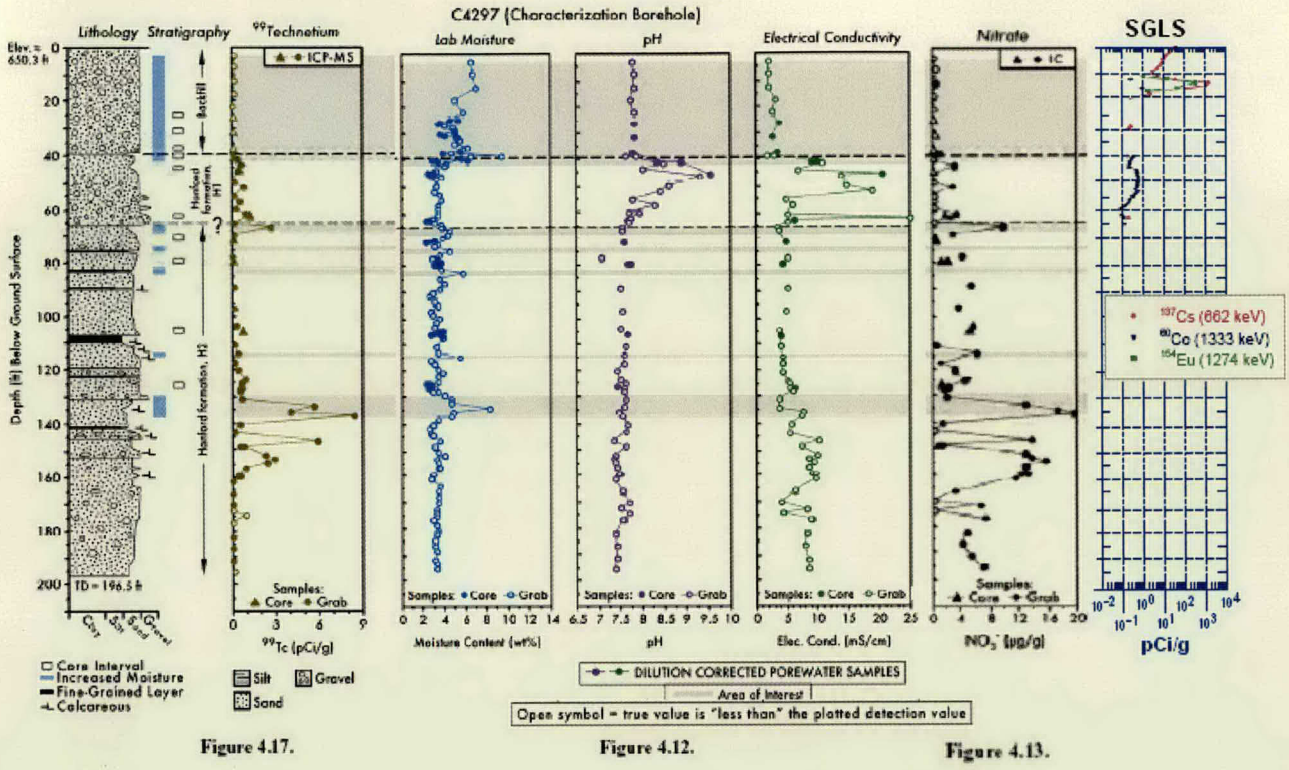


Figure A3-1. Composite of figures 4.12, 4.13 an 4.17 from Brown et al. (2006) and the spectral gamma log of borehole C4297, which is located between tanks C-104 and C-105.

References

Brodeur, J.R., 1993. *Assessment of Unsaturated Zone Radionuclide Contamination Around Single-Shell Tanks 241-C-105 and 241-C-106*, WHC-SD-EN-TI-185, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Brodeur, J.R., 2006. *Recent Leaks From Hanford's High-Level Nuclear Waste Tanks: USDOE's Failure to Monitor, Report or Characterize Tank Leak*, prepared by Energy Sciences & Engineering Kennewick, WA for Heart of America Northwest, publishing production by Priscilla Cole.

Brown, C.F., T.S. Vickerman, R.J. Serne, I.V. Kutnyakov, B.N. Bjornstad, K.N. Geiszler, D.G. Horton, S.R. Baum, D.C. Lanigan, K.E. Parker, R.E. Clayton, M.J. Lindberg, and M.M. Valenta, 2006. *Characterization of Vadose Zone Sediments Below the C Tank Farm: Borehole C4297 and RCRA Borehole 299-E27-22*, PNNL-15503, Pacific Northwest National Laboratory, Richland, Washington.

Brown, R.E. and H.G. Rupert, 1948. *Underground Waste Disposal at Hanford Works*, HW-9671, General Electric Hanford Company, Richland, Washington.

Fecht, K.R., G.V. Last, and K.R. Price, 1977. *Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells*, ARH-ST-156, Atlantic Richfield Hanford Company, Richland, Washington.

Field, J.G. and T.E. Jones, 2006. *Tank Farm Vadose Zone Contamination Volume*, RPP-23405, Rev. 2, CH2M HILL Hanford Group, Inc., Richland, Washington.

Johnson, M.E. and J.G. Field, 2008. *Hanford C-Farm Leak Assessments Report: 241-C-101, 241-C-110, 241-C-111, 241-C-105 and Unplanned Waste Releases*, RPP-ENV-33418, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

Kos, S.E., 1995. *Assessment of Vadose Zone Radionuclide Contamination Around Single-Shell Tanks 241-C-103*, WHC-SD-EN-TI-299, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Price, W.H. and K.R. Fecht, 1976. Geology of the 241-C Tank Farm, Informal Report, ARH-LD-132, Atlantic Richfield Hanford Company, Richland, Washington.

Smith, E.F., 1955. *Structural Evaluation Underground waste Storage Tanks*, HW-37519, General Electric Hanford Company, Richland, Washington.

U.S. Department of Energy (DOE), 1992. *Purex Source Aggregate Area Management Study Report*, DOE/RL-92-04, Draft A, U.S. Department of Energy, Richland, Washington.

DOE, 1997. *TWRS Vadose Zone Contamination Issue Expert Panel Status Report*, DOE/RL-97-49, Rev. 0, U.S. Department of Energy, Richland, Washington.

DOE, 2003. *Hanford Tank Farms Vadose Zone Monitoring Project Annual Monitoring Report for Fiscal Year 2002*, GJO–2003–400–TAC, prepared for U.S. Department of Energy Idaho Operations Office Grand Junction Office Grand Junction, Colorado, by S.M. Stoller Corp., Richland, Washington

Williams, B.A. and S.M. Narbutovskih, 2004. *Borehole Data Package for Four CY 2003 RCRA Wells 299-E27-4, 299-E27-21, 299-E27-22, and 299-E27-23 at Single-Shell Tank, Waste Management Area C, Hanford Site, Washington,* PNNL-14656, Pacific Northwest National Laboratory, Richland, Washington.

Wood, M.I., T.E. Jones, B.N. Bjornstad, D.G. Horton and S.M. Narbutovskih 2003. *Subsurface Conditions Description of the C and A-AX Waste Management Area*, RPP-14430, CH2MHill Hanford Group, Inc. Richland, Washington.

U.S. Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

08-TPD-090

DEC 1 8 2008

Ms. Jane A. Hedges, Program Manager
Nuclear Waste Program
State of Washington
Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99354

Dear Ms. Hedges:

TRANSMITTAL OF THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) FACILITY INVESTIGATION/CORRECTIVE MEASURES STUDY (RFI/CMS) WORK PLAN FOR WASTE MANAGEMENT AREA (WMA) C AS REQUIRED BY HANFORD FEDERAL FACILITIES AGREEMENT AND CONSENT ORDER (AKA TRI-PARTY AGREEMENT) MILESTONE M-045-60

Enclosed for your review are the RFI/CMS Work Plan for WMA C, RPP-PLAN-39114, and the associated Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C, RPP-PLAN-38777. Transmittal of these documents completes Tri-Party Agreement Milestone M-045-60.

The U.S. Department of Energy, Office of River Protection (ORP) and the Tank Operations Contractor, Washington River Protection Solutions LLC (WRPS), are currently conducting closure planning for WMA C, including preparation of a Phase 2 RFI/CMS Report for WMA C. As described in the enclosed plans, the vadose zone characterization required to support this report is expected to involve a minimum of three years of field work. Following completion of the characterization, a performance assessment (PA) will be prepared to support the RFI/CMS report. Given the scope of the PA and the RFI/CMS reports, it is currently estimated that each activity will require one additional year of preparation time. For planning purposes, a minimum of five years is required after approval of the Work Plan for WMA C.

The RFI/CMS (Milestone M-045-61) was established as a milestone date of December 31, 2010, subsequent to the Data Quality Objectives process which scoped the characterization work for WMA C and implemented through the enclosed work plan. The Phase 2 Corrective Measures Implementation Work Plan for WMA C (Milestone M-045-62) has a successive milestone date of July 31, 2012.

Based on the workplan submittal, it is not feasible to complete the identified characterization, prepare the WMA C PA and deliver the RFI/CMS report and the implementation plan by those dates. This issue has been identified and discussed in past Tri-Party Agreement Monthly meetings and during the November 20, 2008, Tri-Party Agreement Quarterly Project Managers' meeting, it was agreed that the current transmittal letter would be used to initiate discussion of potential change request. ORP proposes meeting with Ecology to discuss a draft Tri-Party

DEC 1 8 2008

Agreement change request that will be consistent with the technical scope of the M-045-61 and M-045-62 milestones, and also supportive of closure of WMA C.

We look forward to discussions with Ecology on this subject. If you have any questions, please contact me, (509) 372-2315.

Sincerely,

Shirley J. Olinger, Manager
Office of River Protection

TPD:RWL

Enclosure

cc w/encl:
S. Harris, CTUIR
J. J. Lyon, Ecology
C. L. Whalen, Ecology
S. L. Leckband, HAB
G. Bohnee, NPT
K. Niles, Oregon Energy
R. Jim, YN
Administrative Record
WRPS Correspondence
Environmental Portal, LMSI

Enclosure
08-TPD-090

THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) FACILITY INVESTIGATION/CORRECTIVE MEASURES STUDY (RFI/CMS) WORK PLAN FOR WASTE MANAGEMENT AREA (WMA) C

0080278

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • (509) 372-7950

February 4, 2009

RECEIVED
FEB 12 2009
EDMC

Ms. Shirley J. Olinger, Manager
Office of River Protection
United States Department of Energy
P.O. Box 450, MSIN: H6-60
Richland, Washington 99352

Re: Extension of Review Period for the *RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, RPP-PLAN-39114, Revision 0

Reference: See page 2

Dear Ms. Olinger:

In accordance with the Hanford Federal Facility Agreement and Consent Order, Section 9.2.1, the Department of Ecology requests an extension to perform a detailed review of the above report (reference). We have determined that an additional extension of 70 days is necessary to adequately complete our review of the report and to provide comments. Our comments will be submitted by April 27, 2009.

We have begun our review and identified four issues that require additional discussion. We request a meeting to discuss these issues. These issues are:

- Technetium probe development and use, testing protocol, demonstration and implementation plan, and identification of location to employ the technetium probe.
- The five-year length of the investigation; including retrieval conflicts and closure of C Farm.
- The need for comparison of surface geophysical exploration (SGE) anomalies with analytical data in order to allow for interpretation of SGE results within C Farm.
- Validation of vadose soil characterization as requested by Ecology.

Ecology met with the United States Department of Energy-Office of River Protection and its contractor on the organic sampling locations for the organic analyses. Ecology grants conditional approval to continue work on this project while these issues are discussed and comments are resolved.

Ms. Shirley J. Olinger
February 4, 2009
Page 2

If there are any questions, contact me at 509 372-7914.

Sincerely,

Jeffery J. Lyon
Tank Waste Storage Project Manager
Nuclear Waste Program

mb/aa

Reference: Letter 08-TPD-092, dated December 18, 2008, from S. J. Olinger, USDOE-ORP to J. A. Hedges, Ecology, "Transmittal of the Resource Conservation and Recovery Act (RCRA) Corrective Action Phase II Master Work Plan as Required by Hanford Federal Facility Agreement and Consent Order (AKA Tri-Party Agreement) Milestone M-045-58"

cc: Susan Eberline, WRPS
Stuart Harris, CTUIR
Gabriel Bohnee, NPT
Russell Jim, YN
Susan Leckband, HAB
Ken Niles, ODOE
Administrative Record: SST/Tank Waste Storage
Environmental Portal
USDOE-ORP Correspondence Control

RPP-RPT-38152 Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

MAR 11 2009

09-TPD-006

Mr. Gabriel Bohnee, Director
Environmental Restoration/
Waste Management Program
Nez Perce Tribe
P. O. Box 365
Lapwai, Idaho 83540

Dear Mr. Bohnee:

DATA QUALITY OBJECTIVES (DQO) REPORT, PHASE 2 CHARACTERIZATION FOR WASTE MANAGEMENT AREA (WMA) C CORRECTIVE MEASURES STUDY, RPP-RPT-38152, DRAFT REVISION 0

Reference: NPT letter from G. Bohnee to Shirley J. Olinger, Manager, ORP, "Data Quality Objectives Report, Phase 2 Characterization for Waste Management Area C Corrective Measures Study, RPP-RPT-38152, Draft Rev. 0," dated September 5, 2008.

The U.S. Department of Energy (DOE), Office of River Protection (ORP) acknowledges receipt of your letter and comments on the draft DQO Report, Phase 2 Characterization for WMA C Corrective Measures Study, RPP-RPT-38152, Revision 0. The issues raised by the Referenced letter are consistent with concerns raised by the Nez Perce during the DQO process workshops held in March, May and August 2008, and DOE appreciates your participation. This DQO process defined those data to be acquired in a cost-effective manner that will support decisions on the selection and implementation of corrective measures for the vadose zone in and around WMA C as part of the Phase 2 Resource Conservation and Recovery Act (RCRA) Facility Investigation/Corrective Measures Study (RFI/CMS) process. Participation in this DQO included DOE and our contractors from the Richland Operations Office Groundwater-Vadose Zone Integration Project, the ORP, the Washington Department of Ecology (Ecology), U.S. Environmental Protection Agency (EPA), the Oregon Department of Energy, and the Tribal Nations, inclusive of the Nez Perce. As a result of those workshops and through the DQO process with the regulators, your input has been incorporated in the final DQO and WMA C workplan.

In summary, a number of updates which address the Nez Perce concerns and recommendations with the early DQO have been made which are detailed in the attached Response to Comments (RCR) Form. These modifications include testing and deploying a new detector for the direct push capable of detecting Co-60 and Cs-137 at levels less than 1 pCi/g; testing and validating Surface Geophysical capability for depth resolution using deep electrodes at select sites; additional direct pushes to the northeast of C-100 Series tanks to evaluate down-dip migration of Co-60; direct push to deep vadose zone depths of ~260 ft to the east of WMA C to evaluate contaminant movement near groundwater well 299-E27-14, direct pushes at C-103, between

C106 and C-109, C-108, C-110 and C-111; and additional spectral logging at dry wells and groundwater wells.

The revised DQO report and workplan for WMA C have been developed and the workplan was submitted to Ecology via M-45-60 Milestone in late December 2008. The workplan in under review by Ecology and ORP is undertaking initial characterization as per the workplan, under an Ecology approval conditional on resolution of retrieval schedule/conflict mitigation, updated Sample Analysis Plan independent validation, Surface Geophysical verification and Beta Probe development and subsequent testing for the direct push deployments.

DOE appreciates your participation in the DQO workshops and the letter documenting your concerns and recommendations. Your continued technical involvement improves the quality of the remedial activities underway at Tank Farms and other central plateau efforts underway.

If you have any questions, please contact me, or your staff may contact Glyn Trenchard, Director, Tank Farms Programs and Projects Division, (509) 373-4016.

Sincerely,

Stacy Charboneau, Assistant Manager
for Tank Farms Project

TPD:RWL

Attachment

cc w/attach:
S. Harris, CTUIR
J. A. Hedges, Ecology
J. J. Lyon, Ecology
R. R. Campbell, EPA
J. G. Morse, RL
K. Niles, Oregon
R. Jim, YN

Attachment
09-TPD-006

Review Comment Record (RCR)
RPP-RPT-38152, Draft Revision 0,
Data Quality Objectives Report
Phase 2 Characterization for Waste Management Area C
Corrective Measures Study

Consisting of 9 pages, including coversheet

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
02/27/2009	
3. Project No.	Page 1 of 8

5. Document Number(s)/Title(s)	6. Program/Project/Building Number	7. Reviewer	8. Organization/Group	9. Location/Phone
RPP-RPT-38152, Draft Rev. 0, *Data Quality Objectives Report Phase 2 Characterization for Waste Management Area C Corrective Measures Study*	Tank Farm Vadose Zone Program/TOC/2440 Stevens Center	Gabriel Bohnee	Nez Perce	Lapwai, ID

17. Comment Submittal Approval	10. Agreement With Indicated Comment Disposition(s)	11. CLOSED
Date / Organization Manager (optional) (print and sign)	Reviewer/Point of Contact (print and sign) / Date / Author/Originator (print and sign)	Reviewer/Point of Contact (print and sign) / Date / Author/Originator (print and sign)

12. Item	13. Comments	14. Reviewer Concurrence Required (Y or N)	15. Disposition (provide justification if **NOT** accepted)	16. Status
1	*Nez Perce General Concern #1*: "The DQO fails to recognize that the C tank farm has and continues to contaminate groundwater. Identifying the vadose zone sources of the ongoing degradation of groundwater underneath WMA C should be explicitly stated as a DQO objective."		*Response:* DOE has acknowledged that groundwater beneath WMA C has been contaminated and that this contamination most likely originated from WMA C. This acknowledgement was documented in the Phase 1 WMA C Facility Investigation Report (see DOE/ORP-2008-01, Field Investigation Report for Waste Management Areas C and A-AX, Appendix L, Executive Summary, pages X and XII). However, the specific individual source(s) (i.e. tank/pipeline leak etc.) of that contamination are currently not known. DOE reasserts this statement in the final DQO report and in the WMA C workplan. Specifically, the above source document serves as the basis for the problem statement which concludes that, " …contamination identified in WMA C has caused a need for corrective action". The DQO goes on to define what data are needed and where characterization efforts are planned to define the nature and extent of contamination in and around WMA C so that the appropriate corrective measures can be evaluated and selected for implementation.	
2	*Nez Perce General Concern #2*: "An integrated conceptual model for WMA C has yet to be constructed by DOE. Conceptual models on the current distribution of contaminants in the vadose zone and groundwater and migration from the vadose zone to the aquifer are not clearly presented and are not supported by field data." The Nez Perce raised the following actionable point: "The conceptual model proposed by prior Hanford investigators (e.g. Brown and Ruppert 1948, Fecht et al. 1977, DOE 1992, Brodeur 1993, Kos 1995) and		*Response*: The draft DQO presented four conceptual models applicable to various types of release flux rates and source terms, including that proposed by Dr. Stan Sobczyk. It is DOE's expectation that this characterization effort will further help us to refine the conceptual models for WMA C. Subsequent to the release of RPP-RPT-38152, Draft Rev. 0, Dr. Sobczyk provided additional text and a graphic which further clarified how he would like his conceptual	

REVIEW COMMENT RECORD (RCR)	1. Date 02/27/2009	2. Review No.
	3. Project No.	Page 2 of 8

12. Item	13. Comments	14. Reviewer Concurrence Required (Y or N)	15. Disposition (provide justification if **NOT** accepted)	16. Status
	resurrected by the Nez Perce ERWM has been misrepresented. The conceptual model proposed by the Nez Perce ERWM is described in Attachment 2 and should be the preferred conceptual model since it honors data collected in the field."		model presented in the DQO Report. This information was incorporated into the final DQO Report and in the recently issued WMA C Workplan. DOE would like to clarify that neither the DQO Report nor the WMC workplan identifies a preferred conceptual model. The characterization effort presented in the DQO is intended to provide additional information to assess the current conceptual models (including the conceptual model put forth by the Dr. Sobczyk) and make appropriate refinements. The development of the characterization program has taken into account sample locations suggested by Dr. Sobczyk, which have been augmented with sample locations to support evaluation of his conceptual model	
3	*Nez Perce General Concern #3*: "The proposed characterization methods consist of direct pushes and high resolution resistivity (HRR). The gross gamma logging system used in conjunction with the direct push has a detection limit of approximately ten pCi/g Cs 137 equivalent. This detection limit is greater than the soil cleanup criteria of 6.2 pCi/g for 137 Cs that has been applied in Interim Action Record of Decisions for the 100 Area. It is inappropriate to propose the use of a tool that has detection limit that is higher than potential cleanup standard and for contamination levels which may threaten remediation workers health. High Resolution Resistivity surveys have not proved very reliable in the tank farms in the past…"		*Response*: As a result of the discussions with the Tribes, Ecology, Oregon Department of Energy, EPA, and Ecology via the DQO process, DOE expanded the characterization methodologies to include the following: a. Direct Push Sampling and Logging with the new Bismuth Germanium Oxide (BGO) sonde (can detect Cs-137 and Co-60 at levels less than 1 pCi/g (see below for more information). Direct Push data collection, dictated by objective, can assess the deep vadose zone to groundwater in this area based on past experience (i.e. ~260 ft bgs) without the logistical constraints of large rig placement in Tank Farms. Moreover, Direct Push capabilities enables multiple sampling sites at a fraction of the cost of traditional boreholes. b. Surface Geophysical Exploration (SGE) using deep electrodes emplaced below subsurface pipeline electrical interferences with associated verification sampling protocols. c. Spectral Gamma Logging near tanks C-103, C-104, C-106, C-108, C-109, C-110, C-111, and C-112 d. Spectral Gamma Logging on groundwater wells 299-E27-12, 299-E27-13, 299-E27-14, and 299-E27-15 e. Small mammal tissue sampling for ecological risk	

REVIEW COMMENT RECORD (RCR)	1. Date 02/27/2009	2. Review No.
	3. Project No.	Page 3 of 8

12. Item	13. Comments	14. Reviewer Concurrence Required (Y or N)	15. Disposition (provide justification if **NOT** accepted)	16. Status
			f. Surficial and shallow (< 15 ft bgs) sediment sampling for Ecological risk g. Development and testing of down- hole beta detector as new technology for targeting Tc99 directly, a specific mobile groundwater contaminate of concern (see below) The workplan also cites the potential for supplemental sampling via other established techniques (i.e. traditional drill and sampling), if direct push does not provide the necessary information or if regions require deeper investigations based on targeting from direct push capability. Both DOE and the Nez Perce acknowledge that the characterization efforts at WMA C must take into account both schedule and budget considerations. Our objective is to conduct characterization (both laterally and vertically) of the vadose zone in the most cost-effective manner. DOE believes these tools will provide the most cost-effective means of collecting the data needed to support the Phase 2 RFI/CMS and our decisions. Specific details to Direct Push Logging capabilities cited in (a) and (g) are noted as follows: Consistent with the scope of Phase 2 characterization to support closure and Past Expert Panel recommendations on developing additional characterization tools, ORP is expanding the capability of their current geophysical tools in developing and deploying a more sensitive detector using a modified Bismuth Germinate Oxide (BGO) logging tool for use with direct push technology. Based on recent calibration and field testing, this detector is capable of detecting cesium concentrations as low as 0.5 pCi/g and cobalt as low as 0.6 pCi/g. In addition to the lower man-made radionuclide detection levels, Potassium, Uranium and Thorium ratios provide for potential improved lithologic interpretations from geophysical log data, which enhances the interpretation of stratigraphy in areas devoid of drywells and not logistically suitable for large drilling/driving rig deployment as in Tank Farms.	

REVIEW COMMENT RECORD (RCR)	1. Date 02/27/2009	2. Review No.
	3. Project No.	Page 4 of 8

12. Item	13. Comments	14. Reviewer Concurrence Required (Y or N)	15. Disposition (provide justification if **NOT** accepted)	16. Status
			The calibration of the BGO logging tool will be described in the logging report for the TY direct push effort, due out in the second quarter of 2009. As noted in recent Ecology sponsored monthly groundwater meetings, DOE plans on discussing this recent geophysical logging capability at the monthly Groundwater-Vadose Tribal-Stakeholder meetings in the future. Additionally, ORP is actively trying to assess the viability of a down-hole beta detector for use with the direct push. If deemed practicable, this capability will enhance the characterization options available, as it could measure Tc99, a significant mobile contaminant of concern that can not be measured via standard geophysical gamma technology.	
4	*Nez Perce General Concern #4*: "The proposed locations for additional characterization are not focused on determining the source of current groundwater contamination. Rationales for the locations and reasons for drilling proposed boreholes are not well supported. Tank leaks are assumed to have occurred through spare inlet ports. Depending upon the temperature and the specific gravity of the tank, the overfilling of a tank threatened the structural integrity of the tank (Smith 1955). The issues raised by Smith (1955) are not discussed or addressed in Field and Jones (2006) and Johnson and Field (2007)."		*Response:* DOE believes that the DQO process (which included input from the tribes) and the submitted workplan, has identified sampling locations that will provide the highest probability of locating contamination in the vadose zone, determining the source(s) of that contamination and investigating the source of groundwater contamination in C-Farm. Known and suspected tank and pipeline releases will be investigated. Potential tank leaks, pipeline leaks or overflows will be investigated for C-101 liquid level decreases and the plume near C-105. Additional push locations, including pushes near C-110 and C-111 are be included in the revised DQO in response to your recommendations during the DQO process. The referenced Smith, 1955 document entitled *Structural Evaluation Underground Waste Storage Tanks*, is one of many evaluations which provide insight into structural integrity considerations for the SSTs, particularly in regard to the effects of temperature and the specific gravity of the waste in the tank. DOE has impaneled outside experts in structural integrity and monitoring to advise DOE on the SST program pathforward. The objective of the past leak loss assessment reports of	

REVIEW COMMENT RECORD (RCR)	1. Date 02/27/2009	2. Review No.
	3. Project No.	Page 5 of 8

12. Item	13. Comments	14. Reviewer Concurrence Required (Y or N)	15. Disposition (provide justification if **NOT** accepted)	16. Status
			Field and Jones (2006) and Johnson and Field (2007), was to estimate tank and pipeline release volume and inventory which utilized in-tank measurement assessments and interpreted ex-tank monitoring which integrated mode of failure or operational upsets. These documents were not intended to address structural integrity of the tanks.	
5	*Nez Perce General Concern #5*: "DOE and its contractors should be open to recommendations from the tribes, regulators, expert panels, and stakeholders. While we have participated in numerous meetings of C tank farm, the proposed characterization only marginally addresses one of our concerns (i.e. the ongoing migration of Co near tank C-108). The direct push locations proposed to evaluate tank C-101 are not properly positioned to identify if this tank leak is the source of radionuclides observed at well 299-E27-14. The DQO doesn't propose any sampling to determine the origin of the radionuclides detected at well 299-E27-7."		*Response:* The DQO Report does identify the need to collect data on Co60 migration near tank C-108 as well as other areas in the eastern portions of C- farm and outside of the farm. The direct push locations as stated in the DQO Report are not absolute locations, and will be adjusted based upon actual field conditions and obstructions noted prior to the time of sampling consistent with safe conduct of operations in Tank Farms. DOE believes that sampling at locations E, D, F, H and I sufficiently surround E27-7 to assess Co60 migration in this area. Site E was placed specifically at the request of the Nez Perce to evaluate the down dip movement of Co-60 from C-108. DOE believes sample locations B, S and L will contribute to our understanding of contamination at E27-14 and we will review the benefit of placing a borehole closer to E27-14.	
6	*Nez Perce Specific Recommendation #1*: "Development of drilling locations to characterize tank leaks: determine the origin of the radionuclides detected (299-E27-& and 299-E-14) outside of the C tank farm; and verification of the leak assessment (Johnson and Field 2008) for tank C-111 by drilling a slant hole similar to the slant hole drilled at tank SX-108. This slant hole would start at location "K" as shown on Figure 1 and terminated under tank C-111."		*Response:* Characterization of potential tank leaks is only one objective of this characterization effort. See our response to concern number 5 above regarding E27-7 and E-27-14. The final DQO Report includes two additional sampling locations, one located on the north side of C-110 and one on the north of side of C-111. These will be slant pushes to the south and should provide information on the potential for these tanks to have leaked. Moreover, DOE is pursuing a formal leak status evaluation process of C-111, C-110 and C-105 as recommended by Johnson and Field (2008) and subsequently requested by Ecology. You will be notified of the outcome of these efforts upon completion.	
7	*Nez Perce Specific Recommendation #2*: "Every proposed characterization borehole should be supported by a strike and dip geological cross section, which shows all vadose zone and aquifer field data on contamination, and similar data from geophysical logs."		*Response:* The requested level of detail can be determined from references included in the DQO. Cross-section views and visual information for each of the proposed characterization boreholes will not be included in the DQO but are provided as part of the C-Farm 3-dimensional model which was included in an appendix of the WMA-C Work Plan. The model was presented and copies of the model	

REVIEW COMMENT RECORD (RCR)	1. Date 02/27/2009	2. Review No.
	3. Project No.	Page 6 of 8

12. Item	13. Comments	14. Reviewer Concurrence Required (Y or N)	15. Disposition (provide justification if **NOT** accepted)	16. Status
			were provided to tribes and stakeholders previously during the DQO with accompanying solicitations on areas of improvement requests. No detailed feedback was received and the documentation for the WMA C model is underway and anticipated in the third quarter of fiscal year 2009). Based on your specific interest in the 3-D work, DOE invites your staff to review and comment on drafts of this documentation prior to release if you are interested.	
8	*Nez Perce Specific Recommendation #3*: Implement the recommendations for characterization made by the SX Expert Panel (DOE 1997) over a decade ago.		*Response:* The Expert Panel report (DOE/RL-97-49) from 1997 made a series of recommendations regarding vadose zone characterization. These recommendations have been considered in the development of the DQO. The focus of the report was on borehole methods, including drilling, sampling and logging. The DQO has incorporated these recommendations into planning of logging or relogging existing boreholes, as well as providing selected additional boreholes to groundwater. The Expert Panel also recommended consideration of percussive drilling as an alternative method. Since that Panel recommendation, and consistent with need to work in an operational tank farm environment, percussive drilling methods have evolved into the direct push technique that is included in the DQO. The rational for how and why technologies were selected are now part of the recently released WMA C workplan.	
9	*Nez Perce Specific Recommendation #4:* "The nearby groundwater wells should be logged with the HPGe spectral gamma and neutron-moisture."		*Response:* The groundwater monitoring wells outside of WMA C have been added to the logging program for drywells as an outcome of the DQO. See response to general concern #3	

REVIEW COMMENT RECORD (RCR)	1. Date 02/27/2009	2. Review No.
	3. Project No.	Page 7 of 8

12. Item	13. Comments	14. Reviewer Concurrence Required (Y or N)	15. Disposition (provide justification if **NOT** accepted)	16. Status
10	*Nez Perce Specific Recommendation #5:* Integrate the vadose/groundwater investigations both inside and outside the tank farms by having only one contractor interpreting the existing data and writing DQOs and associated documents."		*Response:* Your recommendation to have one contractor interpreting data and preparing DQOs and associated documents is noted. As previously referenced, EPA, Ecology, Plateau Contractor and the Richland Operations Office were involved in this DQO effort as part of a Multiple Project Team approach that the site has adopted. Moreover, the final DQO and WMA C workplan was submitted to the Richland Operations Office Groundwater-Vadose Zone Integration Project for review and concurrence prior to issuance.	
11	*Nez Perce Specific Recommendation #6:* "Use a pile driver and a cone point and simply pound the casing down with a large diameter casing that support the use of variety of logging tools including the high purity germanium detector as recommended by Brodeur (2006)."		*Response:* DOE believes the DQO process has developed the appropriate characterization methods to collect the data required to support the DQO Report needs in the most cost-effective manner. See response to general concern 3 above.	
12	*Nez Perce Specific Recommendation #7*: When using the direct-push method to collect soil samples, soil samples should be collected as each additional length of pipe is added to drill string. ...If the presence of gamma-emitting radionuclides is used as criteria for the collection of soil samples using the direct-push technology", intervals for sampling should be based on gamma spectra collected with high-purity germanium detector."		*Response:* See our response to general concern #3 and recommendation 6 above.	
13	*Nez Perce Specific Recommendation #8*: "Install drywell monitoring borehole around tank C-102 as recommended by Brodeur (1993)."		*Response*: DOE will continue to review the benefit of installing drywell monitoring holes around C-102. However, more updated interpretations by the cited author indicate an alternative recommendation from that put forth by the Nez Perce comment. Assessment of the Nez Perce cited reference (i.e. WHC-SD-EN-TI-185 rev 0 and rev 0-A, entitled "Assessment of Unsaturated Zone Radionuclide Contamination Around Single-Shell Tanks 241-C-105 and 241-C-106", 1993.) reflected the following summary conclusions for C-102 which are applicable to the Nez Perce recommendation: Page 14, section 2.4.2 identified a potential leak as "...difficult to locate any contamination potentially released from the tank" and potential leak volume was small relative to other tank leaks. The cited document did, however recommend installing and logging monitoring boreholes around tank C-102 "as it may have leaked in	

REVIEW COMMENT RECORD (RCR)	1. Date 02/27/2009	2. Review No.
	3. Project No.	Page 8 of 8

12. Item	13. Comments	14. Reviewer Concurrence Required (Y or N)	15. Disposition (provide justification if **NOT** accepted)	16. Status
			the past and contributed to the contamination thought to originate from C-101, or from the C-104 to C-105 cascade line leak." However, subsequent logging evaluations applicable to this tank (GJO-HAN-18, Grand Junction Office Hanford Tank Farms Vadose Zone C Tank Farm Report, July 1998, Brodeur et. al.) has an updated interpretation on page 64-65 for C-102 with a different recommendation: "A review of historical operations records does not provide evidence this tank has leaked. The contamination showed in the visualizations is most likely associated with other nearby tanks and their associated subsurface pipelines as well as with the pipelines associated with tank C-102. The Co60 beneath the tank is most likely associated with leak events from adjacent tanks or nearby subsurface pipelines. The 137 Cs plume that is located approximately 70 ft below tank C-102 is associated with leak events from nearby tanks and their associated subsurface pipelines."	

Task# ORP-TPD-2009-0006

E-STARS[R] Report
Task Detail Report
03/11/2009 0313

TASK INFORMATION

Task#	ORP-TPD-2009-0006		
Subject	Concur - 09-TPD-006 Data Quality Objectives (DQO) Report, Phase 2 Characterization for Waste Management Area (WMA) C Corrective Measures Study, RPP-RPT-38152, Draft Rev. 0		
Parent Task#		**Status**	CLOSED 03/11/2009
Reference		**Due**	
Originator	Mendoza, Stella	**Priority**	High
Originator Phone	(509) 373-9112	**Category**	None
Origination Date	02/03/2009 0929	**Generic1**	
Remote Task#		**Generic2**	
Deliverable	None	**Generic3**	
Class	Long Term	**View Permissions**	Normal
Instructions	bcc: TPD OFF FILE TPD RDG FILE MGR RDG FILE DEP RDG FILE R. W. Lober, TPD G. D. Trenchard, TPD T. E. Olds, ORP RECORD NOTE: Please concur via Estars.		

ROUTING LISTS

1	Route List	Inactive

- Lober, Robert W - Review - Concur with comments - 02/05/2009 1257
  Instructions:
- Trenchard, Glyn D - Review - Concur - 02/03/2009 0957
  Instructions:
- Charboneau, Stacy L - Review - Concur with comments - 03/11/2009 1511
  Instructions:
- Morse, John G - Review - Concur - 02/03/2009 0951
  Instructions:
- Olinger, Shirley J - Approve - Cancelled - 03/11/2009 1513
  Instructions:

ATTACHMENTS

Attachments

1. 09-TPD-006.attach.rl.doc
2. 09-TPD-006.bohnee.rwl.doc
3. 09-TPD-006.bohnee.rwl.doc

RECEIVED
MAR 11 2009
DOE-ORP/ORPCC

COLLABORATION

COMMENTS

Poster	Lober, Robert W - 02/05/2009 1202

Task# ORP-TPD-2009-0006

	Concur
	Two edits needed. Insert "draft" where indicated on first page and on page 3 response 3d, change "C011" to C111. It should also be noted that reference is made to tank leak assessments C110, C111 and C105 on page 6, response 1, which notes tribal briefing on evaluation outcomes which have yet to be publiclly released., due to ongoing assessment of C105. Program should consider a proactive briefing on results from C110/111 and status of C105 as soon as possible and I'll notiffy communciations of recommendation via email.
Poster	Charboneau, Stacy L (Mendoza, Stella) - 03/11/2009 0303
	Concur
	Ben signed letter for Stacy

TASK DUE DATE HISTORY

No Due Date History

SUB TASK HISTORY

No Subtasks

-- end of report --

Task# ORP-TPD-2009-0006

E-STARS[R] Report
Task Detail Report
03/10/2009 0322

TASK INFORMATION

Task#	ORP-TPD-2009-0006		
Subject	Concur - 09-TPD-006 Data Quality Objectives (DQO) Report, Phase 2 Characterization for Waste Management Area (WMA) C Corrective Measures Study, RPP-RPT-38152, Draft Rev. 0		
Parent Task#		**Status**	Open
Reference		**Due**	
Originator	Mendoza, Stella	**Priority**	High
Originator Phone	(509) 373-9112	**Category**	None
Origination Date	02/03/2009 0929	**Generic1**	
Remote Task#		**Generic2**	
Deliverable	None	**Generic3**	
Class	Long Term	**View Permissions**	Normal
Instructions	bcc: TPD OFF FILE TPD RDG FILE MGR RDG FILE DEP RDG FILE R. W. Lober, TPD G. D. Trenchard, TPD T. E. Olds, ORP RECORD NOTE: Please concur via Estars.		

ROUTING LISTS

1	Route List	Active

- Lober, Robert W - Review - Concur with comments - 02/05/2009 1257
  Instructions:
- Trenchard, Glyn D - Review - Concur - 02/03/2009 0957
  Instructions:
- Charboneau, Stacy L - Review - Awaiting Response - Due Date BK 3/10/07
  Instructions:
- Morse, John G - Review - Concur - 02/03/2009 0951
  Instructions:
- Olinger, Shirley J - Approve - Awaiting Response - Due Date
  Instructions:

ATTACHMENTS

Attachments

1. 09-TPD-006.attach.rl.doc
2. 09-TPD-006.bohnee.rwl.doc
3. 09-TPD-006.bohnee.rwl.doc

COLLABORATION

COMMENTS

Poster	Lober, Robert W - 02/05/2009 1202

Task# ORP-TPD-2009-0006

	Concur
	Two edits needed. Insert "draft" where indicated on first page and on page 3 response 3d, change "C011" to C111. It should also be noted that reference is made to tank leak assessments C110, C111 and C105 on page 6, response 1, which notes tribal briefing on evaluation outcomes which have yet to be publiclly released., due to ongoing assessment of C105. Program should consider a proactive briefing on results from C110/111 and status of C105 as soon as possible and I'll notiffy communciations of recommendation via email.

TASK DUE DATE HISTORY

No Due Date History

SUB TASK HISTORY

No Subtasks

-- end of report --

Document: NA-NPT
Document Date: 04/10/2009
Author: Bohnee G
Addressee: Olinger S.J., Hedges J.A.

Actionee: Rob Lober
Due Date: 05/27/2009

Title: RCRA FACILITY INVESTIGATION/CORRECTIVE MEASURES STUDY WORK PLAN FOR WASTE MANAGEMENT AREA C, RPP-PLAN-39114 REVISION 0

MGR	Olinger, Shirley MGR
	Brazil, Kelly
	Reynolds, Kim
	Gamache, Lori
	Stubblebine, Scott
AMTF	Charboneau, Stacy (Actionee)
	Mendoza, Estella
	Harp, Ben
	Tobias, Shannon
	Kemp, Chris
	Lober, Bob
	Trenchard, Glyn
ENS	Irby, Dennis
	Mauss, Billie
	Koll, Ronald
ESQ	Huffman, Lori
	Gano, Becky
	Taylor, Bill
WTP	Eschenberg, John
DOE-RL	^DOE-RL Correspondence [D.A. Brockman]

Comments:

Records Schedule Information:
AMD-3.3a1a General Operations

Scan?: Yes Sensitive?: No Sensitive Attachments?: No IDMS Folder: ORP General Only

Date ORP CC Rec'd: 05/12/2009

Nez Perce

ENVIRONMENTAL RESTORATION & WASTE MANAGEMENT
P.O. BOX 365 • LAPWAI, IDAHO 83540-0365 • (208) 843-7375 / FAX: 843-7378

April 10, 2009

Ms. Shirley Olinger
Office of River Protection
PO Box 550, MS: H6-60
Richland, WA 99352

Ms. Jane Hedges
Nuclear Waste Program
Washington Department of Ecology
3100 Port of Benton Boulevard
Richland, WA 99352

Re: *RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, RPP-PLAN-39114, Revision 0

Dear Ms. Olinger and Ms. Hedges:

The Nez Perce Tribe retains reserved treaty rights in the Mid-Columbia region under the Treaty of 1855 with the United States Government. These rights have been recognized and affirmed through subsequent Federal and State actions. These actions protect Nez Perce rights to utilize our usual and accustomed resources and resource areas, including those in the Hanford Reach of the Columbia River. Accordingly, the Nez Perce Tribe Environmental Restoration and Waste Management program (ERWM) has support from the Department of Energy (DOE) to participate in and monitor relevant DOE activities. Degradation of groundwater is relevant to reserved treaty rights, and therefore we maintain involvement in waste management/vadose zone/groundwater issues.

The ERWM believes that proper and successful closure of the Waste Management Area C (WMA C) is of extreme importance. As you know, it will set an important precedent for future closures of other WMAs. Consequently, the closure must be methodical, accurate, and must protect the interests of the Tribes and stakeholders. To date, we are convinced the DOE-ORP efforts have been ineffectual in determining the pathways to an obviously contaminated groundwater that is a result of WMA C high level waste. We do not believe DOE-ORP will achieve closure without addressing our very real concerns, which are shared by other Tribes and stakeholders. We recommend that you develop a realistic schedule to achieve closure, which includes a thorough investigation of WMA C. Much can be accomplished, if we work together to properly characterize WMA C in support of closure.

RECEIVED
MAY 12 2009
DOE-ORP/ORPCC

As you are aware, we made extensive comments (dated September 5, 2008) on *Data Quality Objectives Report, Phase 2 Characterization for Waste Management Area C Corrective Measures Study*, RPP-RPT-38152, Draft Rev. 0. Based upon the DOE Office of River Protection's (ORP) letter (dated March 11, 2008) in response to these comments, we have apparently failed to adequately communicate our recommendations for additional characterization at 241-C tank farm. Since we provided a geologic model and mapped the gamma-emitting contamination within the WMA, we believe that we have a basis to support our recommendations for additional characterization at C farm. DOE/ORP still needs to develop an integrated conceptual model for WMA C as detailed in our comments on the draft C WMA DQO and *WMA C 3D Model*, CH2M-37668, Rev. 1 Draft. It appears that our previous comments (dated August 27, 2008) on *WMA C 3D Model*, CH2M-37668, Rev. 1 Draft, have been overlooked by DOE/ORP, and they are included as attachment 1 to this letter.

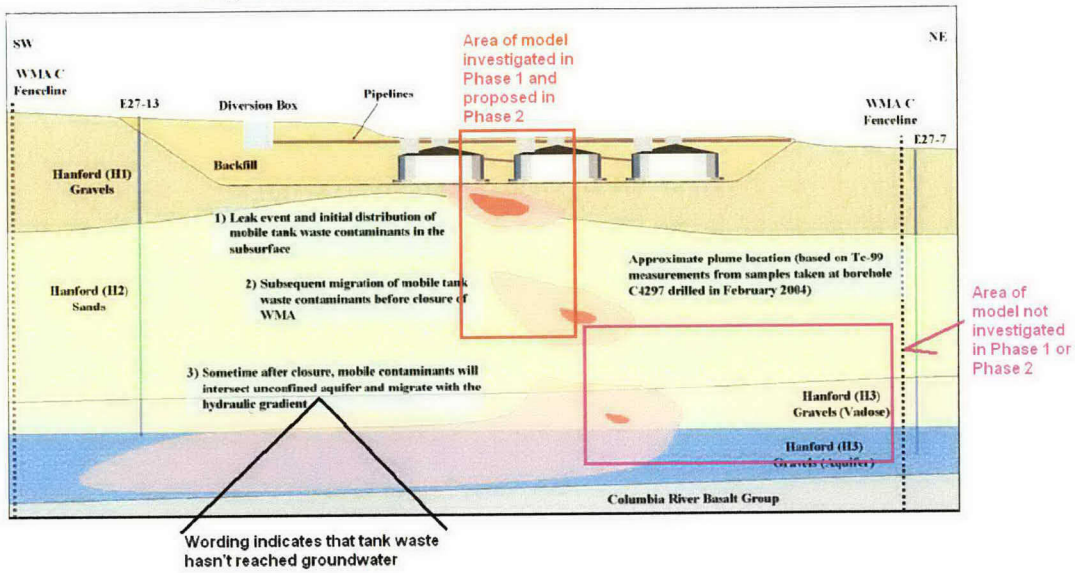
After reviewing the Phase 2 *RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, RPP-PLAN-39114, we believe that you should budget and adjust your timelines for the eventual Phase 3 RCRA Facility Investigation/Corrective Measures Study since the envisioned Phase 2 appears to follow a similar approach as Phase 1. An iterative approach to data collection and interpretation continues to be elusive. We had expected the *RCRA Facility Investigation Report for Hanford Single Shell Tank Waste Management Areas*, DOE/ORP-2008-01, Rev. 0, to perform this function, which it unfortunately didn't do. Ecology's acceptance of this document is problematic. The Work Plan for Waste Management Area C acknowledges that all of the characterization data were not considered and brought into the conceptual model as stated on page 4-29. (*"The Tank Farm Vadose Zone Program technical team plans to use existing information and the characterization data collected during the Phase 1 and near-term (FY 2008) characterization to develop a best basis or best estimate of the concentration and distribution of COC in WMA C. This will involve the integration and synthesis of historical data, process knowledge, in-tank inventory models, and the characterization data collected during Phase 1. The integration and synthesis of these data will require interpolation and extrapolation due to the limitations of collecting samples within the tank farms. This effort will result in a conceptualization of COC concentrations and distributions that would be used to evaluate human health and environmental risks.")* We recommend that Phase 2 not begin until all of the data from Phase 1 have been incorporated into the basis of knowledge for the WMA.

Before the work plan is approved, both DOE and Ecology should understand how the DOE/ORP approach in the Phase 1 characterization of the WMAs can be improved. In our opinion, the approach of Phase 1 was to collect data near the biggest leaks, within areas of known contamination based upon the existing boreholes, and to extrapolate this data via modeling in conjunction with geochemical studies of soil samples. The Phase 1 approach did not attempt to explain existing groundwater conditions underneath the farms. Despite exceeding drinking water standards for over a decade, the sources of groundwater contamination near the SST farms have not been identified by DOE and Ecology. As long as DOE and Ecology are unable to identify the sources of groundwater contamination within the vadose zone, contaminant fate and transport models will lack credibility, remediation efforts will ultimately be inadequate, and determining associated risk will be impossible. One goal of Phase 2 should be to track a leak or spill from its source to groundwater.

The wording within the figure for the Phase 1 Conceptual Model (see below) indicates that mobile contaminants will not reach groundwater until after closure. Simulations of WMA C tank farm groundwater conditions shown in the same document (see below) indicate that concentrations of Tc-99 will not exceed drinking water standards for 12,000 years. However, according to your letter, Appendix L of *RCRA Facility Investigation Report for Hanford single Shell Tank Waste Management Areas*, DOE/ORP-2008-01, Rev. 0, acknowledges that WMA C has "most likely" contaminated groundwater. Our interpretation of current groundwater data indicates that Tc-99 from C tank farm currently exceeds drinking water standards.

RPP-PLAN-39114, Rev. 0 p. 3-20

Figure 3-8. Alternative 1: Phase 1 Conceptual Model



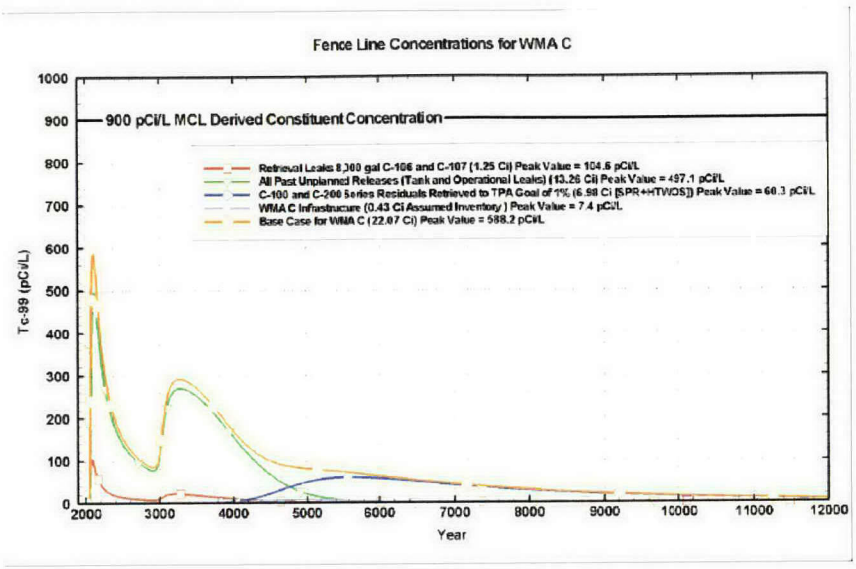


Figure 10-2. Tc-99 Groundwater Concentrations from All WMA C Sources

Both Phase 1 and the proposed Phase 2 appear to ignore areas of the deep vadose zone where contamination in the deep vadose zone can be projected to occur. Critical areas of the deep vadose zone will not be investigated. The C Farm work plan continues to focus the characterization activities on the hypothetical release sites, which is either the "spare inlet hypothesis" or near surface spills. This focus will leave critical areas of the deep vadose zone unevaluated, which will trigger "Phase 3".

Additionally, this focus ignores other potential modes of tank liner failure and ignores the implications of lateral migration of contaminants. For example, on page 4-8, the work plan states: *"The Phase 1 conceptual model was used to select a number of sites to investigate. These sites consist of known or potential release sites that may have impacted the soils (Figure 4-2). To support tanks that may have been overfilled and potentially lost waste out the spare inlet ports, sites A (C-101) and J (C-104) were chosen. Sites B, C, D, R, U, and V were chosen to support possible tank leaks and/or overfill events that lack existing drywell monitoring coverage. This includes southeast side of C-101 (Site B), the C-200-series tanks (Sites C and D, and C-801 (Site R). If contamination is found at Site C, the other C-200-series tanks (C-201, C-202, and C-204) will be investigated (Site D). Sites B, C, D, U, and V are also being investigated to evaluate alternative conceptual model 2."* Since the Nez Perce ERWM model is *"alternative conceptual model 2"*, it appears that we have failed to adequately convey how our model should be used to select drillsites. Sites "U" and "V" test the spare inlet hypothesis and aren't located downdip of the hypothetical leak source. Further, site "U" appears to twin the 30-10-09 drywell while the site "V" appears to split the gap between drywells 30-10-01 and 30-11-09. Site "B" appears close to drywell 30-01-06.

Another problem with the Phase 1 approach is the continued resistance to the creation of visualizations of vadose zone contamination based upon spectral gamma logging data. While it appears acceptable to portray the measurements in individual borehole visualizations of the vadose zone, the preparation of data visualizations of vadose zone contamination resulting from a tank leak are not being generated. Visualizations of vadose zone contamination based on spectral gamma logging that are generated using different algorithms and parameters are useful in identifying data gaps and determining areas for additional characterization. We used this approach in the B-BX-BY area, and this interpretation has withstood the test of conceptual models by the drill bit and time, while the DOE/ORP vadose zone team's results have been discredited. Other than visualizations based on HRR data, we don't believe that a DOE contractor has prepared a visualization of the vadose zone contamination of a tank leak since 2003. We are unaware of DOE/ORP ever issuing a document containing a visualization of vadose zone contamination and groundwater contamination resulting from a tank leak.

High resolution resistivity (HRR) surveys have not proved very reliable in the tank farms in the past, and we don't understand why DOE/ORP continues to promulgate HRR use throughout the farms. For example, the HRR survey of the B-BX-BY area failed to identify the area known to be contaminated by the BX-102 tank leak. Well locations were selected based upon the HRR survey of the B-BX-BY area for the BP-5 investigation. The sample and logging results from these wells failed to identify any significant vadose zone contamination in the areas of low resistivity. Further the continued application of the technique without understanding what went wrong in the B-BX-BY area appears to be ill-advised. We recommend that DOE refine and verify the HRR technique in one area (probably BC Cribs and Trenches) before they apply it in other areas. A process needs to be established for the Tri-parties to consider, evaluate, and formally validate the method. While the environmental "world" accepts certain analytical methods for decision making with recognized legal authority, new methods of such profound consequence require similar rigid control.

The Bismuth Germanate Oxide (BGO) logging system, used in conjunction with the direct push, has reported detection limits of approximately 0.5 pCi/g of ^{137}Cs and 0.6 for ^{60}Co. In the past, the drywells within the C WMA have been logged with Hanford's spectral gamma logging system; this logging system uses a high-purity germanium (HPGe) sonde with a detection limit of approximately 0.1 pCi/g for both ^{137}Cs and ^{60}Co. Hanford's spectral gamma logging system was scrutinized by an expert panel assigned by DOE in 1996, and was accepted as a viable method for characterizing radionuclides. No independent body has considered the small diameter logging and corroborated that the method is viable and detection limits are as reported. Additionally, given the differences in detection limits and lack of consistent standards, it will be extremely difficult to integrate these data into one database where all of the data are directly comparable. For example, due to the higher detection limits and radioactive decay, we estimate that if the BGO system was used to log all the drywells in the C WMA that the BGO sonde would detect ^{60}Co sixty times out of 15,540 measurements while HPGe logging reported 758 detections of ^{60}Co.

In our opinion, little of the Nez Perce ERWM's proposed characterization is included in the RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, RPP-PLAN-39114, Revision 0. According to this work plan the deep vadose zone

contamination detected at wells 299-E27-7 and 299-E27-14 are hardly worthy of further investigation. Contrary to the text of the work plan, the proposed push at site "B" is insufficient to evaluate the C-101 tank leak, 216-C-8 crib, and the contamination at 299-E27-14. The dismissal of deep vadose zone contamination near C tank farm is similar to dismissal of the uranium contamination at well 299-E33-41 near tank BX-102. The contamination at 299-E27-7 was discovered because EPA directed DOE/RL to log the well.

At the present time, ERWM recommends the following:

1. Integrate the vadose/groundwater investigations both inside and outside the tank farms by having only one contractor interpreting the existing data and writing DQOs and associated documents. This contractor should use the existing information and the characterization data collected during the Phase 1 and near-term (FY 2008) characterization to develop a best basis or best estimate of the concentration and distribution of COC in WMA C prior to the collection of data for Phase 2. Ecology should not approve the work plan until the estimate of the distribution of contaminants is complete.
2. DOE/ORP needs to integrate with DOE-RL and be common signatories on these documents so that all available information is considered
3. Incorporate our recommendations for the *WMA C 3D Model*, CH2M-37668, Rev. 1 Draft, which are listed in Attachment 1.
4. DOE should develop an integrated conceptual model for WMA C. Conceptual models on the current distribution of contaminants in the vadose zone and groundwater and migration from the vadose zone to the aquifer are not clearly presented and are not supported by field data. An integrated conceptual model consists of an interpretation of geophysical logs, drillers logs, geologic sample descriptions, soil/sediment sampling and groundwater sampling which depict stratigraphy and vadose and groundwater contamination. Ecology should not approve the work plan until the conceptual model is complete.
5. Stratigraphic controls on waste migration in the vadose zone should be incorporated into the models and considered when selecting new borehole locations.
6. Every proposed characterization borehole should be supported by a strike and dip geological cross section, which shows all vadose zone and aquifer field data on contamination, and similar data from geophysical logs. Ecology should approve the collection of field data only after the supporting information is compiled.
7. DOE should prepare visualizations of the vadose zone contamination in the WMA and the resulting groundwater contamination. Ecology should not approve the work plan until the estimate of the distribution of contaminants is complete.
8. Verification of the leak assessment (RPP-ENV-33418, Rev. 1) for tank C-111 by drilling a slant hole similar to the slant hole drilled at tank SX-108. This slant hole would start at location "K" and terminate under tank C-111.
9. Further characterization at sites "U" and "V" should be removed from the work plan.
10. The proposed Site "B" should be drilled at a location which is located between tank C-101 and groundwater well 299-E27-14, which is approximately the 3 o'clock position at tank C-101.
11. Site "S" should be located midway between tank C-101 and groundwater well 299-E27-14.
12. Site "C" should be located between tank C-201 and groundwater well 299-E27-7.

13. Outside of the C tank farm, use the direct push to collect samples in the deep vadose zone where radionuclides were detected at wells 299-E27-7 and 299-E27-14 by twining these locations.
14. Boreholes should be drilled northeast of each of the 200 series tanks regardless of the amount of contamination found at site "C". Ecology should not approve the work plan unless DOE agrees to characterize all of the 200 series tanks
15. Implement the recommendations for the temperature logging of the drywells in the tank farms made recommendations in the *Tank Waste Remediation System Vadose Zone Contamination Issue: Independent Expert Panel Status Report*, DOE/RL-97-49, Rev. 0.over a decade ago. Ecology should insist that the recommendations of the expert panel are implemented.
16. Modify the direct push to drive casing down with a larger diameter casing that supports the use of a variety of logging tools including the HPGe detector. Ecology should not approve the work plan until DOE agrees to collect geophysical logging data using sondes that are calibrated and with a detection limit of 0.1 pCi/g for ^{60}Co.
17. When using the direct-push method to collect soil samples, soil samples should be collected as each additional length of pipe is added to the drill string. We understand that this interval is approximately every four feet. If the presence of gamma-emitting radionuclides is used as criteria for the collection of soil samples using the "direct-push technology", intervals for sampling should be based on gamma spectra collected using sonde with a detection limit of 0.1 pCi/g for ^{60}Co.
18. Install drywell monitoring boreholes around tank C-102 at the three o'clock and six o'clock positions.

Since we have a limited amount of time and resources to review the work plan, ERWM's anticipates the development of additional recommendations as time permits.

ERWM would appreciate timely participation in the further development of the work plan for WMA C. Please contact Stan Sobczyk of our staff, at (208) 843-7375, ext. 3751 for inclusion into an open decision-making process and close coordination to expedite the work needed to close WMA C in a manner that protects human health and the Nez Perce Tribe's retained treaty rights and the Columbia River.

Sincerely,

Gabriel Bohnee
ERWM Director

Enclosure

Cc: Dave Brockman, DOE/RL
Stuart Harris, CTUIR
Russell Jim, YIN
Ken Niles, Oregon
D. Campbell, EPA

Attachment 1

Nez Perce Tribe ERWM
Comments on:

***WMA C 3D Model*, CH2M-37668, Rev. 1 Draft**

Nez Perce
ENVIRONMENTAL RESTORATION & WASTE MANAGEMENT
P.O. BOX 365 • LAPWAI, IDAHO 83540-0365 • (208) 843-7375 / FAX: 843-7378

August 27, 2008

Robert W. Lober
US DOE, Richland Operations
P.O. Box 550, MSIN: H6-60
Richland, WA 99352

Re: *WMA C 3D Model*, CH2M-37668, Rev. 1 Draft

Dear Mr. Lober:

The Nez Perce Tribe retains reserved treaty rights in the Mid-Columbia region under the Treaty of 1855 with the United States Government. These rights have been recognized and affirmed through subsequent Federal and State actions. These actions protect Nez Perce rights to utilize our usual and accustomed resources and resource areas, including those in the Hanford Reach of the Columbia River. Accordingly, the Nez Perce Tribe Environmental Restoration and Waste Management program (ERWM) has support from the Department of Energy (DOE) to participate in and monitor relevant DOE activities. Degradation of groundwater is relevant to reserved treaty rights, and therefore we maintain involvement in waste management/vadose zone/groundwater issues.

The Nez Perce ERWM appreciates the opportunity to review the *WMA C 3D Model*, CH2M-37668, Rev. 1 Draft. We support the concept of developing three dimensional models of tank farms and waste sites, which we have been doing since 2005. Our three dimensional models are developed by mapping stratigraphic layers as determined by a correlating spectral gamma log and constructing cross sections in the area of interest. We also include vadose zone and groundwater plumes as well as the geology.

The model (*WMA C 3D Model*, CH2M-37668, Rev. 1 Draft) was easy to manipulate to display multiple views. The default views were useful in enabling new users to reset the viewer while viewing the model. Also, we found the instructions in the readme files both clear and applicable. The Nez Perce ERWM recommend the inclusion of the following items into *WMA C 3D Model*, CH2M-37668, Rev. 1 Draft.

1. The well and drywell locations should be labeled
2. Push-hole geophysical results
3. Historic gross gamma logging results (mid 1950s to 1994)
4. Projections of vadose zone plumes
5. Maps of groundwater contamination. Currently, only trend plots for a limited number of constituents are included.
6. High Resolution Resistivity (HRR) results. Since the current HRR survey doesn't contain depth information. The results should be placed in the visualization at a plane with an elevation (~162 m) that is midway between groundwater and the ground surface.
7. Cross sections through drywell locations in the strike and dip directions. The Nez Perce ERWM model consists of four dip cross sections and two strike cross sections. The influence of stratigraphy upon the subsurface distribution of radionuclides in Hanford's subsurface should be recognized. This influence was recognized at least as early as 1948 (Brown and Rupert 1948). The purpose of correlating the stratigraphic units is to evaluate and account for their effect on lateral transport. "Stratification tends to increase spreading of liquids along bedding planes and along contacts between sedimentary units" (Fecht et al. 1977).
8. An integrated geologic model for WMA C. The current geologic model is based upon the author's digitization of cross sections that depict grain-size that are displayed in Price and Fecht (1976) and interpretation of this grain-size information to arrive at stratigraphic units. Instead, the geologic model should be based on an integrated interpretation of geophysical logs, drillers logs and geologic sample descriptions. Further, Bjornstad (2004) doesn't list contacts from Price and Fecht (1976) in the geologic contacts database for the 200 Areas.

The use of geophysical logs to correlate stratigraphy is well established and has been used in tank farms in the past. Within the C tank farm, DOE's most recent use of geophysical dry well logging to correlate stratigraphy was documented in DOE (1992). All spectral gamma and neutron-moisture log data should be correlated in an effort to identify geophysical markers, contaminated zones, and potential contaminant sources. This data acquired in 76 boreholes need to be interpreted and correlated with existing geologic sample descriptions for the tank farm. The spectral gamma-ray logs for the naturally occurring isotopes (^{40}K, ^{238}U, and ^{232}Th) and total gamma logs for each borehole should be compared and correlated with those from surrounding boreholes and checked for the presence of man-made radionuclides. After noting any influences of man-made radionuclides and changes in casing thickness on the spectral and total gamma logs, geophysical markers can be identified. The purpose of this exercise is to identify and correlate sedimentary features between boreholes that may influence the migration of

contaminants in the vadose zone. At least two northwest-southeast (strike) cross-section and four northeast-southwest (dip) cross-sections should be developed for WMA C.

ERWM would appreciate timely participation in the further development of the RCRA field investigation and correction measures for the SST WMAs. Please contact Stan Sobczyk of our staff, at (208) 843-7375, ext. 3751 for inclusion into an open decision-making process and close coordination to expedite the work needed to remediate the vadose zone to protect the Nez Perce Tribe's retained treaty rights and the Columbia River.

Sincerely,

Gabriel Bohnee
Director

Cc: Dave Brockman, DOE RL
Nick Ceto, EPA
Francis SiJohn, DOE RL
Ken Niles, Oregon
Jane Hedges, Ecology
Stuart Harris, CTUIR
Russell Jim, YIN

References

Bjornstad, B.N., 2004. *Geologic Contacts Database for the 200 Areas of the Hanford Site*, WPM-22817, Rev. 0, Fluor Hanford, Richland, Washington.

Brown, R.E. and H.G. Rupert, 1948. *Underground Waste Disposal at Hanford Works*, HW-9671, General Electric Hanford Company, Richland, Washington.

Fecht, K.R., G.V. Last, and K.R. Price, 1977. *Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells*, ARH-ST-156, Atlantic Richfield Hanford Company, Richland, Washington.

Price, W.H. and K.R. Fecht, 1976. Geology of the 241-C Tank Farm, Informal Report, ARH-LD-132, Atlantic Richfield Hanford Company, Richland, Washington.

U.S. Department of Energy (DOE), 1992. *Purex Source Aggregate Area Management Study Report*, DOE/RL-92-04, Draft A, U.S. Department of Energy, Richland, Washington.

0900955
CC Recd: 04/24/2009

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • (509) 372-7950

April 23, 2009

Ms. Shirley J. Olinger, Manager
Office of River Protection
United States Department of Energy
P.O. Box 450, MSIN: H6-60
Richland, Washington 99352

Re: Department of Ecology Review of the *Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C*, RPP-PLAN-3877, Revision 0, Associated with the *RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, RPP-PLAN-39114, Revision 0

Reference: See page 2

Dear Ms. Olinger:

The Department of Ecology reviewed the *Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C*, RPP-PLAN-3877, Revision 0 (reference).

Enclosed are our comments for incorporation into the next revision of this document. We are currently working under the *Field Sampling and Analysis Plan for Sites P and L at Waste Management Area C,* RPP-PLAN-40564, Revision 0.

We have discussed our comments with your staff and your contractors. After Ecology's review of your responses to our comments and the revision of the document, we will either notify you of our approval or request further clarification.

If there are any questions, contact me at 509-372-7914.

Sincerely,

for

Jeffery J. Lyon
Tank Waste Storage Project Manager
Nuclear Waste Program

mb/aa
Enclosure

cc: See page 2

Ms. Shirley J. Olinger
April 23, 2009
Page 2

Reference: Letter 08-TPD-090, dated December 18, 2008, from S. J. Olinger, USDOE-ORP, to J. A. Hedges, Ecology, "Transmittal of the Resource Conservation and Recovery Act (RCRA) Facility Investigation/Corrective Measures Study (RFI/CMS) Work Plan for Waste Management Area (WMA) C as Required by Hanford Federal Facilities Agreement and Consent Order (AKA Tri-Party Agreement) Milestone M-045-60"

cc: Stuart Harris, CTUIR
Gabriel Bohnee, NPT
Russell Jim, YN
Susan Leckband, HAB
Ken Niles, ODOE
Administrative Record: SST/Tank Waste Storage
Environmental Portal
Hanford Operating Record General File

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.
	Project No. WMA C SAP	Page 1 of 2

Document Number(s)/Title(s)	Program/Project/Building Number	Review	Organization/Group	Location/Phone
RPP-PLAN-38777, Rev. 0		Sample and Analysis Plan	Ecology	

Comment Submittal Approval: Agreement with indicated comment disposition(s) Status:

Organization Manager (Optional) Date

Reviewer/Point of Contact Date

Reviewer/Point of Contact

Author/Originator

Author/Originator

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)
1.	General Comment	Please put a scale and North arrow on all maps.
2.	General Comment	Where this document refers to performance assessments and risk assessments, please add text referring to the process that is ongoing with NRC for the WMA C performance assessment. Please make appropriate changes in this document to resolve any inconsistencies between the plans documented here and the ongoing WMA C performance assessment development process.
3.	p. 3-3 item 2	The stated length for slant boreholes is 200 ft. Is this length along the inclined path, or 200 ft. in the vertical dimension? Please clarify.
4.	p. 3-3	Specify what might happen if contaminants are found or are indicated to be below the termination depth of the push hole, especially in light of the fact that the deep vadose zone contaminant profile is largely unknown and that the deep vadose zone is the zone "feeding" groundwater direction. Please address.
5.	General Comment Section 3	C-101 is potentially the largest release from C Farm, and the SST PA indicated that it essentially controlled the risk for releases from C Farm. Please justify why only one push hole is planned at this location.
6.	p 3-4 para 4	What is the basis for using data from C-203 as a basis for deciding whether additional data for other C-200 tanks is needed? Please clarify and explain.
7.	p. 4-1, Section 4.1.1	The text states "If TBP is not detected in any of the samples then organics associated with tank waste will be eliminated from the list of COPCs…" However, samples will be analyzed for pesticides, petroleum, and PCBs, all of which are organics. PCBs and petroleum could come from tank waste. Please use a more specific term than organics for the type of organics that TBP is expected to indicate.

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.
	Project No. WMA C SAP	Page 2 of 2

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)
8.	p. 4-1 section 4.1.1	Please include a discussion on why these five sites were selected for organics, and discuss if organics are present in all tank wastes.
9.	p 4-2 step 1	Analytes do not include elevated pH, elevated Na, SO4, or elevated Cl which have been found in at least two boreholes, one north and one south of C Farm. These are interpreted as evidence of tank waste passing through the site, even though no radiological or dangerous waste constituents are present. Please explain the exclusion of these analytes or include them here
10.	General Comment Section 4	Previous studies indicate that elevated pH (above 8.0) is a likely indicator of the passage of tank waste through soil. pH is neither a cation or anion, but is commonly measured. No mention is made here of pH as a possible indicator of tank waste. Was this an oversight? Please clarify.
11.	p. 5-7 – 5-8, Table 5-3	Please provide detection limits for boron, molybdenum, and tin. These metals are analyzed in soils by other projects so detection limits should be available. Molybdenum is indicated as primary on Table 5-5.
12.	p. 5-10 – 5-13, Table 5-5	The following detection limits are above what Ecology would consider to be WAC 173-340 Method B cleanup levels for soil for the protection of groundwater: Chromium total (exceeds 0.2 mg/kg which would apply to hexavalent Cr) Chloroform (exceeds 0.0038 mg/kg) 1,1-Dichloroethylene (exceeds 5.22E-04 mg/kg) Hexachloroethane (exceeds 0.125 mg/kg) 2-Nitropropane (exceeds 2.08E-05 mg/kg) 1,1,2,2-Tetrachlorethane (exceeds 1.23E-03 mg/kg) Tetrachloroethene (exceeds 8.59E-04 mg/kg) Butanol (exceeds 3.31 mg/kg) Nitrobenzene (exceeds 0.026 mg/kg) Nitroso-di-n-propylamine (exceeds 5.6E-05 mg/kg) Vinyl chloride (exceeds 1.84E-04 mg/kg) Pyridine (exceeds 3.73E-02 mg/kg) 2,4,6-Trichlorphenol (exceeds 4.62E-02 mg/kg) Tributyl phosphate (exceeds 0.677 mg/kg) Benzo(a)pyrene (exceeds 0.232 mg/kg) Aroclor -1232 and Aroclor-1242 (exceed 9.2E-03 mg/kg) Please pursue lower detection limits for these analytes, especially for the more common analytes TBP and Cr.
13.	p 6-1 format V	Ecology will require the characterization data to be validated.

0080878

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • (509) 372-7950

April 23, 2009

Ms. Shirley J. Olinger, Manager
Office of River Protection
United States Department of Energy
P.O. Box 450, MSIN: H6-60
Richland, Washington 99352

Re: Department of Ecology Review of the *Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C*, RPP-PLAN-3877, Revision 0, Associated with the *RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, RPP-PLAN-39114, Revision 0

Reference: See page 2

Dear Ms. Olinger:

The Department of Ecology reviewed the *Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C*, RPP-PLAN-3877, Revision 0 (reference).

Enclosed are our comments for incorporation into the next revision of this document. We are currently working under the *Field Sampling and Analysis Plan for Sites P and L at Waste Management Area C,* RPP-PLAN-40564, Revision 0.

We have discussed our comments with your staff and your contractors. After Ecology's review of your responses to our comments and the revision of the document, we will either notify you of our approval or request further clarification.

If there are any questions, contact me at 509-372-7914.

Sincerely,

for

Jeffery J. Lyon
Tank Waste Storage Project Manager
Nuclear Waste Program

RECEIVED
APR 28 2009
EDMC

mb/aa
Enclosure

cc: See page 2

Ms. Shirley J. Olinger
April 23, 2009
Page 2

Reference: Letter 08-TPD-090, dated December 18, 2008, from S. J. Olinger, USDOE-ORP, to J. A. Hedges, Ecology, "Transmittal of the Resource Conservation and Recovery Act (RCRA) Facility Investigation/Corrective Measures Study (RFI/CMS) Work Plan for Waste Management Area (WMA) C as Required by Hanford Federal Facilities Agreement and Consent Order (AKA Tri-Party Agreement) Milestone M-045-60"

cc: Stuart Harris, CTUIR
Gabriel Bohnee, NPT
Russell Jim, YN
Susan Leckband, HAB
Ken Niles, ODOE
Administrative Record: SST/Tank Waste Storage
Environmental Portal
Hanford Operating Record General File

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.
	Project No. WMA C SAP	Page 1 of 2

Document Number(s)/Title(s)	Program/Project/Building Number	Review	Organization/Group	Location/Phone
RPP-PLAN-38777, Rev. 0		Sample and Analysis Plan	Ecology	

Comment Submittal Approval: Agreement with indicated comment disposition(s) Status:

Organization Manager (Optional) Date Reviewer/Point of Contact Date Reviewer/Point of Contact

Author/Originator Author/Originator

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)
1.	General Comment	Please put a scale and North arrow on all maps.
2.	General Comment	Where this document refers to performance assessments and risk assessments, please add text referring to the process that is ongoing with NRC for the WMA C performance assessment. Please make appropriate changes in this document to resolve any inconsistencies between the plans documented here and the ongoing WMA C performance assessment development process.
3.	p. 3-3 item 2	The stated length for slant boreholes is 200 ft. Is this length along the inclined path, or 200 ft. in the vertical dimension? Please clarify.
4.	p. 3-3	Specify what might happen if contaminants are found or are indicated to be below the termination depth of the push hole, especially in light of the fact that the deep vadose zone contaminant profile is largely unknown and that the deep vadose zone is the zone "feeding" groundwater direction. Please address.
5.	General Comment Section 3	C-101 is potentially the largest release from C Farm, and the SST PA indicated that it essentially controlled the risk for releases from C Farm. Please justify why only one push hole is planned at this location.
6.	p 3-4 para 4	What is the basis for using data from C-203 as a basis for deciding whether additional data for other C-200 tanks is needed? Please clarify and explain.
7.	p. 4-1, Section 4.1.1	The text states "If TBP is not detected in any of the samples then organics associated with tank waste will be eliminated from the list of COPCs…" However, samples will be analyzed for pesticides, petroleum, and PCBs, all of which are organics. PCBs and petroleum could come from tank waste. Please use a more specific term than organics for the type of organics that TBP is expected to indicate.

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.
	Project No. WMA C SAP	Page 2 of 2

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)
8.	p. 4-1 section 4.1.1	Please include a discussion on why these five sites were selected for organics, and discuss if organics are present in all tank wastes.
9.	p 4-2 step 1	Analytes do not include elevated pH, elevated Na, SO4, or elevated Cl which have been found in at least two boreholes, one north and one south of C Farm. These are interpreted as evidence of tank waste passing through the site, even though no radiological or dangerous waste constituents are present. Please explain the exclusion of these analytes or include them here
10.	General Comment Section 4	Previous studies indicate that elevated pH (above 8.0) is a likely indicator of the passage of tank waste through soil. pH is neither a cation or anion, but is commonly measured. No mention is made here of pH as a possible indicator of tank waste. Was this an oversight? Please clarify.
11.	p. 5-7 – 5-8, Table 5-3	Please provide detection limits for boron, molybdenum, and tin. These metals are analyzed in soils by other projects so detection limits should be available. Molybdenum is indicated as primary on Table 5-5.
12.	p. 5-10 – 5-13, Table 5-5	The following detection limits are above what Ecology would consider to be WAC 173-340 Method B cleanup levels for soil for the protection of groundwater: Chromium total (exceeds 0.2 mg/kg which would apply to hexavalent Cr) Chloroform (exceeds 0.0038 mg/kg) 1,1-Dichloroethylene (exceeds 5.22E-04 mg/kg) Hexachloroethane (exceeds 0.125 mg/kg) 2-Nitropropane (exceeds 2.08E-05 mg/kg) 1,1,2,2-Tetrachlorethane (exceeds 1.23E-03 mg/kg) Tetrachloroethene (exceeds 8.59E-04 mg/kg) Butanol (exceeds 3.31 mg/kg) Nitrobenzene (exceeds 0.026 mg/kg) Nitroso-di-n-propylamine (exceeds 5.6E-05 mg/kg) Vinyl chloride (exceeds 1.84E-04 mg/kg) Pyridine (exceeds 3.73E-02 mg/kg) 2,4,6-Trichlorphenol (exceeds 4.62E-02 mg/kg) Tributyl phosphate (exceeds 0.677 mg/kg) Benzo(a)pyrene (exceeds 0.232 mg/kg) Aroclor -1232 and Aroclor-1242 (exceed 9.2E-03 mg/kg) Please pursue lower detection limits for these analytes, especially for the more common analytes TBP and Cr.
13.	p 6-1 format V	Ecology will require the characterization data to be validated.

0080375

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • (509) 372-7950

April 24, 2009

RECEIVED
APR 28 2009
EDMC

Ms. Shirley J. Olinger, Manager
Office of River Protection
United States Department of Energy
P.O. Box 450, MSIN: H6-60
Richland, Washington 99352

Re: Department of Ecology Review of the *RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, RPP-PLAN-39114, Revision 0

Dear Ms. Olinger:

The Department of Ecology reviewed the referenced document. Our enclosed comments need to be part of a larger discussion on Waste Management Area C (WMA C) closure. We have met with your staff and your contractors to discuss differing ideas on WMA C closure and the process to follow. We understand the importance of a mutual agreement on this process and that it may take time to reach an agreement. Therefore, Ecology requests the United States Department of Energy-Office of River Protection to:

- Continue to meet with Ecology to develop and finalize this process.
- Review the enclosed comments and meet with Ecology to discuss the issues and where best to address them.
- Send Ecology the requested information on the next set of pushes in WMA C Farm.

We are available to discuss and resolve issues developed from our review of the *Phase 2 RCRA Facility Investigation/Corrective Measures Study Master Work Plan for Single-Shell Tank Waste Management Areas*, RPP-PLAN-37243, Revision 1. Some of these issues may need to be incorporated into the referenced document.

If there are any questions, contact me at 509-372-7914.

Sincerely,

Jeffery J. Lyon
Tank Waste Storage Project Manager
Nuclear Waste Program

mb/aa
Enclosure

cc: See page 2

Reference: Letter 08-TPD-090, dated December 18, 2008, from S. J. Olinger, USDOE-ORP, to J. A. Hedges, Ecology, "Transmittal of the Resource Conservation and Recovery Act (RCRA) Facility Investigation/Corrective Measures Study (RFI/CMS) Work Plan for Waste Management Area (WMA) C as Required by Hanford Federal Facilities Agreement and Consent Order (AKA Tri-Party Agreement) Milestone M-045-60"

cc: Stuart Harris, CTUIR
Gabriel Bohnee, NPT
Russell Jim, YN
Susan Leckband, HAB
Ken Niles, ODOE
Administrative Record: SST/Tank Waste Management
Environmental Portal
Hanford Operating Record General File
USDOE-ORP Correspondence Control

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 1 of 7

Document Number(s)/Title(s)	Program/Project/Building Number	Reviewer	Organization/Group	Location/Phone
RPP-PLAN-39114, Rev. 0			Ecology	

Comment Submittal Approval: Agreement with indicated comment disposition(s) Status:

Organization Manager (Optional) _____ Date

Reviewer/Point of Contact _____ Date

Reviewer/Point of Contact _____

Author/Originator _____

Author/Originator _____

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)
1.	General Comment	Where this document refers to performance assessments and risk assessments, please add text referring to the process that is ongoing with NRC for the WMA C performance assessment. Please make appropriate changes in this document to resolve any inconsistencies between the plans documented here and the ongoing WMA C performance assessment development process.
2.	General Comment	Units of measure should remain consistent, and where both IU as well as British units are given, a conversion should be provided. For example, compare pg. 2-12, line 42 with Table 2-1 (pg 2-13) where the units are different in the two locations. Please correct at this location and throughout the document.
3.	General Comment	This work plan, RCRA FI/CMS Work Plan for WMA C, Revision 0, Nov 2008, fails to identify the conceptual process for performing RCRA corrective actions to support closure of the SST WMA. The work plan must be revised to address the closure requirements of WAC 173-303.
4.	General Comment	The SST closure plan to be issued by the Department of Ecology will include SST corrective actions. The corrective actions described in this document are not independent actions. These are also closure actions and will be incorporated into the SST closure plan.
5.	General Comment	Source waste sites (soil) inside and potentially adjacent to the WMA are subject to RCRA closure and corrective action, not CERCLA as stated. Groundwater will also be subject to RCRA closure and corrective action, not just CERCLA as stated.
6.	General Comment	Only cleanup actions that meet the closure performance standards will achieve final closure of the WMAs.
7.	General Comment	Characterization of the WMAs must consider the closure performance standards to achieve final closure of the WMAs. All characterization conducted on the SST System, whether within a WMA or on ancillary equipment located outside the WMAs, must identify and incorporate constituents and detection levels to be used in the closure process.

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 1 of 7

Document Number(s)/Title(s)	Program/Project/Building Number	Reviewer	Organization/Group	Location/Phone
RPP-PLAN-39114, Rev. 0			Ecology	

Comment Submittal Approval: Agreement with indicated comment disposition(s) Status:

Organization Manager (Optional) _____ Date

Reviewer/Point of Contact _____ Date

Reviewer/Point of Contact _____

Author/Originator _____

Author/Originator _____

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)
1.	General Comment	Where this document refers to performance assessments and risk assessments, please add text referring to the process that is ongoing with NRC for the WMA C performance assessment. Please make appropriate changes in this document to resolve any inconsistencies between the plans documented here and the ongoing WMA C performance assessment development process.
2.	General Comment	Units of measure should remain consistent, and where both IU as well as British units are given, a conversion should be provided. For example, compare pg. 2-12, line 42 with Table 2-1 (pg 2-13) where the units are different in the two locations. Please correct at this location and throughout the document.
3.	General Comment	This work plan, RCRA FI/CMS Work Plan for WMA C, Revision 0, Nov 2008, fails to identify the conceptual process for performing RCRA corrective actions to support closure of the SST WMA. The work plan must be revised to address the closure requirements of WAC 173-303.
4.	General Comment	The SST closure plan to be issued by the Department of Ecology will include SST corrective actions. The corrective actions described in this document are not independent actions. These are also closure actions and will be incorporated into the SST closure plan.
5.	General Comment	Source waste sites (soil) inside and potentially adjacent to the WMA are subject to RCRA closure and corrective action, not CERCLA as stated. Groundwater will also be subject to RCRA closure and corrective action, not just CERCLA as stated.
6.	General Comment	Only cleanup actions that meet the closure performance standards will achieve final closure of the WMAs.
7.	General Comment	Characterization of the WMAs must consider the closure performance standards to achieve final closure of the WMAs. All characterization conducted on the SST System, whether within a WMA or on ancillary equipment located outside the WMAs, must identify and incorporate constituents and detection levels to be used in the closure process.

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 2 of 7

8.	General Comment	Closure will address structures, soil and groundwater contamination.
9.	General Comment	Both RCRA closure and corrective action will be contained in the SST System closure plan. Corrective action for the SST System is part of the draft closure plan. This section is currently reserved in the closure plan. Detail will be incorporated into the closure plan through permit modifications Ecology is incorporating the corrective action of the SST System into the SST closure plan in order to integrate schedules and physical actions and regulatory requirements.
10.	General Comment	It is inappropriate to use only the document number in referring to documents. This practice is repeated throughout the document.
11.	p. 2-12, sect 2.3.4	Groundwater monitoring at WMA C is conducted FOR compliance with WAC 173-303-400 (and by reference 40 CFR 265, Subpart F) because WMA C is a RCRA TSD unit. Data from some groundwater monitoring wells is used to support the 200-BP-5 groundwater operable unit. Please correct.
12.	Pg. 2-12, lines 16 – 19	B Pond was located east of WMA C (not north) and the B Pond mound led to groundwater flow to the west-northwest. With cessation of discharges to B Pond, groundwater flow direction is slowly changing back to the pre-Hanford west to east direction of groundwater flow. Please correct.
13.	Pg. 2-13, lines 16 – 24	If slug tests at different levels in the well screen indicate different hydraulic conductivities and flow rates, why was a single long screen placed in these wells that bridge different units of differing hydraulic characteristics rather than a single screen at the interval of highest contamination? The effect could be a dilution of contaminants that masks the real level of contamination in a well. Please address.
14.	Pg. 3-3, line 27	WMA C is a RCRA TSD unit, NOT a past practice unit. Appendix C of the HFFACO does not include a 200-PO-3 operable unit, but Appendix B does. Please correct this work plan and make the HFFACO consistent.
15.	Pg. 3-6, line 13	Please explain what "elevated pH values and high sodium content" means if these are considered indicators of the presence or passage of tank waste.
16.	Pg. 3-6, lines 23, 24	Please provide some details regarding the appearance of Tc-99 in a "nearby monitoring well."
17.	Pg. 3-6, 3-7, sect 3.2.1.1	While this is a nice summary of data, it doesn't state whether this data is indicative of a release and why it is. Please clarify and explain.
18.	Pg. 3-13, lines 6, 7	Please provide a technical basis for the statement, "....and the subsequent natural recharge do not appear sufficient to have contaminated groundwater in the 36 to 38 years since the release events."
19.	Pg. 3-18, lines 25-31	As CN is found in groundwater in well 299-E27-7, and the only likely nearby source is C Tank Farm, this constituent should be added to the constituent list. Please add.
20.	Pg. 3-18, lines	This discussion mentions soil waste interaction in the vadose zone to include sorption and precipitation, but doesn't address

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 2 of 7

8.	General Comment	Closure will address structures, soil and groundwater contamination.
9.	General Comment	Both RCRA closure and corrective action will be contained in the SST System closure plan. Corrective action for the SST System is part of the draft closure plan. This section is currently reserved in the closure plan. Detail will be incorporated into the closure plan through permit modifications Ecology is incorporating the corrective action of the SST System into the SST closure plan in order to integrate schedules and physical actions and regulatory requirements.
10.	General Comment	It is inappropriate to use only the document number in referring to documents. This practice is repeated throughout the document.
11.	p. 2-12, sect 2.3.4	Groundwater monitoring at WMA C is conducted FOR compliance with WAC 173-303-400 (and by reference 40 CFR 265, Subpart F) because WMA C is a RCRA TSD unit. Data from some groundwater monitoring wells is used to support the 200-BP-5 groundwater operable unit. Please correct.
12.	Pg. 2-12, lines 16 – 19	B Pond was located east of WMA C (not north) and the B Pond mound led to groundwater flow to the west-northwest. With cessation of discharges to B Pond, groundwater flow direction is slowly changing back to the pre-Hanford west to east direction of groundwater flow. Please correct.
13.	Pg. 2-13, lines 16 – 24	If slug tests at different levels in the well screen indicate different hydraulic conductivities and flow rates, why was a single long screen placed in these wells that bridge different units of differing hydraulic characteristics rather than a single screen at the interval of highest contamination? The effect could be a dilution of contaminants that masks the real level of contamination in a well. Please address.
14.	Pg. 3-3, line 27	WMA C is a RCRA TSD unit, NOT a past practice unit. Appendix C of the HFFACO does not include a 200-PO-3 operable unit, but Appendix B does. Please correct this work plan and make the HFFACO consistent.
15.	Pg. 3-6, line 13	Please explain what "elevated pH values and high sodium content" means if these are considered indicators of the presence or passage of tank waste.
16.	Pg. 3-6, lines 23, 24	Please provide some details regarding the appearance of Tc-99 in a "nearby monitoring well."
17.	Pg. 3-6, 3-7, sect 3.2.1.1	While this is a nice summary of data, it doesn't state whether this data is indicative of a release and why it is. Please clarify and explain.
18.	Pg. 3-13, lines 6, 7	Please provide a technical basis for the statement, "....and the subsequent natural recharge do not appear sufficient to have contaminated groundwater in the 36 to 38 years since the release events."
19.	Pg. 3-18, lines 25-31	As CN is found in groundwater in well 299-E27-7, and the only likely nearby source is C Tank Farm, this constituent should be added to the constituent list. Please add.
20.	Pg. 3-18, lines	This discussion mentions soil waste interaction in the vadose zone to include sorption and precipitation, but doesn't address

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 3 of 7

	8 – 17	desorption which can be facilitated by later addition of moisture to the soil. Please include desorption.
21.	Pg. 3-18, 19, lines 37 through 3	Mention of the depth limitation of information is appropriate here, because push technology and some boreholes do penetrate the entire vadose zone. Yet, contaminants in the deep vadose zone can be inferred based on data from groundwater monitoring wells. Please include depth limitations of characterization boreholes.
22.	Pg. 3-19, line 7	Change "will" to "is expected to," and that expectation was used in model simulations. Please change.
23.	Pg. 3-21, lines 5 – 8	The February 1979 flooding of T Farm is but one example of a process that likely occurred at other farms in February 1979 as well as other times in the past during site operations. Please qualify.
24.	Pg. 3-23, line 15	Clastic dikes are TABULAR (not tubular) bodies. Previous model simulations incorrectly portrayed clastic dikes as pipes and thus incorrectly concluded that clastic dikes have no significance in fate and transport of contaminants to groundwater. Please correct.
25.	Pg. 3-23, lines 34 - 42	While it is true that the possibility of intersecting a clastic dike in a characterization is limited, there is sufficient information on clastic dikes and their properties to "create" an imaginary clastic dike in modeling simulations of fate and transport analyses
26.	General Comment on conceptual models	With each conceptual model, it is possible to also conduct sensitivity studies that vary the input parameter values for a specific input characteristic. For example, one could run sensitivity analyses of the number, geometry and material characteristics of clastic dikes within a farm, the location and number of unsealed boreholes, variations on recharge, flood frequency and volume, and water releases from pipelines. Please include some discussion of sensitivity studies and their value to planning future site characterization and in planning for remediation/closure.
27.	p. 3-24 – 3-27, sect 3.3.5	Please include a conceptual model for shallow releases within C farm. There are at least 6 UPRs inside the farm that have not been discussed in this section, (UPR-200-E-16, UPR-200-E-27, UPR-200-E-68, UPR-200-E-81, UPR-200-E-107, UPR-200-E-118), which include surface spills from pipelines, leaks and airborne releases from diversion boxes and vaults, and airborne releases from tanks.
28.	p.3-27 to 3-42, sect 3.4	Re performance assessment, text on human health risk (Section 3.4.1) appears short, relative to text on eco risk (Section 3.4.2). For example, eco risk describes identification of contaminants of concern (Section 3.4.2.3.1) and uncertainty analysis (Section 3.4.2.3.3), while human health risk does not. Please address.
29.	p. 3-27, sect 3.3.5.5, lines 30-31	Please delete the text "These releases and the conceptual model are not believed to represent a risk to groundwater but potentially are a risk through direct contact and to ecological receptors." Ecology considers them a threat to groundwater as well as a threat through direct contact and ecological contact. WAC 173-340-740(6)(b) gives the point of compliance for soil cleanup levels based on the protection of groundwater to be the soils throughout the site (no depth limit is considered). We will use soil concentrations when evaluating whether or not the UPRs are a threat to groundwater.
30.	p. 3-28, para 4	EPA eco risk guidance should also be listed: 1) EPA. 1998. Guidance for ERA. EPA/630/R-95/002F. 2) EPA. 1997. ERAGS. EPA/540-R-97-006.

		3) EPA. 1997. EPA Region 10 Supplemental ERAGS. EPA 910-R-97-005.
31.	p. 3-29, para 2	Although it is stated, "the reasonably anticipated future land use for the 200 Areas is continued industrial activities for the foreseeable future," it should be acknowledged that land use will be unknown at some time in the future. Therefore, a conservative approach would evaluate a range of human exposure scenarios (e.g., residential, farmer, fisher, Native American), as well as relevant ecological receptors (e.g., terrestrial, aquatic). DD
32.	p. 3-29, sect 3.4.1.1, lines 16-18	The text states "The reasonably anticipated future land use for the 200 Areas is continued industrial activities for the foreseeable future. This land-use assumption is applied to the pathway and receptor considerations in risk calculations for the waste sites." For the groundwater and pathway to groundwater Ecology considers only unrestricted use scenarios (WAC 173-340 Method B) as this is the most beneficial use of the groundwater and is consistent with closure requirements in WAC 173-303-610. Additionally, the Tri-Party response to the Hanford Advisory Board Advice #132 stated "An Industrial land use scenario will set cleanup levels on the Central Plateau. Other scenarios (e.g., residential, recreational) may be used for comparison purposes to support decision making especially for • The post-institutional controls period (> 150 years). • Sites near the Core Zone perimeter to analyze opportunities to "shrink the site." • Early (precedent-setting) closure/remediation decisions. Additionally, Ecology expects evaluation of Native American scenarios. Please evaluate unrestricted as well as Native American scenarios for risk assessment at WMA C.
33.	p.3-29, sect 3.4.1.1, lines 38-41	Please delete the text "Given the local hydrogeology at WMA C, protection of the groundwater from the contaminants, by design, also will result in protection of the Columbia River." This is not the case for contaminants that are more harmful to aquatic biota and those with stringent ambient water quality criteria. This issue was discussed in comment resolution meetings for the SST PA. Ecology realizes that there may be a need to set a point somewhere in the Central Plateau or near the River Corridor for compliance with requirements for surface water protection. This could be acknowledged here.
34.	p. 3-30, sect 3.4.1.4	Though the land use selected by DOE for the Core Zone in the CLUP is industrial (exclusive) for at least the next 50 y, Ecology's expectations for the analysis of risk are included on the attached draft document (*Washington State Department of Ecology Guidance: Exposure Assessment Criteria for the Core Zone of the Central Plateau on the Hanford Site, Mar. 2009 draft*). [Attached]
35.	p. 3-30, para 4	Partitioning land use, according to location inside (i.e., industrial) vs. outside (i.e., unrestricted) the Central Plateau Core Zone, makes sense for the foreseeable future (e.g., institutional control period), but not for longer time horizons (e.g., post institutional control period).
36.	p. 3-31, figure 3-13	Include under the primary release mechanisms surface liquid discharges. An example of this type of release is UPR-200-E-16.
37.	p. 3-31, figure	Re the conceptual exposure model, human and biota receptors could each be subdivided into more specific groups (e.g.,

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 5 of 7

	3-13	residential/industrial/farmer/Native American for human; terrestrial/aquatic for biota). A complete pathway should be shown for human ingestion of biota. "Uptake" of biota is redundant and should be deleted (since ingestion is already specified). As a result of a groundwater connection, surface water and sediments in the Columbia River should be added as exposure media. Complete pathways should be shown for ingestion, inhalation, direct contact, and external radiation of surface water to biota (given their potential exposure at riverbank seeps), as well as ingestion, direct contact, and external radiation of river sediment to biota (as a result of contaminant accumulation in the sediment). Finally, human and biota exposure to vadose zone soils (below 15 ft bgs) may occur via an intruder drilling scenario (where deeper soils are brought to the surface and mixed with surface soils).
38.	p. 3-32, para 1	It is stated, "the ERA for WMA C will adopt relevant methodology and data that were used in the Central Plateau ecological risk assessment (CPERA)." Adopting consistent methods makes sense, although results are currently lacking. That is, the Jan 2008 Central Plateau Terrestrial Ecological Risk Assessment report (p. v in: DOE-2007-50, Draft A, Reissue) noted, "the tank farms [and US Ecology site] were not identified for ecological sampling in Phase II because their operations, regulatory plans, and interim stabilization plans (unique to the tank farms) represented a poor fit from an ecological risk characterization standpoint."
39.	p. 3-32, para 2	MTCA and USDOE ERA guidance should also be consistent with EPA ERA guidance (EPA/630/R-95/002F; EPA/540-R-97-006).
40.	p. 3-32, para 3	In addition to terrestrial eco receptors, risk to aquatic receptors in or near the Columbia River should also be evaluated via a groundwater pathway.
41.	p. 3-33, para 5	The purpose of the WMA C ERA should include evaluation of both terrestrial and aquatic environments.
42.	p. 3-35, para 3	The WAC citation should be "WAC 173-340-7493(2)(a)(i-iv)," not "WAC 173-340-7493(2)(i-iv)."
43.	p. 3-35, para 6	Please clarify that both nonradionuclide and radionuclide COPECs should be derived from the SST DQO (RPP-23403), as well as WMA C soil data, and not be limited to MTCA Table 749-3 and USDOE BCG constituents.
44.	p. 3-36, para 5	The WAC citation should be "WAC 173-340-7493(2)(a)(iv)," not "WAC 173-340-7493(2)(iv)."
45.	p. 3-40, para 1	Substitute "evaluate" for "verify," since contaminant exposure to small mammals is uncertain before tissue data are obtained.
46.	p. 3-40, para 2	Although text indicates that dietary exposure modeling is not identified in WAC 173-340-7493, this method is described for birds and mammals in WAC 173-340-7493(3). DD
47.	p. 3-41 to 3-42, sect 3.4.2.4	In addition to the CPERA and RCBRA, please acknowledge that other eco risk work has been conducted at Hanford (e.g., CRCIA, WTP, 100 Areas, 300 Area, PNNL surveys).
48.	p. 3-43, para 4	Please describe criteria for selecting "threshold indicator constituents."
49.	p. 3-44, para 1	Specify detection limits for Tc-99, I-129, and CN. This section (3.5.1) should be labeled as inorganics and rads, since organics are discussed in the next section (3.5.2).
50.	p. 3-44, para 4	Provide rationale for the number and location of the five sampling locations.
51.	p. 3-44, para 3	Just because TBP is not detected, it is nonconservative to eliminate all organics from the list of COPCs at WMA C.
52.	p.3-44,	Please lower the threshold values of nitrate and hexavalent chromium to concentrations that are used as preliminary

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 6 of 7

	sect 3.5.1	remediation goals or cleanup levels elsewhere on the site. For nitrate this value is 40 mg/kg as N, based on WAC 173-340-747 Equation 747-1 and the MCL for nitrate. For hexavalent chromium, a value of 2 mg/kg is used in consideration of dust resuspension, and a value of 0.2 mg/kg is used both for ecological protection, which is consistent with the value calculated for soil for the protection of groundwater. If 0.2 mg/kg is above the detection level, then the hexavalent chromium indicator concentration should be set at the detection limit.
53.	p. 3-44 – 3-45, sect 3.5.2	Methylene chloride, acetone, 2-butanone, and chloroform may be common lab contaminants but they also may be present in tanks. Some of these have been found in tank headspaces. If they are observed in samples the associated blanks should be considered when deciding if these are from the tanks or a lab source. They should not automatically be attributed to lab contamination.
54.	p. 3-45, para 3	Re PCB congener analysis, please specify Method 1668 and quantify dioxin like toxic equivalents (TEQ) with WHO 2005 toxic equivalency factors (TEFs) for humans/mammals and with WHO 1998 TEFs for fish and birds. PCB congeners should be evaluated in a portion of all soil samples collected at WMA C, rather than being constrained to the initial 5 locations (EPA, 2007). Recommendations for human health risk-based chemical screening and related issues at EPA Region 10 CERCLA and RCRA sites. OEA-095, Memo from Michael Cox).
55.	p. 3-45, para 4	Specify detection limits for pesticides and petroleum products.
56.	section 5, general	Ecology is submitting comments on the Phase 2 Master Work Plan. Please revise this section so that it is consistent with the revisions needed in the master work plan.
57.	General Comment Chapter 5	Soil is one component to be closed as part of the WMA C RCRA closure process following WAC 173-303-610. Therefore, these activities should be called a RCRA Component Closure Work Plan. Please correct in the title and throughout this RPP-PLAN-39114 document.
58.	pg. 5-1 lines 22, 23	Any revisions to the work plan must be submitted to Ecology for APPROVAL. Please correct.
59.	pg. 5-6, lines 38, 39	Groundwater is another component of WMA C to be closed under RCRA. Although HFFACO agrees that groundwater operable units will be closed/remediated under past practice authority, groundwater must at least be addressed here—even if only a reference to another work plan, RI/FS or program is included. Closure/remediation of groundwater must meet closure performance standards of WAC 173-303-610. Please include this information here and in this section of the work plan.
60.	pg. 5-9, Sect. 5.4	See comment 58 and replace all references to corrective measures to closure investigations and closure actions—including the implementation of any interim measures. Please correct.
61.	p. 5-11, para 1	Please add the following EPA guidance: 1) EPA-540-R-070-002. Jan 2008. RAGS, Part F, Supp. Guidance for Inhalation Risk Assessment. 2) EPA/600/R-07/038. Apr 2007. ProUCL Version 4.0, User Guide.
62.	p. 5-11, para 3	It should be a requirement (rather than an option) that other scenarios (i.e., Native American, residential, intruder) be evaluated to assess post-remediation risk.
63.	p. 5-12, para 3	In addition to terrestrial eco risk, aquatic eco risk should be assessed, as a result of a contaminant groundwater pathway to the

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 7 of 7

		Columbia River. Additional ERA guidance should be consulted (e.g., EPA/630/R-95/002F; EPA/540-R-97-006).
64.	pg. 5-14, sect 5.4.7	Pg. 5-14, Sect. 5.4.7 addresses soil only. Soil is one component to be closed under RCRA. Also included are the tanks and the waste contained therein, as well as ancillary equipment. These should be included as closure actions/options. Please address.
65.	pg. 5-21, lines 19-22	Actions in the Central Plateau under CERCLA will have to be coordinated with corrective measures AND closure actions being implemented under a RCRA permit to assure that actions on TSD units fulfill the closure performance standards of WAC 173-303-610. Please correct.
66.	pg. 7-1 and section 7	Pg. 7-1 and Section 7. The title of this section includes program integration, but the section only discusses the various groups that will participate, and not how the program/project and resulting data are integrated. Please revise to address integration activities and how they will be accomplished.
67.	Appendix A	Appendix A is the SAP which is not included, but was released as a separate document. Will the document stand alone, or be incorporated here as Appendix A? Please clarify.
68.	p. B-5, para 1	Water terms (C, I, AUF, d) in the oral exposure equation are not defined. Please fix.
69.	p. B-5, para 2	Provide rationale for 3 transects, a minimum of 6 organisms/transect, and for deriving a mean COPEC tissue concentration by weighting carcass (90%) and liver/kidney (10%) composites.
70.	p. B-6, para 1	The list and hierarchy of analytes given here in Section B1.7 differs slightly from that specified in Section B1.3. Please reconcile.
71.	p. B-8, Table B-2	Please clarify footnote "a" and indicate where it applies in the table body.
72.	p. B-10, para 3	Provide a reference for home range and dispersal distance for a deer mouse.
73.	p. B-10, sect B3.2	The home range specified for a deer mouse is 0.077 hectares. It does not seem reasonable to expect that the home range is known to that degree of precision. Please cite references for this value.
74.	p. B-11, figure B-2	Although the study area dimension is based on a deer mouse home range, provide rationale for specific transect locations (i.e., one perimeter transect group inside WMA C and two vegetated habitat transect groups outside WMA C).

Washington State Department of Ecology Guidance: Exposure Assessment Criteria for the Core Zone of the Central Plateau on the Hanford Site

March 2009 draft

Outline

1.0 Introduction
2.0 Operational Period (next 50 y)
3.0 Institutional Control Period (from 50-150 y)
- **3.1 Industrial land use**
- **3.2 Industrial scenario for nonradiological contaminants (includes U)**
  - **3.2.1 Soil risks**
  - **3.2.2 Groundwater risks**
  - **3.2.3 Air risks**
  - **3.2.4 Site risk/hazard**
  - **3.2.5 Ecological receptors**
- **3.3 Industrial scenario for radiological contaminants**
  - **3.3.1 Risks from all pathways (includes soil)**
  - **3.3.2 Groundwater risks**
  - **3.3.3 Air risks**
  - **3.3.4 Ecological receptors**
- **3.4 Other scenarios to support remedy decisions**
  - **3.4.1 Justification**
  - **3.4.2 Unrestricted land use**
  - **3.4.3 Unrestricted land use for nonradiological contaminants (includes U)**
    - **3.4.3.1 Soil risks (includes ecological receptors)**
    - **3.4.3.2 Groundwater risks**
    - **3.4.3.3 Air risks**
    - **3.4.3.4 Site risk/hazard**
  - **3.4.4 Unrestricted land use for radiological contaminants**
    - **3.4.4.1 Risk from all pathways (includes soil and ecological receptors)**
    - **3.4.4.2 Groundwater risks**
    - **3.4.4.3 Air risks**
  - **3.4.5 Additional pathways**
  - **3.4.6 Native American scenarios**
  - **3.4.7 Intruder risks**

4.0 Post Institutional Control Period (from 150 y and beyond)
5.0 Summary
- **5.1 Operational Period**
- **5.2 Institutional Control Period**
- **5.3 Post Institutional Control Period**

6.0 Tables
- **6.1 Human conceptual exposure model**
- **6.2 Ecological conceptual exposure model**

7.0 References

1.0. Introduction

The purpose of this guidance is to outline exposure assessment criteria, established by the Washington State Department of Ecology ("Ecology"), applicable to operable units (OUs) and waste management areas (WMAs) within the Central Plateau Core Zone of the 200 Areas at the Hanford site, owned and operated by the U.S. Dept. of Energy (USDOE). This guidance is based on the Model Toxics Control Act (MTCA) and implementing regulation (WAC 173-340) (WDOE, 2007a), but also includes other state regulations (e.g., WDOE, 2006), federal criteria for radiological sites (e.g., USEPA, 1989; USEPA, 1997a, USDOE, 2002), and site-specific criteria for evaluating exposure to nonradionuclide and radionuclide contaminants at Hanford (e.g., USDOE, 1995a, USDOE, 1995b; USDOE, 1996; WDOH, 1997). The outline provides a minimum set of requirements for exposure and risk assessment, and applies to baseline risk assessments (pre-remediation risk), risk assessments that support evaluation of remedial alternatives in feasibility studies, and risk assessments in support of waste management area closure.

This guidance is organized by time periods of interest (i.e., operational, institutional control, post institutional control). The first time period is the operational period during which it is expected that cleanup and closure efforts will be the dominant site activities. This period is assumed for this guidance to continue for approximately 50 years from the present. The current level of site restriction is assumed to continue during the operational period. The second time period is the period after which operations have ceased and access to the Core Zone will be restricted through the use of institutional controls. It is expected, during this time, that remedies designed to restrict access to subsurface waste will function as designed. This period is assumed for this guidance to last for 100 years after operations have ceased. The third time period is that after which institutional controls are no longer in place. The remedies designed to restrict access to subsurface waste may begin to fail in this time period. This time period is assumed for this guidance to begin 100 years after operations at the site have ceased.

Exposure assessment criteria are listed for both nonradionuclide and radionuclide contaminants for industrial, unrestricted use (with MTCA pathways and with several pathways additional to MTCA), Native American, and intruder (acute and chronic) scenarios. Additionally, ecological (terrestrial and aquatic biota) exposure evaluation criteria are given. Exposure scenarios are summarized in Table 6.1 for human receptors. Pathways for terrestrial and aquatic ecological receptors are summarized in Table 6.2.

MTCA regulations (WDOE, 2007a) are intended for setting cleanup levels at sites and in media contaminated with hazardous substances. Ecology evaluates compliance with WAC 173-340 by comparison of on-site and off-site media concentrations of hazardous substances against cleanup levels and risk and hazard levels calculated using the methods established in WAC 173-340.

2.0. The Operational Period (next 50 y)

For the next 50 years, it is assumed that the current level of site access will be maintained, and the site users in the Core Zone will be largely Hanford site workers. Hanford site workers receive USDOE Hanford General Employee Training (HGET) and General Employee

Radiological Training (GERT). During the operational period, site worker exposure to contaminants is assumed to be limited to the worker safety standard limits established by USDOE. During this period, Hanford cleanup should proceed such that the risk and hazard levels described in the following subsections of this guidance are achieved, to protect the potential future receptors.

3.0. The Institutional Control Period (from 50-150 y)

After site operations have ended and the USDOE presence continues in a role of maintaining institutional and engineering controls, the Core Zone of the Central Plateau is assumed to be strictly an area of industrial activities. This time period for this guidance is assumed to begin 50 years from the present and assumed to continue for an additional 100 years.

3.1. Industrial Land Use

Currently, the land use in the Core Zone at Hanford is classified as Industrial-Exclusive (USDOE, 1999). This classification applies to portions of the site that are suitable for treatment, storage and disposal of nonradioactive and radioactive wastes. This land use is distinguished from other Hanford site industrial use activities such as reactor operations, mining, manufacturing, assembly sites, food processing, warehousing, transportation-related operations and distribution operations.

The industrial and industrial-exclusive activities listed above are somewhat consistent with the definition for industrial land use in WAC 173-340-200 and -745. However, two additional considerations are needed when determining if a land use should be considered industrial according to WAC 173-340. That is, industrial properties are zoned for industrial use by a city or county conducting land use planning under the Growth Management Act, 36.70A RCW (RCW, 2006); or the properties are zoned for industrial use and adjacent to properties currently used or designated for industrial purposes. If activities at a site do not meet these conditions, the following characteristics should be considered when applying an industrial land use designation, according to WAC 173-340: (1) people generally do not live on the site and exposure is mainly to adult employees; (2) access to the general public is highly limited and controlled; (3) food is generally not grown or raised on the site; (4) operations are often characterized by chemical storage, noise, odors and truck traffic; (5) the surface of the land is often mostly covered by structures and paved areas, limiting potential exposure to soil; (6) commercial support facilities, including offices and restaurants for the industrial employees, but not the public, may be located on industrial sites.

3.2. Industrial Scenario for Nonradiological Contaminants (includes uranium)

Ecology's regulatory authority for cleanup of nonradiological contaminants under an industrial scenario is described in WAC 173-340 (WDOE, 2007a). This regulation specifies methods for cleanup of abiotic media, limits for site risk and hazard, and methods for assessing terrestrial ecological risk.

3.2.1. Soil Risks from Nonradionuclides under the Industrial Scenario

Using an industrial scenario for nonradiological contaminants and uranium (a nephrotoxic metal), the following requirements would apply for soil. For the direct contact pathway (e.g., soil ingestion), soil concentrations are derived using WAC 173-340-745. Additionally, soil concentrations must be protective of groundwater and are derived using WAC 173-340-747 Method B. Method B is required, since groundwater is contiguous inside and outside of the Core Zone, and Method B is required for the unrestricted land use outside of the Core Zone. Furthermore, if subsections (5), (7), (8) or (9) are used to derive soil concentrations for protecting groundwater, Ecology approval is required. Additional guidance for the use of the listed subsections will be provided by Ecology, as needed.

Soil concentrations must also be protective of surface water and are derived using WAC 173-340-730, (not including subsections (2) and (4)) in combination with WAC 173-340-747 Method B. This is necessary because groundwater protection alone may not result in achieving all water quality standards in the river and concentrations protective of all receptors in the river. For instance, a Cr (VI) concentration of 48 μg/L meets WAC 173-340-720 criteria for groundwater (concentration that achieves a hazard quotient of 1). However, the surface water quality criterion (WAC 173-201A) is 10 μg/L (WDOE, 2006). Assuming no dilution at the river (WAC 173-340-730(6)(b)), groundwater at 48 μg/L would not meet the surface water quality criterion for Cr (VI). Consequently, a lower groundwater concentration must be achieved prior to the groundwater/surface water interface. Though attenuation of contamination in the Core Zone is expected during transport to the river in groundwater, attenuation may be off-set by down gradient sources of groundwater contamination. Site-specific groundwater modeling beyond waste site boundaries may be needed to address attenuation and anticipated concentrations at the Columbia River from the Core Zone and down gradient sources of contamination.

It may be necessary to consider the inhalation pathway when deriving soil cleanup levels. Air protection values are derived according to WAC 173-340-750 and are discussed further in Section 3.1.3. WAC 173-340-750 should be used when deriving soil cleanup levels protective of inhalation of soil vapors or resuspended dust associated with a site.

3.2.2. Groundwater Risks from Nonradionuclides under the Industrial Scenario

Groundwater cleanup levels are derived according to WAC 173-340-720, Method B, at the point of compliance. These concentrations assume that the most beneficial use for groundwater is a drinking water source for humans. Federal or state maximum contaminant levels (MCLs) may also apply to drinking water (USEPA, 2006; WDOH, 2008). As previously discussed for soils, groundwater cleanup levels may not always provide protection of ecological receptors at the interface between the groundwater and the Columbia River. In some cases, the state water quality standards (WAC 173-201A) dictate lower water concentrations than the WAC 173-340-720 Method B groundwater cleanup levels. Where controlling source concentrations of contaminants is not effective in reducing groundwater concentrations to levels protective of surface water, Ecology expects further cleanup of groundwater to achieve levels protective of surface water.

During the operational period, as previously stated, human receptors in the Core Zone at the Hanford site are expected to be industrial workers. Though USDOE does not currently plan to access groundwater for human consumption in the Core Zone until it meets drinking water standards, Ecology expects industrial scenarios to include evaluation of the groundwater ingestion pathway. The human receptors, in this case, are assumed to be adults with an average body weight of 70 kg and a drinking water consumption rate of 2 L/day. Evaluation of drinking water ingestion is consistent with potential exposure routes listed for the commercial/industrial population in Exhibit 6-7 in USEPA (1989).

3.2.3. Air Risks from Nonradionuclides under the Industrial Scenario

Air protection values are derived according to WAC 173-340-750. These levels apply to air contamination from contaminated media and/or remedial actions, though not to industrial or commercial operations or processes. On-site receptors are expected to be adults with an average body weight of 70 kg and a breathing rate of 20 m^3/day. Off-site receptors are expected to include adults, and children with an average body weight of 16 kg and a breathing rate of 10 m^3/day.

3.2.4. Site Risk/Hazard from Nonradionuclides under the Industrial Scenario

Site risk and hazard is determined in accordance with WAC 173-340-708. The hazard quotient for individual hazardous contaminants is not to exceed 1. The site hazard index is not to exceed 1.Total site risk for carcinogens, for all contaminants, all pathways and all media, is not to exceed 1E-05. USEPA guidance for risk assessments (e.g. USEPA, 1989) should be followed, in addition to WAC 173-340-708 requirements (WDOE, 2007a).

3.2.5. Industrial Scenario Nonradiological Contaminant Requirements for Ecological Receptors

In addition to protecting human receptors, soil concentrations must be protective of terrestrial and aquatic ecological receptors. For terrestrial ecological receptors, nonradiological contaminants (including uranium) are evaluated, according to WAC 173-340-7490 through -7494 (WDOE, 2007a). During the institutional control period, the Core Zone is expected to have restricted access for humans, but is likely accessible to biota. For ecological receptor evaluations, industrial properties are defined in accordance with WAC 173-340-7490(3)(c). At sites where screening-level ecological risk assessments show exceedences of screening criteria (e.g., MTCA Table 749-3), site-specific ecological risk assessment is required (WAC 173-340-7493). Aquatic ecological receptors should be evaluated with acceptable methods (e.g., USEPA, 1997b; USEPA, 1998).

3.3. Industrial Scenario for Radiological Contaminants

Ecology's regulatory authority over radionuclides is currently unclear. However, radionuclides are hazardous substances and co-contaminants with toxic nonradionuclides (WDOE, 2007a). Ecology has an interest in assuring that total site risk and hazard is maintained at or below

federal and state limits. The following guidelines for radionuclides are consistent with current federal guidelines and are included in this guidance for completeness.

3.3.1. Risks from All Pathways including Soil for Radionuclides under the Industrial Scenario

Consistent with the CERCLA risk range of 1E-04 to 1E-06 (USEPA, 1997a), a dose limit (i.e., total effective dose from all pathways) of 15 mrem/y is the expected limit for industrial workers, unless the workers are specifically trained and monitored for radiological work. The above risk and dose levels also apply to off-site receptors. For workers properly trained and monitored for radiological work (e.g., GERT), it is expected that the contemporary safety standards for such work would be achieved.

Predictions regarding future radiological doses and risk based on fate and transport modeling should be consistent with Exhibit 6-6 in USEPA (1989).

3.3.2. Groundwater Risks from Radionuclides under the Industrial Scenario

Groundwater concentrations should not exceed MCLs for radionuclides (USEPA, 1976) from all current (e.g., groundwater plumes) and future (e.g., soil leaching) contaminant sources at the point of compliance. Groundwater ingestion should be included as a pathway under an industrial scenario (USEPA, 1989).

3.3.3. Air Risks from Radionuclides under the Industrial Scenario

Annual dose from the airborne pathways should not exceed 10 mrem/y for the maximally exposed individual at the site boundary, based on National Emission Standards for Hazardous Air Pollutants (NESHAPS) (CFR, 2006) and WAC 173-480-040 (WDOE, 2007b).

3.3.4. Industrial Scenario Radiological Contaminant Requirements for Ecological Receptors

USDOE (2002) methods should be used to address site biota. Biota Concentration Guidelines (BCGs) represent the general screening phase and apply to soil, sediment, and surface water. Soil and groundwater pathways should ensure that BCGs at the river (surface water and sediment) are not exceeded. BCGs correspond to 0.1 rad/d for terrestrial and riparian animals and 1 rad/d for terrestrial plants and aquatic populations.

3.4. Other Scenarios to Support Remedy Decisions

Other scenarios are discussed here for consideration in making remedial decisions. These additional scenarios are more stringent or sufficiently different than industrial scenarios. The justification for evaluating these scenarios is provided. This justification applies both to the Institutional Control and Post-Institutional Control periods.

3.4.1. Justification

According to 40 CFR 300.515(f), the State may opt for an enhanced remedy, different than the remedy chosen using the CERCLA 9 criteria, if the State is willing to pay the additional cost (CFR, 2007). In order to evaluate enhanced remedies, the State needs an unrestricted use risk assessment for each remedial alternative to evaluate protectiveness. The State may choose a more protective alternative even if it is not the preferred alternative based on the CERCLA 9 criteria.

State regulations allow consideration of alternate reasonably maximally exposed receptors for evaluating the protectiveness of remedies (WDOE, 2007a). WAC 173-340-708(3)(d) states that Ecology can "use alternate reasonable maximum exposure scenarios to help assess the protectiveness to human health of a cleanup action alternative that incorporates remediation levels and uses engineered controls and/or institutional controls to limit exposure to the contamination remaining on the site." WAC 173-340-708(3)(d)(ii) states that other scenarios can be used for evaluating protectiveness of remedies. Additionally, CERCLA allows consideration of additional scenarios for remedial decision making.

Ecology may require evaluation of additional pathways for nonradionuclides (WDOE, 2007a). WAC 173-340-720(1)(d) states that "The department may require more stringent cleanup levels than specified in this section, where necessary to protect other beneficial uses or otherwise protect human health and the environment." For example, inhalation of groundwater during showering is an important pathway for Cr (VI), because it is carcinogenic by this pathway, and it is expected to be a risk driver at Hanford. Other important pathways for Hanford contaminants include food ingestion pathways such as ingestion of garden produce (including fruit), ingestion of wild game and ingestion of fish. For information purposes and remedial decision making, scenarios including additional pathways should be evaluated.

State regulations (WAC 173-340) require that "traditional industrial use" sites with hazardous substance contamination have restricted access to the general public. An unrestricted scenario may apply for the period after which implementation of institutional controls has become ineffective, when there is a higher likelihood of human intrusion.

Finally, there is a desire by USDOE, the regulatory agencies, and stakeholders to shrink the footprint of contamination at Hanford, including decreasing the area of the Core Zone. Therefore, areas inside the current boundary of the Core Zone may ultimately fall outside the Core Zone.

3.4.2. Unrestricted Land Use

Unrestricted land use refers to land use practices in which restrictions on the use of the site or natural resources affected by hazardous substance releases are not required to protect human health and the environment. For unrestricted land use scenarios, both child and adult receptors should be evaluated. Unrestricted land use is the presumed exposure scenario in WAC 173-340 (WDOE, 2007a). Current and future site usage is the basis for estimating a reasonable maximum exposure (RME) under unrestricted land use.

3.4.3. Unrestricted Land Use for Nonradiological Contaminants (includes Uranium)

Ecology's regulatory authority for cleanup of nonradiological contaminants under an unrestricted land use scenario is described in WAC 173-340 (WDOE, 2007a). This regulation specifies methods for cleanup of abiotic media, limits for site risk and hazard, and methods for assessing ecological risk.

3.4.3.1. Soil Risks from Nonradionuclides under the Unrestricted Use Scenario (includes Ecological Receptors)

Soil concentrations should be protective of human direct contact, human ingestion of groundwater beneath the site, inhalation of air on and off the site, human and ecological receptors using surface water down-gradient of the contaminated site, and terrestrial ecological receptors (WDOE, 2007a). Soil direct contact concentrations are derived using WAC 173-340-740. Soil concentrations must be protective of groundwater and are derived using WAC 173-340-747 Method B (use of subsection (5), (7), (8) or (9) methods require Ecology approval). Air protection values must be derived according to WAC 173-340-750 (e.g., when deriving soil cleanup levels protective of inhalation of soil vapors or resuspended dust). Soil concentrations must be protective of surface water, derived using WAC 173-340-730 (not including subsections (2) and (4)), and in combination with WAC 173-340-747 Method B.

Soil concentrations must be protective of terrestrial ecological receptors (i.e., plants, soil biota, wildlife), as specified in WAC 173-340-7490 and WAC 173-340-900 (Table 749-3). As for the industrial scenario, where screening-level ecological risk assessments show exceedences of screening criteria (e.g., MTCA Table 749-3), site-specific ecological risk assessment is required (WAC 173-340-7493). In addition, soil concentrations must be protective of aquatic ecological receptors (i.e., plants, invertebrates, fish). Aquatic ecological risk should be evaluated with acceptable methods (e.g., USEPA, 1997b; USEPA, 1998).

3.4.3.2. Groundwater Risks from Nonradionuclides under the Unrestricted Use Scenario

Groundwater concentrations are derived according to WAC 173-340-720, Method B at the point of compliance. Calculation of groundwater cleanup levels and risk for unrestricted use are essentially the same as those for industrial use, described in Section 3.3.2. In both cases, the most beneficial use of groundwater is a drinking water source.

3.4.3.3. Air Risks from Nonradionuclides under the Unrestricted Use Scenario

Air protection values are derived according to WAC 173-340-750. These levels apply to air contamination from contaminated media and/or remedial actions, though not to industrial or commercial operations or processes. When calculating risks and cleanup levels for noncarcinogens, for both on-site and off-site human receptors, RME individuals are assumed to be children with a body weight of 16 kg and a breathing rate of 10 m^3/day. For carcinogens, the RME individuals are assumed to be adults with an average body weight of 70 kg and a breathing rate of 20 m^3/day.

3.4.3.4. Site Risk/Hazard from Nonradionuclides under the Unrestricted Use Scenario

Site risk and hazard is determined in accordance with WAC 173-340-708. The site hazard quotient for individual hazardous contaminants is not to exceed 1. The site hazard index is not to exceed 1. Site risk for individual carcinogens is not to exceed 1E-06. Total site risk for carcinogens, for all contaminants, all pathways and all media, is not to exceed 1E-05. USEPA guidance for risk assessments (e.g. USEPA, 1989) should be followed, in addition to WAC 173-340-708 requirements (WDOE, 2007a).

3.4.4. Unrestricted Land Use Scenario for Radiological Contaminants

Ecology's regulatory authority over radionuclides is currently unclear. However, radionuclides are hazardous substances and co-contaminants with toxic nonradionuclides. Ecology has an interest in assuring that total site risk and hazard is maintained at or below federal and state limits. The following guidelines for radionuclides are consistent with current federal guidelines and are included in this guidance for completeness.

3.4.4.1. Risks from All Pathways (includes Soil and Ecological Receptors) for Radionuclides under Unrestricted Use Scenario

Consistent with the CERCLA risk range of 10^{-4} to 10^{-6} (USEPA, 1997a), a dose limit (i.e., total effective dose from all pathways) of 15 mrem/y applies to all human receptors (USEPA, 1997a). The dose and risk limits for unrestricted land use are calculated for adults and children, who are assumed to live at the site. The risk and dose levels also apply to off-site receptors.

Predictions regarding future radiological doses and risk based on fate and transport modeling should be consistent with Exhibit 6-6 in USEPA (1989).

As for industrial land use, USDOE Biota Dose Assessment Committee (BDAC) methods should address site biota (USDOE, 2002). BCGs represent the general screening phase and apply to soil, sediment, and surface water. Soil and groundwater pathways should ensure that BCGs at the river (surface water and sediment) are not exceeded. BCGs correspond to 0.1 rad/d for terrestrial and riparian animals and 1 rad/d for terrestrial plants and aquatic populations.

3.4.4.2. Groundwater Risks from Radionuclides under the Unrestricted Use Scenario

Groundwater consumption is assumed for unrestricted land use. As with industrial land use, groundwater concentrations are not to exceed MCLs for radionuclides (USEPA, 1976) from all current (e.g., groundwater plumes) and future (e.g., soil leaching) contaminant sources.

3.4.4.3. Air Risks from Radionuclides under the Unrestricted Use Scenario

Annual dose from the airborne pathways should not exceed 10 mrem/y to the whole body for any member of the public, according to WAC 173-480-040 (WDOE, 2007b).

3.4.5. Risks from Additional Pathways

Residential land use is considered to be the site use requiring the most protective cleanup levels under WAC 173-340 (WDOE, 2007a). The WAC 173-340 regulations interpret residential use as unrestricted use, which has been discussed above as the presumed RME scenario. However, the unrestricted use scenario described in WAC 173-340 omits pathways such as showering, inhalation during showering, and ingestion pathways for consumption of residential produce, livestock, and game (including fish from the Columbia River). It also omits some relevant pathways in EPA/540/1-89/002, Exhibit 6-6 (USEPA, 1989). These pathways could be important future use exposure pathways in the rural setting of the Hanford site. Ecology has an interest in being informed, through evaluation of these pathways, to determine protectiveness of remedial actions and to protect potential other beneficial uses (e.g., agriculture). Table 6.1 indicates additional pathways to evaluate. The evaluation should address both nonradiological and radiological contaminants. Both child and adult receptors should be evaluated when examining the additional pathways.

3.4.6. Native American Scenarios

While Native American scenarios have a variety of pathways in common with unrestricted land use exposure pathways, they often consider additional activities and exposure routes that are consistent with traditional Native American lifestyles. Frequently, they also require different parameter values than unrestricted use scenarios (e.g., higher rates for fish ingestion, inhalation, soil ingestion). Though a number of Native American scenarios have been developed in the history of risk assessment at the Hanford site, two tribes have submitted current exposure scenarios: the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) (Harris and Harper, 2004) and the Yakama Nation (Ridolfi, 2007).

Ecology supports evaluation of current Native American scenarios and additional Native American scenarios that may be submitted by tribes in the future. Ecology's expectations are that the Native American scenarios will be used as specified by the tribes, and will address both nonradiological and radiological contaminants. Ecology has an interest in using Native American scenarios to aid in planning remedial activities and in evaluating protectiveness of remedies. Ecology expects that these scenarios will frequently be the most conservative predictors of potential future risks at the Hanford site.

3.4.7. Risks to Intruders

It is expected that during the institutional control period, intrusion into former waste sites, landfills, and other buried waste will be minimized by actions taken to prevent inadvertent intrusion (e.g., Bradford et al, 2006). However, evaluating risks associated with intrusion during the institutional control period may indicate the adequacy of the institutional control time period and the protectiveness of remedies.

Evaluation of intrusion scenarios should cover all contaminants (nonradiological and radiological). Various modes of intrusion should be evaluated, consistent with potential future activities in a rural setting adjacent to an expanding population center. Acute exposure via

excavation for a home with a basement, drilling, trenching, mining, and road construction should be examined. Post intrusion exposure to children and adults who raise produce (a garden) and have chronic residential exposure, including groundwater ingestion and groundwater use in the garden, should also be evaluated. The post-intrusion residents should be assumed to use material exhumed during intrusion as garden soil and fill and landscaping in their yard of roughly 0.25 acres.

Additionally, the waste that remains buried should be assumed to be positioned beneath or close to the basement and lower floor of the home. A groundwater well on the home site should be assumed as a source of drinking water and a source of water for showering, cleaning, food preparation, and irrigation at the residence. Intruder scenarios should be run for the time period immediately after remedy construction completion. Additional times beyond construction completion should be included, as necessary, to address risks from potential radionuclide in-growth products or other contaminant degradation and transformation products.

4.0. The Post Institutional Control Period (from 150 y and beyond)

The Post Institutional Control Period is expected to begin 100 y after site operations have ended. All scenarios included for the Institutional Control time period should be evaluated for the Post Institutional Control Period, as well. This is derived from the 40 CFR 300.430(e)(9)(iii)(C)(2) requirement to evaluate long term effectiveness (on of the CERCLA 9 criteria) considering, "Adequacy and reliability of controls such as containment systems and institutional controls" (CFR, 2007) It is reasonable to expect that institutional controls will be less reliable for maintaining industrial conditions in the Core Zone beyond 150 y. It is expected that risk evaluations will examine contaminants until the time at which they reach peak concentrations in groundwater at the point of compliance, which may exceed 10000 y (e.g., Bradford et al., 2006).

5.0. Summary

5.1. Operational Period (next 50 y)

Industrial exclusive with DOE HGET/GERT-trained workers and DOE trained radiological workers.

5.2. Institutional Control Period (from 50 to 150 y)

A) Industrial Scenario for Nonradiological Contaminants (includes uranium)

<u>Soil</u>

Soil direct contact concentrations are derived using WAC 173-340-745. Soil concentrations protective of groundwater are derived using WAC 173-340-747 Method B; any use of subsection (5), (7), (8) or (9) methods requires Ecology approval. Soil concentrations protective of surface water are derived using WAC 173-340-730, (not including subsections (2) and (4)) in combination with WAC 173-340-747 Method B.

Groundwater

Groundwater cleanup levels are derived according to WAC 173-340-720, Method B at the point of compliance. Include groundwater ingestion as a pathway in risk assessment.

Air

Air protection values are derived according to WAC 173-340-750.

Site Risk/Hazard (WAC 173-340-708)

Site hazard quotient for individual hazardous contaminants is not to exceed 1. Site hazard index is not to exceed 1. Total site risk for carcinogens, for all contaminants, all pathways and all media, is not to exceed 1E-05. USEPA guidance for risk assessments should be followed in addition to WAC 173-340-708 requirements.

Ecological Receptors

Soil concentrations protective of terrestrial ecological receptors are specified in WAC 173-340-7490 through -7494, and using Table 749-3 for terrestrial ecological risk screening. Soil concentrations protective of aquatic ecological receptors should also be specified with acceptable methods (e.g., USEPA, 1997b; USEPA, 1998).

B) Industrial Scenario for Radiological Contaminants

All Pathways (includes Soil)

15 mrem/y dose limit (total effective dose from all pathways) applies to industrial workers (consistent with CERCLA risk range of 10^{-4} to 10^{-6} per OSWER 9200.4-18). Fate and transport modeling should be consistent with Exhibit 6-6 in EPA/540/1-89/002.

Groundwater

Groundwater concentrations are not to exceed MCLs for radionuclides from all current (e.g., groundwater plumes) and future (e.g., soil leaching) contaminant sources at the point of compliance. Include groundwater ingestion as a pathway in risk assessments.

Air

Annual dose from the airborne pathways is not to exceed 10 mrem/y for the maximally exposed individual at the site boundary, according to NESHAPS and WAC 173-480-040.

Ecological Receptors

USDOE (2002) methods should be used to address site biota. BCGs represent the general screening phase and apply to soil, sediment, and surface water. Soil and groundwater pathways should ensure that BCGs at the river (surface water and sediment) are not exceeded. BCGs correspond to 0.1 rad/d for terrestrial and riparian animals and 1 rad/d for terrestrial plants and aquatic populations.

C) Unrestricted Use for Nonradiological Contaminants (includes Uranium)

Soil (includes Ecological Receptors)

Soil direct contact concentrations are derived using WAC 173-340-740. Soil concentrations protective of groundwater are derived using WAC 173-340-747 Method B; any use of subsection (5), (7), (8) or (9) methods requires Ecology approval. Soil concentrations protective of surface water are derived using WAC 173-340-730 (not including subsections (2) and (4)) in combination with WAC 173-340-747 Method B. Soil concentrations protective of terrestrial ecological receptors (i.e., plants, soil biota, wildlife) are obtained as specified in WAC 173-340-7490 and using Table 749-3 for terrestrial ecological screening. Soil concentrations protective of aquatic ecological receptors (i.e., plants, invertebrates, fish) should also be specified with acceptable methods (e.g., USEPA, 1997b; USEPA, 1998).

Groundwater

Groundwater concentrations are derived according to WAC 173-340-720, Method B at the point of compliance. Include groundwater ingestion as a pathway in risk assessments.

Air

Air protection values are derived according to WAC 173-340-750.

Site Risk/Hazard (WAC 173-340-708)

Site risk for individual carcinogens is not to exceed 1E-06. Total site risk for carcinogens, for all contaminants, all pathways and all media, is not to exceed 1E-05. Site hazard quotient for individual hazardous contaminants is not to exceed 1. Site hazard index is not to exceed 1.

D) Unrestricted Use for Radiological Contaminants

All Pathways (includes Soil and Ecological Receptors)

15 mrem/y dose limit (total effective dose from all pathways) applies to all human receptors (consistent with CERCLA risk range of 10^{-4} to 10^{-6} per OSWER 9200.4-18). The 15 mrem/y dose limit is the target dose limit for the reasonably-anticipated future land use. Fate and transport modeling consistent with Exhibit 6-6 in EPA/540/1-89/002. USDOE (2002) methods should be used to address site biota. BCGs represent the general screening phase and apply to soil, sediment, and surface water. Soil and groundwater pathways should ensure that BCGs at the river (surface water and sediment) are not exceeded. BCGs correspond to 0.1 rad/d for terrestrial and riparian animals and 1 rad/d for terrestrial plants and aquatic populations.

Groundwater

Groundwater concentrations are not to exceed MCLs for radionuclides from all current (e.g., groundwater plumes) and future (e.g., soil leaching) contaminant sources. Groundwater ingestion must be included as a pathway in risk assessments.

Air

Annual dose from the airborne pathways is not to exceed 10 mrem/y to the whole body for any member of the public, according to WAC 173-480-040.

E) Scenario including Additional Pathways

All contaminants (nonradiological and radiological) included. Pathways to include showering, inhalation during showering, and ingestion pathways for consumption of residential produce and livestock, and game (including fish from the Columbia River), and appropriate pathways in EPA/540/1-89/002, Exhibit 6-6, in addition to all of the Unrestricted Use pathways. Both child and adult receptors should be evaluated.

F) Native American Scenarios

All contaminants (nonradiological and radiological) are evaluated, as specified by the tribes.

G) Intruders

All contaminants (nonradiological and radiological) are evaluated. Acute exposure via excavation for a home with a basement, drilling, trenching, mining and road construction should be examined. Scenario for post intrusion residents (children and adults) who raise produce (a garden) and have chronic residential exposure (including groundwater ingestion and groundwater use in the garden) on a residential site of 0.25 acre. The time period for evaluation begins immediately after remedy construction completion. Additional times beyond construction completion should be included, as necessary, to address risks from potential radionuclide in-growth products or other contaminant degradation products.

5.3. Post Institutional Control Period (from 150 y and beyond)

All scenarios included for the 50 to 150 y time period should be evaluated for time periods beyond 150 y. Risk evaluations should examine contaminants until the time at which they reach peak concentrations in groundwater at the point of compliance, which may exceed 10000 y.

6.0. Tables

Table 6.1. Human conceptual exposure model.

Scenario / Pathway	Industrial	Unrestricted Use	Scenario with additional pathways	Native American	Intruder Acute	Intruder Chronic
External Radiation	●	●	●		●	●
Direct Contact (WAC 173-340-745)	●					
Direct Contact (WAC 173-340-740)		●	●		●[c]	●
Groundwater (WAC 173-340-720)	●	●	●			●
Soil for Protection of groundwater (WAC 173-340-747[a])	●	●	●			●
Soil for Protection of Surface Water (WAC 173-340-747[b])	●	●	●			
Air (WAC 173-340-750)	●	●	●			●
Showering			●			
Inhalation during showering			●			
Residential Produce and Livestock			●			●
Game			●			
Fish			●			
Ecological (WAC 173-340-7490 and BDAC)[d]	●	●	●			
All Pathways Specified by Tribes				●		

[a]C_w based on WAC 173-340-720
[b]C_w based on WAC 173-340-730
[c]includes inhalation
[d]See Table 6.2

Table 6.2. Ecological conceptual exposure model.

Medium	Pathway	Terrestrial Receptor			Aquatic Receptor		
		Plant	Invert	Bird/Mam	Plant	Invert	Fish
Air	Inhalation			x			
	Ext surface uptake	x	x	x			
	External radiation	x	x	x			
Soil	Ingestion		x	x			
	Inhalation			x			
	Ext surface uptake	x	x	x			
	External radiation	x	x	x			
Groundwater, Seeps	Ingestion		x	x			
	Ext surface uptake	x					
	External radiation		x	x			
Surface Water	Inhalation			x			x
	Ingestion		x	x		x	x
	Ext surface uptake			x	x	x	x
	External radiation			x	x	x	x
Sediment	Ingestion			x		x	x
	Ext surface uptake			x	x	x	x
	External radiation				x	x	x
Biotic Tissue	Ingestion		x	x		x	x

Abbreviations: invert=invertebrate, mam=mammal, ext=exterior.
Ext surface uptake includes absorption via root, leaf, skin, feather, or other exterior surface tissues.
x=complete pathway.

7.0. References

Bradford, A., D. Esh, A. Ridge, D. Turner, E. Pearcy, J. Winterle, B. Brient, P. Mackin, and P. LaPlante. 2006. Standard review plan for activities related to USDOE waste determinations. NUREG-1854. US Nuclear Regulatory Commission (USNRC), Washington, DC.

CFR (Code of Federal Regulations). 2006. Title 40, Chapter I, Subchapter C, Part 61, National Emission Standards for Hazardous Air Pollutants (NESHAPS), U.S. Environmental Protection Agency, Washington, D.C.

CFR (Code of Federal Regulations). 2007. Title 40, Chapter I, Part 300, National Oil and Hazardous Substances Pollution Contingency Plan (NCP), U.S. Environmental Protection Agency, Washington, D.C.

Harris, S.G. and B.L. Harper. 2004. Exposure scenario for CTUIR traditional subsistence lifeways. Dept Sci and Eng, Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Pendleton, OR. Supplemented by memo from S Harris to J Sands (dated 8/18/05) on response to exposure scenario comments and summary of exposure factors.

RCW (Revised Code of Washington). 2006. Growth management planning by selected counties and cities. 36.70A RCW, Olympia, WA.

Ridolfi, C. 2007. Yakama Nation exposure scenario for Hanford Site risk assessment, Richland, Washington. Ridolfi, Inc., Seattle, WA.

USDOE (US Dept of Energy). 1995a. Hanford site risk assessment methodology (HSRAM). DOE/RL-91-45, Rev 3, Richland, WA.

USDOE (US Dept of Energy). 1995b. Hanford site background: Part 1, Soil background for nonradioactive analytes. DOE/RL-92-24, Rev 3, Richland, WA.

USDOE (US Dept of Energy). 1996. Hanford site background: Part 2, Soil background for radionuclides. DOE/RL-96-12, Rev 0, Richland, WA.

USDOE (US Dept. of Energy). 1999. Hanford comprehensive land use plan. Environmental impact statement. DOE/EIS-0222-F, US Dept. of Energy, Richland, WA, http://www.hanford.gov/doe/eis/hraeis/maintoc.htm.

USDOE (US Dept of Energy). 2002. A graded approach for evaluating radiation doses to aquatic and terrestrial biota. DOE-STD-1153-2002, Washington, DC.

USEPA (US Environmental Protection Agency). 1976. National interim primary drinking water regulations. EPA-570/9-76-003, Washington, DC.

USEPA (US Environmental Protection Agency). 1989. Risk assessment guidance for Superfund, Vol 1, Human health evaluation manual (Part A). EPA/540/1-89/002, Washington, DC.

USEPA (US Environmental Protection Agency). 1997a. Establishment of cleanup levels for CERCLA sites with radioactive contamination. OSWER No 9200.4-18, Washington, DC.

USEPA (US Environmental Protection Agency). 1997b. Ecological risk assessment guidance for superfund (ERAGS)-Process for designing and conducting ecological risk assessments. EPA/540/R-97/006, OSWER-9285.7-25, NTIS PB97-963211INX, Office of Emergency and Remedial Response, Washington, DC.
USEPA (US Environmental Protection Agency). 1998. Guidelines for ecological risk assessment. EPA/630/R-95/002F. Risk Assessment Forum, USEPA, Washington, DC.

USEPA (US Environmental Protection Agency). 2006. 2006 edition of the drinking water standards. EPA 822-R-06-013, Washington, DC.

WDOE (Washington State Dept of Ecology). 2006. Water quality standards for surface waters of the state of Washington. WAC 173-201A, Olympia, WA.

WDOE (Washington State Dept of Ecology). 2007a. Model Toxics Control Act (MTCA) Statute and Cleanup Regulation, WAC 173-340, Pub No. 94-06, Olympia, WA.

WDOE (Washington State Dept of Ecology). 2007b. Ambient air quality standards and emission limits for radionuclides, WAC 173-480, Olympia, WA.

WDOH (Washington State Dept. of Health). 1997. Hanford guidance for radiological cleanup. WDOH/320-015, Rev 1, Olympia, WA.

WDOH (Washington State Dept of Health). 2008. Public water supplies. WAC 246-290, Olympia, WA.

0900973
CC Recd: 04/28/2009

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • (509) 372-7950

April 24, 2009

Ms. Shirley J. Olinger, Manager
Office of River Protection
United States Department of Energy
P.O. Box 450, MSIN: H6-60
Richland, Washington 99352

Re: Department of Ecology Review of the *RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, RPP-PLAN-39114, Revision 0

Dear Ms. Olinger:

The Department of Ecology reviewed the referenced document. Our enclosed comments need to be part of a larger discussion on Waste Management Area C (WMA C) closure. We have met with your staff and your contractors to discuss differing ideas on WMA C closure and the process to follow. We understand the importance of a mutual agreement on this process and that it may take time to reach an agreement. Therefore, Ecology requests the United States Department of Energy-Office of River Protection to:

- Continue to meet with Ecology to develop and finalize this process.
- Review the enclosed comments and meet with Ecology to discuss the issues and where best to address them.
- Send Ecology the requested information on the next set of pushes in WMA C Farm.

We are available to discuss and resolve issues developed from our review of the *Phase 2 RCRA Facility Investigation/Corrective Measures Study Master Work Plan for Single-Shell Tank Waste Management Areas*, RPP-PLAN-37243, Revision 1. Some of these issues may need to be incorporated into the referenced document.

If there are any questions, contact me at 509-372-7914.

Sincerely,

Jeffery J. Lyon
Tank Waste Storage Project Manager
Nuclear Waste Program

mb/aa
Enclosure

cc: See page 2

Ms. Shirley J. Olinger
April 24, 2009
Page 2

Reference: Letter 08-TPD-090, dated December 18, 2008, from S. J. Olinger, USDOE-ORP, to J. A. Hedges, Ecology, "Transmittal of the Resource Conservation and Recovery Act (RCRA) Facility Investigation/Corrective Measures Study (RFI/CMS) Work Plan for Waste Management Area (WMA) C as Required by Hanford Federal Facilities Agreement and Consent Order (AKA Tri-Party Agreement) Milestone M-045-60"

cc: Stuart Harris, CTUIR
Gabriel Bohnee, NPT
Russell Jim, YN
Susan Leckband, HAB
Ken Niles, ODOE
Administrative Record: SST/Tank Waste Management
Environmental Portal
Hanford Operating Record General File
USDOE-ORP Correspondence Control

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 1 of 7

Document Number(s)/Title(s)	Program/Project/Building Number	Reviewer	Organization/Group	Location/Phone
RPP-PLAN-39114, Rev. 0			Ecology	

Comment Submittal Approval: Agreement with indicated comment disposition(s) Status:

Organization Manager (Optional) Date

Reviewer/Point of Contact Date

Reviewer/Point of Contact

Author/Originator

Author/Originator

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)
1.	General Comment	Where this document refers to performance assessments and risk assessments, please add text referring to the process that is ongoing with NRC for the WMA C performance assessment. Please make appropriate changes in this document to resolve any inconsistencies between the plans documented here and the ongoing WMA C performance assessment development process.
2.	General Comment	Units of measure should remain consistent, and where both IU as well as British units are given, a conversion should be provided. For example, compare pg. 2-12, line 42 with Table 2-1 (pg 2-13) where the units are different in the two locations. Please correct at this location and throughout the document.
3.	General Comment	This work plan, RCRA FI/CMS Work Plan for WMA C, Revision 0, Nov 2008, fails to identify the conceptual process for performing RCRA corrective actions to support closure of the SST WMA. The work plan must be revised to address the closure requirements of WAC 173-303.
4.	General Comment	The SST closure plan to be issued by the Department of Ecology will include SST corrective actions. The corrective actions described in this document are not independent actions. These are also closure actions and will be incorporated into the SST closure plan.
5.	General Comment	Source waste sites (soil) inside and potentially adjacent to the WMA are subject to RCRA closure and corrective action, not CERCLA as stated. Groundwater will also be subject to RCRA closure and corrective action, not just CERCLA as stated.
6.	General Comment	Only cleanup actions that meet the closure performance standards will achieve final closure of the WMAs.
7.	General Comment	Characterization of the WMAs must consider the closure performance standards to achieve final closure of the WMAs. All characterization conducted on the SST System, whether within a WMA or on ancillary equipment located outside the WMAs, must identify and incorporate constituents and detection levels to be used in the closure process.

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 2 of 7

8.	General Comment	Closure will address structures, soil and groundwater contamination.
9.	General Comment	Both RCRA closure and corrective action will be contained in the SST System closure plan. Corrective action for the SST System is part of the draft closure plan. This section is currently reserved in the closure plan. Detail will be incorporated into the closure plan through permit modifications Ecology is incorporating the corrective action of the SST System into the SST closure plan in order to integrate schedules and physical actions and regulatory requirements.
10.	General Comment	It is inappropriate to use only the document number in referring to documents. This practice is repeated throughout the document.
11.	p. 2-12, sect 2.3.4	Groundwater monitoring at WMA C is conducted FOR compliance with WAC 173-303-400 (and by reference 40 CFR 265, Subpart F) because WMA C is a RCRA TSD unit. Data from some groundwater monitoring wells is used to support the 200-BP-5 groundwater operable unit. Please correct.
12.	Pg. 2-12, lines 16 – 19	B Pond was located east of WMA C (not north) and the B Pond mound led to groundwater flow to the west-northwest. With cessation of discharges to B Pond, groundwater flow direction is slowly changing back to the pre-Hanford west to east direction of groundwater flow. Please correct.
13.	Pg. 2-13, lines 16 – 24	If slug tests at different levels in the well screen indicate different hydraulic conductivities and flow rates, why was a single long screen placed in these wells that bridge different units of differing hydraulic characteristics rather than a single screen at the interval of highest contamination? The effect could be a dilution of contaminants that masks the real level of contamination in a well. Please address.
14.	Pg. 3-3, line 27	WMA C is a RCRA TSD unit, NOT a past practice unit. Appendix C of the HFFACO does not include a 200-PO-3 operable unit, but Appendix B does. Please correct this work plan and make the HFFACO consistent.
15.	Pg. 3-6, line 13	Please explain what "elevated pH values and high sodium content" means if these are considered indicators of the presence or passage of tank waste.
16.	Pg. 3-6, lines 23, 24	Please provide some details regarding the appearance of Tc-99 in a "nearby monitoring well."
17.	Pg. 3-6, 3-7, sect 3.2.1.1	While this is a nice summary of data, it doesn't state whether this data is indicative of a release and why it is. Please clarify and explain.
18.	Pg. 3-13, lines 6, 7	Please provide a technical basis for the statement, "….and the subsequent natural recharge do not appear sufficient to have contaminated groundwater in the 36 to 38 years since the release events."
19.	Pg. 3-18, lines 25-31	As CN is found in groundwater in well 299-E27-7, and the only likely nearby source is C Tank Farm, this constituent should be added to the constituent list. Please add.
20.	Pg. 3-18, lines	This discussion mentions soil waste interaction in the vadose zone to include sorption and precipitation, but doesn't address

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 3 of 7

	8 – 17	desorption which can be facilitated by later addition of moisture to the soil. Please include desorption.
21.	Pg. 3-18, 19, lines 37 through 3	Mention of the depth limitation of information is appropriate here, because push technology and some boreholes do penetrate the entire vadose zone. Yet, contaminants in the deep vadose zone can be inferred based on data from groundwater monitoring wells. Please include depth limitations of characterization boreholes.
22.	Pg. 3-19, line 7	Change "will" to "is expected to," and that expectation was used in model simulations. Please change.
23.	Pg. 3-21, lines 5 – 8	The February 1979 flooding of T Farm is but one example of a process that likely occurred at other farms in February 1979 as well as other times in the past during site operations. Please qualify.
24.	Pg. 3-23, line 15	Clastic dikes are TABULAR (not tubular) bodies. Previous model simulations incorrectly portrayed clastic dikes as pipes and thus incorrectly concluded that clastic dikes have no significance in fate and transport of contaminants to groundwater. Please correct.
25.	Pg. 3-23, lines 34 - 42	While it is true that the possibility of intersecting a clastic dike in a characterization is limited, there is sufficient information on clastic dikes and their properties to "create" an imaginary clastic dike in modeling simulations of fate and transport analyses
26.	General Comment on conceptual models	With each conceptual model, it is possible to also conduct sensitivity studies that vary the input parameter values for a specific input characteristic. For example, one could run sensitivity analyses of the number, geometry and material characteristics of clastic dikes within a farm, the location and number of unsealed boreholes, variations on recharge, flood frequency and volume, and water releases from pipelines. Please include some discussion of sensitivity studies and their value to planning future site characterization and in planning for remediation/closure.
27.	p. 3-24 – 3-27, sect 3.3.5	Please include a conceptual model for shallow releases within C farm. There are at least 6 UPRs inside the farm that have not been discussed in this section, (UPR-200-E-16, UPR-200-E-27, UPR-200-E-68, UPR-200-E-81, UPR-200-E-107, UPR-200-E-118), which include surface spills from pipelines, leaks and airborne releases from diversion boxes and vaults, and airborne releases from tanks.
28.	p.3-27 to 3-42, sect 3.4	Re performance assessment, text on human health risk (Section 3.4.1) appears short, relative to text on eco risk (Section 3.4.2). For example, eco risk describes identification of contaminants of concern (Section 3.4.2.3.1) and uncertainty analysis (Section 3.4.2.3.3), while human health risk does not. Please address.
29.	p. 3-27, sect 3.3.5.5, lines 30-31	Please delete the text "These releases and the conceptual model are not believed to represent a risk to groundwater but potentially are a risk through direct contact and to ecological receptors." Ecology considers them a threat to groundwater as well as a threat through direct contact and ecological contact. WAC 173-340-740(6)(b) gives the point of compliance for soil cleanup levels based on the protection of groundwater to be the soils throughout the site (no depth limit is considered). We will use soil concentrations when evaluating whether or not the UPRs are a threat to groundwater.
30.	p. 3-28, para 4	EPA eco risk guidance should also be listed: 1) EPA. 1998. Guidance for ERA. EPA/630/R-95/002F. 2) EPA. 1997. ERAGS. EPA/540-R-97-006.

		3) EPA. 1997. EPA Region 10 Supplemental ERAGS. EPA 910-R-97-005.
31.	p. 3-29, para 2	Although it is stated, "the reasonably anticipated future land use for the 200 Areas is continued industrial activities for the foreseeable future," it should be acknowledged that land use will be unknown at some time in the future. Therefore, a conservative approach would evaluate a range of human exposure scenarios (e.g., residential, farmer, fisher, Native American), as well as relevant ecological receptors (e.g., terrestrial, aquatic). DD
32.	p. 3-29, sect 3.4.1.1, lines 16-18	The text states "The reasonably anticipated future land use for the 200 Areas is continued industrial activities for the foreseeable future. This land-use assumption is applied to the pathway and receptor considerations in risk calculations for the waste sites." For the groundwater and pathway to groundwater Ecology considers only unrestricted use scenarios (WAC 173-340 Method B) as this is the most beneficial use of the groundwater and is consistent with closure requirements in WAC 173-303-610. Additionally, the Tri-Party response to the Hanford Advisory Board Advice #132 stated "An Industrial land use scenario will set cleanup levels on the Central Plateau. Other scenarios (e.g., residential, recreational) may be used for comparison purposes to support decision making especially for • The post-institutional controls period (> 150 years). • Sites near the Core Zone perimeter to analyze opportunities to "shrink the site." • Early (precedent-setting) closure/remediation decisions. Additionally, Ecology expects evaluation of Native American scenarios. Please evaluate unrestricted as well as Native American scenarios for risk assessment at WMA C.
33.	p.3-29, sect 3.4.1.1, lines 38-41	Please delete the text "Given the local hydrogeology at WMA C, protection of the groundwater from the contaminants, by design, also will result in protection of the Columbia River." This is not the case for contaminants that are more harmful to aquatic biota and those with stringent ambient water quality criteria. This issue was discussed in comment resolution meetings for the SST PA. Ecology realizes that there may be a need to set a point somewhere in the Central Plateau or near the River Corridor for compliance with requirements for surface water protection. This could be acknowledged here.
34.	p. 3-30, sect 3.4.1.4	Though the land use selected by DOE for the Core Zone in the CLUP is industrial (exclusive) for at least the next 50 y, Ecology's expectations for the analysis of risk are included on the attached draft document (*Washington State Department of Ecology Guidance: Exposure Assessment Criteria for the Core Zone of the Central Plateau on the Hanford Site, Mar. 2009 draft*). [Attached]
35.	p. 3-30, para 4	Partitioning land use, according to location inside (i.e., industrial) vs. outside (i.e., unrestricted) the Central Plateau Core Zone, makes sense for the foreseeable future (e.g., institutional control period), but not for longer time horizons (e.g., post institutional control period).
36.	p. 3-31, figure 3-13	Include under the primary release mechanisms surface liquid discharges. An example of this type of release is UPR-200-E-16.
37.	p. 3-31, figure	Re the conceptual exposure model, human and biota receptors could each be subdivided into more specific groups (e.g.,

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 5 of 7

	3-13	residential/industrial/farmer/Native American for human; terrestrial/aquatic for biota). A complete pathway should be shown for human ingestion of biota. "Uptake" of biota is redundant and should be deleted (since ingestion is already specified). As a result of a groundwater connection, surface water and sediments in the Columbia River should be added as exposure media. Complete pathways should be shown for ingestion, inhalation, direct contact, and external radiation of surface water to biota (given their potential exposure at riverbank seeps), as well as ingestion, direct contact, and external radiation of river sediment to biota (as a result of contaminant accumulation in the sediment). Finally, human and biota exposure to vadose zone soils (below 15 ft bgs) may occur via an intruder drilling scenario (where deeper soils are brought to the surface and mixed with surface soils).
38.	p. 3-32, para 1	It is stated, "the ERA for WMA C will adopt relevant methodology and data that were used in the Central Plateau ecological risk assessment (CPERA)." Adopting consistent methods makes sense, although results are currently lacking. That is, the Jan 2008 Central Plateau Terrestrial Ecological Risk Assessment report (p. v in: DOE-2007-50, Draft A, Reissue) noted, "the tank farms [and US Ecology site] were not identified for ecological sampling in Phase II because their operations, regulatory plans, and interim stabilization plans (unique to the tank farms) represented a poor fit from an ecological risk characterization standpoint."
39.	p. 3-32, para 2	MTCA and USDOE ERA guidance should also be consistent with EPA ERA guidance (EPA/630/R-95/002F; EPA/540-R-97-006).
40.	p. 3-32, para 3	In addition to terrestrial eco receptors, risk to aquatic receptors in or near the Columbia River should also be evaluated via a groundwater pathway.
41.	p. 3-33, para 5	The purpose of the WMA C ERA should include evaluation of both terrestrial and aquatic environments.
42.	p. 3-35, para 3	The WAC citation should be "WAC 173-340-7493(2)(a)(i-iv)," not "WAC 173-340-7493(2)(i-iv)."
43.	p. 3-35, para 6	Please clarify that both nonradionuclide and radionuclide COPECs should be derived from the SST DQO (RPP-23403), as well as WMA C soil data, and not be limited to MTCA Table 749-3 and USDOE BCG constituents.
44.	p. 3-36, para 5	The WAC citation should be "WAC 173-340-7493(2)(a)(iv)," not "WAC 173-340-7493(2)(iv)."
45.	p. 3-40, para 1	Substitute "evaluate" for "verify," since contaminant exposure to small mammals is uncertain before tissue data are obtained.
46.	p. 3-40, para 2	Although text indicates that dietary exposure modeling is not identified in WAC 173-340-7493, this method is described for birds and mammals in WAC 173-340-7493(3). DD
47.	p. 3-41 to 3-42, sect 3.4.2.4	In addition to the CPERA and RCBRA, please acknowledge that other eco risk work has been conducted at Hanford (e.g., CRCIA, WTP, 100 Areas, 300 Area, PNNL surveys).
48.	p. 3-43, para 4	Please describe criteria for selecting "threshold indicator constituents."
49.	p. 3-44, para 1	Specify detection limits for Tc-99, I-129, and CN. This section (3.5.1) should be labeled as inorganics and rads, since organics are discussed in the next section (3.5.2).
50.	p. 3-44, para 4	Provide rationale for the number and location of the five sampling locations.
51.	p. 3-44, para 3	Just because TBP is not detected, it is nonconservative to eliminate all organics from the list of COPCs at WMA C.
52.	p.3-44,	Please lower the threshold values of nitrate and hexavalent chromium to concentrations that are used as preliminary

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 6 of 7

	sect 3.5.1	remediation goals or cleanup levels elsewhere on the site. For nitrate this value is 40 mg/kg as N, based on WAC 173-340-747 Equation 747-1 and the MCL for nitrate. For hexavalent chromium, a value of 2 mg/kg is used in consideration of dust resuspension, and a value of 0.2 mg/kg is used both for ecological protection, which is consistent with the value calculated for soil for the protection of groundwater. If 0.2 mg/kg is above the detection level, then the hexavalent chromium indicator concentration should be set at the detection limit.
53.	p. 3-44 – 3-45, sect 3.5.2	Methylene chloride, acetone, 2-butanone, and chloroform may be common lab contaminants but they also may be present in tanks. Some of these have been found in tank headspaces. If they are observed in samples the associated blanks should be considered when deciding if these are from the tanks or a lab source. They should not automatically be attributed to lab contamination.
54.	p. 3-45, para 3	Re PCB congener analysis, please specify Method 1668 and quantify dioxin like toxic equivalents (TEQ) with WHO 2005 toxic equivalency factors (TEFs) for humans/mammals and with WHO 1998 TEFs for fish and birds. PCB congeners should be evaluated in a portion of all soil samples collected at WMA C, rather than being constrained to the initial 5 locations (EPA, 2007). Recommendations for human health risk-based chemical screening and related issues at EPA Region 10 CERCLA and RCRA sites. OEA-095, Memo from Michael Cox).
55.	p. 3-45, para 4	Specify detection limits for pesticides and petroleum products.
56.	section 5, general	Ecology is submitting comments on the Phase 2 Master Work Plan. Please revise this section so that it is consistent with the revisions needed in the master work plan.
57.	General Comment Chapter 5	Soil is one component to be closed as part of the WMA C RCRA closure process following WAC 173-303-610. Therefore, these activities should be called a RCRA Component Closure Work Plan. Please correct in the title and throughout this RPP-PLAN-39114 document.
58.	pg. 5-1 lines 22, 23	Any revisions to the work plan must be submitted to Ecology for APPROVAL. Please correct.
59.	pg. 5-6, lines 38, 39	Groundwater is another component of WMA C to be closed under RCRA. Although HFFACO agrees that groundwater operable units will be closed/remediated under past practice authority, groundwater must at least be addressed here—even if only a reference to another work plan, RI/FS or program is included. Closure/remediation of groundwater must meet closure performance standards of WAC 173-303-610. Please include this information here and in this section of the work plan.
60.	pg. 5-9, Sect. 5.4	See comment 58 and replace all references to corrective measures to closure investigations and closure actions—including the implementation of any interim measures. Please correct.
61.	p. 5-11, para 1	Please add the following EPA guidance: 1) EPA-540-R-070-002. Jan 2008. RAGS, Part F, Supp. Guidance for Inhalation Risk Assessment. 2) EPA/600/R-07/038. Apr 2007. ProUCL Version 4.0, User Guide.
62.	p. 5-11, para 3	It should be a requirement (rather than an option) that other scenarios (i.e., Native American, residential, intruder) be evaluated to assess post-remediation risk.
63.	p. 5-12, para 3	In addition to terrestrial eco risk, aquatic eco risk should be assessed, as a result of a contaminant groundwater pathway to the

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 7 of 7

		Columbia River. Additional ERA guidance should be consulted (e.g., EPA/630/R-95/002F; EPA/540-R-97-006).
64.	pg. 5-14, sect 5.4.7	Pg. 5-14, Sect. 5.4.7 addresses soil only. Soil is one component to be closed under RCRA. Also included are the tanks and the waste contained therein, as well as ancillary equipment. These should be included as closure actions/options. Please address.
65.	pg. 5-21, lines 19-22	Actions in the Central Plateau under CERCLA will have to be coordinated with corrective measures AND closure actions being implemented under a RCRA permit to assure that actions on TSD units fulfill the closure performance standards of WAC 173-303-610. Please correct.
66.	pg. 7-1 and section 7	Pg. 7-1 and Section 7. The title of this section includes program integration, but the section only discusses the various groups that will participate, and not how the program/project and resulting data are integrated. Please revise to address integration activities and how they will be accomplished.
67.	Appendix A	Appendix A is the SAP which is not included, but was released as a separate document. Will the document stand alone, or be incorporated here as Appendix A? Please clarify.
68.	p. B-5, para 1	Water terms (C, I, AUF, d) in the oral exposure equation are not defined. Please fix.
69.	p. B-5, para 2	Provide rationale for 3 transects, a minimum of 6 organisms/transect, and for deriving a mean COPEC tissue concentration by weighting carcass (90%) and liver/kidney (10%) composites.
70.	p. B-6, para 1	The list and hierarchy of analytes given here in Section B1.7 differs slightly from that specified in Section B1.3. Please reconcile.
71.	p. B-8, Table B-2	Please clarify footnote "a" and indicate where it applies in the table body.
72.	p. B-10, para 3	Provide a reference for home range and dispersal distance for a deer mouse.
73.	p. B-10, sect B3.2	The home range specified for a deer mouse is 0.077 hectares. It does not seem reasonable to expect that the home range is known to that degree of precision. Please cite references for this value.
74.	p. B-11, figure B-2	Although the study area dimension is based on a deer mouse home range, provide rationale for specific transect locations (i.e., one perimeter transect group inside WMA C and two vegetated habitat transect groups outside WMA C).

Washington State Department of Ecology Guidance: Exposure Assessment Criteria for the Core Zone of the Central Plateau on the Hanford Site

March 2009 draft

Outline

1.0 Introduction
2.0 Operational Period (next 50 y)
3.0 Institutional Control Period (from 50-150 y)
- **3.1 Industrial land use**
- **3.2 Industrial scenario for nonradiological contaminants (includes U)**
  - **3.2.1 Soil risks**
  - **3.2.2 Groundwater risks**
  - **3.2.3 Air risks**
  - **3.2.4 Site risk/hazard**
  - **3.2.5 Ecological receptors**
- **3.3 Industrial scenario for radiological contaminants**
  - **3.3.1 Risks from all pathways (includes soil)**
  - **3.3.2 Groundwater risks**
  - **3.3.3 Air risks**
  - **3.3.4 Ecological receptors**
- **3.4 Other scenarios to support remedy decisions**
  - **3.4.1 Justification**
  - **3.4.2 Unrestricted land use**
  - **3.4.3 Unrestricted land use for nonradiological contaminants (includes U)**
    - **3.4.3.1 Soil risks (includes ecological receptors)**
    - **3.4.3.2 Groundwater risks**
    - **3.4.3.3 Air risks**
    - **3.4.3.4 Site risk/hazard**
  - **3.4.4 Unrestricted land use for radiological contaminants**
    - **3.4.4.1 Risk from all pathways (includes soil and ecological receptors)**
    - **3.4.4.2 Groundwater risks**
    - **3.4.4.3 Air risks**
  - **3.4.5 Additional pathways**
  - **3.4.6 Native American scenarios**
  - **3.4.7 Intruder risks**

4.0 Post Institutional Control Period (from 150 y and beyond)
5.0 Summary
- **5.1 Operational Period**
- **5.2 Institutional Control Period**
- **5.3 Post Institutional Control Period**

6.0 Tables
- **6.1 Human conceptual exposure model**
- **6.2 Ecological conceptual exposure model**

7.0 References

1.0. Introduction

The purpose of this guidance is to outline exposure assessment criteria, established by the Washington State Department of Ecology ("Ecology"), applicable to operable units (OUs) and waste management areas (WMAs) within the Central Plateau Core Zone of the 200 Areas at the Hanford site, owned and operated by the U.S. Dept. of Energy (USDOE). This guidance is based on the Model Toxics Control Act (MTCA) and implementing regulation (WAC 173-340) (WDOE, 2007a), but also includes other state regulations (e.g., WDOE, 2006), federal criteria for radiological sites (e.g., USEPA, 1989; USEPA, 1997a, USDOE, 2002), and site-specific criteria for evaluating exposure to nonradionuclide and radionuclide contaminants at Hanford (e.g., USDOE, 1995a, USDOE, 1995b; USDOE, 1996; WDOH, 1997). The outline provides a minimum set of requirements for exposure and risk assessment, and applies to baseline risk assessments (pre-remediation risk), risk assessments that support evaluation of remedial alternatives in feasibility studies, and risk assessments in support of waste management area closure.

This guidance is organized by time periods of interest (i.e., operational, institutional control, post institutional control). The first time period is the operational period during which it is expected that cleanup and closure efforts will be the dominant site activities. This period is assumed for this guidance to continue for approximately 50 years from the present. The current level of site restriction is assumed to continue during the operational period. The second time period is the period after which operations have ceased and access to the Core Zone will be restricted through the use of institutional controls. It is expected, during this time, that remedies designed to restrict access to subsurface waste will function as designed. This period is assumed for this guidance to last for 100 years after operations have ceased. The third time period is that after which institutional controls are no longer in place. The remedies designed to restrict access to subsurface waste may begin to fail in this time period. This time period is assumed for this guidance to begin 100 years after operations at the site have ceased.

Exposure assessment criteria are listed for both nonradionuclide and radionuclide contaminants for industrial, unrestricted use (with MTCA pathways and with several pathways additional to MTCA), Native American, and intruder (acute and chronic) scenarios. Additionally, ecological (terrestrial and aquatic biota) exposure evaluation criteria are given. Exposure scenarios are summarized in Table 6.1 for human receptors. Pathways for terrestrial and aquatic ecological receptors are summarized in Table 6.2.

MTCA regulations (WDOE, 2007a) are intended for setting cleanup levels at sites and in media contaminated with hazardous substances. Ecology evaluates compliance with WAC 173-340 by comparison of on-site and off-site media concentrations of hazardous substances against cleanup levels and risk and hazard levels calculated using the methods established in WAC 173-340.

2.0. The Operational Period (next 50 y)

For the next 50 years, it is assumed that the current level of site access will be maintained, and the site users in the Core Zone will be largely Hanford site workers. Hanford site workers receive USDOE Hanford General Employee Training (HGET) and General Employee

Radiological Training (GERT). During the operational period, site worker exposure to contaminants is assumed to be limited to the worker safety standard limits established by USDOE. During this period, Hanford cleanup should proceed such that the risk and hazard levels described in the following subsections of this guidance are achieved, to protect the potential future receptors.

3.0. The Institutional Control Period (from 50-150 y)

After site operations have ended and the USDOE presence continues in a role of maintaining institutional and engineering controls, the Core Zone of the Central Plateau is assumed to be strictly an area of industrial activities. This time period for this guidance is assumed to begin 50 years from the present and assumed to continue for an additional 100 years.

3.1. Industrial Land Use

Currently, the land use in the Core Zone at Hanford is classified as Industrial-Exclusive (USDOE, 1999). This classification applies to portions of the site that are suitable for treatment, storage and disposal of nonradioactive and radioactive wastes. This land use is distinguished from other Hanford site industrial use activities such as reactor operations, mining, manufacturing, assembly sites, food processing, warehousing, transportation-related operations and distribution operations.

The industrial and industrial-exclusive activities listed above are somewhat consistent with the definition for industrial land use in WAC 173-340-200 and -745. However, two additional considerations are needed when determining if a land use should be considered industrial according to WAC 173-340. That is, industrial properties are zoned for industrial use by a city or county conducting land use planning under the Growth Management Act, 36.70A RCW (RCW, 2006); or the properties are zoned for industrial use and adjacent to properties currently used or designated for industrial purposes. If activities at a site do not meet these conditions, the following characteristics should be considered when applying an industrial land use designation, according to WAC 173-340: (1) people generally do not live on the site and exposure is mainly to adult employees; (2) access to the general public is highly limited and controlled; (3) food is generally not grown or raised on the site; (4) operations are often characterized by chemical storage, noise, odors and truck traffic; (5) the surface of the land is often mostly covered by structures and paved areas, limiting potential exposure to soil; (6) commercial support facilities, including offices and restaurants for the industrial employees, but not the public, may be located on industrial sites.

3.2. Industrial Scenario for Nonradiological Contaminants (includes uranium)

Ecology's regulatory authority for cleanup of nonradiological contaminants under an industrial scenario is described in WAC 173-340 (WDOE, 2007a). This regulation specifies methods for cleanup of abiotic media, limits for site risk and hazard, and methods for assessing terrestrial ecological risk.

3.2.1. Soil Risks from Nonradionuclides under the Industrial Scenario

Using an industrial scenario for nonradiological contaminants and uranium (a nephrotoxic metal), the following requirements would apply for soil. For the direct contact pathway (e.g., soil ingestion), soil concentrations are derived using WAC 173-340-745. Additionally, soil concentrations must be protective of groundwater and are derived using WAC 173-340-747 Method B. Method B is required, since groundwater is contiguous inside and outside of the Core Zone, and Method B is required for the unrestricted land use outside of the Core Zone. Furthermore, if subsections (5), (7), (8) or (9) are used to derive soil concentrations for protecting groundwater, Ecology approval is required. Additional guidance for the use of the listed subsections will be provided by Ecology, as needed.

Soil concentrations must also be protective of surface water and are derived using WAC 173-340-730, (not including subsections (2) and (4)) in combination with WAC 173-340-747 Method B. This is necessary because groundwater protection alone may not result in achieving all water quality standards in the river and concentrations protective of all receptors in the river. For instance, a Cr (VI) concentration of 48 μg/L meets WAC 173-340-720 criteria for groundwater (concentration that achieves a hazard quotient of 1). However, the surface water quality criterion (WAC 173-201A) is 10 μg/L (WDOE, 2006). Assuming no dilution at the river (WAC 173-340-730(6)(b)), groundwater at 48 μg/L would not meet the surface water quality criterion for Cr (VI). Consequently, a lower groundwater concentration must be achieved prior to the groundwater/surface water interface. Though attenuation of contamination in the Core Zone is expected during transport to the river in groundwater, attenuation may be off-set by down gradient sources of groundwater contamination. Site-specific groundwater modeling beyond waste site boundaries may be needed to address attenuation and anticipated concentrations at the Columbia River from the Core Zone and down gradient sources of contamination.

It may be necessary to consider the inhalation pathway when deriving soil cleanup levels. Air protection values are derived according to WAC 173-340-750 and are discussed further in Section 3.1.3. WAC 173-340-750 should be used when deriving soil cleanup levels protective of inhalation of soil vapors or resuspended dust associated with a site.

3.2.2. Groundwater Risks from Nonradionuclides under the Industrial Scenario

Groundwater cleanup levels are derived according to WAC 173-340-720, Method B, at the point of compliance. These concentrations assume that the most beneficial use for groundwater is a drinking water source for humans. Federal or state maximum contaminant levels (MCLs) may also apply to drinking water (USEPA, 2006; WDOH, 2008). As previously discussed for soils, groundwater cleanup levels may not always provide protection of ecological receptors at the interface between the groundwater and the Columbia River. In some cases, the state water quality standards (WAC 173-201A) dictate lower water concentrations than the WAC 173-340-720 Method B groundwater cleanup levels. Where controlling source concentrations of contaminants is not effective in reducing groundwater concentrations to levels protective of surface water, Ecology expects further cleanup of groundwater to achieve levels protective of surface water.

During the operational period, as previously stated, human receptors in the Core Zone at the Hanford site are expected to be industrial workers. Though USDOE does not currently plan to access groundwater for human consumption in the Core Zone until it meets drinking water standards, Ecology expects industrial scenarios to include evaluation of the groundwater ingestion pathway. The human receptors, in this case, are assumed to be adults with an average body weight of 70 kg and a drinking water consumption rate of 2 L/day. Evaluation of drinking water ingestion is consistent with potential exposure routes listed for the commercial/industrial population in Exhibit 6-7 in USEPA (1989).

3.2.3. Air Risks from Nonradionuclides under the Industrial Scenario

Air protection values are derived according to WAC 173-340-750. These levels apply to air contamination from contaminated media and/or remedial actions, though not to industrial or commercial operations or processes. On-site receptors are expected to be adults with an average body weight of 70 kg and a breathing rate of 20 m^3/day. Off-site receptors are expected to include adults, and children with an average body weight of 16 kg and a breathing rate of 10 m^3/day.

3.2.4. Site Risk/Hazard from Nonradionuclides under the Industrial Scenario

Site risk and hazard is determined in accordance with WAC 173-340-708. The hazard quotient for individual hazardous contaminants is not to exceed 1. The site hazard index is not to exceed 1.Total site risk for carcinogens, for all contaminants, all pathways and all media, is not to exceed 1E-05. USEPA guidance for risk assessments (e.g. USEPA, 1989) should be followed, in addition to WAC 173-340-708 requirements (WDOE, 2007a).

3.2.5. Industrial Scenario Nonradiological Contaminant Requirements for Ecological Receptors

In addition to protecting human receptors, soil concentrations must be protective of terrestrial and aquatic ecological receptors. For terrestrial ecological receptors, nonradiological contaminants (including uranium) are evaluated, according to WAC 173-340-7490 through -7494 (WDOE, 2007a). During the institutional control period, the Core Zone is expected to have restricted access for humans, but is likely accessible to biota. For ecological receptor evaluations, industrial properties are defined in accordance with WAC 173-340-7490(3)(c). At sites where screening-level ecological risk assessments show exceedences of screening criteria (e.g., MTCA Table 749-3), site-specific ecological risk assessment is required (WAC 173-340-7493). Aquatic ecological receptors should be evaluated with acceptable methods (e.g., USEPA, 1997b; USEPA, 1998).

3.3. Industrial Scenario for Radiological Contaminants

Ecology's regulatory authority over radionuclides is currently unclear. However, radionuclides are hazardous substances and co-contaminants with toxic nonradionuclides (WDOE, 2007a). Ecology has an interest in assuring that total site risk and hazard is maintained at or below

federal and state limits. The following guidelines for radionuclides are consistent with current federal guidelines and are included in this guidance for completeness.

3.3.1. Risks from All Pathways including Soil for Radionuclides under the Industrial Scenario

Consistent with the CERCLA risk range of 1E-04 to 1E-06 (USEPA, 1997a), a dose limit (i.e., total effective dose from all pathways) of 15 mrem/y is the expected limit for industrial workers, unless the workers are specifically trained and monitored for radiological work. The above risk and dose levels also apply to off-site receptors. For workers properly trained and monitored for radiological work (e.g., GERT), it is expected that the contemporary safety standards for such work would be achieved.

Predictions regarding future radiological doses and risk based on fate and transport modeling should be consistent with Exhibit 6-6 in USEPA (1989).

3.3.2. Groundwater Risks from Radionuclides under the Industrial Scenario

Groundwater concentrations should not exceed MCLs for radionuclides (USEPA, 1976) from all current (e.g., groundwater plumes) and future (e.g., soil leaching) contaminant sources at the point of compliance. Groundwater ingestion should be included as a pathway under an industrial scenario (USEPA, 1989).

3.3.3. Air Risks from Radionuclides under the Industrial Scenario

Annual dose from the airborne pathways should not exceed 10 mrem/y for the maximally exposed individual at the site boundary, based on National Emission Standards for Hazardous Air Pollutants (NESHAPS) (CFR, 2006) and WAC 173-480-040 (WDOE, 2007b).

3.3.4. Industrial Scenario Radiological Contaminant Requirements for Ecological Receptors

USDOE (2002) methods should be used to address site biota. Biota Concentration Guidelines (BCGs) represent the general screening phase and apply to soil, sediment, and surface water. Soil and groundwater pathways should ensure that BCGs at the river (surface water and sediment) are not exceeded. BCGs correspond to 0.1 rad/d for terrestrial and riparian animals and 1 rad/d for terrestrial plants and aquatic populations.

3.4. Other Scenarios to Support Remedy Decisions

Other scenarios are discussed here for consideration in making remedial decisions. These additional scenarios are more stringent or sufficiently different than industrial scenarios. The justification for evaluating these scenarios is provided. This justification applies both to the Institutional Control and Post-Institutional Control periods.

3.4.1. Justification

According to 40 CFR 300.515(f), the State may opt for an enhanced remedy, different than the remedy chosen using the CERCLA 9 criteria, if the State is willing to pay the additional cost (CFR, 2007). In order to evaluate enhanced remedies, the State needs an unrestricted use risk assessment for each remedial alternative to evaluate protectiveness. The State may choose a more protective alternative even if it is not the preferred alternative based on the CERCLA 9 criteria.

State regulations allow consideration of alternate reasonably maximally exposed receptors for evaluating the protectiveness of remedies (WDOE, 2007a). WAC 173-340-708(3)(d) states that Ecology can "use alternate reasonable maximum exposure scenarios to help assess the protectiveness to human health of a cleanup action alternative that incorporates remediation levels and uses engineered controls and/or institutional controls to limit exposure to the contamination remaining on the site." WAC 173-340-708(3)(d)(ii) states that other scenarios can be used for evaluating protectiveness of remedies. Additionally, CERCLA allows consideration of additional scenarios for remedial decision making.

Ecology may require evaluation of additional pathways for nonradionuclides (WDOE, 2007a). WAC 173-340-720(1)(d) states that "The department may require more stringent cleanup levels than specified in this section, where necessary to protect other beneficial uses or otherwise protect human health and the environment." For example, inhalation of groundwater during showering is an important pathway for Cr (VI), because it is carcinogenic by this pathway, and it is expected to be a risk driver at Hanford. Other important pathways for Hanford contaminants include food ingestion pathways such as ingestion of garden produce (including fruit), ingestion of wild game and ingestion of fish. For information purposes and remedial decision making, scenarios including additional pathways should be evaluated.

State regulations (WAC 173-340) require that "traditional industrial use" sites with hazardous substance contamination have restricted access to the general public. An unrestricted scenario may apply for the period after which implementation of institutional controls has become ineffective, when there is a higher likelihood of human intrusion.

Finally, there is a desire by USDOE, the regulatory agencies, and stakeholders to shrink the footprint of contamination at Hanford, including decreasing the area of the Core Zone. Therefore, areas inside the current boundary of the Core Zone may ultimately fall outside the Core Zone.

3.4.2. Unrestricted Land Use

Unrestricted land use refers to land use practices in which restrictions on the use of the site or natural resources affected by hazardous substance releases are not required to protect human health and the environment. For unrestricted land use scenarios, both child and adult receptors should be evaluated. Unrestricted land use is the presumed exposure scenario in WAC 173-340 (WDOE, 2007a). Current and future site usage is the basis for estimating a reasonable maximum exposure (RME) under unrestricted land use.

3.4.3. Unrestricted Land Use for Nonradiological Contaminants (includes Uranium)

Ecology's regulatory authority for cleanup of nonradiological contaminants under an unrestricted land use scenario is described in WAC 173-340 (WDOE, 2007a). This regulation specifies methods for cleanup of abiotic media, limits for site risk and hazard, and methods for assessing ecological risk.

3.4.3.1. Soil Risks from Nonradionuclides under the Unrestricted Use Scenario (includes Ecological Receptors)

Soil concentrations should be protective of human direct contact, human ingestion of groundwater beneath the site, inhalation of air on and off the site, human and ecological receptors using surface water down-gradient of the contaminated site, and terrestrial ecological receptors (WDOE, 2007a). Soil direct contact concentrations are derived using WAC 173-340-740. Soil concentrations must be protective of groundwater and are derived using WAC 173-340-747 Method B (use of subsection (5), (7), (8) or (9) methods require Ecology approval). Air protection values must be derived according to WAC 173-340-750 (e.g., when deriving soil cleanup levels protective of inhalation of soil vapors or resuspended dust). Soil concentrations must be protective of surface water, derived using WAC 173-340-730 (not including subsections (2) and (4)), and in combination with WAC 173-340-747 Method B.

Soil concentrations must be protective of terrestrial ecological receptors (i.e., plants, soil biota, wildlife), as specified in WAC 173-340-7490 and WAC 173-340-900 (Table 749-3). As for the industrial scenario, where screening-level ecological risk assessments show exceedences of screening criteria (e.g., MTCA Table 749-3), site-specific ecological risk assessment is required (WAC 173-340-7493). In addition, soil concentrations must be protective of aquatic ecological receptors (i.e., plants, invertebrates, fish). Aquatic ecological risk should be evaluated with acceptable methods (e.g., USEPA, 1997b; USEPA, 1998).

3.4.3.2. Groundwater Risks from Nonradionuclides under the Unrestricted Use Scenario

Groundwater concentrations are derived according to WAC 173-340-720, Method B at the point of compliance. Calculation of groundwater cleanup levels and risk for unrestricted use are essentially the same as those for industrial use, described in Section 3.3.2. In both cases, the most beneficial use of groundwater is a drinking water source.

3.4.3.3. Air Risks from Nonradionuclides under the Unrestricted Use Scenario

Air protection values are derived according to WAC 173-340-750. These levels apply to air contamination from contaminated media and/or remedial actions, though not to industrial or commercial operations or processes. When calculating risks and cleanup levels for noncarcinogens, for both on-site and off-site human receptors, RME individuals are assumed to be children with a body weight of 16 kg and a breathing rate of 10 m^3/day. For carcinogens, the RME individuals are assumed to be adults with an average body weight of 70 kg and a breathing rate of 20 m^3/day.

3.4.3.4. Site Risk/Hazard from Nonradionuclides under the Unrestricted Use Scenario

Site risk and hazard is determined in accordance with WAC 173-340-708. The site hazard quotient for individual hazardous contaminants is not to exceed 1. The site hazard index is not to exceed 1. Site risk for individual carcinogens is not to exceed 1E-06. Total site risk for carcinogens, for all contaminants, all pathways and all media, is not to exceed 1E-05. USEPA guidance for risk assessments (e.g. USEPA, 1989) should be followed, in addition to WAC 173-340-708 requirements (WDOE, 2007a).

3.4.4. Unrestricted Land Use Scenario for Radiological Contaminants

Ecology's regulatory authority over radionuclides is currently unclear. However, radionuclides are hazardous substances and co-contaminants with toxic nonradionuclides. Ecology has an interest in assuring that total site risk and hazard is maintained at or below federal and state limits. The following guidelines for radionuclides are consistent with current federal guidelines and are included in this guidance for completeness.

3.4.4.1. Risks from All Pathways (includes Soil and Ecological Receptors) for Radionuclides under Unrestricted Use Scenario

Consistent with the CERCLA risk range of 10^{-4} to 10^{-6} (USEPA, 1997a), a dose limit (i.e., total effective dose from all pathways) of 15 mrem/y applies to all human receptors (USEPA, 1997a). The dose and risk limits for unrestricted land use are calculated for adults and children, who are assumed to live at the site. The risk and dose levels also apply to off-site receptors.

Predictions regarding future radiological doses and risk based on fate and transport modeling should be consistent with Exhibit 6-6 in USEPA (1989).

As for industrial land use, USDOE Biota Dose Assessment Committee (BDAC) methods should address site biota (USDOE, 2002). BCGs represent the general screening phase and apply to soil, sediment, and surface water. Soil and groundwater pathways should ensure that BCGs at the river (surface water and sediment) are not exceeded. BCGs correspond to 0.1 rad/d for terrestrial and riparian animals and 1 rad/d for terrestrial plants and aquatic populations.

3.4.4.2. Groundwater Risks from Radionuclides under the Unrestricted Use Scenario

Groundwater consumption is assumed for unrestricted land use. As with industrial land use, groundwater concentrations are not to exceed MCLs for radionuclides (USEPA, 1976) from all current (e.g., groundwater plumes) and future (e.g., soil leaching) contaminant sources.

3.4.4.3. Air Risks from Radionuclides under the Unrestricted Use Scenario

Annual dose from the airborne pathways should not exceed 10 mrem/y to the whole body for any member of the public, according to WAC 173-480-040 (WDOE, 2007b).

3.4.5. Risks from Additional Pathways

Residential land use is considered to be the site use requiring the most protective cleanup levels under WAC 173-340 (WDOE, 2007a). The WAC 173-340 regulations interpret residential use as unrestricted use, which has been discussed above as the presumed RME scenario. However, the unrestricted use scenario described in WAC 173-340 omits pathways such as showering, inhalation during showering, and ingestion pathways for consumption of residential produce, livestock, and game (including fish from the Columbia River). It also omits some relevant pathways in EPA/540/1-89/002, Exhibit 6-6 (USEPA, 1989). These pathways could be important future use exposure pathways in the rural setting of the Hanford site. Ecology has an interest in being informed, through evaluation of these pathways, to determine protectiveness of remedial actions and to protect potential other beneficial uses (e.g., agriculture). Table 6.1 indicates additional pathways to evaluate. The evaluation should address both nonradiological and radiological contaminants. Both child and adult receptors should be evaluated when examining the additional pathways.

3.4.6. Native American Scenarios

While Native American scenarios have a variety of pathways in common with unrestricted land use exposure pathways, they often consider additional activities and exposure routes that are consistent with traditional Native American lifestyles. Frequently, they also require different parameter values than unrestricted use scenarios (e.g., higher rates for fish ingestion, inhalation, soil ingestion). Though a number of Native American scenarios have been developed in the history of risk assessment at the Hanford site, two tribes have submitted current exposure scenarios: the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) (Harris and Harper, 2004) and the Yakama Nation (Ridolfi, 2007).

Ecology supports evaluation of current Native American scenarios and additional Native American scenarios that may be submitted by tribes in the future. Ecology's expectations are that the Native American scenarios will be used as specified by the tribes, and will address both nonradiological and radiological contaminants. Ecology has an interest in using Native American scenarios to aid in planning remedial activities and in evaluating protectiveness of remedies. Ecology expects that these scenarios will frequently be the most conservative predictors of potential future risks at the Hanford site.

3.4.7. Risks to Intruders

It is expected that during the institutional control period, intrusion into former waste sites, landfills, and other buried waste will be minimized by actions taken to prevent inadvertent intrusion (e.g., Bradford et al, 2006). However, evaluating risks associated with intrusion during the institutional control period may indicate the adequacy of the institutional control time period and the protectiveness of remedies.

Evaluation of intrusion scenarios should cover all contaminants (nonradiological and radiological). Various modes of intrusion should be evaluated, consistent with potential future activities in a rural setting adjacent to an expanding population center. Acute exposure via

excavation for a home with a basement, drilling, trenching, mining, and road construction should be examined. Post intrusion exposure to children and adults who raise produce (a garden) and have chronic residential exposure, including groundwater ingestion and groundwater use in the garden, should also be evaluated. The post-intrusion residents should be assumed to use material exhumed during intrusion as garden soil and fill and landscaping in their yard of roughly 0.25 acres.

Additionally, the waste that remains buried should be assumed to be positioned beneath or close to the basement and lower floor of the home. A groundwater well on the home site should be assumed as a source of drinking water and a source of water for showering, cleaning, food preparation, and irrigation at the residence. Intruder scenarios should be run for the time period immediately after remedy construction completion. Additional times beyond construction completion should be included, as necessary, to address risks from potential radionuclide in-growth products or other contaminant degradation and transformation products.

4.0. The Post Institutional Control Period (from 150 y and beyond)

The Post Institutional Control Period is expected to begin 100 y after site operations have ended. All scenarios included for the Institutional Control time period should be evaluated for the Post Institutional Control Period, as well. This is derived from the 40 CFR 300.430(e)(9)(iii)(C)(2) requirement to evaluate long term effectiveness (on of the CERCLA 9 criteria) considering, "Adequacy and reliability of controls such as containment systems and institutional controls" (CFR, 2007) It is reasonable to expect that institutional controls will be less reliable for maintaining industrial conditions in the Core Zone beyond 150 y. It is expected that risk evaluations will examine contaminants until the time at which they reach peak concentrations in groundwater at the point of compliance, which may exceed 10000 y (e.g., Bradford et al., 2006).

5.0. Summary

5.1. Operational Period (next 50 y)

Industrial exclusive with DOE HGET/GERT-trained workers and DOE trained radiological workers.

5.2. Institutional Control Period (from 50 to 150 y)

A) Industrial Scenario for Nonradiological Contaminants (includes uranium)

Soil

Soil direct contact concentrations are derived using WAC 173-340-745. Soil concentrations protective of groundwater are derived using WAC 173-340-747 Method B; any use of subsection (5), (7), (8) or (9) methods requires Ecology approval. Soil concentrations protective of surface water are derived using WAC 173-340-730, (not including subsections (2) and (4)) in combination with WAC 173-340-747 Method B.

Groundwater

Groundwater cleanup levels are derived according to WAC 173-340-720, Method B at the point of compliance. Include groundwater ingestion as a pathway in risk assessment.

Air

Air protection values are derived according to WAC 173-340-750.

Site Risk/Hazard (WAC 173-340-708)

Site hazard quotient for individual hazardous contaminants is not to exceed 1. Site hazard index is not to exceed 1. Total site risk for carcinogens, for all contaminants, all pathways and all media, is not to exceed 1E-05. USEPA guidance for risk assessments should be followed in addition to WAC 173-340-708 requirements.

Ecological Receptors

Soil concentrations protective of terrestrial ecological receptors are specified in WAC 173-340-7490 through -7494, and using Table 749-3 for terrestrial ecological risk screening. Soil concentrations protective of aquatic ecological receptors should also be specified with acceptable methods (e.g., USEPA, 1997b; USEPA, 1998).

B) Industrial Scenario for Radiological Contaminants

All Pathways (includes Soil)

15 mrem/y dose limit (total effective dose from all pathways) applies to industrial workers (consistent with CERCLA risk range of 10^{-4} to 10^{-6} per OSWER 9200.4-18). Fate and transport modeling should be consistent with Exhibit 6-6 in EPA/540/1-89/002.

Groundwater

Groundwater concentrations are not to exceed MCLs for radionuclides from all current (e.g., groundwater plumes) and future (e.g., soil leaching) contaminant sources at the point of compliance. Include groundwater ingestion as a pathway in risk assessments.

Air

Annual dose from the airborne pathways is not to exceed 10 mrem/y for the maximally exposed individual at the site boundary, according to NESHAPS and WAC 173-480-040.

Ecological Receptors

USDOE (2002) methods should be used to address site biota. BCGs represent the general screening phase and apply to soil, sediment, and surface water. Soil and groundwater pathways should ensure that BCGs at the river (surface water and sediment) are not exceeded. BCGs correspond to 0.1 rad/d for terrestrial and riparian animals and 1 rad/d for terrestrial plants and aquatic populations.

C) Unrestricted Use for Nonradiological Contaminants (includes Uranium)

Soil (includes Ecological Receptors)

Soil direct contact concentrations are derived using WAC 173-340-740. Soil concentrations protective of groundwater are derived using WAC 173-340-747 Method B; any use of subsection (5), (7), (8) or (9) methods requires Ecology approval. Soil concentrations protective of surface water are derived using WAC 173-340-730 (not including subsections (2) and (4)) in combination with WAC 173-340-747 Method B. Soil concentrations protective of terrestrial ecological receptors (i.e., plants, soil biota, wildlife) are obtained as specified in WAC 173-340-7490 and using Table 749-3 for terrestrial ecological screening. Soil concentrations protective of aquatic ecological receptors (i.e., plants, invertebrates, fish) should also be specified with acceptable methods (e.g., USEPA, 1997b; USEPA, 1998).

Groundwater

Groundwater concentrations are derived according to WAC 173-340-720, Method B at the point of compliance. Include groundwater ingestion as a pathway in risk assessments.

Air

Air protection values are derived according to WAC 173-340-750.

Site Risk/Hazard (WAC 173-340-708)

Site risk for individual carcinogens is not to exceed 1E-06. Total site risk for carcinogens, for all contaminants, all pathways and all media, is not to exceed 1E-05. Site hazard quotient for individual hazardous contaminants is not to exceed 1. Site hazard index is not to exceed 1.

D) Unrestricted Use for Radiological Contaminants

All Pathways (includes Soil and Ecological Receptors)

15 mrem/y dose limit (total effective dose from all pathways) applies to all human receptors (consistent with CERCLA risk range of 10^{-4} to 10^{-6} per OSWER 9200.4-18). The 15 mrem/y dose limit is the target dose limit for the reasonably-anticipated future land use. Fate and transport modeling consistent with Exhibit 6-6 in EPA/540/1-89/002. USDOE (2002) methods should be used to address site biota. BCGs represent the general screening phase and apply to soil, sediment, and surface water. Soil and groundwater pathways should ensure that BCGs at the river (surface water and sediment) are not exceeded. BCGs correspond to 0.1 rad/d for terrestrial and riparian animals and 1 rad/d for terrestrial plants and aquatic populations.

Groundwater

Groundwater concentrations are not to exceed MCLs for radionuclides from all current (e.g., groundwater plumes) and future (e.g., soil leaching) contaminant sources. Groundwater ingestion must be included as a pathway in risk assessments.

Air

Annual dose from the airborne pathways is not to exceed 10 mrem/y to the whole body for any member of the public, according to WAC 173-480-040.

E) Scenario including Additional Pathways

All contaminants (nonradiological and radiological) included. Pathways to include showering, inhalation during showering, and ingestion pathways for consumption of residential produce and livestock, and game (including fish from the Columbia River), and appropriate pathways in EPA/540/1-89/002, Exhibit 6-6, in addition to all of the Unrestricted Use pathways. Both child and adult receptors should be evaluated.

F) Native American Scenarios

All contaminants (nonradiological and radiological) are evaluated, as specified by the tribes.

G) Intruders

All contaminants (nonradiological and radiological) are evaluated. Acute exposure via excavation for a home with a basement, drilling, trenching, mining and road construction should be examined. Scenario for post intrusion residents (children and adults) who raise produce (a garden) and have chronic residential exposure (including groundwater ingestion and groundwater use in the garden) on a residential site of 0.25 acre. The time period for evaluation begins immediately after remedy construction completion. Additional times beyond construction completion should be included, as necessary, to address risks from potential radionuclide in-growth products or other contaminant degradation products.

5.3. Post Institutional Control Period (from 150 y and beyond)

All scenarios included for the 50 to 150 y time period should be evaluated for time periods beyond 150 y. Risk evaluations should examine contaminants until the time at which they reach peak concentrations in groundwater at the point of compliance, which may exceed 10000 y.

6.0. Tables

Table 6.1. Human conceptual exposure model.

Scenario / Pathway	Industrial	Unrestricted Use	Scenario with additional pathways	Native American	Intruder Acute	Intruder Chronic
External Radiation	●	●	●		●	●
Direct Contact (WAC 173-340-745)	●					
Direct Contact (WAC 173-340-740)		●	●		●[c]	●
Groundwater (WAC 173-340-720)	●	●	●			●
Soil for Protection of groundwater (WAC 173-340-747[a])	●	●	●			●
Soil for Protection of Surface Water (WAC 173-340-747[b])	●	●	●			
Air (WAC 173-340-750)	●	●	●			●
Showering			●			
Inhalation during showering			●			
Residential Produce and Livestock			●			●
Game			●			
Fish			●			
Ecological (WAC 173-340-7490 and BDAC)[d]	●	●	●			
All Pathways Specified by Tribes				●		

[a]C_w based on WAC 173-340-720
[b]C_w based on WAC 173-340-730
[c]includes inhalation
[d]See Table 6.2

Table 6.2. Ecological conceptual exposure model.

Medium	Pathway	Terrestrial Receptor			Aquatic Receptor		
		Plant	Invert	Bird/Mam	Plant	Invert	Fish
Air	Inhalation			x			
	Ext surface uptake	x	x	x			
	External radiation	x	x	x			
Soil	Ingestion		x	x			
	Inhalation			x			
	Ext surface uptake	x	x	x			
	External radiation	x	x	x			
Groundwater, Seeps	Ingestion		x	x			
	Ext surface uptake	x					
	External radiation		x	x			
Surface Water	Inhalation			x			x
	Ingestion		x	x		x	x
	Ext surface uptake			x	x	x	x
	External radiation			x	x	x	x
Sediment	Ingestion			x		x	x
	Ext surface uptake			x	x	x	x
	External radiation				x	x	x
Biotic Tissue	Ingestion		x	x		x	x

Abbreviations: invert=invertebrate, mam=mammal, ext=exterior.
Ext surface uptake includes absorption via root, leaf, skin, feather, or other exterior surface tissues.
x=complete pathway.

7.0. References

Bradford, A., D. Esh, A. Ridge, D. Turner, E. Pearcy, J. Winterle, B. Brient, P. Mackin, and P. LaPlante. 2006. Standard review plan for activities related to USDOE waste determinations. NUREG-1854. US Nuclear Regulatory Commission (USNRC), Washington, DC.

CFR (Code of Federal Regulations). 2006. Title 40, Chapter I, Subchapter C, Part 61, National Emission Standards for Hazardous Air Pollutants (NESHAPS), U.S. Environmental Protection Agency, Washington, D.C.

CFR (Code of Federal Regulations). 2007. Title 40, Chapter I, Part 300, National Oil and Hazardous Substances Pollution Contingency Plan (NCP), U.S. Environmental Protection Agency, Washington, D.C.

Harris, S.G. and B.L. Harper. 2004. Exposure scenario for CTUIR traditional subsistence lifeways. Dept Sci and Eng, Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Pendleton, OR. Supplemented by memo from S Harris to J Sands (dated 8/18/05) on response to exposure scenario comments and summary of exposure factors.

RCW (Revised Code of Washington). 2006. Growth management planning by selected counties and cities. 36.70A RCW, Olympia, WA.

Ridolfi, C. 2007. Yakama Nation exposure scenario for Hanford Site risk assessment, Richland, Washington. Ridolfi, Inc., Seattle, WA.

USDOE (US Dept of Energy). 1995a. Hanford site risk assessment methodology (HSRAM). DOE/RL-91-45, Rev 3, Richland, WA.

USDOE (US Dept of Energy). 1995b. Hanford site background: Part 1, Soil background for nonradioactive analytes. DOE/RL-92-24, Rev 3, Richland, WA.

USDOE (US Dept of Energy). 1996. Hanford site background: Part 2, Soil background for radionuclides. DOE/RL-96-12, Rev 0, Richland, WA.

USDOE (US Dept. of Energy). 1999. Hanford comprehensive land use plan. Environmental impact statement. DOE/EIS-0222-F, US Dept. of Energy, Richland, WA, http://www.hanford.gov/doe/eis/hraeis/maintoc.htm.

USDOE (US Dept of Energy). 2002. A graded approach for evaluating radiation doses to aquatic and terrestrial biota. DOE-STD-1153-2002, Washington, DC.

USEPA (US Environmental Protection Agency). 1976. National interim primary drinking water regulations. EPA-570/9-76-003, Washington, DC.

USEPA (US Environmental Protection Agency). 1989. Risk assessment guidance for Superfund, Vol 1, Human health evaluation manual (Part A). EPA/540/1-89/002, Washington, DC.

USEPA (US Environmental Protection Agency). 1997a. Establishment of cleanup levels for CERCLA sites with radioactive contamination. OSWER No 9200.4-18, Washington, DC.

USEPA (US Environmental Protection Agency). 1997b. Ecological risk assessment guidance for superfund (ERAGS)-Process for designing and conducting ecological risk assessments. EPA/540/R-97/006, OSWER-9285.7-25, NTIS PB97-963211INX, Office of Emergency and Remedial Response, Washington, DC.
USEPA (US Environmental Protection Agency). 1998. Guidelines for ecological risk assessment. EPA/630/R-95/002F. Risk Assessment Forum, USEPA, Washington, DC.

USEPA (US Environmental Protection Agency). 2006. 2006 edition of the drinking water standards. EPA 822-R-06-013, Washington, DC.

WDOE (Washington State Dept of Ecology). 2006. Water quality standards for surface waters of the state of Washington. WAC 173-201A, Olympia, WA.

WDOE (Washington State Dept of Ecology). 2007a. Model Toxics Control Act (MTCA) Statute and Cleanup Regulation, WAC 173-340, Pub No. 94-06, Olympia, WA.

WDOE (Washington State Dept of Ecology). 2007b. Ambient air quality standards and emission limits for radionuclides, WAC 173-480, Olympia, WA.

WDOH (Washington State Dept. of Health). 1997. Hanford guidance for radiological cleanup. WDOH/320-015, Rev 1, Olympia, WA.

WDOH (Washington State Dept of Health). 2008. Public water supplies. WAC 246-290, Olympia, WA.

0900973
CC Recd: 04/28/2009

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • (509) 372-7950

April 24, 2009

Ms. Shirley J. Olinger, Manager
Office of River Protection
United States Department of Energy
P.O. Box 450, MSIN: H6-60
Richland, Washington 99352

Re: Department of Ecology Review of the *RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, RPP-PLAN-39114, Revision 0

Dear Ms. Olinger:

The Department of Ecology reviewed the referenced document. Our enclosed comments need to be part of a larger discussion on Waste Management Area C (WMA C) closure. We have met with your staff and your contractors to discuss differing ideas on WMA C closure and the process to follow. We understand the importance of a mutual agreement on this process and that it may take time to reach an agreement. Therefore, Ecology requests the United States Department of Energy-Office of River Protection to:

- Continue to meet with Ecology to develop and finalize this process.
- Review the enclosed comments and meet with Ecology to discuss the issues and where best to address them.
- Send Ecology the requested information on the next set of pushes in WMA C Farm.

We are available to discuss and resolve issues developed from our review of the *Phase 2 RCRA Facility Investigation/Corrective Measures Study Master Work Plan for Single-Shell Tank Waste Management Areas*, RPP-PLAN-37243, Revision 1. Some of these issues may need to be incorporated into the referenced document.

If there are any questions, contact me at 509-372-7914.

Sincerely,

Jeffery J. Lyon
Tank Waste Storage Project Manager
Nuclear Waste Program

mb/aa
Enclosure

cc: See page 2

Ms. Shirley J. Olinger
April 24, 2009
Page 2

Reference: Letter 08-TPD-090, dated December 18, 2008, from S. J. Olinger, USDOE-ORP, to J. A. Hedges, Ecology, "Transmittal of the Resource Conservation and Recovery Act (RCRA) Facility Investigation/Corrective Measures Study (RFI/CMS) Work Plan for Waste Management Area (WMA) C as Required by Hanford Federal Facilities Agreement and Consent Order (AKA Tri-Party Agreement) Milestone M-045-60"

cc: Stuart Harris, CTUIR
Gabriel Bohnee, NPT
Russell Jim, YN
Susan Leckband, HAB
Ken Niles, ODOE
Administrative Record: SST/Tank Waste Management
Environmental Portal
Hanford Operating Record General File
USDOE-ORP Correspondence Control

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 1 of 7

Document Number(s)/Title(s)	Program/Project/Building Number	Reviewer	Organization/Group	Location/Phone
RPP-PLAN-39114, Rev. 0			Ecology	

Comment Submittal Approval: Agreement with indicated comment disposition(s) Status:

Organization Manager (Optional) _____ Date

Reviewer/Point of Contact _____ Date

Reviewer/Point of Contact _____ Date

Author/Originator

Author/Originator

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)
1.	General Comment	Where this document refers to performance assessments and risk assessments, please add text referring to the process that is ongoing with NRC for the WMA C performance assessment. Please make appropriate changes in this document to resolve any inconsistencies between the plans documented here and the ongoing WMA C performance assessment development process.
2.	General Comment	Units of measure should remain consistent, and where both IU as well as British units are given, a conversion should be provided. For example, compare pg. 2-12, line 42 with Table 2-1 (pg 2-13) where the units are different in the two locations. Please correct at this location and throughout the document.
3.	General Comment	This work plan, RCRA FI/CMS Work Plan for WMA C, Revision 0, Nov 2008, fails to identify the conceptual process for performing RCRA corrective actions to support closure of the SST WMA. The work plan must be revised to address the closure requirements of WAC 173-303.
4.	General Comment	The SST closure plan to be issued by the Department of Ecology will include SST corrective actions. The corrective actions described in this document are not independent actions. These are also closure actions and will be incorporated into the SST closure plan.
5.	General Comment	Source waste sites (soil) inside and potentially adjacent to the WMA are subject to RCRA closure and corrective action, not CERCLA as stated. Groundwater will also be subject to RCRA closure and corrective action, not just CERCLA as stated.
6.	General Comment	Only cleanup actions that meet the closure performance standards will achieve final closure of the WMAs.
7.	General Comment	Characterization of the WMAs must consider the closure performance standards to achieve final closure of the WMAs. All characterization conducted on the SST System, whether within a WMA or on ancillary equipment located outside the WMAs, must identify and incorporate constituents and detection levels to be used in the closure process.

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 2 of 7

8.	General Comment	Closure will address structures, soil and groundwater contamination.
9.	General Comment	Both RCRA closure and corrective action will be contained in the SST System closure plan. Corrective action for the SST System is part of the draft closure plan. This section is currently reserved in the closure plan. Detail will be incorporated into the closure plan through permit modifications Ecology is incorporating the corrective action of the SST System into the SST closure plan in order to integrate schedules and physical actions and regulatory requirements.
10.	General Comment	It is inappropriate to use only the document number in referring to documents. This practice is repeated throughout the document.
11.	p. 2-12, sect 2.3.4	Groundwater monitoring at WMA C is conducted FOR compliance with WAC 173-303-400 (and by reference 40 CFR 265, Subpart F) because WMA C is a RCRA TSD unit. Data from some groundwater monitoring wells is used to support the 200-BP-5 groundwater operable unit. Please correct.
12.	Pg. 2-12, lines 16 – 19	B Pond was located east of WMA C (not north) and the B Pond mound led to groundwater flow to the west-northwest. With cessation of discharges to B Pond, groundwater flow direction is slowly changing back to the pre-Hanford west to east direction of groundwater flow. Please correct.
13.	Pg. 2-13, lines 16 – 24	If slug tests at different levels in the well screen indicate different hydraulic conductivities and flow rates, why was a single long screen placed in these wells that bridge different units of differing hydraulic characteristics rather than a single screen at the interval of highest contamination? The effect could be a dilution of contaminants that masks the real level of contamination in a well. Please address.
14.	Pg. 3-3, line 27	WMA C is a RCRA TSD unit, NOT a past practice unit. Appendix C of the HFFACO does not include a 200-PO-3 operable unit, but Appendix B does. Please correct this work plan and make the HFFACO consistent.
15.	Pg. 3-6, line 13	Please explain what "elevated pH values and high sodium content" means if these are considered indicators of the presence or passage of tank waste.
16.	Pg. 3-6, lines 23, 24	Please provide some details regarding the appearance of Tc-99 in a "nearby monitoring well."
17.	Pg. 3-6, 3-7, sect 3.2.1.1	While this is a nice summary of data, it doesn't state whether this data is indicative of a release and why it is. Please clarify and explain.
18.	Pg. 3-13, lines 6, 7	Please provide a technical basis for the statement, "….and the subsequent natural recharge do not appear sufficient to have contaminated groundwater in the 36 to 38 years since the release events."
19.	Pg. 3-18, lines 25-31	As CN is found in groundwater in well 299-E27-7, and the only likely nearby source is C Tank Farm, this constituent should be added to the constituent list. Please add.
20.	Pg. 3-18, lines	This discussion mentions soil waste interaction in the vadose zone to include sorption and precipitation, but doesn't address

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 3 of 7

	8 – 17	desorption which can be facilitated by later addition of moisture to the soil. Please include desorption.
21.	Pg. 3-18, 19, lines 37 through 3	Mention of the depth limitation of information is appropriate here, because push technology and some boreholes do penetrate the entire vadose zone. Yet, contaminants in the deep vadose zone can be inferred based on data from groundwater monitoring wells. Please include depth limitations of characterization boreholes.
22.	Pg. 3-19, line 7	Change "will" to "is expected to," and that expectation was used in model simulations. Please change.
23.	Pg. 3-21, lines 5 – 8	The February 1979 flooding of T Farm is but one example of a process that likely occurred at other farms in February 1979 as well as other times in the past during site operations. Please qualify.
24.	Pg. 3-23, line 15	Clastic dikes are TABULAR (not tubular) bodies. Previous model simulations incorrectly portrayed clastic dikes as pipes and thus incorrectly concluded that clastic dikes have no significance in fate and transport of contaminants to groundwater. Please correct.
25.	Pg. 3-23, lines 34 - 42	While it is true that the possibility of intersecting a clastic dike in a characterization is limited, there is sufficient information on clastic dikes and their properties to "create" an imaginary clastic dike in modeling simulations of fate and transport analyses
26.	General Comment on conceptual models	With each conceptual model, it is possible to also conduct sensitivity studies that vary the input parameter values for a specific input characteristic. For example, one could run sensitivity analyses of the number, geometry and material characteristics of clastic dikes within a farm, the location and number of unsealed boreholes, variations on recharge, flood frequency and volume, and water releases from pipelines. Please include some discussion of sensitivity studies and their value to planning future site characterization and in planning for remediation/closure.
27.	p. 3-24 – 3-27, sect 3.3.5	Please include a conceptual model for shallow releases within C farm. There are at least 6 UPRs inside the farm that have not been discussed in this section, (UPR-200-E-16, UPR-200-E-27, UPR-200-E-68, UPR-200-E-81, UPR-200-E-107, UPR-200-E-118), which include surface spills from pipelines, leaks and airborne releases from diversion boxes and vaults, and airborne releases from tanks.
28.	p.3-27 to 3-42, sect 3.4	Re performance assessment, text on human health risk (Section 3.4.1) appears short, relative to text on eco risk (Section 3.4.2). For example, eco risk describes identification of contaminants of concern (Section 3.4.2.3.1) and uncertainty analysis (Section 3.4.2.3.3), while human health risk does not. Please address.
29.	p. 3-27, sect 3.3.5.5, lines 30-31	Please delete the text "These releases and the conceptual model are not believed to represent a risk to groundwater but potentially are a risk through direct contact and to ecological receptors." Ecology considers them a threat to groundwater as well as a threat through direct contact and ecological contact. WAC 173-340-740(6)(b) gives the point of compliance for soil cleanup levels based on the protection of groundwater to be the soils throughout the site (no depth limit is considered). We will use soil concentrations when evaluating whether or not the UPRs are a threat to groundwater.
30.	p. 3-28, para 4	EPA eco risk guidance should also be listed: 1) EPA. 1998. Guidance for ERA. EPA/630/R-95/002F. 2) EPA. 1997. ERAGS. EPA/540-R-97-006.

		3) EPA. 1997. EPA Region 10 Supplemental ERAGS. EPA 910-R-97-005.
31.	p. 3-29, para 2	Although it is stated, "the reasonably anticipated future land use for the 200 Areas is continued industrial activities for the foreseeable future," it should be acknowledged that land use will be unknown at some time in the future. Therefore, a conservative approach would evaluate a range of human exposure scenarios (e.g., residential, farmer, fisher, Native American), as well as relevant ecological receptors (e.g., terrestrial, aquatic). DD
32.	p. 3-29, sect 3.4.1.1, lines 16-18	The text states "The reasonably anticipated future land use for the 200 Areas is continued industrial activities for the foreseeable future. This land-use assumption is applied to the pathway and receptor considerations in risk calculations for the waste sites." For the groundwater and pathway to groundwater Ecology considers only unrestricted use scenarios (WAC 173-340 Method B) as this is the most beneficial use of the groundwater and is consistent with closure requirements in WAC 173-303-610. Additionally, the Tri-Party response to the Hanford Advisory Board Advice #132 stated "An Industrial land use scenario will set cleanup levels on the Central Plateau. Other scenarios (e.g., residential, recreational) may be used for comparison purposes to support decision making especially for • The post-institutional controls period (> 150 years). • Sites near the Core Zone perimeter to analyze opportunities to "shrink the site." • Early (precedent-setting) closure/remediation decisions. Additionally, Ecology expects evaluation of Native American scenarios. Please evaluate unrestricted as well as Native American scenarios for risk assessment at WMA C.
33.	p.3-29, sect 3.4.1.1, lines 38-41	Please delete the text "Given the local hydrogeology at WMA C, protection of the groundwater from the contaminants, by design, also will result in protection of the Columbia River." This is not the case for contaminants that are more harmful to aquatic biota and those with stringent ambient water quality criteria. This issue was discussed in comment resolution meetings for the SST PA. Ecology realizes that there may be a need to set a point somewhere in the Central Plateau or near the River Corridor for compliance with requirements for surface water protection. This could be acknowledged here.
34.	p. 3-30, sect 3.4.1.4	Though the land use selected by DOE for the Core Zone in the CLUP is industrial (exclusive) for at least the next 50 y, Ecology's expectations for the analysis of risk are included on the attached draft document (*Washington State Department of Ecology Guidance: Exposure Assessment Criteria for the Core Zone of the Central Plateau on the Hanford Site, Mar. 2009 draft*). [Attached]
35.	p. 3-30, para 4	Partitioning land use, according to location inside (i.e., industrial) vs. outside (i.e., unrestricted) the Central Plateau Core Zone, makes sense for the foreseeable future (e.g., institutional control period), but not for longer time horizons (e.g., post institutional control period).
36.	p. 3-31, figure 3-13	Include under the primary release mechanisms surface liquid discharges. An example of this type of release is UPR-200-E-16.
37.	p. 3-31, figure	Re the conceptual exposure model, human and biota receptors could each be subdivided into more specific groups (e.g.,

	3-13	residential/industrial/farmer/Native American for human; terrestrial/aquatic for biota). A complete pathway should be shown for human ingestion of biota. "Uptake" of biota is redundant and should be deleted (since ingestion is already specified). As a result of a groundwater connection, surface water and sediments in the Columbia River should be added as exposure media. Complete pathways should be shown for ingestion, inhalation, direct contact, and external radiation of surface water to biota (given their potential exposure at riverbank seeps), as well as ingestion, direct contact, and external radiation of river sediment to biota (as a result of contaminant accumulation in the sediment). Finally, human and biota exposure to vadose zone soils (below 15 ft bgs) may occur via an intruder drilling scenario (where deeper soils are brought to the surface and mixed with surface soils).
38.	p. 3-32, para 1	It is stated, "the ERA for WMA C will adopt relevant methodology and data that were used in the Central Plateau ecological risk assessment (CPERA)." Adopting consistent methods makes sense, although results are currently lacking. That is, the Jan 2008 Central Plateau Terrestrial Ecological Risk Assessment report (p. v in: DOE-2007-50, Draft A, Reissue) noted, "the tank farms [and US Ecology site] were not identified for ecological sampling in Phase II because their operations, regulatory plans, and interim stabilization plans (unique to the tank farms) represented a poor fit from an ecological risk characterization standpoint."
39.	p. 3-32, para 2	MTCA and USDOE ERA guidance should also be consistent with EPA ERA guidance (EPA/630/R-95/002F; EPA/540-R-97-006).
40.	p. 3-32, para 3	In addition to terrestrial eco receptors, risk to aquatic receptors in or near the Columbia River should also be evaluated via a groundwater pathway.
41.	p. 3-33, para 5	The purpose of the WMA C ERA should include evaluation of both terrestrial and aquatic environments.
42.	p. 3-35, para 3	The WAC citation should be "WAC 173-340-7493(2)(a)(i-iv)," not "WAC 173-340-7493(2)(i-iv)."
43.	p. 3-35, para 6	Please clarify that both nonradionuclide and radionuclide COPECs should be derived from the SST DQO (RPP-23403), as well as WMA C soil data, and not be limited to MTCA Table 749-3 and USDOE BCG constituents.
44.	p. 3-36, para 5	The WAC citation should be "WAC 173-340-7493(2)(a)(iv)," not "WAC 173-340-7493(2)(iv)."
45.	p. 3-40, para 1	Substitute "evaluate" for "verify," since contaminant exposure to small mammals is uncertain before tissue data are obtained.
46.	p. 3-40, para 2	Although text indicates that dietary exposure modeling is not identified in WAC 173-340-7493, this method is described for birds and mammals in WAC 173-340-7493(3). DD
47.	p. 3-41 to 3-42, sect 3.4.2.4	In addition to the CPERA and RCBRA, please acknowledge that other eco risk work has been conducted at Hanford (e.g., CRCIA, WTP, 100 Areas, 300 Area, PNNL surveys).
48.	p. 3-43, para 4	Please describe criteria for selecting "threshold indicator constituents."
49.	p. 3-44, para 1	Specify detection limits for Tc-99, I-129, and CN. This section (3.5.1) should be labeled as inorganics and rads, since organics are discussed in the next section (3.5.2).
50.	p. 3-44, para 4	Provide rationale for the number and location of the five sampling locations.
51.	p. 3-44, para 3	Just because TBP is not detected, it is nonconservative to eliminate all organics from the list of COPCs at WMA C.
52.	p.3-44,	Please lower the threshold values of nitrate and hexavalent chromium to concentrations that are used as preliminary

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 6 of 7

	sect 3.5.1	remediation goals or cleanup levels elsewhere on the site. For nitrate this value is 40 mg/kg as N, based on WAC 173-340-747 Equation 747-1 and the MCL for nitrate. For hexavalent chromium, a value of 2 mg/kg is used in consideration of dust resuspension, and a value of 0.2 mg/kg is used both for ecological protection, which is consistent with the value calculated for soil for the protection of groundwater. If 0.2 mg/kg is above the detection level, then the hexavalent chromium indicator concentration should be set at the detection limit.
53.	p. 3-44 – 3-45, sect 3.5.2	Methylene chloride, acetone, 2-butanone, and chloroform may be common lab contaminants but they also may be present in tanks. Some of these have been found in tank headspaces. If they are observed in samples the associated blanks should be considered when deciding if these are from the tanks or a lab source. They should not automatically be attributed to lab contamination.
54.	p. 3-45, para 3	Re PCB congener analysis, please specify Method 1668 and quantify dioxin like toxic equivalents (TEQ) with WHO 2005 toxic equivalency factors (TEFs) for humans/mammals and with WHO 1998 TEFs for fish and birds. PCB congeners should be evaluated in a portion of all soil samples collected at WMA C, rather than being constrained to the initial 5 locations (EPA, 2007). Recommendations for human health risk-based chemical screening and related issues at EPA Region 10 CERCLA and RCRA sites. OEA-095, Memo from Michael Cox).
55.	p. 3-45, para 4	Specify detection limits for pesticides and petroleum products.
56.	section 5, general	Ecology is submitting comments on the Phase 2 Master Work Plan. Please revise this section so that it is consistent with the revisions needed in the master work plan.
57.	General Comment Chapter 5	Soil is one component to be closed as part of the WMA C RCRA closure process following WAC 173-303-610. Therefore, these activities should be called a RCRA Component Closure Work Plan. Please correct in the title and throughout this RPP-PLAN-39114 document.
58.	pg. 5-1 lines 22, 23	Any revisions to the work plan must be submitted to Ecology for APPROVAL. Please correct.
59.	pg. 5-6, lines 38, 39	Groundwater is another component of WMA C to be closed under RCRA. Although HFFACO agrees that groundwater operable units will be closed/remediated under past practice authority, groundwater must at least be addressed here—even if only a reference to another work plan, RI/FS or program is included. Closure/remediation of groundwater must meet closure performance standards of WAC 173-303-610. Please include this information here and in this section of the work plan.
60.	pg. 5-9, Sect. 5.4	See comment 58 and replace all references to corrective measures to closure investigations and closure actions—including the implementation of any interim measures. Please correct.
61.	p. 5-11, para 1	Please add the following EPA guidance: 1) EPA-540-R-070-002. Jan 2008. RAGS, Part F, Supp. Guidance for Inhalation Risk Assessment. 2) EPA/600/R-07/038. Apr 2007. ProUCL Version 4.0, User Guide.
62.	p. 5-11, para 3	It should be a requirement (rather than an option) that other scenarios (i.e., Native American, residential, intruder) be evaluated to assess post-remediation risk.
63.	p. 5-12, para 3	In addition to terrestrial eco risk, aquatic eco risk should be assessed, as a result of a contaminant groundwater pathway to the

REVIEW COMMENT RECORD	Date April 8, 2009	General Comment
	Project No. WMA C Work Plan	Page 7 of 7

		Columbia River. Additional ERA guidance should be consulted (e.g., EPA/630/R-95/002F; EPA/540-R-97-006).
64.	pg. 5-14, sect 5.4.7	Pg. 5-14, Sect. 5.4.7 addresses soil only. Soil is one component to be closed under RCRA. Also included are the tanks and the waste contained therein, as well as ancillary equipment. These should be included as closure actions/options. Please address.
65.	pg. 5-21, lines 19-22	Actions in the Central Plateau under CERCLA will have to be coordinated with corrective measures AND closure actions being implemented under a RCRA permit to assure that actions on TSD units fulfill the closure performance standards of WAC 173-303-610. Please correct.
66.	pg. 7-1 and section 7	Pg. 7-1 and Section 7. The title of this section includes program integration, but the section only discusses the various groups that will participate, and not how the program/project and resulting data are integrated. Please revise to address integration activities and how they will be accomplished.
67.	Appendix A	Appendix A is the SAP which is not included, but was released as a separate document. Will the document stand alone, or be incorporated here as Appendix A? Please clarify.
68.	p. B-5, para 1	Water terms (C, I, AUF, d) in the oral exposure equation are not defined. Please fix.
69.	p. B-5, para 2	Provide rationale for 3 transects, a minimum of 6 organisms/transect, and for deriving a mean COPEC tissue concentration by weighting carcass (90%) and liver/kidney (10%) composites.
70.	p. B-6, para 1	The list and hierarchy of analytes given here in Section B1.7 differs slightly from that specified in Section B1.3. Please reconcile.
71.	p. B-8, Table B-2	Please clarify footnote "a" and indicate where it applies in the table body.
72.	p. B-10, para 3	Provide a reference for home range and dispersal distance for a deer mouse.
73.	p. B-10, sect B3.2	The home range specified for a deer mouse is 0.077 hectares. It does not seem reasonable to expect that the home range is known to that degree of precision. Please cite references for this value.
74.	p. B-11, figure B-2	Although the study area dimension is based on a deer mouse home range, provide rationale for specific transect locations (i.e., one perimeter transect group inside WMA C and two vegetated habitat transect groups outside WMA C).

Washington State Department of Ecology Guidance: Exposure Assessment Criteria for the Core Zone of the Central Plateau on the Hanford Site

March 2009 draft

Outline

1.0 Introduction
2.0 Operational Period (next 50 y)
3.0 Institutional Control Period (from 50-150 y)
- **3.1 Industrial land use**
- **3.2 Industrial scenario for nonradiological contaminants (includes U)**
  - **3.2.1 Soil risks**
  - **3.2.2 Groundwater risks**
  - **3.2.3 Air risks**
  - **3.2.4 Site risk/hazard**
  - **3.2.5 Ecological receptors**
- **3.3 Industrial scenario for radiological contaminants**
  - **3.3.1 Risks from all pathways (includes soil)**
  - **3.3.2 Groundwater risks**
  - **3.3.3 Air risks**
  - **3.3.4 Ecological receptors**
- **3.4 Other scenarios to support remedy decisions**
  - **3.4.1 Justification**
  - **3.4.2 Unrestricted land use**
  - **3.4.3 Unrestricted land use for nonradiological contaminants (includes U)**
    - **3.4.3.1 Soil risks (includes ecological receptors)**
    - **3.4.3.2 Groundwater risks**
    - **3.4.3.3 Air risks**
    - **3.4.3.4 Site risk/hazard**
  - **3.4.4 Unrestricted land use for radiological contaminants**
    - **3.4.4.1 Risk from all pathways (includes soil and ecological receptors)**
    - **3.4.4.2 Groundwater risks**
    - **3.4.4.3 Air risks**
  - **3.4.5 Additional pathways**
  - **3.4.6 Native American scenarios**
  - **3.4.7 Intruder risks**

4.0 Post Institutional Control Period (from 150 y and beyond)
5.0 Summary
- **5.1 Operational Period**
- **5.2 Institutional Control Period**
- **5.3 Post Institutional Control Period**

6.0 Tables
- **6.1 Human conceptual exposure model**
- **6.2 Ecological conceptual exposure model**

7.0 References

1.0. Introduction

The purpose of this guidance is to outline exposure assessment criteria, established by the Washington State Department of Ecology ("Ecology"), applicable to operable units (OUs) and waste management areas (WMAs) within the Central Plateau Core Zone of the 200 Areas at the Hanford site, owned and operated by the U.S. Dept. of Energy (USDOE). This guidance is based on the Model Toxics Control Act (MTCA) and implementing regulation (WAC 173-340) (WDOE, 2007a), but also includes other state regulations (e.g., WDOE, 2006), federal criteria for radiological sites (e.g., USEPA, 1989; USEPA, 1997a, USDOE, 2002), and site-specific criteria for evaluating exposure to nonradionuclide and radionuclide contaminants at Hanford (e.g., USDOE, 1995a, USDOE, 1995b; USDOE, 1996; WDOH, 1997). The outline provides a minimum set of requirements for exposure and risk assessment, and applies to baseline risk assessments (pre-remediation risk), risk assessments that support evaluation of remedial alternatives in feasibility studies, and risk assessments in support of waste management area closure.

This guidance is organized by time periods of interest (i.e., operational, institutional control, post institutional control). The first time period is the operational period during which it is expected that cleanup and closure efforts will be the dominant site activities. This period is assumed for this guidance to continue for approximately 50 years from the present. The current level of site restriction is assumed to continue during the operational period. The second time period is the period after which operations have ceased and access to the Core Zone will be restricted through the use of institutional controls. It is expected, during this time, that remedies designed to restrict access to subsurface waste will function as designed. This period is assumed for this guidance to last for 100 years after operations have ceased. The third time period is that after which institutional controls are no longer in place. The remedies designed to restrict access to subsurface waste may begin to fail in this time period. This time period is assumed for this guidance to begin 100 years after operations at the site have ceased.

Exposure assessment criteria are listed for both nonradionuclide and radionuclide contaminants for industrial, unrestricted use (with MTCA pathways and with several pathways additional to MTCA), Native American, and intruder (acute and chronic) scenarios. Additionally, ecological (terrestrial and aquatic biota) exposure evaluation criteria are given. Exposure scenarios are summarized in Table 6.1 for human receptors. Pathways for terrestrial and aquatic ecological receptors are summarized in Table 6.2.

MTCA regulations (WDOE, 2007a) are intended for setting cleanup levels at sites and in media contaminated with hazardous substances. Ecology evaluates compliance with WAC 173-340 by comparison of on-site and off-site media concentrations of hazardous substances against cleanup levels and risk and hazard levels calculated using the methods established in WAC 173-340.

2.0. The Operational Period (next 50 y)

For the next 50 years, it is assumed that the current level of site access will be maintained, and the site users in the Core Zone will be largely Hanford site workers. Hanford site workers receive USDOE Hanford General Employee Training (HGET) and General Employee

Radiological Training (GERT). During the operational period, site worker exposure to contaminants is assumed to be limited to the worker safety standard limits established by USDOE. During this period, Hanford cleanup should proceed such that the risk and hazard levels described in the following subsections of this guidance are achieved, to protect the potential future receptors.

3.0. The Institutional Control Period (from 50-150 y)

After site operations have ended and the USDOE presence continues in a role of maintaining institutional and engineering controls, the Core Zone of the Central Plateau is assumed to be strictly an area of industrial activities. This time period for this guidance is assumed to begin 50 years from the present and assumed to continue for an additional 100 years.

3.1. Industrial Land Use

Currently, the land use in the Core Zone at Hanford is classified as Industrial-Exclusive (USDOE, 1999). This classification applies to portions of the site that are suitable for treatment, storage and disposal of nonradioactive and radioactive wastes. This land use is distinguished from other Hanford site industrial use activities such as reactor operations, mining, manufacturing, assembly sites, food processing, warehousing, transportation-related operations and distribution operations.

The industrial and industrial-exclusive activities listed above are somewhat consistent with the definition for industrial land use in WAC 173-340-200 and -745. However, two additional considerations are needed when determining if a land use should be considered industrial according to WAC 173-340. That is, industrial properties are zoned for industrial use by a city or county conducting land use planning under the Growth Management Act, 36.70A RCW (RCW, 2006); or the properties are zoned for industrial use and adjacent to properties currently used or designated for industrial purposes. If activities at a site do not meet these conditions, the following characteristics should be considered when applying an industrial land use designation, according to WAC 173-340: (1) people generally do not live on the site and exposure is mainly to adult employees; (2) access to the general public is highly limited and controlled; (3) food is generally not grown or raised on the site; (4) operations are often characterized by chemical storage, noise, odors and truck traffic; (5) the surface of the land is often mostly covered by structures and paved areas, limiting potential exposure to soil; (6) commercial support facilities, including offices and restaurants for the industrial employees, but not the public, may be located on industrial sites.

3.2. Industrial Scenario for Nonradiological Contaminants (includes uranium)

Ecology's regulatory authority for cleanup of nonradiological contaminants under an industrial scenario is described in WAC 173-340 (WDOE, 2007a). This regulation specifies methods for cleanup of abiotic media, limits for site risk and hazard, and methods for assessing terrestrial ecological risk.

3.2.1. Soil Risks from Nonradionuclides under the Industrial Scenario

Using an industrial scenario for nonradiological contaminants and uranium (a nephrotoxic metal), the following requirements would apply for soil. For the direct contact pathway (e.g., soil ingestion), soil concentrations are derived using WAC 173-340-745. Additionally, soil concentrations must be protective of groundwater and are derived using WAC 173-340-747 Method B. Method B is required, since groundwater is contiguous inside and outside of the Core Zone, and Method B is required for the unrestricted land use outside of the Core Zone. Furthermore, if subsections (5), (7), (8) or (9) are used to derive soil concentrations for protecting groundwater, Ecology approval is required. Additional guidance for the use of the listed subsections will be provided by Ecology, as needed.

Soil concentrations must also be protective of surface water and are derived using WAC 173-340-730, (not including subsections (2) and (4)) in combination with WAC 173-340-747 Method B. This is necessary because groundwater protection alone may not result in achieving all water quality standards in the river and concentrations protective of all receptors in the river. For instance, a Cr (VI) concentration of 48 μg/L meets WAC 173-340-720 criteria for groundwater (concentration that achieves a hazard quotient of 1). However, the surface water quality criterion (WAC 173-201A) is 10 μg/L (WDOE, 2006). Assuming no dilution at the river (WAC 173-340-730(6)(b)), groundwater at 48 μg/L would not meet the surface water quality criterion for Cr (VI). Consequently, a lower groundwater concentration must be achieved prior to the groundwater/surface water interface. Though attenuation of contamination in the Core Zone is expected during transport to the river in groundwater, attenuation may be off-set by down gradient sources of groundwater contamination. Site-specific groundwater modeling beyond waste site boundaries may be needed to address attenuation and anticipated concentrations at the Columbia River from the Core Zone and down gradient sources of contamination.

It may be necessary to consider the inhalation pathway when deriving soil cleanup levels. Air protection values are derived according to WAC 173-340-750 and are discussed further in Section 3.1.3. WAC 173-340-750 should be used when deriving soil cleanup levels protective of inhalation of soil vapors or resuspended dust associated with a site.

3.2.2. Groundwater Risks from Nonradionuclides under the Industrial Scenario

Groundwater cleanup levels are derived according to WAC 173-340-720, Method B, at the point of compliance. These concentrations assume that the most beneficial use for groundwater is a drinking water source for humans. Federal or state maximum contaminant levels (MCLs) may also apply to drinking water (USEPA, 2006; WDOH, 2008). As previously discussed for soils, groundwater cleanup levels may not always provide protection of ecological receptors at the interface between the groundwater and the Columbia River. In some cases, the state water quality standards (WAC 173-201A) dictate lower water concentrations than the WAC 173-340-720 Method B groundwater cleanup levels. Where controlling source concentrations of contaminants is not effective in reducing groundwater concentrations to levels protective of surface water, Ecology expects further cleanup of groundwater to achieve levels protective of surface water.

During the operational period, as previously stated, human receptors in the Core Zone at the Hanford site are expected to be industrial workers. Though USDOE does not currently plan to access groundwater for human consumption in the Core Zone until it meets drinking water standards, Ecology expects industrial scenarios to include evaluation of the groundwater ingestion pathway. The human receptors, in this case, are assumed to be adults with an average body weight of 70 kg and a drinking water consumption rate of 2 L/day. Evaluation of drinking water ingestion is consistent with potential exposure routes listed for the commercial/industrial population in Exhibit 6-7 in USEPA (1989).

3.2.3. Air Risks from Nonradionuclides under the Industrial Scenario

Air protection values are derived according to WAC 173-340-750. These levels apply to air contamination from contaminated media and/or remedial actions, though not to industrial or commercial operations or processes. On-site receptors are expected to be adults with an average body weight of 70 kg and a breathing rate of 20 m^3/day. Off-site receptors are expected to include adults, and children with an average body weight of 16 kg and a breathing rate of 10 m^3/day.

3.2.4. Site Risk/Hazard from Nonradionuclides under the Industrial Scenario

Site risk and hazard is determined in accordance with WAC 173-340-708. The hazard quotient for individual hazardous contaminants is not to exceed 1. The site hazard index is not to exceed 1.Total site risk for carcinogens, for all contaminants, all pathways and all media, is not to exceed 1E-05. USEPA guidance for risk assessments (e.g. USEPA, 1989) should be followed, in addition to WAC 173-340-708 requirements (WDOE, 2007a).

3.2.5. Industrial Scenario Nonradiological Contaminant Requirements for Ecological Receptors

In addition to protecting human receptors, soil concentrations must be protective of terrestrial and aquatic ecological receptors. For terrestrial ecological receptors, nonradiological contaminants (including uranium) are evaluated, according to WAC 173-340-7490 through -7494 (WDOE, 2007a). During the institutional control period, the Core Zone is expected to have restricted access for humans, but is likely accessible to biota. For ecological receptor evaluations, industrial properties are defined in accordance with WAC 173-340-7490(3)(c). At sites where screening-level ecological risk assessments show exceedences of screening criteria (e.g., MTCA Table 749-3), site-specific ecological risk assessment is required (WAC 173-340-7493). Aquatic ecological receptors should be evaluated with acceptable methods (e.g., USEPA, 1997b; USEPA, 1998).

3.3. Industrial Scenario for Radiological Contaminants

Ecology's regulatory authority over radionuclides is currently unclear. However, radionuclides are hazardous substances and co-contaminants with toxic nonradionuclides (WDOE, 2007a). Ecology has an interest in assuring that total site risk and hazard is maintained at or below

federal and state limits. The following guidelines for radionuclides are consistent with current federal guidelines and are included in this guidance for completeness.

3.3.1. Risks from All Pathways including Soil for Radionuclides under the Industrial Scenario

Consistent with the CERCLA risk range of 1E-04 to 1E-06 (USEPA, 1997a), a dose limit (i.e., total effective dose from all pathways) of 15 mrem/y is the expected limit for industrial workers, unless the workers are specifically trained and monitored for radiological work. The above risk and dose levels also apply to off-site receptors. For workers properly trained and monitored for radiological work (e.g., GERT), it is expected that the contemporary safety standards for such work would be achieved.

Predictions regarding future radiological doses and risk based on fate and transport modeling should be consistent with Exhibit 6-6 in USEPA (1989).

3.3.2. Groundwater Risks from Radionuclides under the Industrial Scenario

Groundwater concentrations should not exceed MCLs for radionuclides (USEPA, 1976) from all current (e.g., groundwater plumes) and future (e.g., soil leaching) contaminant sources at the point of compliance. Groundwater ingestion should be included as a pathway under an industrial scenario (USEPA, 1989).

3.3.3. Air Risks from Radionuclides under the Industrial Scenario

Annual dose from the airborne pathways should not exceed 10 mrem/y for the maximally exposed individual at the site boundary, based on National Emission Standards for Hazardous Air Pollutants (NESHAPS) (CFR, 2006) and WAC 173-480-040 (WDOE, 2007b).

3.3.4. Industrial Scenario Radiological Contaminant Requirements for Ecological Receptors

USDOE (2002) methods should be used to address site biota. Biota Concentration Guidelines (BCGs) represent the general screening phase and apply to soil, sediment, and surface water. Soil and groundwater pathways should ensure that BCGs at the river (surface water and sediment) are not exceeded. BCGs correspond to 0.1 rad/d for terrestrial and riparian animals and 1 rad/d for terrestrial plants and aquatic populations.

3.4. Other Scenarios to Support Remedy Decisions

Other scenarios are discussed here for consideration in making remedial decisions. These additional scenarios are more stringent or sufficiently different than industrial scenarios. The justification for evaluating these scenarios is provided. This justification applies both to the Institutional Control and Post-Institutional Control periods.

3.4.1. Justification

According to 40 CFR 300.515(f), the State may opt for an enhanced remedy, different than the remedy chosen using the CERCLA 9 criteria, if the State is willing to pay the additional cost (CFR, 2007). In order to evaluate enhanced remedies, the State needs an unrestricted use risk assessment for each remedial alternative to evaluate protectiveness. The State may choose a more protective alternative even if it is not the preferred alternative based on the CERCLA 9 criteria.

State regulations allow consideration of alternate reasonably maximally exposed receptors for evaluating the protectiveness of remedies (WDOE, 2007a). WAC 173-340-708(3)(d) states that Ecology can "use alternate reasonable maximum exposure scenarios to help assess the protectiveness to human health of a cleanup action alternative that incorporates remediation levels and uses engineered controls and/or institutional controls to limit exposure to the contamination remaining on the site." WAC 173-340-708(3)(d)(ii) states that other scenarios can be used for evaluating protectiveness of remedies. Additionally, CERCLA allows consideration of additional scenarios for remedial decision making.

Ecology may require evaluation of additional pathways for nonradionuclides (WDOE, 2007a). WAC 173-340-720(1)(d) states that "The department may require more stringent cleanup levels than specified in this section, where necessary to protect other beneficial uses or otherwise protect human health and the environment." For example, inhalation of groundwater during showering is an important pathway for Cr (VI), because it is carcinogenic by this pathway, and it is expected to be a risk driver at Hanford. Other important pathways for Hanford contaminants include food ingestion pathways such as ingestion of garden produce (including fruit), ingestion of wild game and ingestion of fish. For information purposes and remedial decision making, scenarios including additional pathways should be evaluated.

State regulations (WAC 173-340) require that "traditional industrial use" sites with hazardous substance contamination have restricted access to the general public. An unrestricted scenario may apply for the period after which implementation of institutional controls has become ineffective, when there is a higher likelihood of human intrusion.

Finally, there is a desire by USDOE, the regulatory agencies, and stakeholders to shrink the footprint of contamination at Hanford, including decreasing the area of the Core Zone. Therefore, areas inside the current boundary of the Core Zone may ultimately fall outside the Core Zone.

3.4.2. Unrestricted Land Use

Unrestricted land use refers to land use practices in which restrictions on the use of the site or natural resources affected by hazardous substance releases are not required to protect human health and the environment. For unrestricted land use scenarios, both child and adult receptors should be evaluated. Unrestricted land use is the presumed exposure scenario in WAC 173-340 (WDOE, 2007a). Current and future site usage is the basis for estimating a reasonable maximum exposure (RME) under unrestricted land use.

3.4.3. Unrestricted Land Use for Nonradiological Contaminants (includes Uranium)

Ecology's regulatory authority for cleanup of nonradiological contaminants under an unrestricted land use scenario is described in WAC 173-340 (WDOE, 2007a). This regulation specifies methods for cleanup of abiotic media, limits for site risk and hazard, and methods for assessing ecological risk.

3.4.3.1. Soil Risks from Nonradionuclides under the Unrestricted Use Scenario (includes Ecological Receptors)

Soil concentrations should be protective of human direct contact, human ingestion of groundwater beneath the site, inhalation of air on and off the site, human and ecological receptors using surface water down-gradient of the contaminated site, and terrestrial ecological receptors (WDOE, 2007a). Soil direct contact concentrations are derived using WAC 173-340-740. Soil concentrations must be protective of groundwater and are derived using WAC 173-340-747 Method B (use of subsection (5), (7), (8) or (9) methods require Ecology approval). Air protection values must be derived according to WAC 173-340-750 (e.g., when deriving soil cleanup levels protective of inhalation of soil vapors or resuspended dust). Soil concentrations must be protective of surface water, derived using WAC 173-340-730 (not including subsections (2) and (4)), and in combination with WAC 173-340-747 Method B.

Soil concentrations must be protective of terrestrial ecological receptors (i.e., plants, soil biota, wildlife), as specified in WAC 173-340-7490 and WAC 173-340-900 (Table 749-3). As for the industrial scenario, where screening-level ecological risk assessments show exceedences of screening criteria (e.g., MTCA Table 749-3), site-specific ecological risk assessment is required (WAC 173-340-7493). In addition, soil concentrations must be protective of aquatic ecological receptors (i.e., plants, invertebrates, fish). Aquatic ecological risk should be evaluated with acceptable methods (e.g., USEPA, 1997b; USEPA, 1998).

3.4.3.2. Groundwater Risks from Nonradionuclides under the Unrestricted Use Scenario

Groundwater concentrations are derived according to WAC 173-340-720, Method B at the point of compliance. Calculation of groundwater cleanup levels and risk for unrestricted use are essentially the same as those for industrial use, described in Section 3.3.2. In both cases, the most beneficial use of groundwater is a drinking water source.

3.4.3.3. Air Risks from Nonradionuclides under the Unrestricted Use Scenario

Air protection values are derived according to WAC 173-340-750. These levels apply to air contamination from contaminated media and/or remedial actions, though not to industrial or commercial operations or processes. When calculating risks and cleanup levels for noncarcinogens, for both on-site and off-site human receptors, RME individuals are assumed to be children with a body weight of 16 kg and a breathing rate of 10 m^3/day. For carcinogens, the RME individuals are assumed to be adults with an average body weight of 70 kg and a breathing rate of 20 m^3/day.

3.4.3.4. Site Risk/Hazard from Nonradionuclides under the Unrestricted Use Scenario

Site risk and hazard is determined in accordance with WAC 173-340-708. The site hazard quotient for individual hazardous contaminants is not to exceed 1. The site hazard index is not to exceed 1. Site risk for individual carcinogens is not to exceed 1E-06. Total site risk for carcinogens, for all contaminants, all pathways and all media, is not to exceed 1E-05. USEPA guidance for risk assessments (e.g. USEPA, 1989) should be followed, in addition to WAC 173-340-708 requirements (WDOE, 2007a).

3.4.4. Unrestricted Land Use Scenario for Radiological Contaminants

Ecology's regulatory authority over radionuclides is currently unclear. However, radionuclides are hazardous substances and co-contaminants with toxic nonradionuclides. Ecology has an interest in assuring that total site risk and hazard is maintained at or below federal and state limits. The following guidelines for radionuclides are consistent with current federal guidelines and are included in this guidance for completeness.

3.4.4.1. Risks from All Pathways (includes Soil and Ecological Receptors) for Radionuclides under Unrestricted Use Scenario

Consistent with the CERCLA risk range of 10^{-4} to 10^{-6} (USEPA, 1997a), a dose limit (i.e., total effective dose from all pathways) of 15 mrem/y applies to all human receptors (USEPA, 1997a). The dose and risk limits for unrestricted land use are calculated for adults and children, who are assumed to live at the site. The risk and dose levels also apply to off-site receptors.

Predictions regarding future radiological doses and risk based on fate and transport modeling should be consistent with Exhibit 6-6 in USEPA (1989).

As for industrial land use, USDOE Biota Dose Assessment Committee (BDAC) methods should address site biota (USDOE, 2002). BCGs represent the general screening phase and apply to soil, sediment, and surface water. Soil and groundwater pathways should ensure that BCGs at the river (surface water and sediment) are not exceeded. BCGs correspond to 0.1 rad/d for terrestrial and riparian animals and 1 rad/d for terrestrial plants and aquatic populations.

3.4.4.2. Groundwater Risks from Radionuclides under the Unrestricted Use Scenario

Groundwater consumption is assumed for unrestricted land use. As with industrial land use, groundwater concentrations are not to exceed MCLs for radionuclides (USEPA, 1976) from all current (e.g., groundwater plumes) and future (e.g., soil leaching) contaminant sources.

3.4.4.3. Air Risks from Radionuclides under the Unrestricted Use Scenario

Annual dose from the airborne pathways should not exceed 10 mrem/y to the whole body for any member of the public, according to WAC 173-480-040 (WDOE, 2007b).

3.4.5. Risks from Additional Pathways

Residential land use is considered to be the site use requiring the most protective cleanup levels under WAC 173-340 (WDOE, 2007a). The WAC 173-340 regulations interpret residential use as unrestricted use, which has been discussed above as the presumed RME scenario. However, the unrestricted use scenario described in WAC 173-340 omits pathways such as showering, inhalation during showering, and ingestion pathways for consumption of residential produce, livestock, and game (including fish from the Columbia River). It also omits some relevant pathways in EPA/540/1-89/002, Exhibit 6-6 (USEPA, 1989). These pathways could be important future use exposure pathways in the rural setting of the Hanford site. Ecology has an interest in being informed, through evaluation of these pathways, to determine protectiveness of remedial actions and to protect potential other beneficial uses (e.g., agriculture). Table 6.1 indicates additional pathways to evaluate. The evaluation should address both nonradiological and radiological contaminants. Both child and adult receptors should be evaluated when examining the additional pathways.

3.4.6. Native American Scenarios

While Native American scenarios have a variety of pathways in common with unrestricted land use exposure pathways, they often consider additional activities and exposure routes that are consistent with traditional Native American lifestyles. Frequently, they also require different parameter values than unrestricted use scenarios (e.g., higher rates for fish ingestion, inhalation, soil ingestion). Though a number of Native American scenarios have been developed in the history of risk assessment at the Hanford site, two tribes have submitted current exposure scenarios: the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) (Harris and Harper, 2004) and the Yakama Nation (Ridolfi, 2007).

Ecology supports evaluation of current Native American scenarios and additional Native American scenarios that may be submitted by tribes in the future. Ecology's expectations are that the Native American scenarios will be used as specified by the tribes, and will address both nonradiological and radiological contaminants. Ecology has an interest in using Native American scenarios to aid in planning remedial activities and in evaluating protectiveness of remedies. Ecology expects that these scenarios will frequently be the most conservative predictors of potential future risks at the Hanford site.

3.4.7. Risks to Intruders

It is expected that during the institutional control period, intrusion into former waste sites, landfills, and other buried waste will be minimized by actions taken to prevent inadvertent intrusion (e.g., Bradford et al, 2006). However, evaluating risks associated with intrusion during the institutional control period may indicate the adequacy of the institutional control time period and the protectiveness of remedies.

Evaluation of intrusion scenarios should cover all contaminants (nonradiological and radiological). Various modes of intrusion should be evaluated, consistent with potential future activities in a rural setting adjacent to an expanding population center. Acute exposure via

excavation for a home with a basement, drilling, trenching, mining, and road construction should be examined. Post intrusion exposure to children and adults who raise produce (a garden) and have chronic residential exposure, including groundwater ingestion and groundwater use in the garden, should also be evaluated. The post-intrusion residents should be assumed to use material exhumed during intrusion as garden soil and fill and landscaping in their yard of roughly 0.25 acres.

Additionally, the waste that remains buried should be assumed to be positioned beneath or close to the basement and lower floor of the home. A groundwater well on the home site should be assumed as a source of drinking water and a source of water for showering, cleaning, food preparation, and irrigation at the residence. Intruder scenarios should be run for the time period immediately after remedy construction completion. Additional times beyond construction completion should be included, as necessary, to address risks from potential radionuclide in-growth products or other contaminant degradation and transformation products.

4.0. The Post Institutional Control Period (from 150 y and beyond)

The Post Institutional Control Period is expected to begin 100 y after site operations have ended. All scenarios included for the Institutional Control time period should be evaluated for the Post Institutional Control Period, as well. This is derived from the 40 CFR 300.430(e)(9)(iii)(C)(2) requirement to evaluate long term effectiveness (on of the CERCLA 9 criteria) considering, "Adequacy and reliability of controls such as containment systems and institutional controls" (CFR, 2007) It is reasonable to expect that institutional controls will be less reliable for maintaining industrial conditions in the Core Zone beyond 150 y. It is expected that risk evaluations will examine contaminants until the time at which they reach peak concentrations in groundwater at the point of compliance, which may exceed 10000 y (e.g., Bradford et al., 2006).

5.0. Summary

5.1. Operational Period (next 50 y)

Industrial exclusive with DOE HGET/GERT-trained workers and DOE trained radiological workers.

5.2. Institutional Control Period (from 50 to 150 y)

A) Industrial Scenario for Nonradiological Contaminants (includes uranium)

Soil

Soil direct contact concentrations are derived using WAC 173-340-745. Soil concentrations protective of groundwater are derived using WAC 173-340-747 Method B; any use of subsection (5), (7), (8) or (9) methods requires Ecology approval. Soil concentrations protective of surface water are derived using WAC 173-340-730, (not including subsections (2) and (4)) in combination with WAC 173-340-747 Method B.

Groundwater

Groundwater cleanup levels are derived according to WAC 173-340-720, Method B at the point of compliance. Include groundwater ingestion as a pathway in risk assessment.

Air

Air protection values are derived according to WAC 173-340-750.

Site Risk/Hazard (WAC 173-340-708)

Site hazard quotient for individual hazardous contaminants is not to exceed 1. Site hazard index is not to exceed 1. Total site risk for carcinogens, for all contaminants, all pathways and all media, is not to exceed 1E-05. USEPA guidance for risk assessments should be followed in addition to WAC 173-340-708 requirements.

Ecological Receptors

Soil concentrations protective of terrestrial ecological receptors are specified in WAC 173-340-7490 through -7494, and using Table 749-3 for terrestrial ecological risk screening. Soil concentrations protective of aquatic ecological receptors should also be specified with acceptable methods (e.g., USEPA, 1997b; USEPA, 1998).

B) Industrial Scenario for Radiological Contaminants

All Pathways (includes Soil)

15 mrem/y dose limit (total effective dose from all pathways) applies to industrial workers (consistent with CERCLA risk range of 10^{-4} to 10^{-6} per OSWER 9200.4-18). Fate and transport modeling should be consistent with Exhibit 6-6 in EPA/540/1-89/002.

Groundwater

Groundwater concentrations are not to exceed MCLs for radionuclides from all current (e.g., groundwater plumes) and future (e.g., soil leaching) contaminant sources at the point of compliance. Include groundwater ingestion as a pathway in risk assessments.

Air

Annual dose from the airborne pathways is not to exceed 10 mrem/y for the maximally exposed individual at the site boundary, according to NESHAPS and WAC 173-480-040.

Ecological Receptors

USDOE (2002) methods should be used to address site biota. BCGs represent the general screening phase and apply to soil, sediment, and surface water. Soil and groundwater pathways should ensure that BCGs at the river (surface water and sediment) are not exceeded. BCGs correspond to 0.1 rad/d for terrestrial and riparian animals and 1 rad/d for terrestrial plants and aquatic populations.

C) Unrestricted Use for Nonradiological Contaminants (includes Uranium)

Soil (includes Ecological Receptors)

Soil direct contact concentrations are derived using WAC 173-340-740. Soil concentrations protective of groundwater are derived using WAC 173-340-747 Method B; any use of subsection (5), (7), (8) or (9) methods requires Ecology approval. Soil concentrations protective of surface water are derived using WAC 173-340-730 (not including subsections (2) and (4)) in combination with WAC 173-340-747 Method B. Soil concentrations protective of terrestrial ecological receptors (i.e., plants, soil biota, wildlife) are obtained as specified in WAC 173-340-7490 and using Table 749-3 for terrestrial ecological screening. Soil concentrations protective of aquatic ecological receptors (i.e., plants, invertebrates, fish) should also be specified with acceptable methods (e.g., USEPA, 1997b; USEPA, 1998).

Groundwater

Groundwater concentrations are derived according to WAC 173-340-720, Method B at the point of compliance. Include groundwater ingestion as a pathway in risk assessments.

Air

Air protection values are derived according to WAC 173-340-750.

Site Risk/Hazard (WAC 173-340-708)

Site risk for individual carcinogens is not to exceed 1E-06. Total site risk for carcinogens, for all contaminants, all pathways and all media, is not to exceed 1E-05. Site hazard quotient for individual hazardous contaminants is not to exceed 1. Site hazard index is not to exceed 1.

D) Unrestricted Use for Radiological Contaminants

All Pathways (includes Soil and Ecological Receptors)

15 mrem/y dose limit (total effective dose from all pathways) applies to all human receptors (consistent with CERCLA risk range of 10^{-4} to 10^{-6} per OSWER 9200.4-18). The 15 mrem/y dose limit is the target dose limit for the reasonably-anticipated future land use. Fate and transport modeling consistent with Exhibit 6-6 in EPA/540/1-89/002. USDOE (2002) methods should be used to address site biota. BCGs represent the general screening phase and apply to soil, sediment, and surface water. Soil and groundwater pathways should ensure that BCGs at the river (surface water and sediment) are not exceeded. BCGs correspond to 0.1 rad/d for terrestrial and riparian animals and 1 rad/d for terrestrial plants and aquatic populations.

Groundwater

Groundwater concentrations are not to exceed MCLs for radionuclides from all current (e.g., groundwater plumes) and future (e.g., soil leaching) contaminant sources. Groundwater ingestion must be included as a pathway in risk assessments.

Air

Annual dose from the airborne pathways is not to exceed 10 mrem/y to the whole body for any member of the public, according to WAC 173-480-040.

E) Scenario including Additional Pathways

All contaminants (nonradiological and radiological) included. Pathways to include showering, inhalation during showering, and ingestion pathways for consumption of residential produce and livestock, and game (including fish from the Columbia River), and appropriate pathways in EPA/540/1-89/002, Exhibit 6-6, in addition to all of the Unrestricted Use pathways. Both child and adult receptors should be evaluated.

F) Native American Scenarios

All contaminants (nonradiological and radiological) are evaluated, as specified by the tribes.

G) Intruders

All contaminants (nonradiological and radiological) are evaluated. Acute exposure via excavation for a home with a basement, drilling, trenching, mining and road construction should be examined. Scenario for post intrusion residents (children and adults) who raise produce (a garden) and have chronic residential exposure (including groundwater ingestion and groundwater use in the garden) on a residential site of 0.25 acre. The time period for evaluation begins immediately after remedy construction completion. Additional times beyond construction completion should be included, as necessary, to address risks from potential radionuclide in-growth products or other contaminant degradation products.

5.3. Post Institutional Control Period (from 150 y and beyond)

All scenarios included for the 50 to 150 y time period should be evaluated for time periods beyond 150 y. Risk evaluations should examine contaminants until the time at which they reach peak concentrations in groundwater at the point of compliance, which may exceed 10000 y.

6.0. Tables

Table 6.1. Human conceptual exposure model.

Scenario / Pathway	Industrial	Unrestricted Use	Scenario with additional pathways	Native American	Intruder Acute	Intruder Chronic
External Radiation	●	●	●		●	●
Direct Contact (WAC 173-340-745)	●					
Direct Contact (WAC 173-340-740)		●	●		●[c]	●
Groundwater (WAC 173-340-720)	●	●	●			●
Soil for Protection of groundwater (WAC 173-340-747[a])	●	●	●			●
Soil for Protection of Surface Water (WAC 173-340-747[b])	●	●	●			
Air (WAC 173-340-750)	●	●	●			●
Showering			●			
Inhalation during showering			●			
Residential Produce and Livestock			●			●
Game			●			
Fish			●			
Ecological (WAC 173-340-7490 and BDAC)[d]	●	●	●			
All Pathways Specified by Tribes				●		

[a]C_w based on WAC 173-340-720
[b]C_w based on WAC 173-340-730
[c]includes inhalation
[d]See Table 6.2

Table 6.2. Ecological conceptual exposure model.

Medium	Pathway	Terrestrial Receptor			Aquatic Receptor		
		Plant	Invert	Bird/Mam	Plant	Invert	Fish
Air	Inhalation			x			
	Ext surface uptake	x	x	x			
	External radiation	x	x	x			
Soil	Ingestion		x	x			
	Inhalation			x			
	Ext surface uptake	x	x	x			
	External radiation	x	x	x			
Groundwater, Seeps	Ingestion		x	x			
	Ext surface uptake	x					
	External radiation		x	x			
Surface Water	Inhalation			x			x
	Ingestion		x	x		x	x
	Ext surface uptake			x	x	x	x
	External radiation			x	x	x	x
Sediment	Ingestion			x		x	x
	Ext surface uptake			x	x	x	x
	External radiation				x	x	x
Biotic Tissue	Ingestion		x	x		x	x

Abbreviations: invert=invertebrate, mam=mammal, ext=exterior.
Ext surface uptake includes absorption via root, leaf, skin, feather, or other exterior surface tissues.
x=complete pathway.

7.0. References

Bradford, A., D. Esh, A. Ridge, D. Turner, E. Pearcy, J. Winterle, B. Brient, P. Mackin, and P. LaPlante. 2006. Standard review plan for activities related to USDOE waste determinations. NUREG-1854. US Nuclear Regulatory Commission (USNRC), Washington, DC.

CFR (Code of Federal Regulations). 2006. Title 40, Chapter I, Subchapter C, Part 61, National Emission Standards for Hazardous Air Pollutants (NESHAPS), U.S. Environmental Protection Agency, Washington, D.C.

CFR (Code of Federal Regulations). 2007. Title 40, Chapter I, Part 300, National Oil and Hazardous Substances Pollution Contingency Plan (NCP), U.S. Environmental Protection Agency, Washington, D.C.

Harris, S.G. and B.L. Harper. 2004. Exposure scenario for CTUIR traditional subsistence lifeways. Dept Sci and Eng, Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Pendleton, OR. Supplemented by memo from S Harris to J Sands (dated 8/18/05) on response to exposure scenario comments and summary of exposure factors.

RCW (Revised Code of Washington). 2006. Growth management planning by selected counties and cities. 36.70A RCW, Olympia, WA.

Ridolfi, C. 2007. Yakama Nation exposure scenario for Hanford Site risk assessment, Richland, Washington. Ridolfi, Inc., Seattle, WA.

USDOE (US Dept of Energy). 1995a. Hanford site risk assessment methodology (HSRAM). DOE/RL-91-45, Rev 3, Richland, WA.

USDOE (US Dept of Energy). 1995b. Hanford site background: Part 1, Soil background for nonradioactive analytes. DOE/RL-92-24, Rev 3, Richland, WA.

USDOE (US Dept of Energy). 1996. Hanford site background: Part 2, Soil background for radionuclides. DOE/RL-96-12, Rev 0, Richland, WA.

USDOE (US Dept. of Energy). 1999. Hanford comprehensive land use plan. Environmental impact statement. DOE/EIS-0222-F, US Dept. of Energy, Richland, WA, http://www.hanford.gov/doe/eis/hraeis/maintoc.htm.

USDOE (US Dept of Energy). 2002. A graded approach for evaluating radiation doses to aquatic and terrestrial biota. DOE-STD-1153-2002, Washington, DC.

USEPA (US Environmental Protection Agency). 1976. National interim primary drinking water regulations. EPA-570/9-76-003, Washington, DC.

USEPA (US Environmental Protection Agency). 1989. Risk assessment guidance for Superfund, Vol 1, Human health evaluation manual (Part A). EPA/540/1-89/002, Washington, DC.

USEPA (US Environmental Protection Agency). 1997a. Establishment of cleanup levels for CERCLA sites with radioactive contamination. OSWER No 9200.4-18, Washington, DC.

USEPA (US Environmental Protection Agency). 1997b. Ecological risk assessment guidance for superfund (ERAGS)-Process for designing and conducting ecological risk assessments. EPA/540/R-97/006, OSWER-9285.7-25, NTIS PB97-963211INX, Office of Emergency and Remedial Response, Washington, DC.
USEPA (US Environmental Protection Agency). 1998. Guidelines for ecological risk assessment. EPA/630/R-95/002F. Risk Assessment Forum, USEPA, Washington, DC.

USEPA (US Environmental Protection Agency). 2006. 2006 edition of the drinking water standards. EPA 822-R-06-013, Washington, DC.

WDOE (Washington State Dept of Ecology). 2006. Water quality standards for surface waters of the state of Washington. WAC 173-201A, Olympia, WA.

WDOE (Washington State Dept of Ecology). 2007a. Model Toxics Control Act (MTCA) Statute and Cleanup Regulation, WAC 173-340, Pub No. 94-06, Olympia, WA.

WDOE (Washington State Dept of Ecology). 2007b. Ambient air quality standards and emission limits for radionuclides, WAC 173-480, Olympia, WA.

WDOH (Washington State Dept. of Health). 1997. Hanford guidance for radiological cleanup. WDOH/320-015, Rev 1, Olympia, WA.

WDOH (Washington State Dept of Health). 2008. Public water supplies. WAC 246-290, Olympia, WA.

U.S. Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

JUN 24 2009

09-TPD-050

Ms. Jane A. Hedges, Program Manager
Nuclear Waste Program
Washington State
Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99354

Dear Ms. Hedges:

THE WASHINGTON STATE DEPARTMENT OF ECOLOGY (ECOLOGY) COMMENTS ON THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) FACILITY INVESTIGATION/CORRECTIVE MEASURES STUDY WORK PLAN FOR WASTE MANAGEMENT AREA (WMA) C, RPP-PLAN-39114, REVISION O

References:

1. Ecology letter from J. J. Lyon, Ecology, to S. J. Olinger, ORP, "Department of Ecology Review of the RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, RPP-PLAN-39114, Revision 0," dated April 24, 2009.

2. Ecology letter from J. J. Lyon, Ecology, to S. J. Olinger, ORP, "Department of Ecology Review of the Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C, RPP-PLAN-38777, Revision 0, Associated with the RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, RPP-PLAN-39114, Revision 0," dated April 23, 2009.

3. Nez Perce letter from G. Bohnee to S. J. Olinger, ORP, and J. A. Hedges, Ecology, "RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, RPP-PLAN-39114, Revision 0," dated April 10, 2009.

The U.S. Department of Energy (DOE), Office of River Protection (ORP), received your comments on the *RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, RPP-PLAN-39114, Revision 0 (Reference 1) and Appendix A of the Work Plan, *Sampling and Analysis Plan* (SAP) *for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C,* RPP-PLN-38777, Revision 0 (Reference 2). Per the request in your letter, we will continue to meet with you to develop the process for WMA C closure.

ORP reviewed your comments and is in the process of responding to them. Once we receive your concurrence on the proposed changes, we will make changes to both RPP-PLAN-39114 and Appendix A SAP with a Revision 1 within 120 days. We have arranged a meeting with your technical staff to discuss the specific wording of the changes requested by Ecology. Per ongoing discussions with your staff, we will also address comments provided both to you and to ORP by the Nez Perce, formally received on May 12, 2009 (Reference 3) in this update.

As noted in your letter, several comments relate to issues developed in Ecology's review of the *Phase 2 RCRA Facility Investigation/Corrective Measures Study Master Work Plan for Single-Shell Tank Waste Management Areas*, RPP-PLAN-37243, Revision 1. These comments cannot be addressed simply through changes to RPP-PLAN-39114, and are the subject of a series of workshops already underway with your staff. Once these workshops reach resolution, the outcome will be separately documented. Should this result in additional changes to the WMA C work plan, we will provide a further update for your approval.

It should also be noted that a number of comments are related to the Performance Assessment. However, after the release of the RPP-PLAN-39114, a process was started with Ecology, the Nuclear Regulatory Commission, the Environmental Protection Agency, the Tribal Nations, and interested stakeholders to develop the scope (conceptual exposure model, conceptual site model, selection of numerical codes, etc.) through a series of workshops. This process will be noted in the revision to RPP-PLAN-39114 and in the comment responses.

If you have any questions, please contact me, or contact Stacy Charboneau, Assistant Manager for Tank Farms Project, (509) 373-9112.

Sincerely,

Shirley J. Olinger, Manager
Office of River Protection

TPD:RWL

cc: S. Harris, CTUIR
J. J. Lyon, Ecology
C. L. Whalen, Ecology
D. A. Faulk, EPA
S. L. Leckband, HAB
G. Bohnee, NPT
K. Niles, Oregon Energy
R. Jim, YN
Administrative Record
WRPS Correspondence
Environmental Portal

REVIEW COMMENT RECORD	Date August 10, 2009	General Comment
	Project No. WMA C Sampling and Analysis Plan	Page Page 1 of 1

Document Number(s)/Title(s)	Program/Project/Building Number	Review	Organization/Group	Location/Phone
RPP-PLAN-38777, Rev. 0		Sample and Analysis Plan	Ecology	Mike Barnes 372-7927

Comment Submittal Approval: Agreement with indicated comment disposition(s) Status:

Organization Manager (Optional) — 8/10/2009 Date — Reviewer/Point of Contact — Date — Reviewer/Point of Contact

Author/Originator — Author/Originator

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Disposition
1.	General Comment	Please put a scale and North arrow on all maps.		**Response:** Document clearance will not clear a document that contains maps with coordinates, scales, north arrows or street names. These items have been removed from the maps at the request of document clearance.
2.	General Comment	Where this document refers to performance assessments and risk assessments, please add text referring to the process that is ongoing with NRC for the WMA C performance assessment. Please make appropriate changes in this document to resolve any inconsistencies between the plans documented here and the ongoing WMA C performance assessment development process.		**Response:** This document does not reference performance assessments. It does reference ecological risk assessments in terms of what additional sampling data is necessary for ecological risk assessments. It does state that requirements for collecting data for the CMS are provided in the WMA C Work Plan (RPP-PLAN-39114). It is that document that should reference the ongoing process with the NRC. However, it should also be noted that the work plan was written and delivered to Ecology in December 2008; the ongoing process with the NRC was not developed until February 2009.
3.	p. 3-3 item 2	The stated length for slant boreholes is 200 ft. Is this length along the inclined path, or 200 ft. in the vertical dimension? Please clarify.		**Response:** The document will be revised to state the 200 ft is the total length (inclined path) of the slant probehole.

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Disposition
4.	p. 3-3	Specify what might happen if contaminants are found or are indicated to be below the termination depth of the push hole, especially in light of the fact that the deep vadose zone contaminant profile is largely unknown and that the deep vadose zone is the zone "feeding" groundwater direction. Please address.		**Response:** This is discussed in detail in the Work Plan (RPP-PLAN-39114) p4-24, Lines 6-14 which states the following "*Should contamination be found in any of the soil sampling probeholes at their total depth, additional or other characterization technologies may be deployed to define the maximum depth of contamination at an unspecified date in the future. This data would be shared with Ecology to determine a path forward and implemented before corrective measures in the deep vadose zone area of interest. If the decision is to collect additional samples at deeper depths, then either this work plan will be amended or a separate work plan will be prepared which states the characterization technique to be used (direct push, borehole, etc.), the number of samples to be taken at depth, the total depth of the new characterization hole, and how to complete the new hole in accordance to WAC 173-160.*" The primary purpose of this document is to provide instructions to the laboratory and the preparer of the Field Sampling and Analysis Plan.
5.	General Comment Section 3	C-101 is potentially the largest release from C Farm, and the SST PA indicated that it essentially controlled the risk for releases from C Farm. Please justify why only one push hole is planned at this location.		**Response:** Table 3-1 identifies up to 3 direct pushes to be completed at C-101. At site A, one – two direct pushes are to be completed, while at site B, one direct push is to be completed. Furthermore, Chapter 4 of the Work Plan identifies the direct push at Site S is to be completed to test movement of contaminants down stratigraphic dip from C-101.
6.	p 3-4 para 4	What is the basis for using data from C-203 as a basis for deciding whether additional data for other C-200 tanks is needed? Please clarify and explain.		**Response:** Based on reconsiderations and comments from the Nez Perce, at least one direct push will occur at each of the C-200 series tanks (C-201, C-202, C-203 and C-204). The text was modified to indicate this change.
7.	p. 4-1, Section 4.1.1	The text states "If TBP is not detected in any of the samples then organics associated with tank waste will be eliminated from the list of COPCs…" However, samples will be analyzed for pesticides, petroleum, and PCBs, all of which are organics. PCBs and petroleum could come from tank waste. Please use a more specific term than organics for the type of organics that TBP is expected to indicate.		**Response:** Will revise the text to indicate the organics (i.e. VOA, SVOA, DRO/GRO, PCBs) will be eliminated if TBP is not found. TBP was chosen because it has the highest probability of being found. It is the only organic constituent other than acetone and 2-Butanone found above detection limits in all tank residual samples and it is found at higher concentrations 75 to 73,000 µg/g (mg/kg) which is 10 to 100,000 times higher than all other

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Disposition
				organics including PCB. It was presented during the DQO process that if TBP is not found than it is unlikely that other organic (i.e. VOA, SVOA, DRO/GRO, PCBs) contaminants related to tank waste would be found. Furthermore, if the data for the organic analytes from the pre-retrieval samples taken at the C-200 Tanks is examined, the Best Basis Inventory reports the following organic analytes were found above the MDL in the pre-retrieval samples Butylbenzylphthalate, 1-Butanol, Acetone, Aroclor 1254, 2-Butanone, Xylenes (total), Xylene (m & p), Trichloroethene, Xylene (o), Hexone, Methylenechloride, Toluene. The mean concentrations for Butylbenzylphthalate, 1-Butanol, Acetone were 66.7 ug/g, 16.8 ug/g, and 1.01 ug/g, respectively. The only PCB above MDL was Aroclor-1254 with a mean concentration of 0.46 ug/g. 2-Butanone had a mean concentration of 0.29 ug/g, with the rest of the non-detected organic analytes having a mean concentration of less than 0.1 ug/g. Tri-Butyl Phosphate was found as a TIC in all of the pre-retrieval samples with the highest concentration found at C-204 at greater than 200,000 ug/g. Tri-butyl phosphate in the post-retrieval samples for these tanks had results ranging from ~5,000 mg/kg (C-201) to ~73,000 mg/kg (C-204). Other organic compounds found above detection limits in some, but not all tank residuals, are Butylbenzylphthalate (3.27 mg/kg (C-103)), Di-n-butylphthalate (6.11 mg/kg C-103, 6.08 mg/kg C-204), Hexone (2.27E-02 mg/kg C-202), Xylenes (Total) (2.0E-02 mg/kg C-203) Additionally, the work plan and the SAP have been modified to include the following language "*The stepped approach will also be further evaluated following the examination of the sample results from the first five direct*

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Disposition
				pushes. The approach may be modified after consultation with Washington's Department of Ecology."
8.	p. 4-1 section 4.1.1	Please include a discussion on why these five sites were selected for organics, and discuss if organics are present in all tank wastes.		**Response:** Will revise the text to include the following discussion: WIDS indicates that the release occurred in the waste transfer line near the 241-CR-151 Diversion Box on October 15, 1969. The release is associated with the 241-CR-151 Diversion Box, the 241-C-102 tank and the PUREX 202-A Building. The source of the release was in an underground transfer line from the 202-A Building to the 241-C-102 tank via the 241-CR-151 diversion box. Analysis of the History of 241-C Farm, Stephen F. Agnew. LAUR-93-3605. October 1993 states: "An organic layer was noted in C-102 in 1969 and reported (Anderson, T. D. "Organics in 102-C Tank," letter to W. L. Godfrey, October 2, 1969) to be 36 kgal. This organic layer was subsequently transferred to C-103 in a P-10 pumping of C-102 in 1975. There is a recorded transfer of 111 kgal in '75-4, but the level change in C-102 indicated that only 25 kgal was transferred, with another 8 kgal in '78-3, for a total of 33 kgal. Presumably, this combined 33 kgal transfer was largely the organic layer, and would have left 3 kgal in C-102." RPP-PLAN-39114, Rev.0 Table 2-8 indicates that in "2-1965 - PUREX CWP2 - "A liquid level rise in Tank 103-C, the cesium feed tank, was apparently caused by a failed line in the encasement between the 152-CR diversion box and Tank 102-C which permitted coating waste from the PUREX Plant to leak into the encasement and drain to Tanks 101-C, 102-C, and 103-C via the tank Pump pits. Coating waste has been routed through a spare line to Tank 102-C and no further leaks have been detected. The coating waste solution accumulated in Tank 103-C did not significantly affect cesium loading capability as a cask was loaded normally following the incident."

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Disposition
				"Note: Pipeline 8041 is inside a concrete encasement was used to route the PUREX CW to SST C-102 (see drawing H-2-44501, sheet 92). This encasement traverses from diversion box 24 1-CR- 152 along the west side of SSTs C-101, C- 102, and C- 103. In order for the PUREX CW to drain into SSTs C-101, C-102, and C-103, the encasement containing the failed transfer pipeline must have partially filled with waste. The integrity of this encasement is unknown and may have leaked waste to the soil. Drawing H-2-2338, sheet 45 indicates pipeline 8041 is out of service. Pipeline 8041 connects from nozzle U-3 in the 24 1-CR-152 diversion box and nozzle U-2 in pit 02C atop SST C-102." Based upon this information it would appear that the potential exists that more than one release may have occurred in and around CR-151,CR-152 and C-101/102/103 tanks from 1965 to 1969. While waste is referenced as PUREX coating waste (WIDS), PUREX cladding waste (RPP-PLAN-39114) the presence of organics is documented in C-102 during this time frame. While these data are inconclusive that a release of organic contaminated wasted occurred the rationale for selecting sites in the DQO was to identify areas of known or suspected releases having some potential for containing organic contamination. It was felt that sample locations "L" and "P" satisfied this criteria which are located at each end of the encasement.
9.	p 4-2 step 1	Analytes do not include elevated pH, elevated Na, SO4, or elevated Cl which have been found in at least two boreholes, one north and one south of C Farm. These are interpreted as evidence of tank waste passing through the site, even though no radiological or dangerous waste constituents are present. Please explain the exclusion of these analytes or include them here		**Response:** This two-step optimization process was discussed in detail during the DQO process and is given in the DQO (RPP-RPT-38152). The key analytes were selected because they reliable indicate waste passing through the sediments, while elevated Na, SO4, or Cl in and of themselves do not. When elevated pH is found, it also found with the key analytes. We have not found elevated pH without the presence of one or more

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Disposition
				of the key analytes (see RPP-35484, Field Investigation Report for WMAs A-AX and C). We disagree with the statement that "*These are interpreted as evidence of tank waste passing through the site, even though no radiological or dangerous waste constituents are present*". The data in the Field Investigation Report RPP-35484 p 3-7 line 31clearly states that "nitrate-sodium rich fluids" were encountered at the well to the north (E27-22) so dangerous waste was present at this location, but no radionuclides. Chloride, sodium, and sulfate can also be elevated as a result of the geochemistry/ depositional environment of the formation but without the presence of either radionuclides and/or hazardous waste it is difficult to state whether or not elevated values of chloride, sodium, and sulfate are related to waste streams/ unplanned/planned releases or natural background. With regard to pH, the pH values from samples taken from the wells to the north and south vary between 7.43 to 7.6 at E27-22 and 7.09 to 7.71 at E27-155. These are not considered elevated pH values. The results from Step 1 along with any methods based results (from step 1) will be shared with Ecology before stopping at step 2. Additionally, the work plan and the SAP have been modified to include the following language "*The stepped approach will also be further evaluated following the examination of the sample results from the first five direct pushes. The approach may be modified after consultation with Washington's Department of Ecology.*"

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Disposition
10.	General Comment Section 4	Previous studies indicate that elevated pH (above 8.0) is a likely indicator of the passage of tank waste through soil. pH is neither a cation or anion, but is commonly measured. No mention is made here of pH as a possible indicator of tank waste. Was this an oversight? Please clarify.		**Response:** Granted, elevated pH is an indicator and the text will be revised to state that. However, the indicators chosen (i.e. nitrate, tc-99, and uranium-238) are also found when elevated pH is found (see tables 3-1 and tables 3-8 of RPP-35484 (Field Investigation Report for WMA A-AX and C). Furthermore, contaminants such as nitrate and Tc-99 are found when pH is not elevated.
11.	p. 5-7 – 5-8, Table 5-3	Please provide detection limits for boron, molybdenum, and tin. These metals are analyzed in soils by other projects so detection limits should be available. Molybdenum is indicated as primary on Table 5-5.		**Response:** The requested detection limits will be included. They are Molybdenum = 4.0 µg/g; Boron = 6.0 µg/g; and Tin = 6.0 µg/g
12.	p. 5-10 – 5-13, Table 5-5	The following detection limits are above what Ecology would consider to be WAC 173-340 Method B cleanup levels for soil for the protection of groundwater: Chromium total (exceeds 0.2 mg/kg which would apply to hexavalent Cr) Chloroform (exceeds 0.0038 mg/kg) 1,1-Dichloroethylene (exceeds 5.22E-04 mg/kg) Hexachloroethane (exceeds 0.125 mg/kg) 2-Nitropropane (exceeds 2.08E-05 mg/kg) 1,1,2,2-Tetrachlorethane (exceeds 1.23E-03 mg/kg) Tetrachloroethene (exceeds 8.59E-04 mg/kg) Butanol (exceeds 3.31 mg/kg) Nitrobenzene (exceeds 0.026 mg/kg) Nitroso-di-n-propylamine (exceeds 5.6E-05 mg/kg) Vinyl chloride (exceeds 1.84E-04 mg/kg) Pyridine (exceeds 3.73E-02 mg/kg) 2,4,6-Trichlorphenol (exceeds 4.62E-02 mg/kg) Tributyl phosphate (exceeds 0.677 mg/kg) Benzo(a)pyrene (exceeds 0.232 mg/kg) Aroclor -1232 and Aroclor-1242 (exceed 9.2E-03 mg/kg) Please pursue lower detection limits for these analytes, especially for the more common analytes TBP and Cr.		**Response:** Discussions have been held with the laboratory on improving detection limits. The laboratory believes if it can maximize the sample size, it can lower the detection limit on chromium to ~0.15 µg/g and the table in the SAP will be modified to show the new detection limit for chromium. We have requested that they do so. With regards to the VOAs: 1,1-Dichloroethylene 1,1,2,2-Tetrachlorethane Chloroform 2-Nitropropane Tetrachloroethene Butanol Vinyl chloride The detection limits are what the laboratory considers achievable if collecting the sample under EPA method 5035A (which is the required method for collecting VOA samples in soil) and using SW-846 methods. With Regards to the SVOAs and PCBs Hexachloroethane Nitrobenzene Nitroso-di-n-propylamine Pyridine

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Disposition
				2,4,6-Trichlorphenol Tributyl phosphate Benzo(a)pyrene Aroclor -1232 and Aroclor-1242 The laboratory follows the standard SW-846 methods and the detection limits reported in this document are what is considered achievable by laboratory. If Ecology knows of any methods to lower the detection limits of the identified analytes, please forward those methods to us so that we can send them onto the laboratory for evaluation.
13.	p 6-1 format V	Ecology will require the characterization data to be validated.		**Response:** The text will be revise to state that minimum of 5% of the samples will be validated

REVIEW COMMENT RECORD	Date August 10, 2009	General Comment
	Project No. WMA C Work Plan	Page Page 1 of 24

Document Number(s)/Title(s)	Program/Project/Building Number	Reviewer	Organization/Group	Location/Phone
RPP-PLAN-39114, Rev. 0	Vadose Zone Program	Various	Ecology	Mike Barnes 372-7927

Comment Submittal Approval: Agreement with indicated comment disposition(s) Status:

Organization Manager (Optional) 8-10-2009 Date Reviewer/Point of Contact Date Reviewer/Point of Contact

Author/Originator Author/Originator

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Response(s) (Provide technical justification for the response, if not accepted).
1.	General Comment	Where this document refers to performance assessments and risk assessments, please add text referring to the process that is ongoing with NRC for the WMA C performance assessment. Please make appropriate changes in this document to resolve any inconsistencies between the plans documented here and the ongoing WMA C performance assessment development process.	**Accepted.** It should also be noted that a number of comments are related to the performance assessment. However, after the release of the RPP-PLAN-39114, a process has been started with Ecology, NRC, EPA, Tribal Nations, and interested stakeholders to develop the scope (conceptual exposure model, conceptual site model, selection of numerical codes, etc.) through a series of working sessions or workshops. This process will be noted in the revision to RPP-PLAN-39114 and in the comment responses.
2.	General Comment	Units of measure should remain consistent, and where both IU as well as British units are given, a conversion should be provided. For example, compare pg. 2-12, line 42 with Table 2-1 (pg 2-13) where the units are different in the two locations. Please correct at this location and throughout the document.	**Response:** A metric conversion chart is provided at the beginning of the document (p. xiv) to do conversions. The text remains the same and represents the original document's measurements to maintain accuracy and prevent typographical and conversion errors based on previous comments received from Ecology. Information derived from historical or referenced sources is presented in the units cited in the reference. Field and

			laboratory data are presented in the units as measured in the field or as reported by the laboratory. Due to the loss of precision in converting units, the reader is expected to make the conversion to ensure the correct precision appropriate for the reader's purpose. The following website provides unit conversions http://www.onlineconversion.com/
3.	General Comment	This work plan, RCRA FI/CMS Work Plan for WMA C, Revision 0, Nov 2008, fails to identify the conceptual process for performing RCRA corrective actions to support closure of the SST WMA. The work plan must be revised to address the closure requirements of WAC 173-303.	**Response:** This work plan was submitted to meet HFFACO Milestone M-45-60, which states "Submit to Ecology for review and approval as an Agreement Primary Document, DOE's Phase 2 RFI/CMS Work Plan and Sampling and Analysis Plan (SAP) for WMA C." The associated Change Control Form (M-45-06-03) states, "This change package establishes a framework for completion of corrective measures within C-Farm and a Phase 2 Tank Farm Correction Action Master Work Plan to define the overall corrective action completion approach and sequence for other tank farms." It was never designed "to identify the conceptual process for performing RCRA correction actions to support closure of the SST WMA." According to revisions to Appendix I from the above-mentioned Change Control Form, "the Phase 2 corrective action process Master Work Plan will describe the overall corrective action conceptual process and sequencing approach for all single shell tank farms." Not this work plan. This comment relates to issues developed in Ecology's review of the *Phase 2 RCRA Facility Investigation/Corrective Measures Study Master Work Plan for Single-Shell Tank Waste Management Areas*, RPP-PLAN-37243, Revision 1. These comments cannot be addressed simply through changes to RPP-PLAN-39114, and are the subject of a series of workshops already underway with your staff. Once these workshops reach resolution, the outcome will be separately documented. Should this result in additional changes to the WMA C work plan, we will provide a further update for your

			approval as described through Section 9.3 of the HFFACO Action Plan.
4.	General Comment	The SST closure plan to be issued by the department of Ecology will include SST corrective actions. The corrective actions described in this document are not independent actions. These are also closure actions and will be incorporated into the SST closure plan.	**Response:** See Response to comment #3.
5.	General Comment	Source waste sites (soil) inside and potentially adjacent to the WMA are subject to RCRA closure and corrective action, not CERCLA as stated. Groundwater will also be subject to RCRA closure and corrective action, not just CERCLA as stated.	**Response:** See Response to comment #3.
6.	General Comment	Only cleanup actions that meet the closure performance standards will achieve final closure of the WMAs.	**Response:** See Response to comment #3.
7.	General Comment	Characterization of the WMAs must consider the closure performance standards to achieve final closure of the WMAs. All characterization conducted on the SST System, whether within a WMA or on ancillary equipment located outside the WMAs, must identify and incorporate constituents and detection levels to be used in the closure process.	**Response:** See comment response to 3. Constituents that have been identified in the *Single-Shell Tank Component Closure Data Quality Objectives*, RPP-23403, Rev. 3, are the constituents being addressed in the characterization effort. The constituents identified in the associated DQO report and SAP for this work plan are in agreement with Ecology and were addressed during the DQO process for this work with Ecology, the Tribal Nations and stakeholders. As cited on page 3-43, under Section 3.5, "The DQO for this work plan (RPP-RPT-38152) used the same approach as RPP-23403. Rev. 3 for developing analytical parameters. In this approach, "primary" constituents were identified from the Hanford Facility Dangerous Waste Part A Permit Application, Form 3, Revision 8, for the SST system [Letter 03-ED-009, "Hanford Facility Dangerous Waste Part A Permit Application Form 3, Revision 8, for the Single-Shell Tank (SST) System"] (Part A), underlying hazardous constituents, 10 CFR 61.55, "Licensing Requirements for Land Disposal of

			Radioactive Waste," and identified potential risk contributors. Analytical methods were identified for the primary constituents. In addition to the identified constituents, a number of these methods can also detect many other chemicals or radionuclides. These other or "secondary" analytes will be evaluated and reported using strategies described in RPP-23403.
8.	General Comment	Closure will address structures, soil and groundwater contamination.	**Response:** This work plan was a requirement to satisfy HFFACO Milestone M-45-60 as stated in the document. The work plan addresses releases or potential releases through the corrective action process for soils and groundwater, not structures. Other documentation, like a closure plan will address all of these as noted in your comment.
9.	General Comment	Both RCRA closure and corrective action will be contained in the SST System closure plan. Corrective action for the SST System is part of the draft closure plan. This section is currently reserved in the closure plan. Detail will be incorporated into the closure plan through permit modifications Ecology is incorporating the corrective action of the SST System into the SST closure plan in order to integrate schedules and physical actions and regulatory requirements.	**Response:** See Response to comment #3.
10.	General Comment	It is inappropriate to use only the document number in referring to documents. This practice is repeated throughout the document.	**Response:** The document number as a citation has been used in numerous reports. It is based on the protocol established at Hanford to issue unique numbers for document control and configuration. Because it is a unique number, no other document has it and thus eliminates confusion as to which document is being referenced, unlike Smith, 2003.
11.	p. 2-12 Sect	Groundwater monitoring at WMA C is conducted FOR	**Accepted.** Text will read, "At WMA C, groundwater monitoring

	2.3.4	compliance with WAC 173-303-400 (and by reference 40 CFR 265, Subpart F) because WMA C is a RCRA TSD unit. Data from some groundwater monitoring wells is used to support the 200-BP-5 groundwater operable unit. Please correct.	is conducted FOR compliance with WAC 173-303-400 (and by reference 40 CFR 265, Subpart F) because WMA C is a HWMA TSD unit. Data from some groundwater monitoring wells are used to support the 200-BP-5 CERCLA groundwater operable unit." Note that CERCLA was added and RCRA was changed to HWMA since the regulations cited are state requirements.
12.	Pg. 2-12, lines 16 – 19	B Pond was located east of WMA C (not north) and the B Pond mound led to groundwater flow to the west-northwest. With cessation of discharges to B Pond, groundwater flow direction is slowly changing back to the pre-Hanford west to east direction of groundwater flow. Please correct.	**Partially accepted.** The sentence will be changed to indicate that B Pond is located east-northeast of WMA C. Based on historical data from PNNL-15837, *Data Package for Past and Current Groundwater Flow Contamination beneath Single-Shell Tank Waste Management Areas*. From this report on p. 3.16, ". . . groundwater flow directions in the area of WMA C have been fairly constant and to the southwest between 1958 and the present." Currently in the annual groundwater monitoring reports, groundwater flow remains in a southwest direction.
13.	Pg. 2-13, lines 16 – 24	If slug tests at different levels in the well screen indicate different hydraulic conductivities and flow rates, why was a single long screen placed in these wells that bridge different units of differing hydraulic characteristics rather than a single screen at the interval of highest contamination? The effect could be a dilution of contaminants that masks the real level of contamination in a well. Please address.	**Response:** This work plan as designated in HFFACO M-45-60 addresses soil characterization at WMA C. It does not address groundwater well testing. This section discusses background information on WMA C including ancillary equipment, geology, and WMA historical operations. The reference provided in the above table gives the rationale for completion technique used.
14.	Pg. 3-3, line 27	WMA C is a RCRA TSD unit, NOT a past practice unit. Appendix C of the HFFACO does not include a 200-PO-3 operable unit, but Appendix B does. Please correct this work plan and make the HFFACO consistent.	**Accepted.** You are correct that is why Appendix B is cited, not Appendix C of the HFFACO. It is not the TOC scope to make the HFFACO consistent. This scope is part of DOE, Ecology and EPA, the Tri-Parties.
15.	Pg. 3-6, line 13.	Please explain what "elevated pH values and high sodium content" means if these are considered indicators of the presence or passage of tank waste.	**Accepted.** We will provide the values that are given on pp. 3-6 and 3-7 in Section 3.2.1.1 to indicate what "elevated pH and high sodium content" means and reference the FIR for WMAs C and A-AX (RPP-35484) for further information.

16.	Pg. 3-6, lines 23, 24	Please provide some details regarding the appearance of Tc-99 in a "nearby monitoring well".	**Accepted.** The "nearby monitoring well" is actually "nearby monitoring wells" in the text and will be identified accordingly, "(299-E27-4, 299-E27-13, 299-E27-14, 299-E27-21 and 299-E27-23)" after "wells".
17.	Pg. 3-6, 3-7, Sect. 3.2.1.1.	While this is a nice summary of data, it doesn't state whether this data is indicative of a release and why it is. Please clarify and explain.	**Accepted.** We will clearly state in Section 3.2.1 and 3.2.1.1 that this is tank waste contamination. In addition, at the beginning of Section 3.2.1 (a), it states "Chemical analyses of sediments retrieved from borehole C4297 near C-105 showed several features characteristic of tank waste vadose zone contamination." The beginning line presented in Section 3.2.1.1 starts off saying "Borehole C4297 was drilled near the source of the C-105 leak near the southwest portion of C-105." The overall section of 3.2 is entitled "Nature and Extent of Contamination Determined From Phase 1 Investigations", which discusses known tank waste releases. We will provide additional text to clearly indicate the presence of tank waste past through these zones and reference the FIR for WMAs C and A-AX (RPP-35484).
18.	Pg. 3-13, lines 6, 7.	Please provide a technical basis for the statement, "….and the subsequent natural recharge do not appear sufficient to have contaminated groundwater in the 36 to 38 years since the release events."	**Accepted.** This sentence will be deleted since no direct support is available to support this statement.
19.	Pg. 3-18, lines 25-31	As Cn is found in groundwater in well 299-E27-7, and the only likely nearby source is C Tank Farm, this constituent should be added. Please add.	**Response:** Cyanide is a constituent and contaminant of concern that has impacted groundwater at WMA C. It has been identified as such in the work plan and the SAP. In this section on conceptual models as indicated on p. 3-17, lines 12-22 states, "Rather than evaluating individual leaks sequentially, the summary discussion in Appendix A of DOE/ORP-2008-01 is oriented toward comparisons of similar information related to several leak events where possible, particularly the larger leaks that are more completely characterized. The purpose of these comparisons is to emphasize and describe those key characteristics and processes that are common to all leak events

			and therefore are indicative of systematic behavior. At the same time, it is important to keep in mind that each tank waste release site is unique in some way and that site-specific factors not emphasized in this general discussion may provide significant impacts to contaminant behavior in the subsurface. These factors, which must be determined from site specific evaluation, may result in more refined or alternative conceptual models that are most appropriate for a given site." This conceptual model discussion acknowledges we are well aware of tank waste releases that are site-specific in nature as well as their similar characteristics related to migration.
20.	Pg. 3-18, lines 8 – 17	This discussion mentions soil waste interaction in the vadose zone to include sorption and precipitation, but doesn't address desorption which can be facilitated by later addition of moisture to the soil. Please include desorption.	**Accepted.** The word desorption will be added.
21.	Pg. 3-18, 19, lines 37 through 3	Mention of the depth limitation of information is appropriate here, because push technology and some boreholes do penetrate the entire vadose zone. Yet, contaminants in the deep vadose zone can be inferred based on data from groundwater monitoring wells. Please include depth limitations of characterization boreholes.	**Accepted.** A range of depth for the characterization boreholes will be included. None of these are probeholes using push technology. Most of them were boreholes and extended through the depth of contamination. Depth limitations in the work plan were decided in the DQOs associated with those Phase 1 work plans and included boreholes in SX, T, TX, BX, and B.
22.	Pg. 3-19, line 7.	Change "will" to "is expected to", and that expectation was used in model simulations. Please change.	**Accepted.** Text will be changed to read, "… an engineered barrier is expected to reduce recharge rates from approximately 100 mm/yr to much less than 1.0 mm/yr for some time (PNNL-14744)."
23.	Pg. 3-21, lines 5 – 8.	The February 1979 flooding of T Farm is but one example of a process that likely occurred at other farms in February 1979 as well as other times in the past during site operations. Please qualify.	**Accepted.** Text will be added to state, "Flooding events probably occurred at other tank farms in the past during site operations. In 2001 and 2002, interim measures were conducted to mitigate flooding on tank farms."
24.	Pg. 3-23, line	Clastic dikes are TABULAR (not tubular) bodies.	**Partially accepted.** The typographical error will be corrected.

	15	Previous model simulations incorrectly portrayed clastic dikes as pipes and thus incorrectly concluded that clastic dikes have no significance in fate and transport of contaminants to groundwater. Please correct.	For information purposes to provide better understanding of how this is portrayed in a 2-D simulation for this response: A clastic dike placed in a 2-D model is infinite in a 2-D cross-section. This information will not be added to the document, since the discussion is on conceptual models and not simulations. Simulations are not discussed in this section and are inappropriate at this time with the ongoing performance assessment working session process started with Ecology, NRC, EPA, Tribal Nations, and interested stakeholders. The ongoing process started with Ecology, NRC, EPA, Tribal Nations, and interested stakeholders to develop the scope (conceptual exposure model, conceptual site model, selection of numerical codes, etc.) through a series of working sessions or workshops will address model simulations. Please see comment response 1.
25.	Pg. 3-23. Lines 34 - 42.	While it is true that the possibility of intersecting a clastic dike in a characterization is limited, there is sufficient information on clastic dikes and their properties to "create" an imaginary clastic dike in modeling simulations of fate and transport analyses	**Response:** Simulations are not discussed in this section and are inappropriate at this time with the ongoing performance assessment working session process started with Ecology, NRC, EPA, Tribal Nations, and interested stakeholders. The ongoing process started with Ecology, NRC, EPA, Tribal Nations, and interested stakeholders to develop the scope (conceptual exposure model, conceptual site model, selection of numerical codes, etc.) through a series of working sessions or workshops will address model simulations. Please see comment response 1.
26.	General Comment on conceptual models	With each conceptual model, it is possible to also conduct sensitivity studies that vary the input parameter values for a specific input characteristic. For example, one could run sensitivity analyses of the number, geometry and material characteristics of clastic dikes within a farm, the location and number of	**Response:** Simulations are not discussed in this section and are inappropriate at this time with the ongoing performance assessment working session process started with Ecology, NRC, EPA, Tribal Nations, and interested stakeholders. The ongoing process started with Ecology, NRC, EPA, Tribal Nations, and interested stakeholders to develop the scope (conceptual exposure

		unsealed boreholes, variations on recharge, flood frequency and volume, and water releases from pipelines. Please include some discussion of sensitivity studies and their value to planning future site characterization and in planning for remediation/closure.	model, conceptual site model, selection of numerical codes, etc.) through a series of working sessions or workshops will address model simulations. Please see comment response 1.
27.	p. 3-24 – 3-27, Section 3.3.5	Please include a conceptual model for shallow releases within C farm. There are at least 6 UPRs inside the farm that have not been discussed in this section, (UPR-200-E-16, UPR-200-E-27, UPR-200-E-68, UPR-200-E-81, UPR-200-E-107, UPR-200-E-118), which include surface spills from pipelines, leaks and airborne releases from diversion boxes and vaults, and airborne releases from tanks.	**Accepted:** A conceptual model for shallow releases within C farm section exists in the work plan (Section 3.3.5.4). In Section 3.3.5.5, Conceptual Model of Contaminated Surface Sites outside the C Farm, UPR-200-E-107, -115, -118 and -91 are discussed. UPR-200-E-16, -27 and -68 will be added. The title will be modified to remove outside the C Farm since some of these UPRs are inside the tank farm. UPR-81 is a pipeline leak that is addressed in Section 3.3.5.3, which addresses the conceptual models for pipelines, diversion boxes and CR vault. In Hanford Site Waste Management Units Report (DOE/RL-88-30, Rev. 18) created to meet the requirements of the HFFACO Action Plan Section 3.5, UPRs -16, -27, -68 have been consolidated with 200-E-133. Consolidation is defined in the document as "the site will be dispositioned as part of another site. 200-E-133 is included as part of boundary to be characterized in the DQO process. Please see comment response 1 that address the ongoing performance assessment working sessions that will address conceptual models.
28.	p. 3-27 to 3-42, Section 3.4	Re performance assessment, text on human health risk (Section 3.4.1) appears short, relative to text on eco risk (Section 3.4.2). For example, eco risk describes identification of contaminants of concern (Section 3.4.2.3.1) and uncertainty analysis (Section 3.4.2.3.3),	**Response:** This entire section will be revised based on the ongoing performance assessment working sessions for WMA C. Additional wording will be included to state, "After submittal to Ecology in December 2008, a process was developed in February 2009 and is ongoing that addresses performance assessments. The ongoing process started with Ecology, NRC, EPA, Tribal

		while human health risk does not. Please address.	Nations, and interested stakeholders to develop the scope (conceptual exposure model, conceptual site model, selection of numerical codes, etc.) through a series of working sessions or workshops will address various performance assessment issues." Please see comment response 1.
29.	p. 3-27, Section 3.3.5.5, lines 30-31	Please delete the text "These releases and the conceptual model are not believed to represent a risk to groundwater but potentially are a risk through direct contact and to ecological receptors." Ecology considers them a threat to groundwater as well as a threat through direct contact and ecological contact. WAC 173-340-740(6)(b) gives the point of compliance for soil cleanup levels based on the protection of groundwater to be the soils throughout the site (no depth limit is considered). We will use soil concentrations when evaluating whether or not the UPRs are a threat to groundwater.	**Accepted.** This text will be deleted. Please see comment response 1 and 28.
30.	p. 3-28, para 4	EPA eco risk guidance should also be listed: 1) EPA. 1998. Guidance for ERA. EPA/630/R-95/002F. 2) EPA. 1997. ERAGS. EPA/540-R-97-006. 3) EPA. 1997. EPA Region 10 Supplemental ERAGS. EPA 910-R-97-005.	**Accepted.** We will include these references. Please see comment response 1 and 28.
31.	p. 3-29, para 2	Although it is stated, "the reasonably anticipated future land use for the 200 Areas is continued industrial activities for the foreseeable future," it should be acknowledged that land use will be unknown at some time in the future. Therefore, a conservative approach would evaluate a range of human exposure scenarios (e.g., residential, farmer, fisher, Native American), as well as relevant ecological receptors (e.g., terrestrial,	**Accepted.** This text will be deleted. Please see comment response 1 and 28.

		aquatic). DD	
32.	p. 3-29, Section 3.4.1.1, Lines 16-18	The text states "The reasonably anticipated future land use for the 200 Areas is continued industrial activities for the foreseeable future. This land-use assumption is applied to the pathway and receptor considerations in risk calculations for the waste sites." For the groundwater and pathway to groundwater Ecology considers only unrestricted use scenarios (WAC 173-340 Method B) as this is the most beneficial use of the groundwater and is consistent with closure requirements in WAC 173-303-610. Additionally, the Tri-Party response to the Hanford Advisory Board Advice #132 stated "An Industrial land use scenario will set cleanup levels on the Central Plateau. Other scenarios (e.g., residential, recreational) may be used for comparison purposes to support decision making especially for • The post-institutional controls period (> 150 years). • Sites near the Core Zone perimeter to analyze opportunities to "shrink the site". • Early (precedent-setting) closure/remediation decisions. " Additionally, Ecology expects evaluation of Native American scenarios. Please evaluate unrestricted as well as Native American scenarios for risk assessment at WMA C.	**Accepted.** This text will be deleted. Please see comment response 1 and 28.
33.	p.3-29, Section 3.4.1.1, Lines 38-41	Please delete the text "Given the local hydrogeology at WMA C, protection of the groundwater from the contaminants, by design, also will result in protection of the Columbia River." This is not the case for	**Accepted.** This text will be deleted. Please see comment response 1 and 28.

		contaminants that are more harmful to aquatic biota and those with stringent ambient water quality criteria. This issue was discussed in comment resolution meetings for the SST PA. Ecology realizes that there may be a need to set a point somewhere in the Central Plateau or near the River Corridor for compliance with requirements for surface water protection. This could be acknowledged here.	
34.	p. 3-30, Section 3.4.1.4	Though the land use selected by DOE for the Core Zone in the CLUP is industrial (exclusive) for at least the next 50 y, Ecology's expectations for the analysis of risk are included on the attached draft document (*Washington State Department of Ecology Guidance: Exposure Assessment Criteria for the Core Zone of the Central Plateau on the Hanford Site, Mar. 2009 draft*).	**Response:** This text will be deleted. Please see comment response 1 and 28.
35.	p. 3-30, para 4	Partitioning land use, according to location inside (i.e., industrial) vs. outside (i.e., unrestricted) the Central Plateau Core Zone, makes sense for the foreseeable future (e.g., institutional control period), but not for longer time horizons (e.g., post institutional control period).	**Response:** This text will be deleted. Please see comment response 1 and 28.
36.	p. 3-31, Figure 3-13	Include under the primary release mechanisms surface liquid discharges. An example of this type of release is UPR-200-E-16.	**Response:** This figure was deleted. Please see comment response 1 and 28.
37.	p. 3-31, Figure 3-13	Re the conceptual exposure model, human and biota receptors could each be subdivided into more specific groups (e.g., residential/industrial/farmer/Native American for human; terrestrial/aquatic for biota). A complete pathway should be shown for human ingestion of biota. "Uptake" of biota is redundant and should be deleted (since ingestion is already specified).	**Response:** This figure was deleted. Please see comment response 1 and 28.

		As a result of a groundwater connection, surface water and sediments in the Columbia River should be added as exposure media. Complete pathways should be shown for ingestion, inhalation, direct contact, and external radiation of surface water to biota (given their potential exposure at riverbank seeps), as well as ingestion, direct contact, and external radiation of river sediment to biota (as a result of contaminant accumulation in the sediment). Finally, human and biota exposure to vadose zone soils (below 15 ft bgs) may occur via an intruder drilling scenario (where deeper soils are brought to the surface and mixed with surface soils).	
38.	p. 3-32, para 1	It is stated, "the ERA for WMA C will adopt relevant methodology and data that were used in the Central Plateau ecological risk assessment (CPERA)." Adopting consistent methods makes sense, although results are currently lacking. That is, the Jan 2008 Central Plateau Terrestrial Ecological Risk Assessment report (p. v in: DOE-2007-50, Draft A, Reissue) noted, "the tank farms [and US Ecology site] were not identified for ecological sampling in Phase II because their operations, regulatory plans, and interim stabilization plans (unique to the tank farms) represented a poor fit from an ecological risk characterization standpoint."	**Accepted:** Clarity will be provided that states, "This ecological risk assessment is not tiering off of the CPERA, just adopting consistence methods to maintain consistency." Please see comment response 1 and 28.
39.	p. 3-32, para 2	MTCA and USDOE ERA guidance should also be consistent with EPA ERA guidance (EPA/630/R-95/002F; EPA/540-R-97-006).	**Accepted:** Guidance documents cited will be added. Please see comment response 1 and 28.
40.	p. 3-32, para 3	In addition to terrestrial eco receptors, risk to aquatic	**Accepted:** A new section entitled, "Aquatic Receptors of

		receptors in or near the Columbia River should also be evaluated via a groundwater pathway.	Concern" will be added in Section 3.4.2.2. The section will read as follows: **"Aquatic Receptors of Concern.** Aquatic receptors of concern will be evaluated through numerical modeling." Please see comment response 1 and 28.
41.	p. 3-33, para 5	The purpose of the WMA C ERA should include evaluation of both terrestrial and aquatic environments.	**Accepted:** Same as comment response #40. Please see comment response 1 and 28.
42.	p. 3-35, para 3	The WAC citation should be "WAC 173-340-7493(2)(a)(i-iv)," not "WAC 173-340-7493(2)(i-iv)."	**Accepted.** Text will be corrected to reflect the comment.
43.	p. 3-35, para 6	Please clarify that both nonradionuclide and radionuclide COPECs should be derived from the SST DQO (RPP-23403), as well as WMA C soil data, and not be limited to MTCA Table 749-3 and USDOE BCG constituents.	**Accepted.** The text needs no modification, because it already says the starting COPECs will be derived from RPP-23403. RPP-23403 includes both radionuclides and nonradionuclides as constituents. This is also consistent with the groundwater COPCs using RPP-23403.
44.	p. 3-36, para 5	The WAC citation should be "WAC 173-340-7493(2)(a)(iv)," not "WAC 173-340-7493(2)(iv)."	**Accepted.** Text will be corrected to reflect the comment.
45.	p. 3-40, para 1	Substitute "evaluate" for "verify," since contaminant exposure to small mammals is uncertain before tissue data are obtained.	**Accepted.** Text will be corrected to reflect the comment.
46.	p. 3-40, para 2	Although text indicates that dietary exposure modeling is not identified in WAC 173-340-7493, this method is described for birds and mammals in WAC 173-340-7493(3).	**Accepted:** "and dietary exposure modeling" will be deleted.
47.	p. 3-41 to 3-42, Section 3.4.2.4	In addition to the CPERA and RCBRA, please acknowledge that other eco risk work has been conducted at Hanford (e.g., CRCIA, WTP, 100 Areas,	**Accepted.** Text will be added with the citation to these documents and referenced in the reference section of the document.

		300 Area, PNNL surveys).	
48.	p. 3-43, para 4	Please describe criteria for selecting "threshold indicator constituents."	**Accepted.** The criteria for selecting these "threshold indicator constituents" are based on their historically associated with tank waste, indicative of tank farm constituents released into the environment and drive risk, and were the most detected constituents in Phase 1 investigations. These criteria will be added to the text of the work plan.
49.	p. 3-44, para 1	Specify detection limits for Tc-99, I-129, and CN. This section (3.5.1) should be labeled as inorganics and rads, since organics are discussed in the next section (3.5.2).	**Accepted.** The text will be changed to read "Detected at Method Detection Limit". Text will be added to state, "Sample analysis will be performed using a two-step approach. Step 1 analytes and methods are a subset of Step 2 analytes and methods. If a Step 1 threshold is met or exceeded, then all Step 2 methods (minus methods already performed in Step 1) will be performed."
50.	p. 3-44, para 4	Provide rationale for the number and location of the five sampling locations.	**Accepted.** Will revise the text to include the following discussion: WIDS indicates that the release occurred in the waste transfer line near the 241-CR-151 Diversion Box on October 15, 1969. The release is associated with the 241-CR-151 Diversion Box, the 241-C-102 tank and the PUREX 202-A Building. The source of the release was in an underground transfer line from the 202-A Building to the 241-C-102 tank via the 241-CR-151 diversion box. Analysis of the History of 241-C Farm, Stephen F. Agnew. LAUR-93-3605. October 1993 states: "An organic layer was noted in C-102 in 1969 and reported (Anderson, T. D. "Organics in 102-C Tank," letter to W. L. Godfrey, October 2, 1969) to be 36 kgal. This organic layer was subsequently transferred to C-103 in a P-10 pumping of C-102 in 1975. There is a recorded transfer of 111 kgal in '75-4, but the

			level change in C-102 indicated that only 25 kgal was transferred, with another 8 kgal in '78-3, for a total of 33 kgal. Presumably, this combined 33 kgal transfer was largely the organic layer, and would have left 3 kgal in C-102." RPP-PLAN-39114, Rev.0 Table 2-8 indicates that in "2-1965 - PUREX CWP2 - "A liquid level rise in Tank 103-C, the cesium feed tank, was apparently caused by a failed line in the encasement between the 152-CR diversion box and Tank 102-C which permitted coating waste from the PUREX Plant to leak into the encasement and drain to Tanks 101-C, 102-C, and 103-C via the tank Pump pits. Coating waste has been routed through a spare line to Tank 102-C and no further leaks have been detected. The coating waste solution accumulated in Tank 103-C did not significantly affect cesium loading capability as a cask was loaded normally following the incident." "Note: Pipeline 8041 is inside a concrete encasement was used to route the PUREX CW to SST C-102 (see drawing H-2-44501, sheet 92). This encasement traverses from diversion box 24 1-CR- 152 along the west side of SSTs C-101, C- 102, and C- 103. In order for the PUREX CW to drain into SSTs C-101, C-102, and C-103, the encasement containing the failed transfer pipeline must have partially filled with waste. The integrity of this encasement is unknown and may have leaked waste to the soil. Drawing H-2-2338, sheet 45 indicates pipeline 8041 is out of service. Pipeline 8041 connects from nozzle U-3 in the 24 1-CR-152 diversion box and nozzle U-2 in pit 02C atop SST C-102." Based upon this information it would appear that the potential exists that more than one release may have occurred in and around CR-151,CR-152 and C-101/102/103 tanks from 1965 to

			1969. While waste is referenced as PUREX coating waste (WIDS), PUREX cladding waste (RPP-PLAN-39114) the presence of organics is documented in C-102 during this time frame. While these data are inconclusive that a release of organic contaminated wasted occurred the rationale for selecting sites in the DQO was to identify areas of known or suspected releases having some potential for containing organic contamination. It was felt that sample locations "L" and "P" satisfied these criteria which are located at each end of the encasement.
51.	p. 3-44, para 3	Just because TBP is not detected, it is nonconservative to eliminate all organics from the list of COPCs at WMA C.	**Response:** Will revise the text to indicate the organics (i.e. VOA, SVOA, DRO/GRO, PCBs) will be eliminated if TBP is not found. TBP was chosen because it has the highest probability of being found. It is the only organic constituent other than acetone and 2-Butanone found above detection limits in all tank residual samples and it is found at higher concentrations 75 to 73,000 µg/g (mg/kg) which is 10 to 100,000 times higher than all other organics including PCB. It was presented during the DQO process that if TBP is not found than it is unlikely that other organic (i.e. VOA, SVOA, DRO/GRO, PCBs) contaminants related to tank waste would be found. Furthermore, if the data for the organic analytes from the pre-retrieval samples taken at the C-200 Tanks is examined, the Best Basis Inventory reports the following organic analytes were found above the MDL in the pre-retrieval samples Butylbenzylphthalate, 1-Butanol, Acetone, Aroclor 1254, 2-Butanone, Xylenes (total), Xylene (m & p), Trichloroethene, Xylene (o), Hexone, Methylenechloride, Toluene. The mean concentrations for Butylbenzylphthalate, 1-Butanol, Acetone were 66.7 ug/g, 16.8 ug/g, and 1.01 ug/g, respectively. The only PCB above MDL was Aroclor-1254 with a mean concentration of 0.46 ug/g. 2-Butanone had a mean concentration of 0.29 ug/g,

			with the rest of the non-detected organic analytes having a mean concentration of less than 0.1 ug/g. Tri-Butyl Phosphate was found as a TIC in all of the pre-retrieval samples with the highest concentration found at C-204 at greater than 200,000 ug/g. Tri-butyl phosphate in the post-retrieval samples for these tanks had results ranging from ~5,000 mg/kg (C-201) to ~73,000 mg/kg (C-204). Other organic compounds found above detection limits in some, but not all tank residuals, are Butylbenzylphthalate (3.27 mg/kg (C-103)), Di-n-butylphthalate (6.11 mg/kg C-103, 6.08 mg/kg C-204), Hexone (2.27E-02 mg/kg C-202), Xylenes (Total) (2.0E-02 mg/kg C-203). Additionally, the work plan and the SAP have been modified to include the following language "*The stepped approach will also be further evaluated following the examination of the sample results from the first five direct pushes. The approach may be modified after consultation with Washington's Department of Ecology.*"
52.	p.3-44, Section 3.5.1	Please lower the threshold values of nitrate and hexavalent chromium to concentrations that are used as preliminary remediation goals or cleanup levels elsewhere on the site. For nitrate this value is 40 mg/kg as N, based on WAC 173-340-747 Equation 747-1 and the MCL for nitrate. For hexavalent chromium, a value of 2 mg/kg is used in consideration of dust resuspension, and a value of 0.2 mg/kg is used both for ecological protection, which is consistent with the value calculated for soil for the protection of	**Response:** These threshold values are based on soil background levels established in the footnoted documents, not on clean-up requirements. Please see comment response # 49.

		groundwater. If 0.2 mg/kg is above the detection level, then the hexavalent chromium indicator concentration should be set at the detection limit.	
53.	p. 3-44 – 3-45, Section 3.5.2	Methylene chloride, acetone, 2-butanone, and chloroform may be common lab contaminants but they also may be present in tanks. Some of these have been found in tank headspaces. If they are observed in samples the associated blanks should be considered when deciding if these are from the tanks or a lab source. They should not automatically be attributed to lab contamination.	**Accepted.** The intent of the discussion was intended to capture that if observed in samples, the associated blanks will be considered when deciding if these are from contamination associated with a tank release or a lab source. The text will be modified to reflect the above statement.
54.	p. 3-45, para 3	Re PCB congener analysis, please specify Method 1668 and quantify dioxin like toxic equivalents (TEQ) with WHO 2005 toxic equivalency factors (TEFs) for humans/mammals and with WHO 1998 TEFs for fish and birds. PCB congeners should be evaluated in a portion of all soil samples collected at WMA C, rather than being constrained to the initial 5 locations (EPA. 2007. Recommendations for human health risk-based chemical screening and related issues at EPA Region 10 CERCLA and RCRA sites. OEA-095, Memo from Michael Cox).	**Accepted.** The analytical method will be specified as EPA Method 1668. The language in the sampling and analysis plan has been modified to include the following "*Results from the initial five samples will be used in an attempt to establish a correlation between PCB Aroclors and congeners. The correlation will be used to evaluate whether or not future analysis of PCB congeners is necessary*."
55.	p. 3-45, para 4	Specify detection limits for pesticides and petroleum products.	**Accepted.** For the contaminants available the detection limits will be specified. Aldrin 0.1 mg/kg Benzene hexachloride (including lindane) 6 mg/kg Chlordane 1 mg/kg DDT/DDD/DDE (total) 0.75 mg/kg Dieldrin 0.07 mg/kg Endrin 0.2 mg/kg

			Hexachlorobenzene 17 mg/kg Heptachlor/heptachlor epoxide (total) 0.4 mg/kg Pentachlorophenol 3 mg/kg TBP Detected Gasoline range organics 100 mg/kg Diesel range organics 200 mg/kg
56.	Section 5, general	Ecology is submitting comments on the Phase 2 Master Work Plan. Please revise this section so that it is consistent with the revisions needed in the master work plan.	**Response:** Changes have been made in Section 5 to eliminate as much as possible any changes that would be required based on changes to the Phase 2 Master Work Plan. Section 5.5 and 5.6 has been removed. Discussion of program integration has been minimized to support field work aspects only.
57.	GENERAL COMMENT Chapter 5.	Soil is one component to be closed as part of the WMA C RCRA closure process following WAC 173-303-610. Therefore, these activities should be called a RCRA Component Closure Work Plan. Please correct in the title and throughout this RPP-PLAN-39114 document.	**Response:** This work plan was submitted to meet HFFACO Milestone M-45-60, which states "Submit to Ecology for review and approval as an Agreement Primary Document, DOE's Phase 2 RFI/CMS Work Plan and Sampling and Analysis Plan (SAP) for WMA C. Please see the response to comment 56.
58.	Pg. 5-1 lines 22, 23.	Any revisions to the work plan must be submitted to Ecology for APPROVAL. Please correct.	**Response:** No correction is warranted. This is straight from Section 9.3 of HFFACO specifically addressing document revisions. The first sentence will be modified to read, "approval BY ECOLOGY without notification of Ecology and DOE."
59.	Pg. 5-6, lines 38, 39.	Groundwater is another component of WMA C to be closed under RCRA. Although HFFACO agrees that groundwater operable units will be closed/remediated under past practice authority, groundwater must at least be addressed here—even if only a reference to another work plan, RI/FS or program is included. Closure/remediation of groundwater must meet closure performance standards of WAC 173-303-610. Please include this information here and in this section of the	**Accepted.** A reference to the BP-5 work plan or program for groundwater will be added as will the criteria that all structures, soils and groundwater must meet closure performance standards of WAC 173-303-610.

		work plan.	
60.	Pg. 5-9, Sect. 5.4.	See comment 58 and replace all references to corrective measures to closure investigations and closure actions—including the implementation of any interim measures. Please correct.	**Response:** This work plan was submitted to meet HFFACO Milestone M-45-60, which states "Submit to Ecology for review and approval as an Agreement Primary Document, DOE's Phase 2 RFI/CMS Work Plan and Sampling and Analysis Plan (SAP) for WMA C.
61.	p. 5-11, para 1	Please add the following EPA guidance: 1) EPA-540-R-070-002. Jan 2008. RAGS, Part F, Supp. Guidance for Inhalation Risk Assessment. 2) EPA/600/R-07/038. Apr 2007. ProUCL Version 4.0, User Guide.	**Accepted.** This EPA guidance documents will be added to the list.
62.	p. 5-11, para 3	It should be a requirement (rather than an option) that other scenarios (i.e., Native American, residential, intruder) be evaluated to assess post-remediation risk.	**Response:** Residential is being addressed. As you know, it is a requirement for residential and industrial land uses to be used to establish a cleanup level. The other scenarios are not a regulatory requirement under WAC 173-340-708(3)(d).
63.	p. 5-12, para 3	In addition to terrestrial eco risk, aquatic eco risk should be assessed, as a result of a contaminant groundwater pathway to the Columbia River. Additional ERA guidance should be consulted (e.g., EPA/630/R-95/002F; EPA/540-R-97-006).	**Accepted.** These guidelines will be included in this section to be consistent.
64.	Pg. 5-14, Sect. 5.4.7	Pg. 5-14, Sect. 5.4.7 addresses soil only. Soil is one component to be closed under RCRA. Also included are the tanks and the waste contained therein, as well as ancillary equipment. These should be included as closure actions/options. Please address.	**Response:** This follows the requirements of the HFFACO Milestone 45-60 that this document was intended to meet. Ongoing closure documents will address the tanks and waste contained therein, as well as ancillary equipment and other structures on WMA C. This includes groundwater.
65.	Pg. 5-21, lines 19-22.	Actions in the Central Plateau under CERCLA will have to be coordinated with corrective measures AND closure actions being implemented under a RCRA	**Response:** This entire section (Section 5.5) has been deleted to address comment #56.

		permit to assure that actions on TSD units fulfill the closure performance standards of WAC 173-303-610. Please correct.	
66.	Pg. 7-1 and Section 7	Pg. 7-1 and Section 7. The title of this section includes program integration, but the section only discusses the various groups that will participate, and not how the program/project and resulting data are integrated. Please revise to address integration activities and how they will be accomplished.	**Accepted.** The following text will be provided to clarify integration activities and how they will be accomplished. An insert on page 7-1, after line 30: A detailed draft work breakdown structure has been developed as part of the Tank Operations Contract Performance Management Baseline. This draft work breakdown structure lays out the scope elements that address vadose zone characterization and corrective measures, including interim measures, as well as closure and regulatory actions. After page 7-2 line 16 add: A draft Tank Operations Contract Performance Management Baseline, providing detailed scope, schedule and logic of activities in the next 5-10 years, and broader information regarding long term activities. This draft baseline provides a schedule for the characterization activities described in this work plan, as well as the related activities required to complete corrective measures. The baseline addresses both regulatory and physical actions that must be performed to address closure, and shows how corrective actions are logically related to closure actions. ORP has initiated a series of workshops with Ecology and the TOC to further define the closure plan for WMA C, including the corrective measures related work described in this work plan. These workshops will be used to better define future activities as the baseline is finalized.
67.	Appendix A	Appendix A is the SAP which is not included, but was released as a separate document. Will the document stand alone, or be incorporated here as Appendix A? Please clarify.	The SAP is a stand-alone document.

68.	p. B-5, para 1	Water terms (C, I, AUF, d) in the oral exposure equation are not defined. Please fix.	**Accepted.** These oral exposure equation water terms are negligible for terrestrial exposure because there is no contaminated surface water source is present in the WMA C tank farm investigation area. Therefore, water parameters have been omitted from the terrestrial wildlife exposure equation.
69.	p. B-5, para 2	Provide rationale for 3 transects, a minimum of 6 organisms/transect, and for deriving a mean COPEC tissue concentration by weighting carcass (90%) and liver/kidney (10%) composites.	**Accepted.** Six organisms per transect will yield the minimum sample mass required for COPEC analysis. While this number of samples is not statistically based, the number of samples is sufficient for exploratory data analyses including calculation of mean concentrations, upper confidence limits (UCLs) on the mean, and contaminant distributions (e.g., box plots). The two habitat transects are situated in vegetated areas within close proximity to the WMA C tank farm, thus are areas appropriate for capturing potential exposure from WMA C. The perimeter transect is intended to capture small mammals in direct association with WMA C. The location and number of transects is intended to optimize successful capture of small mammals for tissue analysis. The exposure point concentration calculations use weighted COPEC concentrations in small mammal carcass and organs to account for differential uptake by tissues (i.e., potential bioconcentration in the organs). Liver and kidney weights will be recorded and their contaminant contributions to diet accounted for on a fraction-of-body-weight basis. This will be clarified in the text. The following clarification will also be included in the text to document the rationale for the isolation of liver and kidney tissue: "Liver and kidneys are target organs for accumulation of some types of COPECs, including metals In addition, these organs have tissue-specific toxicity reference values (TRVs) for

			some COPECs which allow for extrapolation between the concentrations observed in the field and laboratory-based effects."
70.	p. B-6, para 1	The list and hierarchy of analytes given here in Section B1.7 differs slightly from that specified in Section B1.3. Please reconcile.	**Accepted.** Inconsistencies in the text have been reconciled.
71.	p. B-8, Table B-2	Please clarify footnote "a" and indicate where it applies in the table body.	**Accepted.** Footnote "a" was included in error. Footnotes have been reconciled.
72.	p. B-10, para 3	Provide a reference for home range and dispersal distance for a deer mouse.	**Accepted.** The origin of home range and dispersal distance values have been cited in the text. The values are average home range and dispersal distance calculated from representative environments listed in EPA/600/R-93/187, p. 2-298.
73.	p. B-10, Section B3.2	The home range specified for a deer mouse is 0.077 hectares. It does not seem reasonable to expect that the home range is known to that degree of precision. Please cite references for this value.	**Accepted.** This value is an average home range calculated from representative environments listed in EPA/600/R-93/187, p. 2-298. Values have been cited in the text.
74.	p. B-11, Figure B-2	Although the study area dimension is based on a deer mouse home range, provide rationale for specific transect locations (i.e., one perimeter transect group inside WMA C and two vegetated habitat transect groups outside WMA C).	**Accepted.** Two transect locations are based on available habitat for foraging small mammals and proximity to areas of known or suspected contamination in WMA C. These vegetated (habitat) transect locations are situated in close proximity to WMA C, thereby increasing likelihood of contaminant exposure and subsequent transport. Because WMA C is largely non-vegetated, the instance of inhabitation or site use by small mammals is likely to be limited. However, the perimeter transect will capture small mammals directly using the site. This explanation has been included in Section B3.2.1.

TWRS/ CFarm
X-M-45

0085243

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • (509) 372-7950

September 28, 2009

Included Administrative Record

TO: Valarie Peery

FROM: Jeff Lyon

SUBJECT: Waste Management Area-C (WMA-C) 1996 Memorandum of Understanding (Section II., D, and E) briefing provided to the Environmental Protection Agency (EPA) on August 26, 2009

The Department of Ecology presented the attached information at the Tri-Party Agreement (TPA) briefing to EPA on WMA-C, and in support of the Ecology/EPA Memorandum of Understanding. Participants were from EPA, the United States Department of Energy-Office of River Protection, and Washington River Protection Solutions. In the briefing, we reviewed the "RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C," RPP-PLAN-39114, Revision 0 (Work Plan), submitted for milestone M-45-60. I initialed the attached material and notes from that TPA briefing on September 25, 2009. I hope that these attachments can be submitted as part of the C-Farm Administrative Record. Once our response letter is peer reviewed and signed, I will include that in the file as well.

We provided this briefing because we are the lead agency and the TPA offers us the opportunity to discuss any potential concerns with the non-lead agency, EPA, regarding these actions. For any changes we are suppose to include updates as an agenda item for the TPA Project Manager Meeting Quarterly Meetings.

Attachments

cc: Cheryl Whalen, Cleanup Section Manager

RECEIVED
FEB 25 2010
EDMC

M-045-60

S-2-4, H011

Attachments

1. Attendee List
2. Notes
3. Presentation "EPA TPA Briefing on WMC-C RFI Work Plan"
4. Waste management Area C Work Plan for Corrective Measures
5. Pages iii-v of RPP-PLAN-39114, Rev. 1 – Table ES-1 Sample Plan WMA C Phase 2 Characterization for RFI/CMS (3Sheets)
6. Appendix I – Single-Shell Tank System Waste Retrieval and Closure Process
7. Page 4-10 of RPP-PLAN-3911, Rev. 1 – Figure 4-2 Sample Locations for Phase 2 Characterization
8. Email dated July 8, 2009, from Helen Brownell, EPA, to Jeff Lyon, Ecology "Re: WMA-C Soil Characterization for Closure"
9. Meeting Notice, "Updated: Briefing for WMA-C closure – soil characterization"

Name	ORG	PHONE
MARK TRIPLETT	PNNL	376-1825
Jeff Lyon	Ecy	539-1996
Larry Gadbois	EPA	376-9884
Rod Lobos	EPA	376-3749
Zelma Jackson	ECY	372-7910
Dib Goswami	ECY	372-7902
Mike Barnes	Ecology	372-7927
Chris Kemp	ORP	373-0649
Craig Cameron	EPA	376-8665
Dennis Faulk	EPA	6-8631
Cheryl Whalen	Ecology	372-7972
DAN PARKER	WRPS	372-0766
Brenda Jentzen	Ecy	372-7912
JOE CAGGIANO	ECY	372-7915
Jeff Luke	WRPS	
Susan Eberlein	WRPS	3721689
Bob Lober	ORP	

WMAC RFI/CMS Work Plan Meeting

08/26/09

Hw 9-25-09
TPA Briefing 6/26

SAP UMA-C

Larry G.
8/26/09

Can they push to 200'? Basic assumption in their plan.
1st + then 2nd push idea is good (log, then collect soil samples)

Why ~~do~~ is the max depth for C-~~3~~100 Series tanks 200 ft, and for 200 series it is 160 ft max? Why don't we want to know what is below that depth?

Figure 3-2 All the data collection is within the red dotted perimeter, but the study boundary is shown larger (yellow dotted line). There is no study planned between the red dots + yellow dotted line.

3.4 1st paragraph Holding times in SW-846 are requirements, not just "recommended."
Last sentence is really bad.

5 sites for multi suite analysis is not many on which to dismiss highly suspect potential COPCs.

9-25-09
DBrechins
8/24

Briefing for EPA 8/26/09

EPA TPA Briefing on WMA-C RFI Work Plan

August 26th
2009

TPA Briefing for EPA

- Ecology Tank Farm Storage Project goal for Closure of WMA-C by 2019
- TPA milestone M-45-60, DOE's Phase 2 RFI/CMS Work Plan for WMA-C
- Briefing Goal
  - provide information and the WMA-C RFI Work Plan
  - request EPA comments if desired
  - meet EPA expectations outlined in the MOU and the TPA
- Briefing includes Soil Characterization Work Plan information for Waste Management Area C (WMA-C)
- Work Plan will identify the soil characterization necessary to provide information to make a closure decision in WMA-C and support the SST PA

Expectations

Process to satisfy -

1. TPA
   - Appendix I- Section 3.1 and by reference {from 3.1 - Section 5.5 and 5.6} (SST System Closure Regulatory Integration Strategy, page I-9);
   - TPA Action Plan, Lead Regulatory Agency Concept (page 7),
   - Section 5.1 (page 5-1),
   - Section 6.3 (Page 6-5), and by reference from 6.3 - Section 7.4.2 (page 7-17) - functionally equivalent information gathered in the CERCLA process through the RI as described in Section 7)
   - ?EIS to ensure compliance with NEPA — Federal NEPA
2. MOU for WA State, Dept. of Ecology and EPA

ROD

EPA Response

- Provide review comments for resolution
- Express in letter
  - Confirm these actions (reference to Appendix I process) are CERCLA equivalent based on EPA authority
  - Indicate EPA response to Ecology Closure decision following
  - Other items suggested by EPA
- How will this process "address" or incorporate closure decisions in ROD?

Check in occasional => get EPA pitfalls => CERCLA => gets concurrence from Ecy => letter. => case MOU.; EIS- procedural => Program perspective => NEPA decision vs CERCLA decision / No requirement to put CERCLA decision over Ecy;

8/26/2009

EPA Feedback

- When will the closure/TPA process be incorporated into a ROD?
- What do we need to do to assure coordination with EPA?
- Does the existing WMA C work plan cover all characterization needed to support both RCRA corrective action and CERCLA remedy selection?

Points for further discussion

- How does the work within the RFI/CMS ensure a consistent remedy selection. EPA insight on the following topics:
  - Submittal of both RFI/CMS and RI/FS for their respective authorities, then manage via permit – clarify expectations for TPA or other authorities.
  - Will this have any effects on a CPP document, referencing CMS for a CERCLA remedy selection – clarify expectations for TPA or other authorities.
  - Elimination of RFI/CMS completely – Not Ecology's position
  - What are your thoughts on the relationship between WMA C PA and the Central Plateau Baseline Risk Assessment
  - What do you anticipate for coordination of these 2 efforts?

- TPA says it out.

8/26/2009

Current text

- Where information regarding treatment, management, and disposal of radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954) is incorporated into this document, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of the Revised Code of Washington (RCW) 70.105, "Hazardous Waste Management Act," and its implementing regulations, but is provided for information purposes only.

Suggested text

- Consistent with par 19 of the TPA, this plan addresses all aspects of contamination, including AEA material. However the inclusion of AEA materials in the plan does not confer state RCRA or HWMA authority over otherwise exempt AEA spent, byproduct, and special nuclear material.

- proposed by EPA to US DOE

4

Check in occasional => get EPA pitfalls => CERCLA => gets concurrence from Ecy => letter => cse MOU; EIS - procedural => Program perspective => NEPA decision vs CERCLA decision / No requirement to put CERCLA decision over Ecy;

8/26/2009

EPA Feedback

- When will the closure/TPA process be incorporated into a ROD?
- What do we need to do to assure coordination with EPA?
- Does the existing WMA C work plan cover all characterization needed to support both RCRA corrective action and CERCLA remedy selection?

Points for further discussion

- How does the work within the RFI/CMS ensure a consistent remedy selection. EPA insight on the following topics:
  - Submittal of both RFI/CMS and RI/FS for their respective authorities, then manage via permit – clarify expectations for TPA or other authorities.
  - Will this have any effects on a CPP document, referencing CMS for a CERCLA remedy selection – clarify expectations for TPA or other authorities.
  - Elimination of RFI/CMS completely – Not Ecology's position
  - What are your thoughts on the relationship between WMA C PA and the Central Plateau Baseline Risk Assessment
  - What do you anticipate for coordination of these 2 efforts?

- TPA lays it out.

8/26/2009

Current text

- Where information regarding treatment, management, and disposal of radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954) is incorporated into this document, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of the Revised Code of Washington (RCW) 70.105, "Hazardous Waste Management Act," and its implementing regulations, but is provided for information purposes only.

Suggested text

- Consistent with par 19 of the TPA, this plan addresses all aspects of contamination, including AEA material. However the inclusion of AEA materials in the plan does not confer state RCRA or HWMA authority over otherwise exempt AEA spent, byproduct, and special nuclear material.

- Proposed by EPA to US DOE

PA-2012

Waste Management Area C Work Plan for Corrective Measures

Purpose:

Provide the information needed to perform a corrective measures study for Waste Management Area (WMA) C.

- Specifically, identify the soil characterization requirements for the corrective measures study.
- Address the nature and extent of contamination sufficiently to allow decisions on corrective measures supporting closure.
- Include both radiological and chemical constituents.

See Figure I-1 of the TPA for the context of the Corrective Measures Study in closure of WMA C.

Process:

- The Data Quality Objectives (DQO) Process was used to identify the soil characterization information needed to support a corrective measures study in WMA C. DOE Office of River Protection, Washington State Department of Ecology, Environmental Protection Agency and Hanford site contractor participated in the process.
- Results of the DQO process were communicated to stakeholders and input sought before finalizing the DQO document, RPP-RPT-38152.
- A work plan, RPP-PLAN-39114, was developed to address the data needs identified in the DQO process.
- Additional work will be performed to address needs not associated with site characterization (e.g. evaluation of available technologies for soil remediation).

Stakeholder and Tribal involvement:

- Workshop held with Tribes and State of Oregon, March 6, 2008 (Nez Perce not available)
- Met with Nez Perce, March 25, 2008
- Follow on workshop with Tribes, May 8, 2008
- Visit to State of Oregon in Salem Oregon, May 12, 2008
- Follow on meeting with Tribe to provide feedback on how their input was integrated into DQO, plan, August 21, 2008

Plan:

- RPP-PLAN-39114, RCRA Facility Investigation/Corrective Measures Work Plan for Waste Management Area C, identifies multiple soil sampling locations and depths, as well as the suite of analyses required to understand the impact of waste leaks on the soil.

- RPP-PLAN-39114 was formally transmitted from ORP to Ecology in December 2008. Ecology comments (including those forwarded by stakeholders, tribes and the public) are in the process of being resolved, and characterization is underway. The scope of characterization is expected to take about 4 years.

Plan Implementation:

- RPP-PLAN-39114 lays out data needs based on the DQO – new information may identify changes or additional data needs
- The plan recognizes that tank waste is currently impacting groundwater – it may not be possible to identify all sources of ground water contamination
- The plan tries to maximize the amount of information gained by use of a combination of direct push logging and sampling, electrical resistivity measurements, logging existing boreholes
    - Trade-offs have been made between number of sampling locations and number of samples/sampling depths at each location
    - Direct push at multiple locations is used instead of wide-bore drilling at few locations to obtain more extensive coverage
    - Innovative methods are being pursued (more sensitive gamma logging, test of a beta detector)
- Changes to the plan will require Ecology approval per the TPA process

- RPP-PLAN-39114 was formally transmitted from ORP to Ecology in December 2008. Ecology comments (including those forwarded by stakeholders, tribes and the public) are in the process of being resolved, and characterization is underway. The scope of characterization is expected to take about 4 years.

Plan Implementation:

- RPP-PLAN-39114 lays out data needs based on the DQO – new information may identify changes or additional data needs
- The plan recognizes that tank waste is currently impacting groundwater – it may not be possible to identify all sources of ground water contamination
- The plan tries to maximize the amount of information gained by use of a combination of direct push logging and sampling, electrical resistivity measurements, logging existing boreholes
    - Trade-offs have been made between number of sampling locations and number of samples/sampling depths at each location
    - Direct push at multiple locations is used instead of wide-bore drilling at few locations to obtain more extensive coverage
    - Innovative methods are being pursued (more sensitive gamma logging, test of a beta detector)
- Changes to the plan will require Ecology approval per the TPA process

Table ES-1. Sample Plan WMA C Phase 2 Characterization for RFI/CMS (3 sheets)

Map Design.	Group[a]	Location	Deployment	Number of Holes	Average Number of Samples	Known or Suspected Event	Objective	Access Availability	Ecology/ Stakeholder Interest
A	G3	Spare inlet 241-C-101	Direct push, slant	1-2	8	Tank over fill. Loss through spare inlet	Characterize C-101 release and refine conceptual models 1, 2, and 4	Fair	High
B	G2	241-C-101, south side	Direct push, vertical or slant	1	8	Tank release	Characterize C-101 release and refine conceptual models 1 and 2	Good	High
C	G4	241-C-203	Direct push, slant	3	3: 0-15 ft 15: >15 ft	Tank leak and/or tank over fill. Loss through spare inlet	Determine if C-200 actually leaked and refine conceptual models 1, 2, and 4	Fair	Moderate to high
D	G4	241-C-201 241-C-202 241-C-204	Direct push, slant	1-2/tank	8	200 series tank leaks	Determine if C-200 actually leaked and refine conceptual models 1, 2, and 4	Fair	Moderate, depending on C-203 results
E	G2	Between 241-C-106 and 200-C-109	Direct push, vertical	1	8	Suspected release	Assess ^{60}Co and refine conceptual models 1, 2, and 4	Fair	High
F	G2	Bldg C-801 chemical drain	Direct push, vertical	1	8	Suspected release site	Assess release of PUREX waste, ^{137}Cs and ^{99}Tc, and ^{60}Co and refine conceptual models 1, 2, and 4	Good	Moderate to high
G	G2	Between Bldg C-801 and 241-C-103	Direct push, vertical	1	8	Suspected transfer line release site	Assess release and ^{60}Co and refine conceptual models 1, 2, and 4	Good	High
H	G5	Northeast side of E-91	Direct push, vertical	1	8	Surface release	Surface exposures and assess ^{60}Co and surface release conceptual Model	Good	High
I	G5	Northeast side of E-115	Direct push, vertical or slant	1	8	Surface release	Surface exposures and assess ^{60}Co and surface release conceptual model, refine conceptual models 1, 2, and 4	Good	High
J	G3	241-C-104	Direct push, slant	1	8	Tank release	Assess suspected release and refine conceptual models 1, 2, and 4	Fair	High
K	G2	241-C-108	Direct push, vertical or slant	1	8	Transfer line leak, hot dry well (09-02)	Assess suspected release and refine conceptual models 1, 2, and 4	Poor	High
L	G2	241-C-103 and 241-C-106	Drywell logging and direct push, vertical	2 / log drywells	8	Potential transfer line leak and tank over fill	Update logging data for ^{60}Co, ^{137}Cs, uranium, and moisture and assess potential release and refine conceptual models 1, 2, and 4	Fair	Moderate

Table ES-1. Sample Plan WMA C Phase 2 Characterization for RFI/CMS (3 sheets)

Map Design.	Group[a]	Location	Deployment	Number of Holes	Average Number of Samples	Known or Suspected Event	Objective	Access Availability	Ecology/ Stakeholder Interest
M	G7	241-C-104, 108, 109, 110, 111, and 112	Drywell logging	N/A	N/A		Update logging data for ^{60}Co, ^{137}Cs, uranium, and moisture	Fair to good	Moderate
N	G8	UPR-86, UPR-82 and UPR-81	SGE	N/A	N/A		Test SGE, define plume at unplanned releases (UPR)-82 and -86; refine conceptual models 1, 2, and 4	Good	High
O	G9	WMA C	SGE	N/A	N/A		3-D vision of suspected releases – may lead to supplemental sample locations	Good	High
P	G1	UPR-81	Balance of direct pushes to complete characterization	3	8	Known release site	Characterize release and refine conceptual models 1, 2, and 4	Good	High
Q	G6	UPR-82	Direct push through center of UPR-82	1	8	Known release site	Penetrate center of mass, and refine conceptual models 1, 2, and 4	Good	High
R	G2	241-C-301 Catch Tank	Direct push vertical	1	8	Unlined concrete catch tank	Assess potential catch tank release and refine conceptual models 1, 2, and 4	Good	Moderate to high
S	G5	UPR-72 and C-8 Drain	Direct push vertical	1	8	Buried radioactive material and French drain from 241 CR Building are in this area	Assess presence of buried material and potential releases to C-8 drain and refine conceptual models 1, 2, and 4	Good	Moderate to high
T	TBD	TBD, based on SGE data for entire WMA	TBD, direct push vertical and/or slant	TBD	TBD	Previously unknown release sites	TBD	TBD	Moderate to high
U	G3	C-110	Direct push, slant	1	8	Tank leak and/or tank over fill. Loss through spare inlet	Characterize C-110 release and conceptual models 1, 2, and 4	Fair	High

Table ES-1. Sample Plan WMA C Phase 2 Characterization for RFI/CMS (3 sheets)

Map Design.	Group[a]	Location	Deployment	Number of Holes	Average Number of Samples	Known or Suspected Event	Objective	Access Availability	Ecology/ Stakeholder Interest
M	G7	241-C-104, 108, 109, 110, 111, and 112	Drywell logging	N/A	N/A		Update logging data for ^{60}Co, ^{137}Cs, uranium, and moisture	Fair to good	Moderate
N	G8	UPR-86, UPR-82 and UPR-81	SGE	N/A	N/A		Test SGE, define plume at unplanned releases (UPR)-82 and -86; refine conceptual models 1, 2, and 4	Good	High
O	G9	WMA C	SGE	N/A	N/A		3-D vision of suspected releases – may lead to supplemental sample locations	Good	High
P	G1	UPR-81	Balance of direct pushes to complete characterization	3	8	Known release site	Characterize release and refine conceptual models 1, 2, and 4	Good	High
Q	G6	UPR-82	Direct push through center of UPR-82	1	8	Known release site	Penetrate center of mass, and refine conceptual models 1, 2, and 4	Good	High
R	G2	241-C-301 Catch Tank	Direct push vertical	1	8	Unlined concrete catch tank	Assess potential catch tank release and refine conceptual models 1, 2, and 4	Good	Moderate to high
S	G5	UPR-72 and C-8 Drain	Direct push vertical	1	8	Buried radioactive material and French drain from 241 CR Building are in this area	Assess presence of buried material and potential releases to C-8 drain and refine conceptual models 1, 2, and 4	Good	Moderate to high
T	TBD	TBD, based on SGE data for entire WMA	TBD, direct push vertical and/or slant	TBD	TBD	Previously unknown release sites	TBD	TBD	Moderate to high
U	G3	C-110	Direct push, slant	1	8	Tank leak and/or tank over fill. Loss through spare inlet	Characterize C-110 release and conceptual models 1, 2, and 4	Fair	High

Table ES-1. Sample Plan WMA C Phase 2 Characterization for RFI/CMS (3 sheets)

Map Design.	Group[a]	Location	Deployment	Number of Holes	Average Number of Samples	Known or Suspected Event	Objective	Access Availability	Ecology/ Stakeholder Interest
V	G2	C-111	Direct push vertical	1	8	Tank leak and/or tank overfill. Loss through spare inlet	Characterize C-111 release and conceptual conceptual models 1, 2, and 4	Good	High
W	G9	299-E27-4, 299-E27-12, 299-E27-13, 299-E27-14, 299-E27-15	Log groundwater monitoring wells outside of WMA C				Log wells to collect data on U, ^{60}Co, ^{137}Cs, and moisture	Good	High

[a] Group refers to the expected work package associated with the characterization effort broadly defined as follows:

G1 = Direct push at UPR-81 (covered by existing work package).
G2 = Vertical direct pushes at nine investigative sites around the 100-series SSTs.
G3 = Slant direct pushes at three investigative sites around the 100-series SSTs.
G4 = Slant direct push at the C-200 Series tanks.
G5 = Outside the WMA, vertical direct push at the investigative sites.
G6 = Vertical direct push through gunite at UPR-82.
G7 = Drywell logging at select dry wells.
G8 = Three separate SGE areas at the following locations: UPR-81, UPR-82, and UPR-86.
G9 = Deploy SGE at WMA C taking into account the results from testing at site N.

APPENDIX I - SINGLE-SHELL TANK SYSTEM WASTE RETRIEVAL AND CLOSURE PROCESS

Figure I-1.
Single-Shell Tank Waste Management Area (WMA)
Waste Retrieval and Closure Process

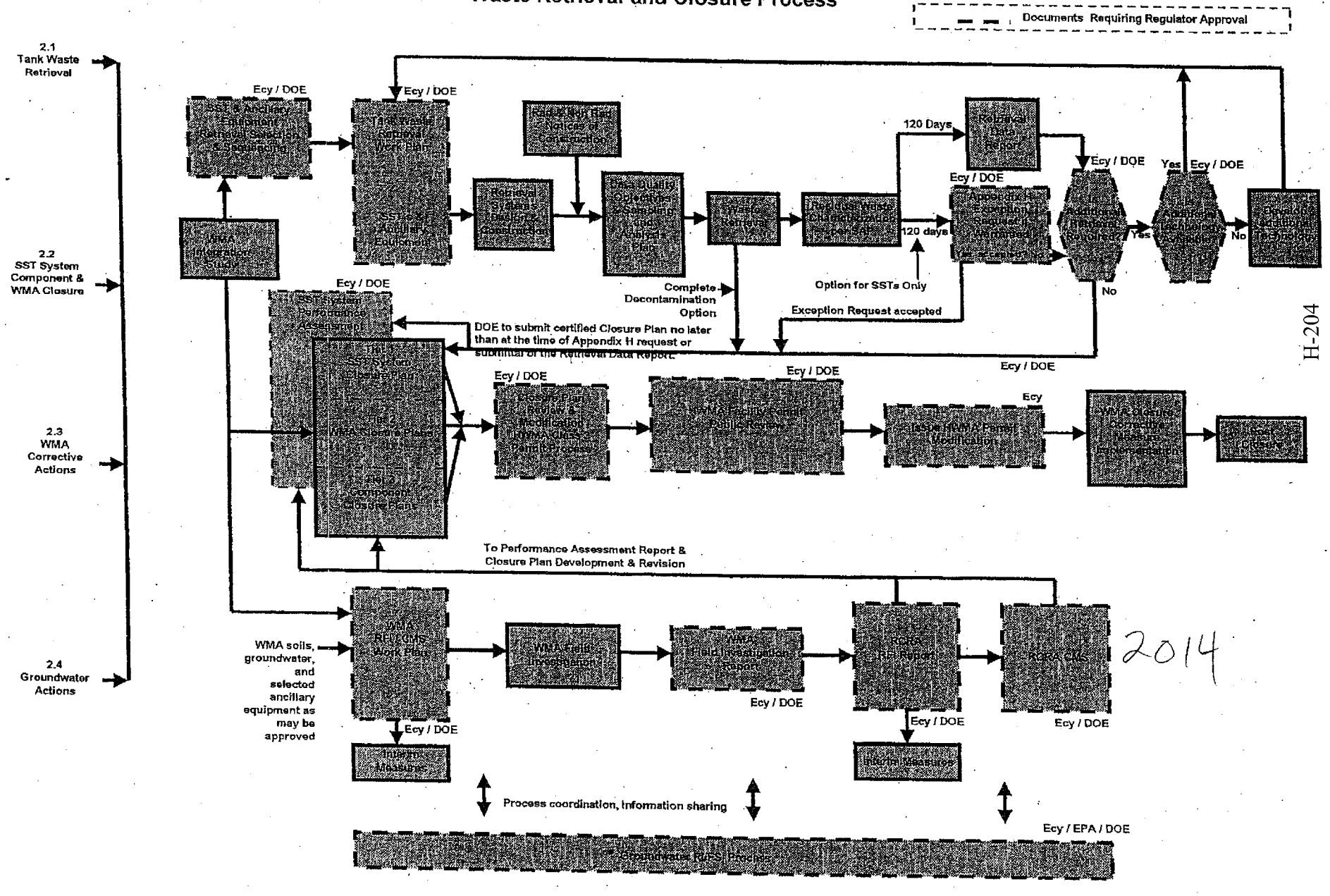
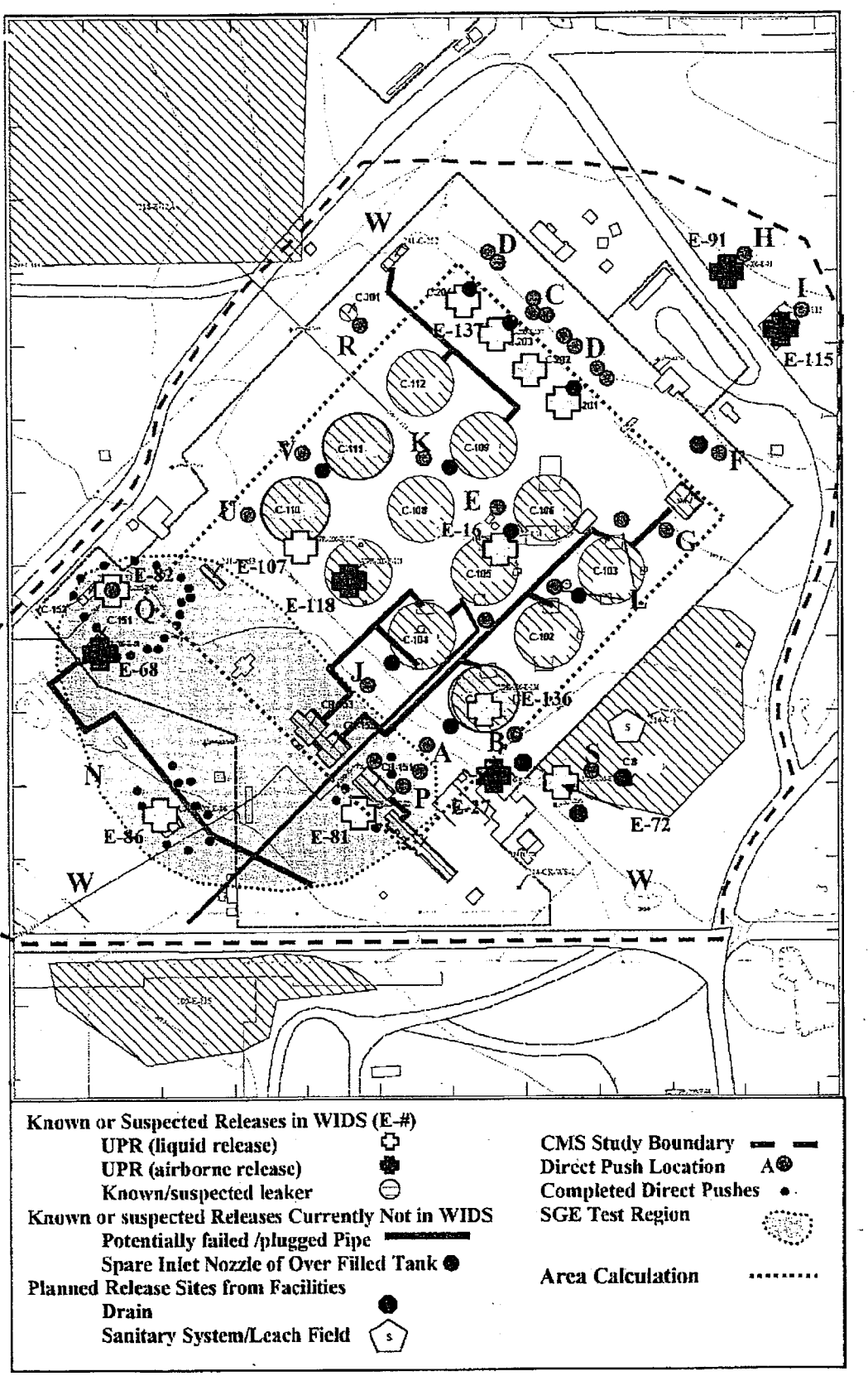


Figure 4-2. Sample Locations for Phase 2 Characterization



Lyon, Jeffery (ECY)

From: Brownell.Helen@epamail.epa.gov
Sent: Wednesday, July 08, 2009 8:01 AM
To: Lyon, Jeffery (ECY)
Subject: Re: WMA-C Soil Characterization for Closure

Jeff - The week of August 24-28 works for most people in the office.
Please go ahead and invite Dave Bartus. It's not necessary to provide us a copy of the work plan. Times I would suggest are: 8/24 afternoon,
8/25 morning, 8/26 any time, 8/27 afternoon.

Helen Brownell
Office Manager
U.S. EPA Hanford Project Office
(509)376-6865
(509)376-2396 (fax)
brownell.helen@epa.gov

"Lyon, Jeffery (ECY)" <JLYO461@ECY.WA.GOV>
07/07/2009 06:44 PM

To
Helen Brownell/R10/USEPA/US@EPA

cc
Rod Lobos/R10/USEPA/US@EPA, Craig Cameron/R10/USEPA/US@EPA, Dennis Faulk/R10/USEPA/US@EPA, Larry Gadbois/R10/USEPA/US@EPA, "Lober, Robert W" <Robert W Lober@orp.doe.gov>, <Susan J Eberlein@RL.gov>, "Whalen, Cheryl (ECY)" <CWHA461@ECY.WA.GOV>, "Barnes, Michael (ECY)" <miba461@ECY.WA.GOV>, "Jackson, Zelma (ECY)" <ZJAC461@ECY.WA.GOV>

Subject
WMA-C Soil Characterization for Closure

Helen, I have been working on getting a TPA briefing together from the Ecology Tank Farms Project for EPA. This briefing will be for the Soil Characterization Work Plan in Waste Management Area C (WMA-C),TPA milestone M-45-60, DOE's Phase 2 RFI/CMS Work Plan for WMA-C.

Our original date for the briefing (July 13) was not confirmed, and I would like to propose July 23rd as our preferred alternate choice. The next dates available are August 24 - 28, and then September 8-11. The delay in time is due to the conflicting schedules at our end.

I also would like to ask anyone if they believe that it is appropriate to extend the invitation to Mr. Bartus?

This Phase 2 Work Plan will be the soil characterization necessary to provide information to make a closure decision in WMA-C.

My intent is to provide information and the WMA-C RFI Work Plan to get EPA comments and to meet EPA expectations outlined in the MOU and the TPA.

Our focus for the briefing is to address:

(1)Appendix I- Section 3.1 (SST System Closure Regulatory Integration Strategy, page I-9);

(2) TPA Action Plan, Lead Regulatory Agency Concept (page 7), Section 5.1 (page 5-1), Section 6.3 (Page 6-5), and by reference from 6.3 - Section 7.4.2 (page 7-17) - functionally equivalent information gathered in the CERCLA process through the RI as described in Section 7)

(3) MOU for WA State, Dept. of Ecology and EPA

If EPA would like to receive a copy of the WMA-C Phase 2 Work Plan.
Please let me know.

Dennis suggested that I contact you to coordinate a meeting date and time. Can you help us out?

Thanks

Jeffery J. Lyon
NWP Specialist, TPA Project Manager
3100 Posrt of Benton Boulevard
Richland, Washington 99352

Phone - Office: (509) 372-7914; Cell: (509) 539-1996

Hallelujah, grace like rain falls down on me - Todd Agnew, "Grace Like Rain"

Lyon, Jeffery (ECY)

Subject:	Updated: Briefing for WMA C closure - soil characterization
Location:	EPA Handford Office changed to Ecology room 3A
Start:	Wed 8/26/2009 1:00 PM
End:	Wed 8/26/2009 5:00 PM
Show Time As:	Tentative
Recurrence:	(none)
Meeting Status:	Meeting organizer
Organizer:	Lyon, Jeffery (ECY)
Required Attendees:	Barnes, Michael (ECY); Jackson, Zelma (ECY); 'BROWNELL. HELEN@EPA. GOV'; 'Robert Lober'; 'Susan Eberlein'; Whalen, Cheryl (ECY); 'Bartus, Dave'; Cameron.Craig@epamail.epa.gov; FAULK.DENNIS@EPA.GOV; Jentzen, Brenda (ECY)
Optional Attendees:	'Helen Brownell/R10/USEPA/US'
Categories:	Important

EPA, Ecology approved date and time.

Does this work for WRPS and USDOE?

U.S. Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

NOV 0 2 2009

09-TPD-118

Ms. Jane A. Hedges, Program Manager
Nuclear Waste Program
Washington State
Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99354

Dear Ms. Hedges:

TRANSMITTAL OF THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) FACILITY INVESTIGATION/CORRECTIVE MEASURES STUDY (RFI/CMS) WORK PLAN FOR WASTE MANAGEMENT AREA (WMA) C REVISION 1.

Attached are the revised copies of RFI/CMS Work Plan for WMA C, RPP-PLAN-39114, and the associated Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in WMA C, RPP-PLAN-38777 (attached). These revised documents address the comments transmitted to the U. S. Department of Energy, Office of River Protection (ORP) on April 24, 2009, by the State of Washington Department of Ecology (Ecology).

Attached along with the revised documents is the Review Comment Records (RCR) showing the original comment, along with ORP's response to each comment. These responses were reviewed by Ecology in a meeting held on June 18, 2009. A redline-strikeout copy of each document was subsequently prepared based on the June 18, 2009 meeting. The proposed revisions were reviewed with Ecology's staff in a meeting held on August 10, 2009. Concurrence of Ecology's staff for the purposes of these documents can also be found in the attachment. ORP requests Ecology's approval to implement this work plan.

It should also be noted the vadose zone characterization required to support this report is expected to involve a minimum of three years of field work. Following completion of the characterization, the WMA C performance assessment (PA) will be revised to support the RFI/CMS report. Given the scope of the PA and the RFI/CMS reports, it is currently estimated that each activity will require one additional year of preparation time. For planning purposes, a minimum of five years is required after approval of the Work Plan for WMA C.

The RFI/CMS (Milestone M-045-61) was established as a milestone date of December 31, 2010, prior to completion of the Data Quality Objectives (DQO) process for WMA C soils. The DQO process identified the characterization work for WMA C as described in the enclosed work plan. The Phase 2 Corrective Measures Implementation Work Plan for WMA C (Milestone M-045-62) has a successive milestone date of July 31, 2012.

Based on the work plan schedule, it is not feasible to complete the identified characterization, prepare the WMA C PA, and deliver the RFI/CMS report, and the implementation plan by those dates. As a result, these dates have been modified accordingly in the change package currently undergoing public review and comment.

If you have any questions, you may contact me, or your staff may contact Stacy Charboneau, Assistant Manager for Tank Farms Project, (509)373-3841.

Sincerely,

Shirley J. Olinger, Manager
Office of River Protection

TPD:RWL

Attachment: Compact Disc

cc w/Compact Disc:
S. Harris, CTUIR
J. J. Lyon, Ecology
C. L. Whalen, Ecology
R. R. Campbell, EPA
K. Niles, Oregon
R. Jim, YN
Administrative Record
Environmental Portal, LMSI
WRPS Correspondence

ATTACHMENT TO

09-TPD-118

SAMPLING AND ANALYSIS PLAN FOR PHASE 2 CHARACTERIZATION OF VADOSE ZONE SOIL IN WMA C, RPP-PLAN-38777

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • (509) 372-7950

November 12, 2009

Mr. Dennis A. Faulk, Program Manager
Hanford Project Office
US Environmental Protection Agency
309 Bradley Blvd, Suite 115, MSIN: B1-46
Richland, Washington 99352

Re: Waste Management Area-C (WMA-C) Soil Characterization for Corrective Action and Closure

Dear Mr. Faulk:

The Department of Ecology (Ecology) appreciates the opportunity to provide the U.S. Environmental Protection Agency (USEPA) Hanford office with a WMA-C briefing. We are grateful for the participation and contributions of the United States Department of Energy (USDOE) and USDOE contractor Washington River Protection Solutions (WRPS) in this briefing. In the briefing, we reviewed the WMA-C Resource Conservation and Recovery Act Investigation/Corrective Measures Study (RFI/CMS) Work Plan (RPP-PLAN-39114, Rev. 0), submitted for Hanford Federal Facility Agreement and Consent Order (HFFACO) Milestone M-45-60 as a primary document.

We provided the briefing in accordance with the provisions in the Memorandum of Understanding (MOU) between USEPA and Ecology. We sent the material and notes from this MOU briefing to our Administrative Record and to the HFFACO Administrative Record as part of the WMA-C file.

I would like to highlight key points and summarize Ecology's understanding from this briefing.

1. We understand that our briefing satisfied the expectations of you and your staff, those expressed in the MOU, and those expressed in the HFFACO requirements of Section 5.6 of Attachment 2, Action Plan, page 5-5.

2. We understand that USEPA supports the process outlined in paragraphs 17 and 19, of HFFACO Article IV, pages 10 and 11. To meet these requirements, USDOE must provide a characterization plan that meets all regulatory requirements. To clarify the intent of this document, USEPA provided proposed text revisions to the work plan, as a starting point. The goal of text changes will be to ensure that the USDOE work plan indicates their intent to provide information consistent with the HFFACO requirements. Ecology also supports the intent of the HFFACO process. We will continue to make every effort to ensure the work plan will be revised to clarify the USDOE intended purpose of this document, and resolve the suggested clarification you provided.

3. Ecology believes that the results from implementing this work plan will be sufficient to meet HFFACO requirements. These requirements include:
   - Corrective measures decisions and WMA-C closure decisions (both under the Washington State Dangerous Waste Regulations Washington Administrative Code [WAC] 173-303 and the implementing requirements in WAC 173-340).
   - All information necessary to integrate USDOE's Comprehensive Environmental Response Compensation and Liability Act (CERCLA) response obligations and meet or exceed all other applicable or relevant federal and state requirements to the extent required by Section 121 of CERCLA, 42 United States Code, Section 9621.

Ecology understands that USEPA agrees that it is the intent of the WMA-C RFI/CMS to identify actions necessary to implement and complete remedial corrective actions, and Closure and Post-Closure requirements for all aspects of soil contamination for WMA-C. After Ecology reviews and approves the RFI/CMS Work Plan, USDOE will submit the Corrective Measures Implementation Plan (M-045-62) as a HFFACO primary document. Following approval of the Corrective Measures Implementation Plan, USDOE, and Ecology will have agreement on all necessary remedial and corrective actions for WMA-C. These actions and requirements are intended to prevent the need for further remedial or corrective actions.

Last, as we stated in the meeting, Ecology and USDOE will provide occasional updates as significant information develops or when changes are made in the work plan. We will include these updates as an agenda item for the HFFACO Section 4.1 Project Manager Meetings.

Again, Ecology would like to thank you for your participation.

If there are any questions, contact me at 509-372-7914.

Sincerely,

Jeffery J. Lyon
Tank Waste Storage Project Manager
Nuclear Waste Program

aa

cc: Craig Cameron, EPA
Larry Gadbois, EPA
Rod Lobos, EPA
Stacy Charboneau, USDOE
Chris Kemp, USDOE
Bob Lober, USDOE
Mark Triplett, PNNL
Dan Parker, WRPS
Jeff Luke, WRPS
Susan Eberline, WRPS
Andy Fitz, AGO
WRPS Correspondence Control
USDOE-ORP Correspondence Control

Office of River Protection

DEC 22 2009

09-TPD-075

Mr. Gabriel Bohnee, Director
Environmental Restoration and Waste Management
P. O. Box 365
Lapwai, Idaho 83540-0365

Dear Mr. Bonhee:

THE STATE OF WASHINGTON DEPARTMENT OF ECOLOGY (ECOLOGY) AND THE U.S. DEPARTMENT OF ENERGY (DOE), OFFICE OF RIVER PROTECTION (ORP) TECHNICAL RESPONSE TO NEZ PERCE COMMENTS ON WASTE MANAGEMENT AREA (WMA) C WORKPLAN

References:
1. Letter from G. Bohnee, ERWM; to S. J. Olinger, ORP; and J. Hedges, Ecology, "Data Quality Objectives Report, Phase 2 Characterization for Waste Management Area C Corrective Measures Study, RPP-RPT-38152, Draft Rev. 0," dated September 5, 2008.

2. Letter from G. Bohnee, ERWM; to S. J. Olinger, ORP; and J. Hedges, Ecology, "RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, RPP-PLAN-39114, Revision 0," dated April 10, 2009.

ORP and Ecology appreciate your continued participation in Data Quality Objectives (DQO) workshops, subsequent comments on the DQO report (Reference 1) and the recent comments and recommendations on the submitted Resource Conservation and Recovery (RCRA) Facility Investigation/Corrective Measures Study Work plan for WMA C, RPP-PLAN-39114, Revision 0 (Reference 2).

The development of the RCRA Facility Investigation/Corrective Measures Study Work plan for WMA C and the supporting DQO utilized four tribal workshop sessions in March, May, and August, 2008 with Ecology, DOE Richland Operations Office and ORP. In addition, one planning session was held specifically with the Nez Perce Tribe to discuss identified issues and to develop a technical work plan approach which was delivered to Ecology on December 30, 2008. The Nez Perce letter cites some global concerns and documents specific recommendations. Both the global concerns and the specific recommendations have been considered by both ORP and Ecology and the plan will be updated as discussed in the attached Response to Comments form.

U.S. Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

Washington State
Department of Ecology
3100 Port of Benton Blvd
Richland, Washington 99354

DEC 22 2009
09-TPD-075

DOE ORP and Ecology welcome your continued participation in the development of the WMA C Performance Assessment workshops and your technical input into the various activities necessary to support cleanup decisions.

Shirley J. Olinger, Manager
U.S. Department of Energy
Office of River Protection

Jane A. Hedges, Program Manager
Nuclear Waste Program
State of Washington,
Department of Ecology

Attachment

cc w/attach:
S. Harris, CTUIR
J. J. Lyon, Ecology
C. L. Whalen, Ecology
R. R. Campbell, EPA
K. Niles, Oregon
J. A. Conrad, RL
R. Jim, YN
Administrative Record
Environmental Portal, LMSI
WRPS Correspondence

U.S. Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

Washington State Department of Ecology
Address
Address
Richland, Washington 99354

DEC 22 2009

Attachment
09-TPD-075

Review Comment Record

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.	
	Project No. WMA C SAP	Page Page 1 of 14	

Document Number(s)/Title(s)	Program/Project/Building Number	Review	Organization/Group	Location/Phone
RPP-PLAN-39114, Rev. 0		WMA C Work Plan	Nez Perce	

Comment Submittal Approval: Agreement with indicated comment disposition(s) Status:

Organization Manager (Optional) Date Reviewer/Point of Contact Date Reviewer/Point of Contact

Author/Originator Author/Originator

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Response
1.	General Comment	The wording within the figure for the Phase 1 Conceptual Model (see below) indicates that mobile contaminants will not reach groundwater until after closure.		**Response:** With regard to the conceptual model given in Figure 3-8 (included in your letter), this figure shows conceptual model based on field data observed at borehole C4297 and described in RPP-35484, Field Investigation Report for Waste Management Areas C and A-AX. At this location, the highest levels of Tc-99 was found at 137 ft bgs, the drilling and sampling continued to 195 ft bgs with 20 samples taken from 137 ft to 195 ft bgs. All samples analyzed for Tc-99 below 160 ft bgs were below levels of quantification. With regard to other contaminants, the highest levels nitrate correlated to the same depth as the highest levels of Tc-99, but was found at lower levels between 160 ft bgs and 195 ft bgs. No ^{137}Cs was found in the samples below 12 ft bgs, but was found to a depth of 20 ft in the spectral gamma logs. Co-60 was not detected either in the spectral gamma logs or in the samples taken below 66 ft bgs. The gap shown in Figure 3-8 is correct based on the vadose zone samples we have taken at borehole C4297, which is also mentioned in the text on the Figure 3-8. Furthermore, the conceptual model given in Figure 3-8 was expanded in Figure 3-9 to acknowledge the presences of deep

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.	
	Project No. WMA C SAP	Page Page 2 of 14	

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Response
				vadose contamination and contamination of the groundwater related to enhanced recharge encountering tank waste in the vadose zone. This tank waste will be transported to the deep vadose and unconfined aquifer with enhanced recharge.
2.	General Comment	After reviewing the Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, RPP-PLAN-39114, we believe that you should budget and adjust your timelines for the eventual Phase 3 RCRA Facility Investigation/Corrective Measures Study since the envisioned Phase 2 appears to follow a similar approach as Phase 1. An iterative approach to data collection and interpretation continues to be elusive.		**Response:** Phase 3 RCRA Facility Investigation/Corrective Measures Study will not be required. The Phase 2 RCRA Corrective Action process is designed to address all Single-Shell Tank Waste Management Areas. In Appendix I of the Hanford Federal Facility Agreement and Consent Order entitled, SINGLE-SHELL TANK SYSTEM WASTE RETRIEVAL AND CLOSURE PROCESS, "Ecology reserves the right to require additional characterization either through a Phase 2 corrective action process or through the development of a component closure activity plan if additional characterization is required." Ecology has chosen to use the Phase 2 Corrective Action Process to accomplish this goal. Under Section 2.4 of Appendix I related to groundwater impacts, "Ecology, as the lead agency for SST system closure, EPA, and DOE are electing to investigate and remediate groundwater under past practice authority. The information generated through the groundwater RI/FS or RFI/CMS process will be utilized in the development of SST system closure plans and performance assessment." This regulatory approach will allow Ecology and EPA, through their regulatory authorities, to address both radionuclides and chemical contaminants of concern associated with groundwater. This approach benefits an integrated approach that won't require another phase of investigation and remediation. It is designed to get public, stakeholder and Tribal Nation involvement to ensure adequate, acceptable, compliant, realistic achievement of remediation and closure of the SST WMA system.
3.	General Comment	Both Phase 1 and the proposed Phase 2 appear to ignore areas of the deep vadose zone where contamination in the deep vadose zone can be projected to occur. Critical areas of the deep vadose zone will not be investigated. The C Farm work plan continues to focus the		**Response:** We do not support that Phase 2 will "ignore areas of the deep vadose zone where contamination in the deep vadose zone can be projected to occur." Instead Phase 2 is a robust approach that takes areal soil samples across WMA C as well as

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.	
	Project No. WMA C SAP	Page Page 3 of 14	

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Response
		characterization activities on the hypothetical release sites, which is either the "spare inlet hypothesis" or near surface spills. This focus will leave critical areas of the deep vadose zone unevaluated, which will trigger "Phase 3".		depth samples in the vertical direction. This approach will address both the deep vadose zone associated with potential groundwater impacts, and shallow soils for impacts associated with potential direct contact across the WMA C and surrounding vicinity. The shallow soil zone (0-15 feet below ground surface) is an area that both the regulators, Tribal Nations and stakeholders have expressed was not fully addressed in Phase 1. The work plan also states in Section 4.6: "Should contamination be found in any of the soil sampling probeholes at their total depth, additional or other characterization technologies may be deployed to define the maximum depth of contamination at an unspecified date in the future. This data would be shared with Ecology to determine a path forward and implemented before corrective measures in the deep vadose zone area of interest. If the decision is to collect additional samples at deeper depths, then either this work plan will be amended or a separate work plan will be prepared which states the characterization technique to be used (direct push, borehole, etc.), the number of samples to be taken at depth, the total depth of the new characterization hole, and how to complete the new hole in accordance to WAC 173-160."
4.	General Comment	Since the Nez Perce ERWM model is "alternative conceptual model 2", it appears that we have failed to adequately convey how our model should be used to select drillsites. Sites "U" and "V" test the spare inlet hypothesis and aren't located downdip of the hypothetical leak source. Further, site "u" appears to twin the 30-10-09 drywell while the site "V" appears to split the gap between drywells 20-10-01 and 30-11-09. Site "B" appears close to drywell 30-01-06.		**Response:** You are correct with regards to Sites "U" and "V" not located stratigraphic downdip. These sites should not have been included in the sentence on Line 38 on page 4-8 and will be removed from when the document is revised for the incorporation of Ecology's comments. Section 4.4.2 describes how Nez Perce ERWM was used to select sampling sites. However, sites "U" and "V" were chosen during the DQO to meet other objectives as stated by the Umatilla tribe during DQO meeting in August 2008. For planning purposes site "B" is located a little south of where it should be. However, the actual location will be determined by site accessibility.

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.	
	Project No. WMA C SAP	Page Page 4 of 14	

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Response
5.	General Comment	We recommend that DOE refine and verify the HRR technique in one area (probably BC Cribs and Trenches) before they apply it in other areas. A process needs to be established for the Tri-parties to consider, evaluate, and formally validate the method. While the "world" accepts certain analytical methods for decision making with recognized legal authority, new methods of such profound consequence require similar rigid control.		**Response:** The HRR survey system is another technique that is designed to address the more mobile contaminants related to waste releases that were "saline" in nature (e.g., NaNO3). This system has been applied commercially in the petroleum industry. It is another technique, like the spectral gamma logging system, the high rate logging system, direct push technology, traditional drilling of boreholes, and other techniques that aid in providing data and information to understand the nature and extent of the various contaminants. Ongoing work in WMA C is refining and verifying or validating the electric resistivity plumes with collected soil sample data. When this work is completed, we will be glad to share the information with you and others.
6.	General Comment	The Bismuth Germanate Oxide (BGO) logging system, used in conjunction with the direct push, has a reported detection limits of approximately 0.5 pCi/g of 137Cs and 0.6 for ^{60}Co. In the past, the drywells within the C WMA have been logged with Hanford's spectral gamma logging system; this logging system uses a high-purity germanium (HPGe) sonde with a detection limit of approximately 0.1 pCi/g for both ^{137}Cs and ^{60}Co. Hanford's spectral gamma logging system was scrutinized by an expert panel assigned by DOE in 1996, and was accepted as a viable method for characterizing radionuclides. No independent body has considered the small diameter logging and corroborated that the method is viable and detection limits are as reported. Additionally, given the differences in detection limits and lack of consistent standards, it will be extremely difficult to integrate these data into one database where all of the data are directly comparable. For example, due to the higher detection limits and radioactive decay, we estimate that if the BGO system was used to log all the drywells in the C WMA that the BGO sonde would detect 60Co sixty times out of 15,540 measurements while HPGe logging reported 758 detections of ^{60}Co.		Response: The Bismuth Germanate Oxide logging system has been calibrated to the high-purity germanium (HPGe) sonde in the TY tank farm. At three different locations, the small diameter NaI probe was calibrated to various sondes. These can be reviewed in the following reports: RPP-34623 using a borehole in BX, -02-04, in T farm -01-04 drywell in report RPP-34645 and finally the TY report (RPP-RPT-41110) using the BGO sonde in drywell -03-06. The sonde was calibrated to ^{60}Co at 0.6 pCi/g and the ^{137}Cs was calibrated to 0.5 pCi/g. These are the lowest detection limits, however, normal count times produce a detection limit closer to 1.2 pCi/g for ^{60}Co and 1 pCi/g for ^{137}Cs. DOE is also interested in locating not just ^{60}Co but also contaminants of concern that impact human health and/or the environment, such as ^{99}Tc, Nitrate, Chromium, etc in the vadose. Cobalt-60 does not usually impact human health and the environment when found in the vadose zone because of its short half-life. Within WMA C the association of contaminants of concern to ^{60}Co is uncertain. This is most likely due to the fact the contaminants of concern were generated by processing of fission products, while ^{60}Co is an activation product of ^{59}Co and ^{60}Ni usually caused by impurities in cladding. From the samples

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.	
	Project No. WMA C SAP	Page Page 5 of 14	

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Response
				and logging taken to date, ^{99}Tc and nitrate was found (in borehole C4297) from approximately 40 ft bgs to 195 ft bgs, with the highest concentrations found at 137 ft bgs, while ^{60}Co was found from approximately 38 ft bgs to 66 ft bgs with the highest concentration found at 46 ft bgs. At UPR-200-E-82, the highest concentrations of ^{99}Tc and nitrate were found at 77 ft bgs, but ^{60}Co was undetected in the samples. At the present time, the BGO tool represents a compromise between the NaI tool which has a detection limit of 10 pCi/g for ^{60}Co and the HPGe, which requires larger drilling rig. Using a larger drill rig would prevent sampling at a number of the locations identified in the DQO and work plan because of the ongoing retrieval activities at WMA C.
7.	General Comment	Simulations of WMA C tank farm groundwater conditions shown in the same document (see below) indicate that concentrations of ^{99}Tc will not exceed drinking water standards for 12,000 years. However according to your letter, Appendix L of RCRA Facility Investigation Report for Hanford single Shell Tank Waste Management Areas, DOE/ORP-2008-01, Rev. 0, acknowledges that WMA C has "most likely" contaminated groundwater. Our interpretation of current groundwater data indicates that Tc-99 from C tank farm currently exceeds drinking water standards.		**Response:** The simulation of groundwater conditions presented in your letter is Figure 10-2 in Chapter 10 of DOE/ORP-2008-01. This simulation was not corrected to the field data that supports the simulations of the groundwater conditions that were modeled for Field Investigation Report of WMAs C and A-AX (Appendix L of DOE/ORP-2008-01 (see figure 4-2 of Appendix L; also RPP-35484[Figure 4-2]). The Field Investigation Report indicates technetium-99 groundwater concentrations will exceed the drinking water standards representing the unplanned release site UPR-200-E-82 (see figure below from Appendix L of DOE/ORP-2008-01). We concur with your conclusion that current groundwater data does show technetium-99 groundwater concentration exceeds drinking water standards at WMA C. This has been true for numerous years and is not disputed and is acknowledged in Field Investigation Report of WMAs C and A-AX (Appendix L of DOE/ORP-2008-01; also RPP-35484). Therefore, Figure 10-2 of Chapter 10 in DOE/ORP-2008-01 will be updated to reflect this.
8.	General Commen	In our opinion, little of the Nez Perce ERWM's proposed characterization is included in the RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, RPP-PLAN-39114, Revision 0. According to this work plan the deep vadose zone		**Response:** Your concerns with the deep vadose zone contamination detected at wells 299-E-27-7 and 299-E-27-14, 216-C-8 crib and tank C-101 are of tremendous importance to DOE, Ecology, and the contractor. Every effort has been and

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Response
		contamination detected at wells 299-E27-7 and 299-E27-14 are hardly worthy of further investigation. Contrary to the text of the work plan, the proposed push at site "B" is insufficient to evaluate the C-101 tank leak, 216-C-8 crib, and the contamination at 299-E7-14. The dismissal of deep vadose zone contamination near C tank farm is similar to dismissal of the uranium contamination at well 299-E33-41 near tank BX-102. The contamination at 299-E27-7 was discovered because EPA directed DOE/RL to log the well.		continues to be made addressing these known areas of contamination, and other areas where historical records indicate a potential release may have occurred. We clearly have sites selected to investigate around the two groundwater wells (Sites F, I, H and S), 216-C-8 (Site S), and tank C-101 (Sites A and B) areas as you have stated in your letter. Should contamination be found, more characterization will be done in order to mitigate future impacts and facilitate meeting regulatory requirements for WMA C closure.
9.	Specific Comment # 1	Integrate the vadose/groundwater investigations both inside and outside the tank farms by having only one contractor interpreting the existing data and writing DQOs and associated documents. This contractor should use the existing information and the characterization data collected during the Phase I and near-term (FY 2008) characterization to develop a best basis or best estimate of the concentration and distribution of COC in WMA C prior to the collection of data for Phase 2. Ecology should not approve the work plan until the estimate of the distribution of contaminants is complete.		**Response:** Both the Office of River Protection, Richland Operations Office (RL) and Ecology and Environmental Protection Agency (EPA) recognize the need for ongoing integration between the vadose zone and groundwater efforts to resolve characterization and remediation workscope, funding and schedules. To that end, your recommendation regarding integration was implemented for the DQO and Work plan development, with members from Ecology, BP-5 Groundwater Operable Unit, Richland Operations Office (RL) and EPA participating. Prior to release, the document was reviewed by RL, their comments incorporated, and their concurrence received. It is anticipated that additional integration needs will be required by both Offices for continuing BP-5 and C Farm Corrective Action characterization and remediation efforts, and contractual obligations are in place by DOE which use the Groundwater-Vadose Zone Multi-Project Teams, to address issues as needed. Your specific technical request for additional boreholes as noted in recommendation 10 is being addressed through these integration efforts. All data available from Phase 1 and FY2008 characterization was incorporated at the time of work plan development. It is recognized that new data continues to be obtained, and a review process is in place to consider that data and its impact on the work plan. U.S. DOE-ORP has provided an update of the workplan to h Ecology as required by the HFFACO Document Review and Comment Process under

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.	
	Project No. WMA C SAP	Page Page 7 of 14	

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Response
				Chapter 9 of the Hanford Federal Facility Agreement and Consent Order. If warranted by new data, future revisions to the work plan will be initiated in collaboration with the WDOE
10.	Specific Comment # 2	DOE/ORP needs to integrate with DOE-RL and be common signatories on these documents so that all available information is considered		As noted above, the plan was developed with DOE-RL participation, the document was reviewed by RL, their comments incorporated, and their concurrence received.
11.	Specific Comment # 3	Incorporate our recommendations for the *WMA C 3D Model*, CH2M-37668, Rev. I Draft, which are listed in Attachment 1.		(Items 3 through 7) These recommendations provide suggestions for improvement of the 3-dimensional visualization tool that was developed to help communicate the body of information available for WMA C. This tool was provided as a draft specifically to solicit recommendations such as these from regulators and stakeholders who may find the tool useful. We appreciate these recommendations and will incorporate them into the update to the tool. We are undertaking updates now and will continue through the entire characterization effort as new data or information is obtained. Once updated, visualizations will be provided, with supporting documentation to interested Tribal Nations and stakeholders at various points in the entire process. This tool will be used through the current WMA C PA working sessions and other formats that would benefit from these visualizations.
12.	Specific Comment # 4	DOE should develop an integrated conceptual model for WMA C. Conceptual models on the current distribution of contaminants in the vadose zone and groundwater and migration from the vadose zone to the aquifer are not clearly presented and are not supported by field data. An integrated conceptual model consists of an interpretation of geophysical logs, driller's logs, geologic sample descriptions, soil sediment sampling and groundwater sampling which depict stratigraphy and vadose and groundwater contamination. Ecology should not approve the work plan until the conceptual model is complete.		**Response:** See Response to Specific Comment #3
13.	Specific Comment # 5	Stratigraphic controls on waste migration in the vadose zone should be incorporated into the models and considered when selecting new borehole locations.		**Response:** See Response to Specific Comment #3

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.	
	Project No. WMA C SAP	Page Page 8 of 14	

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Response
14.	Specific Comment # 6	Every proposed characterization borehole should be supported by a strike and dip geological cross section, which shows all vadose zone and aquifer field data on contamination, and similar data from geophysical logs. Ecology should approve the collection of field data only after the supporting information is compiled.		**Response:** See Response to Specific Comment #3
15.	Specific Comment # 7	DOE should prepare visualizations of the vadose zone contamination in the WMA and the resulting groundwater contamination. Ecology should not approve the work plan until the estimate of the distribution of contaminants is complete.		**Response:** See Response to Specific Comment #3
16.	Specific Comment # 8	Verification of the leak assessment (RPP-ENV-33418, Rev. 1) for tank C-111 by drilling a slant hole similar to the slant hole drilled at tank SX-108. This slant hole would start at location "K" and terminate under tank C-111.		**Response:** We concur that a slant borehole under tank C-111 would be valuable in evaluating historic leak information. Due to current farm configuration of waste retrieval equipment, we cannot bring in a drill rig to drill a borehole similar to that drilled for SX-108. However, we plan to place a slant push mode probe hole under tank C-111 to evaluate whether a release from this tank occurred. As indicated in the response to recommendation 17 and in the work plan (Section 4.6), direct push technology using the hydraulic hammer provides accessibility of some of these sites that would be limited by waste retrieval operation equipment located on the surface and subsurface infrastructure interferences associated with deploying a conventional drill rig within WMA C. It should be recognized that a low probability of hitting the contamination exists, based on the historic gamma logging and spectral gamma logging as reported in Grand Junction Office (GJO) addendum report (*Hanford Tank Farms Vadose Zone, Addendum to the C Tank Farm Report* [GJO-98-39-TARA) in Section 5. The report states, "There appears to be little contamination around tanks C-110 and C-111, both of which are assumed leakers." It goes on to say, "Historical logs near tank C-111 showed no evidence of a past leak from this tank." It does suggest that the contaminants may have migrated downward and did not extend laterally to reach the surrounding monitoring boreholes (i.e., drywells). Therefore, the probability of hitting contamination under tank C-111 is quite low. The basis for

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.	
	Project No. WMA C SAP	Page Page 9 of 14	

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Response
				placing tank C-111 as a "leaker" is a level decrease of 8.5 inches from 1965 through 1969 that would equal a total of 23,400 gal. In 1989, the leak loss value assigned was a 5.5 kgal. leak. New temperature data can document the tank evaporation over this time period to account for this decrease as noted in *241-C-111 Tank Leak Assessment Report*, RPP-ASMT-39155, dated October 2008. If a slant probehole beginning at the west-southwest corner of the tank is not feasible, then this slant probehole should not be installed because of the low probability of hitting any contaminants. This point of entry would align with the point of release associated with an overfill at the spare inlet ports and would be follow in the direction of the assumed release under the tank, (i.e., down stratigraphic dip and lateral spreading from the point of release) exactly the same strategy and alignment used on the SX-108 slant borehole, (see RPP-7884, Field Investigation Report for Waste Management Area S-SX, for the rationale of placement). This strategy would support alternative conceptual model 2 of the work plan. The text states, "Sites B, C, D, R, U, and V were chosen to support possible tank leaks and/or overfill events that lack existing drywell monitoring coverage." The text continues with the following statement, "Sites B, C, D, U, and V are also being investigated to evaluate alternative conceptual model 2."
17.	Specific Comment # 9	Further characterization at sites "U" and "V" should be removed from the work plan.		**Response:** A number of participants in the DQO process that supported the development of the WMA C work plan had specific reasons for needing additional soil information at locations U and V. Thus, these locations will remain part of the work plan. See response to number 8 for some of the specific reasons for needing additional soil information at locations U and V.
18.	Specific Comment # 10	The proposed Site "B" should be drilled at a location which is located between tank C-101 and groundwater well 299-E27-14, which is approximately the 3 o'clock position at tank C-101.		**Response:** These three items suggest changes to the locations of the push mode probe holes at sites B, S, and C. Proposed Site B is approximately located at the 3 o'clock position at tank C-101. These locations were chosen to accommodate specific issues that were identified during the DQO process, taking into account the

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.	
	Project No. WMA C SAP	Page Page 10 of 14	

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Response
				limitations of space for soil exploration inside the tank farms (for example, some location must be adjusted due to subsurface pipelines or other infrastructure). We respect the request for information between tank C-101 and groundwater well 299-E27-14, and between tank C-201 and groundwater well 299-E27-7. We requested from the the Soil and Groundwater Remediation Project that a well be placed in that vicinity. However, when the area between 299-E27-14 and C-101 was examined, it was determined that a drill rig could not be safely place in this area due to existing facilities. To work safely on the Hanford Site, the drill rig cannot be placed closer than 50 ft from any facility. This limited the location of well on the southeastern side of WMA C approximately 61 m due south of 299-E27-14. For the well north of WMA C, the Soil and Groundwater Remediation Project would be place 500 ft north of WMA C to better understand the source of sulfate to the north and to serve as an upgradientwell for WMA C because it may be more representative of groundwater unaffected by the WMA. Due to the ongoing retrieval activities in WMA C, working in and around WMA C is very constricted. We would be more than happy to arrange a site visit for representatives of the Nez Perce to see the difficulty of siting vadose zone characterization activities within WMA C
19.	Specific Comment # 11	Site "S" should be located midway between tank C-101 and groundwater well 299-E27-14.		**Response:** The location of site "S" was chosen during the WMA C DQO to evaluate contamination around UPR-200-E-76 and the C-8 French Drain and will be moved.
20.	Specific Comment # 12	Site "C" should be located between tank C-201 and groundwater well 299-E27-7.		**Response:** Site "C" was specifically chosen to collect samples close to C-203 and will not be moved.
21.	Specific Comment # 13	Outside of the C tank farm, use the direct push to collect samples in the deep vadose zone where radionuclides were detected at wells 299-E27-7 and 299-E27-14 by twining these locations.		**Response:** The request to twin groundwater wells with direct push is a reasonable technical request. Although soil samples from direct pushes have been acquired, they are spatially separated by tens of feet from soil samples associated with boreholes. These soil samples can be compared and show

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.	
	Project No. WMA C SAP	Page Page 11 of 14	

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Response
				similarities in pH and moisture content. However, with the potential changes in soil properties that might occur over those distances a meaningful comparison related to the differences in techniques is problematic. It would be more beneficial to have direct push soil samples that were located a few feet (~2 ft) apart from soil samples from a borehole to allow a more valid comparison. This twinning exercise will also support the technical merits of using moisture as an indicator for soil sampling targets. . Based on logging results of new groundwater well we will either place direct push probe near the well or, we will place the direct push probes holes to twin the geophysical logging of existing wells..
22.	Specific Comment # 14	Boreholes should be drilled northeast of each of the 200 series tanks regardless of the amount of contamination found at site "C". Ecology should not approve the work plan unless DOE agrees to characterize all of the 200 series tanks.		**Response:** We agree to place a minimum of one slant direct push probe hole northeast of each C-200 tank. Note that the location and equipment configuration does not support drilling boreholes as recommended at these Sites (Site D); therefore, these slant probeholes will be implemented. The conceptual model discussed in the DQO report (RPP-RPT-38152), and supported by the work plan, assumes the potential that all four C-200 tanks may have released waste, but in relatively small volumes (~500 gal). The small volume leaks would not have provided a driving force for waste migration, so the contaminants should still be detected near the tank bottoms. If leaked, the contaminants should be present underneath the C-200 series tanks. The past leak reports, DQO report and the work plan support that the highest probable C-200- series tank that may have an associated release is tank C-203; therefore, this was the chosen tank to conduct 3 slant pushes underneath it. Pushing a direct push probe hole under the other C-200 tanks was discussed and considered in the sampling strategy during the DQO process through the timeframe of the summer of 2008, but was later changed to investigating the release from tank C-203 only since it had a higher probability of detecting a release. Although the DQO recommended not drilling at tanks C-201, C-202, and C-204 if

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Response
				contamination was not found at C-203, it does make to place a minimum of one slant direct push at each of the C-200 tanks and the work plan will change to reflect this.
23.	Specific Comment # 15	Implement the recommendations for the temperature logging of the drywells in the tank farms made recommendations in the Tank Waste Remediation System Vadose Zone Contamination Issue: Independent Expert Panel Status Report, DOE/RI-97-49. Rev. 0. over decade ago. Ecology should insist that the recommendations of the expert panel are implemented.		**Response:** DOE-ORP has implemented the recommendations for temperature logging. This was completed during the de-commissioning of the slant borehole underneath SX-108 (41-09-39). The results are given in the Field Investigation Report for WMA S-SX (RPP-7884) and in the Slant Borehole Completion Report (RPP-6917 p21, and Figure 7). • In the borehole completion, report it is specifically stated that "It is not possible to ascertain the dispersion effects of the conductive iron casing and air filled interior void space on the temperatures reported." • In the cited report, the ability to differentiate between air in the casing (casing temperature) and the formation temperatures would be a complicated effort to resolve according to the cited document and the follow-on document, *Vadose Zone Expert Panel Meeting-Meeting Closeout Report* (DOE/RL-98-67). The Closeout Report states, "Even given good, representative formation temperature measurements, the task of distinguishing the effect of heat-producing contaminant in the formation from other effects, especially heat from the tanks and cooling effect of recharge, will not be easy." This was recently verified with Rick McCain of Stoller. Because of the problems in interpreting the temperature logs from borehole 41-09-39, temperature logging was discontinued after completing it for borehole 41-09-39.
24.	Specific Comment # 16	Modify the direct push to drive casing down with a larger diameter casing that supports the use of a variety of logging tools including the HPGe detector. Ecology should not approve the work plan until DOE agrees to collect geophysical logging data using sonde that are calibrated and with a detection limit of 0.1 pCi/g for ^{60}Co.		**Response:** We will continue to evaluate and improve direct push technology and other appropriate technologies with a goal of expanding the capabilities available for use in soil characterization that provides a better cost benefit. However, we will not stop current characterization while awaiting development

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Response
				of new methods. Note that the use of some technologies is currently limited inside the tank farms due to the density of tank farm equipment and subsurface infrastructure. Additionally, one example is the ongoing development for a ^{99}Tc sensor. At the present time, levels of ^{99}Tc contamination in soil are determined by laboratory analysis of soil samples. This methodology is labor intensive and provides samples only at selected intervals in the vadose zone. In keeping with DOE's roadmap strategy to develop advanced sampling and characterization technologies, we are pursuing development of a ^{99}Tc sensor. A ^{99}Tc sensor can be deployed during the placement of direct-push probeholes, which could quickly indicate where sampling intervals should be located. The advantage such a probe would provide in soil characterization efforts is to avoid costs associated with null sample results that result from sampling an uncontaminated zone in the soil column. If FY2009 laboratory testing of a prototype ^{99}Tc sensor is successful, future field tests will be planned. (Also see response to General Comment #6)
25.	Specific Comment # 17	When using the direct-push method to collect soil samples, soil samples should be collected as each additional length of pipe is added to the drill string. We understand that this interval is approximately every four feet. If the presence of gamma-emitting radionuclides is used as criteria for the collection of soil samples using the "direct-push technology", intervals for sampling should be based on gamma spectra collected using sonde with a detection limit of 0.1 pCi/g for ^{60}CO.		**Response:** The depth interval for collecting soil samples was discussed in the DQO process. There is a balance that must be achieved between the number of probe holes that can be placed (giving greater spatial coverage) and the number of samples that can be taken from each probe hole (give more detailed depth information). The DQO team members believe that the current configuration provides a reasonable balance. However, before samples are taken, the geophysical logs, geology, and moisture logs are reviewed with the DQO team members, if there is information that would suggest take additional samples, additional samples will be taken. The capability of sampling with the push rig has increased from 1 to 2 soil samples per hole when first deployed to multiple soil samples per probe hole. This system design for multiple soil samples is the same system designed for the SX-108 slant borehole, only smaller. The

REVIEW COMMENT RECORD	Date 4/07/2009	Review No.	
	Project No. WMA C SAP	Page Page 14 of 14	

Item	Page #	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated.)	Concurrence	Response
				advantage of this technology is ease in deployment, better option of evaluating lateral extent of contamination, no contaminated soil cutting being brought to the surface, and lower costs. The direct push technology will use the dual string approach where multiple samples can be collected. In the 200 East Area, the direct push technology has demonstrated the ability to go to great depths (~200 ft). This is an advantage over traditional drilling of a borehole that is more expensive, cannot easily evaluate lateral extent of contamination, and brings contaminated soil cuttings to the surface.
26.	Specific Comment # 18	Install drywell monitoring boreholes around tank C-102 at the three o'clock and six o'clock positions.		**Response:** The placement of drywell monitoring boreholes around C-102 is problematic because of the tank location at the edge of a hill. We acknowledge the idea and potential value of having more monitoring capability near this tank, and would welcome further discussion with you on how this might be achieved, given the physical constraints in the location. In addition, DOE has selected national expertise to assess tank integrity and monitoring of the SSTs and we appreciate the Nez Perce's as well as the other Tribal Nations' active involvement in that assessment effort. DOE and Ecology will revisit additional monitoring capabilities for SSTs as a result of the panel's deliberations.

0085502

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • (509) 372-7950

March 29, 2010

Ms. Shirley J. Olinger, Manager
Office of River Protection
United States Department of Energy
P.O. Box 450, MSIN: H6-60
Richland, Washington 99352

Re: *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C,* RPP-PLAN-39114, Revision 1 (Work Plan)

Dear Ms. Olinger:

The Department of Ecology (Ecology) approves the Work Plan. We discussed our comments and concerns with the United States Department of Energy-Office of River Protection (USDOE-ORP). USDOE-ORP incorporated our comments into the Work Plan.

USDOE-ORP and Ecology attended meetings to discuss the technical issues of the Work Plan. Ecology is concerned with the lack of progress made at Waste Management Area (WMA) C since January 2010. We would like to meet with USDOE-ORP and the contractor to discuss the following issues:

- The recovery for the missed WMA C Work Plan pushes schedule to date.
- A critical path and recovery plan to meet the schedule as defined in Figure 6-1 of the Work Plan.
- The low priority given the C Farm Direct Push and Surface Geophysical Exploration in the Integration Priority List, Fiscal Year 2010.
- USDOE-ORP's current plans for integrating the direct pushes with the C Farm retrieval program.

Please schedule the first meeting before April 25, 2010. To document our decisions, USDOE-ORP and Ecology will record meeting minutes and enter them into the Tri-Party (TPA) Administrative Record, as part of the monthly TPA Project Manager meeting minutes.

If there are any questions, contact me at 509-372-7914.

Sincerely,

Jeffery J. Lyon
Tank Waste Storage Project Manager
Nuclear Waste Program

RECEIVED
MAR 31 2010
EDMC

mb/aa

cc: See page 2

cc: Stuart Harris, CTUIR
Gabriel Bohnee, NPT
Russell Jim, YN
Susan Leckband, HAB
Ken Niles, ODOE
Administrative Record: WMA-C
Environmental Portal
Hanford Operating Record General File
USDOE-ORP Correspondence Control

1000425
EP Rec'd: 03/31/2010

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • (509) 372-7950

March 29, 2010

Ms. Shirley J. Olinger, Manager
Office of River Protection
United States Department of Energy
P.O. Box 450, MSIN: H6-60
Richland, Washington 99352

Re: *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C,* RPP-PLAN-39114, Revision 1 (Work Plan)

Dear Ms. Olinger:

The Department of Ecology (Ecology) approves the Work Plan. We discussed our comments and concerns with the United States Department of Energy-Office of River Protection (USDOE-ORP). USDOE-ORP incorporated our comments into the Work Plan.

USDOE-ORP and Ecology attended meetings to discuss the technical issues of the Work Plan. Ecology is concerned with the lack of progress made at Waste Management Area (WMA) C since January 2010. We would like to meet with USDOE-ORP and the contractor to discuss the following issues:

- The recovery for the missed WMA C Work Plan pushes schedule to date.
- A critical path and recovery plan to meet the schedule as defined in Figure 6-1 of the Work Plan.
- The low priority given the C Farm Direct Push and Surface Geophysical Exploration in the Integration Priority List, Fiscal Year 2010.
- USDOE-ORP's current plans for integrating the direct pushes with the C Farm retrieval program.

Please schedule the first meeting before April 25, 2010. To document our decisions, USDOE-ORP and Ecology will record meeting minutes and enter them into the Tri-Party (TPA) Administrative Record, as part of the monthly TPA Project Manager meeting minutes.

If there are any questions, contact me at 509-372-7914.

Sincerely,

Jeffery J. Lyon
Tank Waste Storage Project Manager
Nuclear Waste Program

mb/aa

cc: See page 2

cc: Stuart Harris, CTUIR
Gabriel Bohnee, NPT
Russell Jim, YN
Susan Leckband, HAB
Ken Niles, ODOE
Administrative Record: WMA-C
Environmental Portal
Hanford Operating Record General File
USDOE-ORP Correspondence Control

TRI-PARTY AGREEMENT

Change Notice Number TPA-CN- 382	TPA CHANGE NOTICE FORM	Date: February 23, 2011
Document Number, Title, and Revision: RPP-PLAN-39114, *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, Revision 1		Date Document Last Issued: October 6, 2010
Originator: J.R. Robertson		Phone: 376-8162

Description of Change:
Revise Appendix B, *Sampling and Analysis Instructions for Small Mammal Sampling in WMA C*, to reflect field conditions that have changed since the time the document was issued, and to include discussion of quality assurance and quality control requirements.

R.W. Lober (**DOE**) and J. Lyon (**Lead Regulatory Agency**) agree that the proposed change modifies an approved workplan/document and will be processed in accordance with the Tri-Party Agreement Action Plan, Section 9.0, *Documentation and Records*, and not Chapter 12.0, *Changes to the Agreement*.

Revisions to Appendix B of RPP-PLAN-39114 are as follows:

- Updates to habitat transect locations to reflect field conditions that have changed since issuance of the document (e.g., construction of a parking lot over one transect),
- Inclusion of text regarding quality assurance and quality control requirements,
- Correction of minor (insignificant) editorial errors,
- Corrections to the listing of typically required training,
- Deletion of references to specific trap manufacturers,
- Clarification of sample collection and packaging requirements (compositing, field weighing, freezing, packaging, and digestion and sterilization),
- Correction and clarification of laboratory analytes.

Revised pages are attached. Additions and deletions are shown in redline/strikeout text with change bars in the page margins.

Justification and Impacts of Change:
The primary drivers for revising the document are (1) to recognize the conversion of a portion of one of the originally identified sampling habitats to a parking lot, which makes that area unfit for use as a sampling habitat, and (2) to include previously omitted text pertaining to quality assurance and quality control requirements. During the revision process, DOE is taking the opportunity to correct errors and provide clarifications in the document.

Approvals:

DOE Project Manager	2-25-11 Date	[X] Approved [ ] Disapproved
EPA Project Manager	Date	[ ] Approved [ ] Disapproved
Ecology Project Manager	2-25-11 Date	[X] Approved [ ] Disapproved

A-6005-413 (REV 1)

APPENDIX B

SAMPLING AND ANALYSIS INSTRUCTIONS FOR SMALL MAMMAL SAMPLING IN WMA C

TABLE OF CONTENTS

B1.0 INTRODUCTION B-1
B1.1 BACKGROUND B-1
B1.2 PREVIOUS INVESTIGATIONS ..... B-4~~B-3~~
B1.3 INDICATOR CONTAMINANTS ..... B-4~~B-3~~
B1.4 PROBLEM DEFINITION ..... B-5~~B-4~~
B1.5 DIETARY EXPOSURE ..... B-6~~B-4~~
B1.6 DECISIONS TO BE MADE ..... B-6~~B-5~~
B1.7 CONTINGENCIES ..... B-7~~B-6~~
B2.0 PROJECT MANAGEMENT ..... B-8~~B-7~~
B2.1 PROJECT TASK ORGANIZATION ..... B-8~~B-7~~
B2.2 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA B-8~~B-7~~
B2.3 SPECIAL TRAINING REQUIREMENTS ..... B-10~~B-9~~
B3.0 MEASUREMENT/DATA ACQUISITION ..... B-12~~B-11~~~~B-10~~
B3.1 SAMPLING PROCESS DESIGN ..... B-12~~B-11~~~~B-10~~
B3.2 SAMPLING METHOD REQUIREMENTS ..... B-12~~B-11~~~~B-10~~
B3.2.1 SMALL MAMMAL SAMPLING ..... B-12~~B-11~~~~B-10~~
B3.2.2 SAMPLE HANDLING, SHIPPING, AND CUSTODY REQUIREMENTS..... B-21~~B-20~~~~B-18~~
B3.2.3 QUALITY CONTROL REQUIREMENTS ..... B-21~~B-20~~~~B-19~~
B3.2.4 INSTRUMENT CALIBRATION AND MAINTENANCE ..... B-21~~B-20~~~~B-19~~
B3.2.5 FIELD DOCUMENTATION ..... B-22~~B-20~~~~B-19~~
B4.0 ASSESSMENTS AND RESPONSE ACTIONS ..... B-23~~B-21~~~~B-20~~
B5.0 DATA VERIFICATION AND VALIDATION REQUIREMENTS ..... B-24~~B-22~~~~B-21~~
B6.0 MANAGEMENT OF INVESTIGATION-DERIVED WASTE ..... B-25~~B-23~~~~B-22~~
B7.0 HEALTH AND SAFETY ..... B-26~~B-24~~~~B-23~~
B8.0 REFERENCES ..... B-27~~B-25~~~~B-24~~

LIST OF FIGURES

Figure B-1. Hanford Site Map. ..... B-3~~B-2~~
Figure B-2. WMA C Small Mammal Sampling Design. ..... B-14~~B-13~~~~B-12~~

LIST OF TABLES

Table B-1. Analytical Suites and Methods for Small Mammal Tissues. ..... B-5~~B-4~~
Table B-2. Analytical Performance Requirements for Tissue Analyses. (2 sheets) ..... B-9~~B-8~~
Table B-3. Sample Collection and Packaging Requirements (per sample basis) .... B-19~~B-18~~~~B-17~~

ACRONYMS

AEA	alpha energy analysis
AVMA	American Veterinary Medical Association
CFR	Code of Federal Regulations
COPEC	contaminant of potential ecological concern
DOE	U.S. Department of Energy
ERA	ecological risk assessment
GEA	gamma energy analysis
GPC	gas proportional counting
HASQARD	*Hanford Analytical Services Quality Assurance Requirements Document*
HEPA	high-efficiency particulate air
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
PCB	polychlorinated biphenyl
QA	quality assurance
RCRA	*Resource Conservation and Recovery Act of 1976*
RCBRA	River Corridor Baseline Risk Assessment
~~SAF~~	~~sample authorization form~~
SAI	sampling and analysis instruction
SAP	sampling and analysis plan
SST	single-shell tank
STR	subcontract technical representative
WAC	*Washington Administrative Code*
WMA	waste management area
WRPS	Washington River Protection Solutions, LLC

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
Inches	25.4	millimeters	millimeters	0.039	inches
Inches	2.54	centimeters	centimeters	0.394	inches
Feet	0.305	meters	meters	3.281	feet
Yards	0.914	meters	meters	1.094	yards
Miles	1.609	kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.035	ounces
pounds	0.454	kilograms	kilograms	2.205	pounds
ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
tablespoons	15	milliliters	liters	2.1	pints
fluid ounces	30	milliliters	liters	1.057	quarts
gallons	3.8	liters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	millibecquerel	millibecquerels	0.027	picocuries

B1.0 INTRODUCTION

This sampling and analysis instruction (SAI) guide was prepared to provide the requirements for the sampling and analysis activities to be performed in support of the Corrective Measures Study for Waste Management Area C (WMA C). This SAI describes the field work necessary to collect the data identified in RPP-RPT-38152, *Data Quality Objectives Report Phase 2 Characterization for Waste Management Area C RCRA Field Investigation/Corrective Measures Study*. This SAI defines data collection methods for small mammals to augment the screening-level ecological risk assessment.

WMA C is one of several single-shell tank (SST) farm waste management areas located in the 200 East Area of the Hanford Site (see Figure B-1). Past releases to soil have resulted in contamination that will require evaluation and cleanup under the *Resource Conservation and Recovery Act of 1976* (RCRA) corrective action program in accordance with the *Hanford Federal Facility Agreement and Consent Order* (HFFACO) (Ecology et al. 1989), also known as the Tri-Party Agreement. Elements of the corrective action process include soil characterization, assessment of risk from past releases to soil, evaluation and selection of corrective measures alternatives, and implementation of the selected corrective measures.

In support of the evaluation and selection of corrective measures alternatives, contaminant concentrations in abiotic and biotic media will be compared to endpoint criteria specified by Washington State regulations, U.S. Environmental Protection Agency technical guidance, U.S. Department of Energy (DOE) technical guidance, or as supported by the scientific literature. The approach for ecological risk assessment for WMA C is documented in Section 3.4.2 of this document.

Sampling and analysis of soil at WMA C will follow the specifications documented in the Sampling and Analysis Plan (SAP) provided as Appendix A of the main document. The sampling and analysis tasks presented in this SAI guide are specific to small mammal collection and analysis to obtain data for use in dietary exposure modeling in the ecological risk assessment for WMA C.

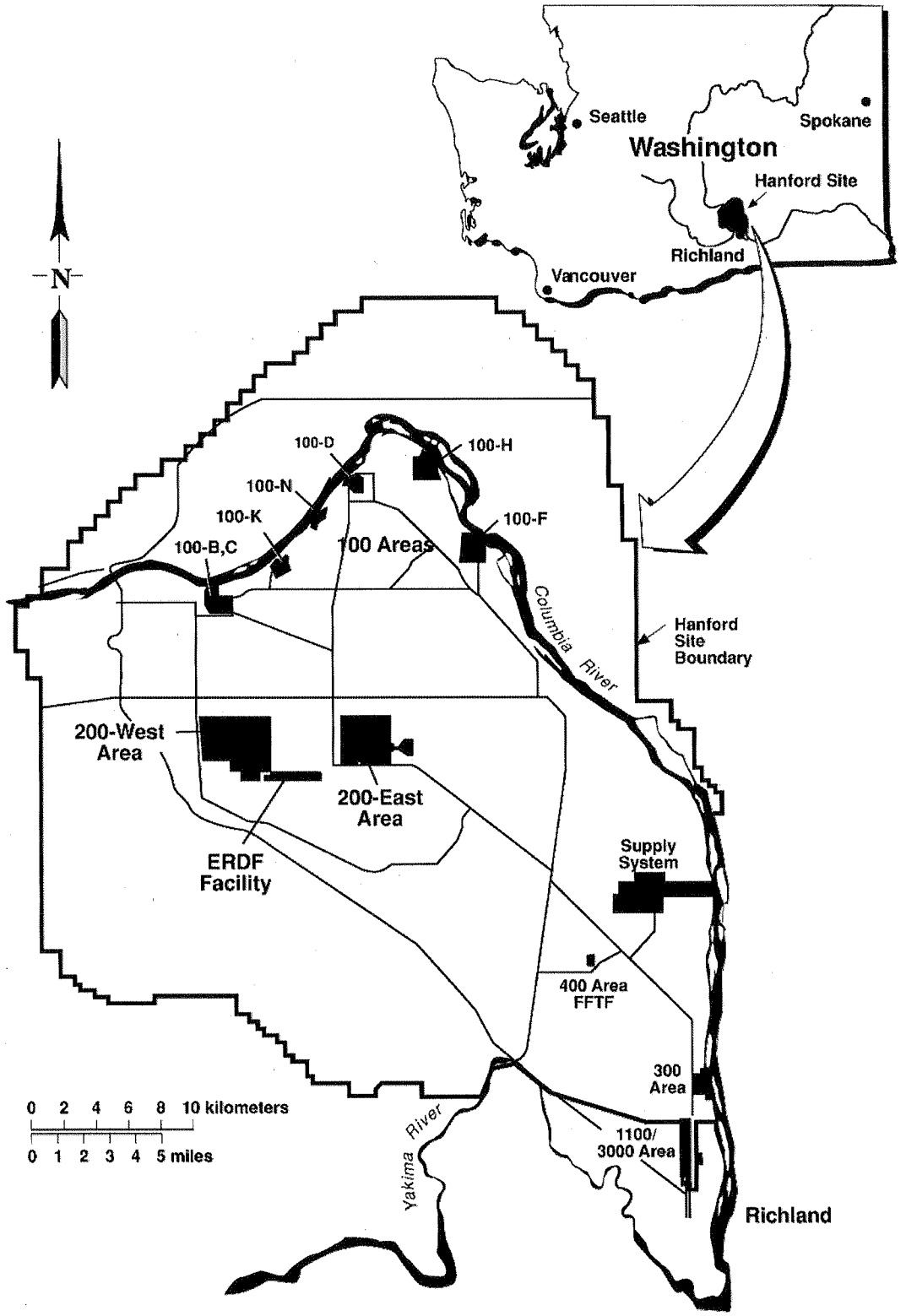
B1.1 BACKGROUND

The Hanford Site became a federal facility in 1943 when the U.S. Government took possession of the land to produce weapons-grade plutonium during World War II. The Hanford Site's production mission continued until the late 1980s when the mission changed from producing nuclear materials to cleaning up the radioactive and hazardous wastes that had been generated during the previous decades. The Central Plateau, which encompasses the tank farms, consists of approximately 75 mi^2 (195 km^2) near the middle of the Hanford Site (see Figure B-1). The Central Plateau contains approximately 900 excess facilities formerly used in the plutonium production process.

WMA C is an SST farm located on the eastern portion of the 200 East Area. WMA C is currently undergoing Phase 2 investigation to support development and implementation of

corrective measures. This SAI documents the methods for the collection of biological data (small mammal tissue) to support ecological risk assessment in the SST farms.

Figure B-1. Hanford Site Map.



B1.2 PREVIOUS INVESTIGATIONS

Phase 1 characterization for soils of WMA C was documented in RPP-35484, *Field Investigation Report for Waste Management Areas C and A-AX.*

Previous investigations of ecological risk at the Hanford Site date back to the early 1990s (WHC-SD-EN-TI-122, *Biological Uptake of 300-FF-5 Operable Unit Contaminants*). Work is being performed concurrently with this project as part of the Central Plateau Ecological Risk Assessment Project (WMP-20570, *Central Plateau Terrestrial Ecological Risk Assessment Data Quality Objectives Summary Report – Phase I*), the River Corridor Baseline Risk Assessment (RCBRA), and WMP-23141, *100-NR-2 Groundwater Operable Unit Ecological Risk Assessment Data Quality Objectives Summary Report,* and DOE/RL-2005-22, *100-NR-2 Study Area Ecological Risk Assessment Sampling and Analysis Plan.* Monitoring activities and data collection efforts to support ecological risk assessment (ERA), performed on an ongoing basis by the Pacific Northwest National Laboratory as part of ~~U.S. Department of Energy's (~~DOE's~~)~~ Public Safety and Resource Protection Program, are available on request from the DOE Richland Operations Office.

B1.3 INDICATOR CONTAMINANTS

Indicator contaminants for small mammal tissue analysis consist of the nonradionuclide constituents listed in *Washington Administrative Code* (WAC) 173-340-7493, "Site-Specific Terrestrial Ecological Evaluation Procedures" (Table 749-3), for which a wildlife benchmark is provided. While analytical suites are not limited to these contaminants specifically, performance of suite analyses ensures that these indicator contaminants are captured for evaluation as contaminants of potential ecological concern (COPECs). Radionuclides are not addressed by the WAC but potentially pose risk to wildlife at WMA C via the dietary exposure pathway from small mammals. Radionuclide analyses will be performed on small mammal tissues to determine the type and quantity of radionuclides in the ecosystem, and their subsequent risks to predator species. Contaminant suite analyses to be performed for upland soil and tissues are listed in Table B-1, which is derived from Table 3-2 of RPP-PLAN-39114, *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*.

Environmental conditions often limit the ability to collect a sufficient amount of sample material for the analyses of all indicator contaminants; therefore, the full list of indicator contaminants must be prioritized for samples with limited sample mass. In general, the priorities for these samples (in order from highest to lowest) are gamma spectroscopy, metals (SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, Methods 6010/6020 and 7471), radiogenic strontium, polychlorinated biphenyls (PCB) and pesticides (SW-846 Methods 8082 and 8081A, respectively), isotopic uranium, isotopic plutonium, isotopic thorium, and semivolatile organic compounds ~~(SVOCs)~~ (SW-846 Method 8270A) or most current approved SW-846 methodology. Gamma spectroscopy is listed as the highest analytical priority because it is a nondestructive analysis, requires significantly more mass than other analyses, but may not be feasible for some samples.

B1.4 PROBLEM DEFINITION

The purpose of the ERA for WMA C is to ascertain risk to receptors from COPECs originating from SST farm operations. The presence of contaminants in biological tissue (i.e., small mammals) is indicative of exposure and may serve as an exposure pathway to higher trophic predators, such as raptors and carnivorous mammals. Information gathered from small mammal tissue analyses will substantiate current exposure and aid in the development and implementation of corrective measures to ensure long-term protection of human health and the environment.

Table B-1. Analytical Suites and Methods for Small Mammal Tissues

Analyte Group	Analytical Methods[a]	Analyzed in Tissues[b]	Indicator Contaminants[c]
Inorganic chemicals (Metals)	6010~~/6020~~	Yes	Arsenic, barium, cadmium, chromium (total), copper, ~~barium,~~ lead, manganese, molybdenum, nickel, ~~manganese, selenium,~~ zinc
	6020/200.8	Yes	Selenium
	7471/200.8	Yes	Mercury (total) ~~(inorganic), mercury (organic),~~
PCBs and pesticides	8082 (PCBs)	Yes	PCB ~~mixtures~~ aroclors ~~(total)~~
	8081~~A~~ (pesticides)	Yes	Aldrin, ~~benzene~~, chlordane, dieldrin, endrin, DDT, ~~/~~DDD, ~~/~~DDE ~~(total)~~, heptachlor, ~~/~~heptachlor epoxide ~~(total)~~, benzene hexachloride (including lindane)
Semivolatile organic ~~chemicals~~compounds	8310 or 8270	Yes	Benzo(a)pyrene
	8270~~A~~	Yes	Hexachlorobenzene~~, chlorinated dibenzofurans (total), dioxins~~, pentachlorophenol
Radionuclides	Gamma energy analysis (GEA)	Yes	^{134}Cs, ^{137}Cs, ^{60}Co, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{226}Ra
	Alpha energy analysis (AEA)	Yes	^{241}Am
	Isotopic plutonium (AEA)	Yes	^{238}Pu
	Isotopic thorium (AEA)	Yes	^{228}Th, ^{232}Th
	Isotopic uranium (AEA)	Yes	$^{233/234}$U, ^{235}U, ^{238}U
	Total radioactive strontium (GPC)	Yes	^{90}Sr

[a] All analyses obtained by these methods.
[b] Analyses are subject to obtaining a sufficient amount of small mammal whole organism tissue.
[c] Indicator contaminants for small mammal tissues are those that identified as WAC soil indicator contaminants for wildlife plus radionuclides.
GPC = gas prorportional counting

B1.5 DIETARY EXPOSURE

Dietary exposure to COPECs will be evaluated using methodology published in EPA/600/R-93/187, *Wildlife Exposure Factors Handbook*. The principal aspect of vertebrate exposure is the measurement of COPEC concentrations in food and abiotic media. The exposure evaluation for higher trophic level receptors (i.e., badger and red-tailed hawk) is based on the food intake rates and diet preference of representative small mammal species. The general equation for dietary exposure to badger and red-tailed hawk is as follows:

$$E_{oral} = C_{soil} \cdot I_{soil} \cdot AUF_{soil} + C_{food} \cdot I_{food} \cdot AUF_{food}$$

where

E_{oral} = the estimated oral daily dose for a COPEC (mg/kg/day)

C_{soil} = the concentration of chemical constituent x in soil (mg/kg dry weight)

I_{soil} = the normalized daily soil ingestion rate (kg of soil / [kg of body weight • day])

AUF_{soil} = the area use factor that represents the fraction of soil ingested from a contaminated area (this fraction is set to one)

C_{food} = the concentration of COPEC in food (mg/kg dry weight)

I_{food} = the normalized daily dietary ingestion rate (kg of food [dry weight] / [kg of body weight • day])

AUF_{food} = the fraction of the diet derived from a contaminated area (this fraction is set to one).

B1.6 DECISIONS TO BE MADE

The sampling of small mammal tissue in WMA C will help establish ecological exposure and transport pathways to chemicals and radionuclides present in the SST farms. The quantity of samples collected and the duration of the evaluation will be appropriate to inform the corrective measures study which is being performed concurrently for WMA C. Samples will be collected from three distinct transects: the WMA C perimeter fenceline transect, and two habitat transects located in proximity to but outside of the WMA C perimeter. A composite of kidney and liver tissues from a minimum of six captured organisms per transect group will serve as indicators of bioconcentration of inorganic contaminants in these target organs. The remaining small mammal carcasses (whole organism, minus the liver and kidney) will be composited separately for analysis. Liver and kidneys are target organs for accumulation of some types of COPECs, including metals. In addition, these organs have tissue-specific toxicity reference values for some COPECs which allow for extrapolation between the concentrations observed in the field and laboratory-based effects. In the dietary exposure model, a weighted average of the COPEC concentrations in carcass and organs (liver and kidney) is used as the exposure point

concentration. Liver and kidney weights will be recorded for each sample and their contaminant contributions to diet accounted for on a fraction-of-body-weight basis.

A minimum of six organisms per transect group will be combined into two composite samples (one liver/kidney composite and one carcass composite) per transect group for analysis. The carcass composite will be further subdivided as necessary to support analytical needs. Under this study design, ~~six~~ at least nine samples will be submitted for analysis~~: three composite samples of liver and kidney tissue from collected organisms, and the three composite samples of small mammal carcass~~, with at least three samples representing each of the three transect groups. While the number of samples to be collected is not statistically based, the number of samples is sufficient to meet analytical sample mass requirements and also to perform exploratory data analyses (i.e., calculate mean concentrations and upper confidence limits on the mean, and comparing contaminant distributions using boxplots).

A portion of the carcass composite sample from each transect will be analyzed for organic constituents, including PCB aroclors. Another portion of these samples will be reserved for possible subsequent analysis. When available, the aroclor results from each transect will be evaluated together with available RCRA facility investigation analytical results for PCB aroclors and congeners in WMA C soils to determine whether a reserved carcass composite sample from any of the transects should be analyzed for PCB congeners. The carcass composite, rather than liver/kidney composite, will be analyzed for this purpose, because PCBs concentrate in the lipid tissues of the carcass.

B1.7 CONTINGENCIES

It is necessary to prepare for contingency sampling in the event that planned sample numbers are compromised. For example, it may be that insufficient sample mass exists for a particular group targeted for tissue analyses. In the event of low capture frequency, additional sampling may be performed until adequate sample mass requirements are met. For all samples the analytes shall be measured in the following general priority order: gamma spectroscopy (first because it is a nondestructive analysis; it is assumed that samples measured for gamma radiation will be available for other analyses, but it requires a significant mass so it may not always be appropriate), metals, total radioactive strontium, PCBs and pesticides, isotopic uranium, isotopic plutonium, isotopic thorium, and ~~SVOCs~~semivolatile organic compounds.

A small quantity of sample mass from each transect will be reserved at the sample preparation laboratory to allow for follow-on analysis of PCB congeners.

B2.0 PROJECT MANAGEMENT

This section addresses the roles and responsibilities of the project management team to ensure that project participants understand the sampling goals and approaches to be used and that the planned outputs are appropriately documented.

B2.1 PROJECT TASK ORGANIZATION

This project will be managed by Washington River Protection Solutions, LLC (WRPS). The WRPS will assign a project manager, a risk assessment manager, and a subcontract technical representative (STR). The risk assessment manager has overall responsibility for this project including oversight of the project schedule and budget. The manager makes final project decisions with the authority to commit the necessary resources to perform activities.

The WRPS STR is responsible for coordination and oversight of all environmental data collection activities, including sampling, field analytical measurements, and field ecological observations. The STR is responsible for tracking and reporting the progress of field work and laboratory analysis and interfacing with quality assurance (QA), health and safety, and cultural resources representatives to ensure work is performed in accordance with all project objectives and requirements, such as those specified in this SAI.

Sample collection will be performed by qualified subcontractors in accordance with this SAI and applicable procedures documented in the SAP~~ampling and Analysis Plan~~ (Appendix A of the main document). Subcontractor and WRPS field personnel will provide ~~daily~~ weekly status during fieldwork and report problems in the field and to the STR.

The project QA representative oversees quality control and laboratories and is independent of the personnel performing data generation. The QA representative is responsible for ensuring field and laboratory activities are performed in accordance with WRPS project quality management plans, WRPS-approved field and laboratory subcontractor QA plans, and applicable procedures. The QA representative is also responsible for coordinating and performing audits and assessments of field and laboratory work.

B2.2 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The detection limits and precision and accuracy requirements for each of the analyses performed are summarized for biotic tissue in Table B-2. The process for determining these requirements is documented in existing ERA planning documentation, including data quality objective reports and SAPs for the Central Plateau Terrestrial ERA and the RCBRA. The matrix-specific target COPEC quantitation limits used in this SAI were derived for the RCBRA and Central Plateau Terrestrial ERA by calculating the COPEC concentrations in prey that would result in a predator dose approaching the threshold toxicity reference values. For additional detail on derivation of these numbers, see planning documentation for those reports.

Table B-2. Analytical Performance Requirements for Tissue Analyses (2 sheets)

Indicator Con taminant	Chemical Abstracts Service Number	Analytical Instrument and/or Method	Laboratory Target Detection Limit[a] (pCi/g or mg/kg)	Precision	Accuracy
Radionuclides					
Americium-241	14596-10-2	AEA	0.1	±30%	70-130
Cesium-134	13967-70-9	GEA	0.1	±30%	70-130
Cesium-137	10045-97-3	GEA	0.1	±30%	70-130
Cobalt-60	10198-40-0	GEA	0.05	±30%	70-130
Europium-152	14683-23-9	GEA	0.1	±30%	70-130
Europium-154	15585-10-1	GEA	0.1	±30%	70-130
Europium-155	14391-16-3	GEA	0.1	±30%	70-130
Plutonium-238	13981-16-3	Isotopic Pu - AEA	1.0	±30%	70-130
Radium-226	13982-63-3	GEA	0.1	±30%	70-130
Strontium-90	10098-97-2	Total rad Sr – GPC	1	±30%	70-130
Thorium-228	14274-82-9	Isotopic Th – AEA	1.0	±30%	70-130
Thorium-232	14274-82-9	Isotopic Th - AEA	1	±30%	70-130
Uranium-233/234	13966-29-5	Isotopic U - AEA	1	±30%	70-130
Uranium-235	15117-96-1	Isotopic U - AEA	1	±30%	70-130
Uranium-238	7440-61-1	Isotopic U - AEA	1	±30%	70-130
~~Organics~~Pesticides and PCBs					
~~Pesticides~~Aldrin	309-00-2~~Chemical-specific~~	Method 8081~~A~~	0.0017	±30%	50-150
Benzene hexachloride (including lindane) (i.e., gamma-BHC [lindane])	58-89-9	Method 8081	0.0017	±30%	50-150
Chlordane	57-74-9	Method 8081	0.017	±30%	50-150
Dieldrin	60-57-1	Method 8081	0.003	±30%	50-150
Endrin	72-20-8	Method 8081	0.003	±30%	50-150
DDT	50-29-3	Method 8081	0.003	±30%	50-150
DDD	72-54-8	Method 8081	0.003	±30%	50-150
DDE	72-55-9	Method 8081	0.003	±30%	50-150
Heptachlor	76-44-8	Method 8081	0.0017	±30%	50-150
Heptachlor epoxide	1024-57-3	Method 8081	0.0017	±30%	50-150
~~PCBs~~Aroclor-1016	12674-11-2~~Chemical-specific~~	~~PCBs—EPA~~ Method 8082	0.017	±30%	50-150
Aroclor-1221	11104-28-2	Method 8082	0.017	±30%	50-150
Aroclor-1232	11141-16-5	Method 8082	0.017	±30%	50-150
Aroclor-1242	53469-21-9	Method 8082	0.017	±30%	50-150
Aroclor-1248	12672-29-6	Method 8082	0.017	±30%	50-150
Aroclor-1254	11097-69-1	Method 8082	0.017	±30%	50-150
Aroclor-1260	11096-82-5	Method 8082	0.017	±30%	50-150
Semivolatile Organic Compounds					

Table B-2. Analytical Performance Requirements for Tissue Analyses (2 sheets)

Indicator Con taminant	Chemical Abstracts Service Number	Analytical Instrument and/or Method	Laboratory Target Detection Limit[a] (pCi/g or mg/kg)	Precision	Accuracy
~~Semivolatile organic chemicalscompounds~~Benzo(a)pyrene	50-32-8~~Chemical-specific~~	~~SVOA~~ Method 8310 or 8270~~A~~	~~Chemical-specific~~0.33	±30%	50-150
Hexachlorobenzene	118-74-1	Method 8270	0.33	±30%	50-150
Pentachlorophenol	87-86-5	Method 8270	0.33	±30%	50-150
Metals					
Arsenic	7440-38-2	~~Metals~~Method 6010	10~~/1~~	±30%	70-130
Barium	7440-39-3	Method 6010~~Metals~~	2~~/0.5~~	±30%	70-130
Cadmium	7440-43-9	Method 6010~~Metals~~	0.5~~/0.2~~	±30%	70-130
Chromium (~~III~~total)	7440-47-3	Method 6010~~Metals~~	1~~/0.2~~	±30%	70-130
Copper	7440-50-8	Method 6010~~Metals~~	1	±30%	70-130
~~Iron~~Lead	7439-92-1~~7439-89-6~~	Method 6010~~Metals~~	5	±30%	70-130
Manganese	7439-96-5	Method 6010~~Metals~~	5	±30%	70-130
Mercury (total)	7439-97-6	Method 7471 or 200.8	0.2	±30%	70-130
Molybdenum	7439-98-7	Method 6010~~Metals~~	2	±30%	70-130
Nickel	7440-02-0	Method 6010~~Metals~~	4~~0~~	±30%	70-130
Selenium	7782-49-2	Method 6020 or 200.8~~Metals~~	0.1	±30%	70-130
Zinc	7440-66-6	Method 6010~~Metals~~	1	±30%	70-130

[a] Achievable detection limits may be affected if insufficient material is available for analysis. ~~Where two values are presented, second value refers to inductively coupled plasma trace detection limit.~~

AEA = alpha energy analysis
GEA = gamma energy analysis
GPC = gas proportional counting
SVOA = semivolatile organic analysis

B2.3 SPECIAL TRAINING REQUIREMENTS

Hanford General Employee Training ~~The following training~~ is typically required for subcontractors deployed to the site in support of sampling activities. ~~:~~

- ~~Site-specific Waste Management Instruction.~~
- ~~Integrated Work Control Program.~~
- ~~Hanford General Employee Training.~~
- ~~First aid and cardio-pulmonary resuscitation training.~~
- ~~Cultural Resource Awareness Training (at least one person on each crew).~~
- ~~Ecological resource and biological hazard training.~~

The following additional training may be required for certain areas:

- Site-specific Waste Management Instruction.
- Integrated Work Control Program.
- Rad Worker II (for entry into posted radiological control zones)
- 24-hour Hazardous Waste Worker Training (for entry into waste sites with ongoing remedial activities).
- Ecological resource and biological hazard training.

The qualifications of field personnel must be forwarded to the WRPS STR and must be approved by the STR prior to beginning work.

B3.0 MEASUREMENT/DATA ACQUISITION

This chapter presents the sampling design and requirements for sampling methods, sample handling and custody, and analytical methods. The requirements for instrument calibration and maintenance, supply inspections, and data management are also addressed.

B3.1 SAMPLING PROCESS DESIGN

The sample design reflects the project work scope developed in the main body ~~Section 3.4.2~~ of RPP-PLAN-39114~~this document~~. This SAI contains sample design details, summary tables, and figures that address sampling procedures, sampling locations, sampling frequencies, and field and laboratory requirements.

B3.2 SAMPLING METHOD REQUIREMENTS

Sampling will be performed in accordance with this SAI guide. The "study area" refers to the perimeter fenceline of the WMA C property and two habitat areas outside of the fenceline in proximity to the industrial area (Figure B-1). The dimension of the study area is based on a deer mouse home range (approximately 0.077 hectares, which is based on average home range data from representative environments listed in EPA/600/R-93/187, p. 2-298), which equates to a median dispersal distance of approximately 150 m. Dominant small mammal species anticipated for collection in the study include deer mice (*Peromyscus maniculatus*) or pocket mice (*Perognathus parvus*). A minimum of six animals per transect group (total of 18 mice) will be collected and prepared for analysis. Collection of a small number of additional animals may occur to support preparation of laboratory quality control samples.

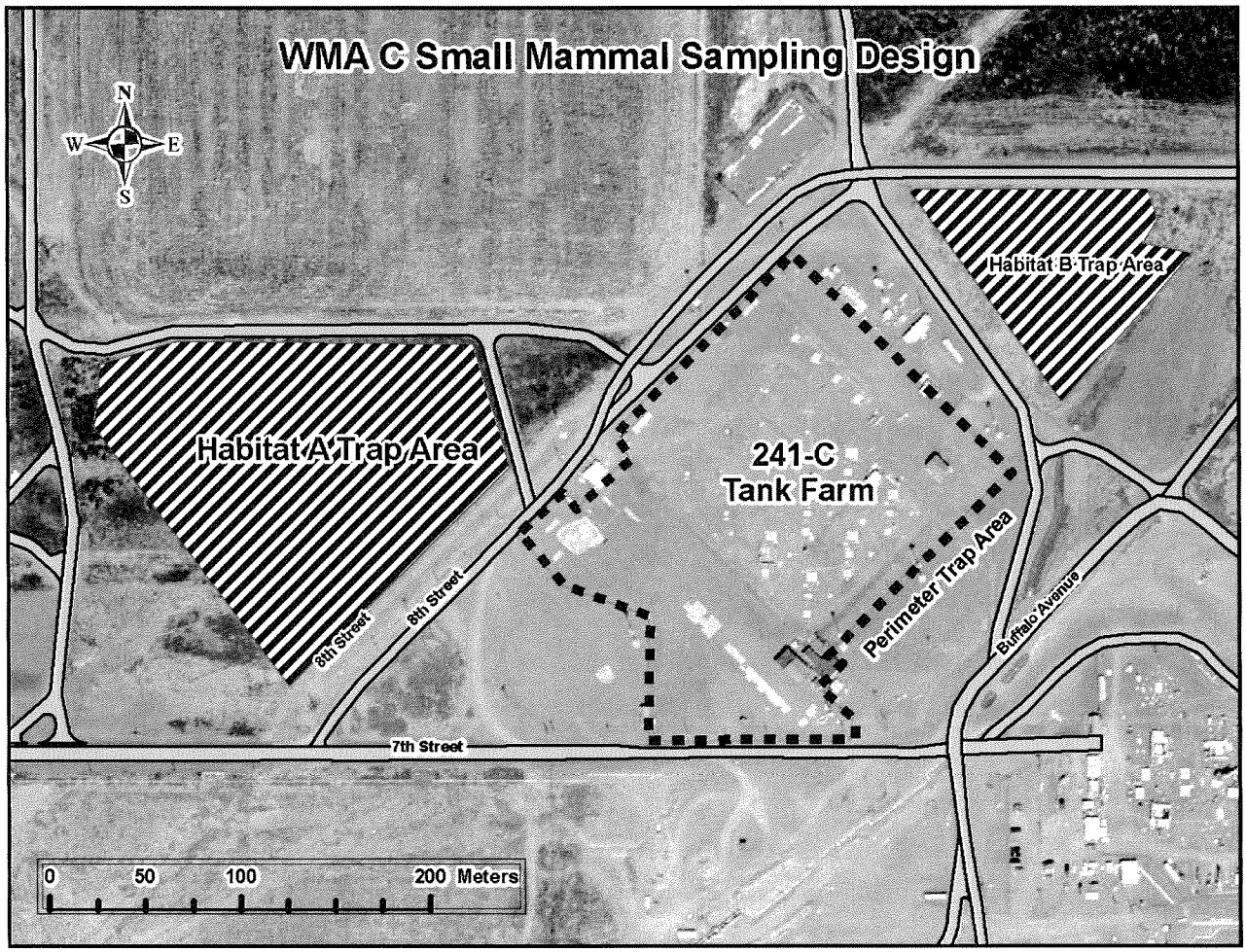
B3.2.1 SMALL MAMMAL SAMPLING

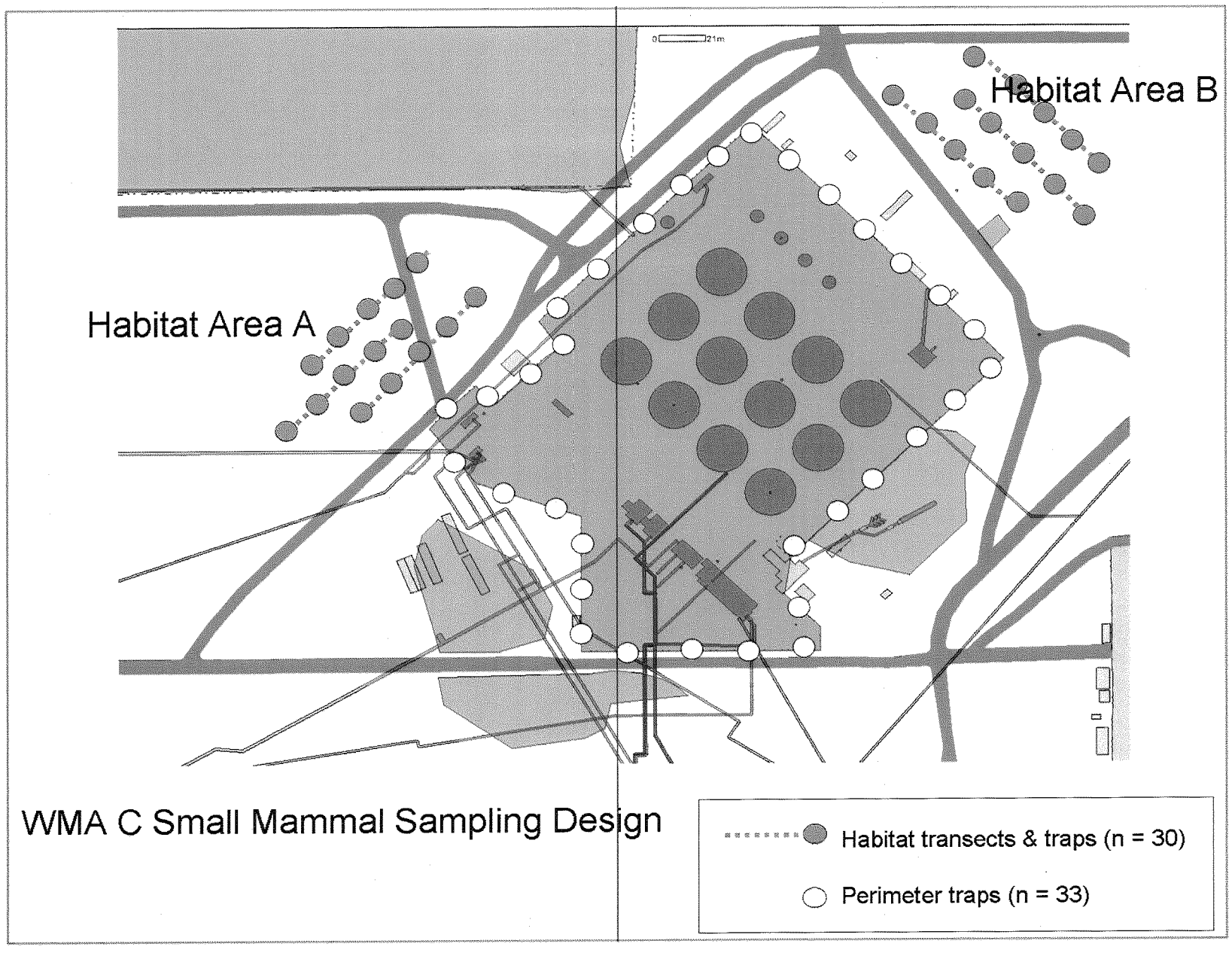
Three transect groups (one perimeter and two habitat transect groups) of ~~Sherman~~ live traps [with recommended approximate measurements of 8 cm (3 in.) wide by 9 cm (3.5 in.) high by 23 cm (9 in.) long] will be placed to accommodate the shape of the investigation area. Because WMA C is largely non-vegetated, inhabitation or site use by small mammals is likely to be limited. However, the perimeter transect will capture small mammals directly using the site. The two vegetated transect locations, which offer potential habitat for small mammals, are situated in close proximity to WMA C, thereby increasing likelihood of contaminant exposure and subsequent transport.

Due to the scarcity of habitat within the WMA C property fenceline, it is expected that the capture rate will be less than in vegetated areas. For the perimeter fenceline transect, traps will be spaced systematically at 25-m (82-ft) intervals along the perimeter fenceline of WMA C (Figure B-2). Two habitat transect groups will be established in vegetation communities adjacent to and outside of the WMA C property boundary. Habitat transect groups A and B (Figure B-2) vary in shape~~, but~~~~will~~ and each group will consist of at least three staggered trap lines~~, approximately 100 m (330 ft) long~~. Up to f~~F~~ive traps will be placed along each ~~100-m~~trap line transect, with the distance between traps and trap lines to be approximately 25 m (82 ft).

Each habitat transect group will have a minimum of 10 traps. The location for the trap where an animal is captured will be noted in the field logbook.

Figure B-2. WMA C Small Mammal Sampling Design.




0
21m
Habitat Area B
Habitat Area A
WMA C Small Mammal Sampling Design
Habitat transects & traps (n = 30)
Perimeter traps (n = 33)

The animals will be trapped over a sufficient number of nights to obtain at least six mice for each transect group, for a total of at least 18 mice. Collection of a small number of additional mice may be necessary to support preparation of quality control samples and analysis for PCB congeners. The number of trap-days required to collect at least six animals per transect group will be recorded. This will provide a relative measure of animal density. A minimum of six mice per transect group will be dissected and combined into two composite samples (one liver/kidney composite and one carcass composite) per transect group for analysis. The carcass composite will be further subdivided as necessary to support analytical needs. The composite samples will represents the average concentration of COPECs at ~~the site~~ each transect that are available for uptake to higher trophic species through the dietary pathway.

Information on species, approximate age, sex, reproductive status (subadults/adults and nonscrotal males/scrotal males, and nonlactating/lactating females), ~~body weights [±2.0 g (0.1 oz)],~~ and general external condition (any gross deformities, hair loss, infections, lesions, etc.) will be recorded in the field logbook for all captured animals. Animals captured and released (nontarget animals, such as juvenile mice) should be marked so that the total number of new captures per trap-night can be used to represent relative abundance estimates measured and documented for each study site.

At the laboratory, the mammals will be weighed on a calibrated balance (± 0.01 g) and then rinsed thoroughly with deionized water to remove most exterior soil per HASQARD (DOE/RL-96~~8~~-68, *Hanford Analytical Services Quality Assurance Requirements*). Small mammals are to be analyzed exclusive of external concentrations so that these data will be better suited to developing bioaccumulation models. The exposure models incorporate incidental soil ingestion; therefore, rinsing the mammals prevents double counting soil ingestion in exposure model calculations. Further sample preparation includes dissecting organs (liver/kidney) from the carcass (including the gastrointestinal tract) for weighing and separate homogenization.

B3.2.1.1 Trapping Instructions

~~Sherman~~ L~~l~~ive -traps should be used to collect small mammals. The number of small mammal traps installed and the number of nights the traps are left open may vary according to the size and configuration of the study grid and the trapping effort required to satisfy minimum sample size requirements. However, it is important to maintain a systematic distance between traps to ensure equal probability of having a capture. NOTE: The collector must have a valid Washington State scientific collection permit to conduct small mammal trapping in Washington State. A flag should be placed at the beginning of each trap line that identifies the Washington State scientific collection permit number (specific contact information is provided on the investigation area sign), contact name, and phone number.

Field Trapping Equipment List:

1. Plastic bags.
2. High-efficiency particulate air (HEPA) mask.

3. Lysol® solution and spray bottle.

~~4. Spring scales [with at least 2 g (0.1 oz) intervals].~~

~~5.~~4. Rubber gloves (gardening or thicker) or leather gloves.

~~6.~~5. Field ~~trapping record form~~logbook.

~~7.~~6. Nontoxic permanent marker.

~~8.~~7. Ice and cooler (preferably two coolers).

~~9.~~8. Scientific collection permit.

~~10.~~9. ~~Sherman l~~Live traps (small mammal sizes).

~~11.~~10. Trap shades (one for each trap where vegetation or cover/shade is limited).

Small Mammal Trapping Instructions:

1. Set traps in accordance with specification in Section B3.2.1.1.
2. Traps should be spaced systematically 25 m (~82 ft) apart along each transect.
3. Place traps nearby or underneath vegetation/rocks to reduce likelihood of heat-stress/ cold-stress. If natural cover is insufficient to prevent heat/cold stress to animals, then a trap shade should be placed over the top of the trap and secured to the ground with stakes or heavy objects.
4. Set trap trigger sensitivity to ensure consistent trapping success efforts between areas.
5. Bait traps with an oatmeal-peanut butter mixture [approximately 30 mL (2 tbsp) of peanut butter and 2.7 L (0.7 gal) of oatmeal in a 4-L (1-gal) zippered plastic bag].
6. Check traps daily, preferably before ambient temperatures exceed approximately 90°F.
7. If samples are abundant, ~~sacrifice~~ use only reproductively active specimens for contaminant analysis.
8. When traps have been tripped and a small mammal is captured, don a HEPA mask (optional) and gloves, and position yourself in a generally upwind direction from the trapped animal.
9. Empty trap contents (small mammal, bait, and feces) into a new plastic bag. If animal is not ~~sacrificed~~selected for collection, mark the ventral portion of its tail with a black, blue, or red nontoxic permanent marker to ensure all marked animals can be identified later if recaptured.
10. Record species, age, sex, and reproductive status~~, and weight~~, and note any abnormalities of condition ~~on~~ in the field ~~record form~~logbook. (Do not record this information if the animal has been previously captured and recorded.)

® Lysol is a registered trademark of Rickitt Benckiser, Inc., Richmond, Virginia.

11. If animal is selected for collection, euthanize selected small mammals by American Veterinary Medical Association ("AVMA Panel on Euthanasia," AVMA 1986) approved cervical dislocation technique.
12. Place each ~~sacrificed~~ euthanized specimen in a new plastic bag, labeled with the date, trap grid, trap number, sample number (1 of 6, etc.), collection permit number, and collector's initials, and store in an iced cooler until samples can be transferred to the laboratory for sample preparation process.
13. Reset the trap, checking the sensitivity, and re-bait the trap.
14. Spray hands (with gloves donned) with Lysol solution, doff the HEPA mask, and then gloves.
15. Record all trapping efforts ~~on~~ in small mammal field ~~record forms~~logbook.

~~15.~~16. Freeze the collected specimens until sufficient number of specimens is obtained to prepare each of the desired samples.

B3.2.1.2 Small Mammal Condition Inspections and Tissue Sample Preparations at the Laboratory

Small Mammal Laboratory Equipment List:

1. Appropriate sample containers (see Table B-3).
2. Autoclave.
3. Stainless steel forceps.
4. Blunt scissors.
5. Surgical (nitrile) gloves.
6. Liqui-nox®[1] solution.
7. Deionized water (Teflon®[2] squeeze bottle).
8. Teflon weighing and wash tray.
9. Calibrated balance (±0.01 g).
10. Laboratory-grade blender.
11. Absorbent paper and aluminum weigh boats.
12. Lysol solution (5% Lysol) and spray bottle.
13. Animal necropsy/gross external observations form.
14. Chain-of-custody seals.
15. Chain-of-custody form.
16. Dry ice.

[1] Liqui-nox® is a registered trademark of Alconox, Inc., White Plains, New York.
[2] Teflon® is a registered trademark of I. E. du Pont de Nemours and Company, Wilmington, Delaware.

17. Laboratory grade blend and stainless steel 500-mL cup.

~~**Table B-3. Sample Collection and Packaging Requirements (per sample basis)**~~

~~Sample Type~~	~~Sample Container Requirements~~	~~Analyte Group~~	~~Target Sample Volume~~
~~Mammal carcass~~	~~Plastic bag, transferred to amber glass bottle with polyethylene cap prior to laboratory shipment~~	~~PCBs, PEST~~	~~250 g~~
		~~Inorganic chemicals~~	~~50 g~~
		~~Radionuclides~~	~~500 g~~
~~Mammal liver/kidney~~	~~Amber glass bottle with polyethylene cap~~	~~Inorganic chemicals only~~	~~75 g~~

Table B-3. Sample Collection and Packaging Requirements (per sample basis)

Sample Type	Target Biota Sample Mass Per Transect[a]	Pre-Processing Sample Container Requirements	Post-Processing Sample Container Requirements	Analyte Group
Mammal carcass	100 g[b]	Plastic bag	Amber glass bottle or polyethylene bottle with polyethylene cap	Inorganic chemicals, Radionuclides
	75 g[c]	Plastic bag	Amber glass bottles with Teflon-lined cap	Organic compounds
Mammal liver/kidney	1 g[d]	NA	Amber glass bottle or polyethylene bottle with polyethylene cap	Inorganic chemicals only

[a] The information contained in this table is based on laboratory estimates and is subject to change if alternative laboratories are used or laboratory requirements are modified.

[b] One (1) sample container with approximately 100 g of processed mammal carcass composite in 500 ml total digestate. Mixture must remain in solution and not precipitate out. (Tissue settling from digestate may result in inaccurate results.)

[c] A minimum of 25 g of biota sample mass is required to complete the analyses for organic compounds; however, additional mass may be collected to support preparation of laboratory quality control samples (matrix spike/matrix spike duplicate). Collection of a small amount of additional sample mass will also be required to support the possible need to perform PCB congener analysis.

[d] One (1) sample container with approximately 1 g of processed mammal liver/kidney composite in 50 ml total digestate.

Small Mammal Sample Inspection Instructions:

1. Remove samples to be processed from refrigerated locked storage. Keep ~~organism~~ animal sealed in plastic bag until transported to the biological hood in the laboratory.

2. Don latex/rubber gloves, open the bag under the biological hood, remove the specimen from the bag, and observe animal's general external condition.

~~2.~~3. Weigh animal ~~on~~ using a pre-cleaned aluminum or Teflon tared weighing tray and calibrated scale (±0.01 g), ~~digital scale while sealed in bag (0.01 g)~~ and record whole animal weight (0.01 g) on the animal sample processing form.

~~3. Open the bag under the biological hood.~~

~~4. Don latex/rubber gloves.~~

~~5.~~4. ~~Remove specimen from the bag, observe animal's general external condition, and then t~~Thoroughly rinse specimen for approximately 30 seconds in the ~~Teflon~~ pre-cleaned aluminum or Teflon wash tray containing deionized water ~~for approximately 30 seconds~~. (Thoroughly c~~C~~lean ~~container~~ the wash tray with Liqui-nox solution and rinse with deionized water between each small mammal sample rinsing event.)

~~6.~~5. Place specimen on new absorbent towel or a pre-cleaned sheet of aluminum foil (still in biological hood).

~~7.~~6. Thoroughly w~~W~~ash gloves and dissection instruments with Liqui-nox solution and rinse with deionized water.

~~8.~~7. Conduct ~~final~~ general animal condition inspection ~~(gross external necropsy)~~, looking for abnormalities, and record species, age, sex, weight, and reproductive status on the animal sample processing form or in the laboratory record book.

~~9.~~8. Dissect ~~organism~~ animal with pre-cleaned stainless steel scissors and forceps to remove kidneys and liver for composite analysis. Note any unusual coloration or appearance of organs, internal parasites, etc. ~~in the laboratory record book or on~~on the sample processing form.

~~10.~~9. Briefly rinse the target organs with deionized water and place organs on pre-cleaned aluminum or Teflon tared weighing tray (or tared sample bottle) and record organ weights on the animal sample processing form ~~on~~ using a calibrated scale (±0.01 g).

~~11.~~10. Place carcass (whole ~~organism~~ animal minus kidney and liver tissues) in appropriate sample container(s) according to analytes and sample mass requirements prescribed in the sample authorization form.

~~12.~~11. Tissue subsamples for carcass and organs will be prepared separately by blending tissues in a laboratory-grade blender with dry ice for approximately 30 sec to 1 minute to allow homogenization. (NOTE: The tissue should be partly frozen before attempting to homogenize with blender.) (NOTE: A minimum of one equipment blank will be performed on the laboratory grade blender to ensure equipment cleaning procedures are adequate. An equipment blank will be provided to each lab performing analytical work.)

~~13.~~12. Small mammal samples analyzed for non-organic analyses will be ~~require~~ autoclaved~~ing~~ at 121°C for at least 90 minutes or digested in nitric acid to eliminate hantavirus concerns prior to submitting samples to the analytical laboratories. ~~(NOTE: See special container, sample preservation, and preparation requirements for small mammals.) Sterilization should be verified with sterile indicator test device.~~Samples analyzed for semi-volatile organic compounds, PCBs, and pesticides will not be sterilized prior to submission to the analytical laboratory because these samples can-not be digested or autoclaved prior to analyses.

13. Label sample containers consistent with the sample analysis report.

14. Place non-digested samples in the freezer for temporary storage prior to shipment to the analytical laboratories.

15. After all small mammal samples are prepared, thoroughly clean fume hood and all sample processing tools using a disinfectant solution (1% bleach or 5% Lysol). Let solution stand on all surfaces for at least 1 minute before wiping clean.

16. Record pertinent sample preparation activities (deionized water, purity, etc.) in the laboratory record book.

B3.2.2 SAMPLE HANDLING, SHIPPING, AND CUSTODY REQUIREMENTS

All sample handling, shipping, and custody requirements will be consistent with established WRPS procedures and HASQARD (DOE/RL-96-68). Sample transportation shall be in compliance with the applicable regulations for packaging, marking, labeling, and shipping hazardous materials, hazardous substances, and hazardous waste that are mandated by the U.S. Department of Transportation [Title 49 *Code of Federal Regulations* (CFR) 171-177, Chapter 1, "Research and Special Programs Administration, Department of Transportation"; Part 171, "General Information, Regulations, and Definitions," through Part 177, "Carriage by Public Highway"] in association with the International Air Transportation Authority, DOE requirements, and applicable program-specific implementing procedures.

B3.2.3 QUALITY CONTROL REQUIREMENTS

The quality control procedures must be followed in the field and laboratory to ensure that reliable data are obtained. When performing this field sampling effort, care shall be taken to prevent the cross-contamination of sampling equipment, sample bottles, and other equipment that could compromise sample integrity. Each specimen will be thoroughly rinsed for approximately 30 seconds in a pre-cleaned aluminum or Teflon wash tray containing deionized water. Rinsing is intended to remove most exterior soil per HASQARD (DOE/RL-96-68). A minimum of one equipment blank will be performed on the laboratory grade blender to ensure equipment cleaning procedures are adequate. An equipment blank will be provided to each lab performing analytical work. Other typical field quality control (i.e., duplicates, splits, etc.) are not applicable to the small mammal sampling. The WRPS or subcontractor QA plan will be reviewed for consistency with HASQARD (DOE/RL-96-68~~, *Hanford Analytical Services Quality Assurance Requirements* (HASQARD~~).

B3.2.4 INSTRUMENT CALIBRATION AND MAINTENANCE

All field screening and analytical instruments shall be calibrated and maintained in accordance with HASQARD (DOE/RL-96-68). The results from all instrument calibration and maintenance activities shall be recorded in a bound logbook in accordance with procedures outlined in the most recent WRPS procedure for maintenance of field logbooks.

B3.2.5 FIELD DOCUMENTATION

Project documentation and records include field logbooks, field measurement records, chain-of-custody records, analytical data packages, and validation reports. At the direction of the task lead, all data packages and/or validation reports shall be subject to technical review before submittal to regulatory agencies or inclusion in reports/technical memoranda. When appropriate, electronic access shall be through computerized databases (e.g., Hanford Environmental Information System). Where electronic data are not available, hard copies will be provided in accordance with Section 9.6 of the HFFACO~~*Hanford Federal Facility Agreement and Consent Order*~~ (Ecology et al. 1989).

Field documentation shall be kept in accordance with the most recent WRPS procedures for

1. Field logbooks.
2. Environmental site identification and information reporting.
3. Chain of custody.

B4.0 ASSESSMENTS AND RESPONSE ACTIONS

Random surveillance and assessments may be conducted in accordance with the most recent QA plan or its equivalent, TFC-PLN-02, *Quality Assurance Program Description*, for the RCRA corrective action process. Deficiencies identified by one of these assessments shall be reported in accordance with TFC-ESHQ-Q_PP-P-02, "Quality Assurance Surveillances." When appropriate, corrective actions will be taken by the project engineer in accordance with HASQARD Volume 1, Section 4.0, to minimize recurrence.

B5.0 DATA VERIFICATION AND VALIDATION REQUIREMENTS

Data verification and validation are performed on analytical data sets primarily to confirm that sampling and chain-of-custody documentation is complete, sample numbers can be tied to the specific sampling location, samples were analyzed within the required holding times, and analyses met the data quality requirements specified in this SAI. All data verification and validation shall be performed in accordance with Attachment 3 of the main document and the current TFC-PLN-17, *Document Control and Records Management Program.*

B6.0 MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Waste generated by sampling activities will be managed consistent with the most recent waste management plan or its equivalent, TFC-PLN-33, *Waste Management Basis*, for the RCRA corrective action process.

Unused samples and associated laboratory waste for analysis will be dispositioned in accordance with the laboratory contract and agreements. In accordance with 40 CFR 300.440, "National Oil and Hazardous Substances Pollution Contingency Plan," "Procedures for Planning and Implementing Off-Site Response Actions," Remedial Project Manager approval is required before unused samples or waste is returned from offsite laboratories.

B7.0 HEALTH AND SAFETY

All field operations will be performed in accordance with the most recent TFC-PLN-43, *Tank Farm Contractor Health and Safety Plan*, and TFC-PLN-47,*Worker Safety and Health Program*, or their equivalent, for the RCRA Corrective Action Program.

B8.0 REFERENCES

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*, as amended.

49 CFR ~~171-177~~, "Transportation," Parts 171 through 177, *Code of Federal Regulations*, as amended.

AVMA 1986, "AVMA Panel on Euthanasia," *JAVMA*, Vol 188(3), pp. 252-68.

~~BHI-01757, 2005, *DQO Summary Report for the 100 Area and 300 Area Component of the RCBRA*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.~~

DOE/RL-96-68, 2007, *Hanford Analytical Services Quality Assurance Requirements Documents (HASQARD),* Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2005-22, 2005, *100-NR-2 Study Area Ecological Risk Assessment Sampling and Analysis Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

EPA/600/R-93/187, 1993, *Wildlife Exposure Factors Handbook*, Office of Health and Environmental Assessment, U.S. Environmental Protection Agency, Washington, D.C. Available on the Internet at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=2799

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

RPP-35484, 2007, *Field Investigation Report for Waste Management Areas C and A-AX,* Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-PLAN-39114, 2010, *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, Rev. 1A, Washington River Protection Solutions, Richland, Washington.

RPP-RPT-38152, 2008, *Data Quality Objectives Report Phase 2 Characterization for Waste Management Area C RCRA Field Investigation/Corrective Measures Study*, Rev. 0, Washington River Protection Solutions, Richland, Washington.

SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, Third Edition, as amended, U.S. Environmental Protection Agency, Washington, D.C., September 1986.

~~WMP-20570, 2004, *Central Plateau Terrestrial Ecological Risk Assessment Data Quality Objectives Summary Report,* Rev. 0, Fluor Hanford, Inc., Richland, Washington.~~

TFC-ESHQ-Q_PP-P-02, as revised, "Quality Assurance Surveillances," Washington River Protection Solutions LLC, Richland, Washington.

TFC-PLN-02, as revised, *Quality Assurance Program Description,* Washington River Protection Solutions LLC, Richland, Washington.

TFC-PLN-17, as revised, *Document Control and Records Management Program Description*, Washington River Protection Solutions LLC, Richland, Washington.

TFC-PLN-33, as revised, *Waste Management Basis*, Washington River Protection Solutions LLC, Richland, Washington.

TFC-PLN-43, as revised, *Tank Farm Contractor Health and Safety Plan*, Washington River Protection Solutions LLC, Richland, Washington.

TFC-PLN-47, as revised, *Worker Safety and Health Program*, Washington River Protection Solutions LLC, Richland, Washington.

WAC 173-340-7493, "Site-Specific Terrestrial Ecological Evaluation Procedures," *Washington Administrative Code*, as amended.

WHC-SD-EN-TI-122, 1993, *Biological Uptake of 300-FF-5 Operable Unit Contaminants*, Westinghouse Hanford Company, Richland, Washington.

WMP-20570, 2004, *Central Plateau Terrestrial Ecological Risk Assessment Data Quality Objectives Summary Report,* Rev. 0, Fluor Hanford, Inc., Richland, Washington.

WMP-23141, 2004, *100-NR-2 Groundwater Operable Unit Ecological Risk Assessment Data Quality Objectives Summary Report*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

This page intentionally left blank

1

TRI-PARTY AGREEMENT

Change Notice Number TPA-CN- 422	TPA CHANGE NOTICE FORM	Date: February 15, 2011
Document Number, Title, and Revision: RPP-PLAN-38777, Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C		Date Document Last Issued: October 6, 2010
Originator: A.M. Templeton		Phone: 373-5589

Description of Change:
Revise Table 5-3, Required Detection Limits for Non-Radionuclides by adding Cyanide and its required detection limit.

R.W. Lober (**DOE**) and J. Lyon (**Lead Regulatory Agency**) agree that the proposed change modifies an approved workplan/document and will be processed in accordance with the Tri-Party Agreement Action Plan, Section 9.0, *Documentation and Records*, and not Chapter 12.0, *Changes to the Agreement*.

Table 5-3 of RPP-PLAN-38777, Rev. 2, is modified as follows.

- Cyanide is added to the table under a subheading entitled "Other Inorganics." Cyanide is identified as a Single-Shell Tank Primary contaminant, and the required detection limit of 0.5 mg/kg is added to the table.
- A footnote is added to the table identifying that this required detection limit is needed to meet the Model Toxics Control Act 3-phase model derived soil concentrations for the protection of groundwater.

Additionally, Section 8.0, References, has been modified to include the Model Toxics Control Act, Chapter 173-340 of the Washington Administrative Code.

Note: Include affected page number(s)

Justification and Impacts of Change:

This required detection limit is needed to meet the Model Toxics Control Act 3-Phase model derived soil concentrations for protection of groundwater for cyanide.

Approvals:

DOE Project Manager	2-25-11 Date	[✓] Approved [ ] Disapproved
EPA Project Manager	Date	[ ] Approved [ ] Disapproved
Ecology Project Manager	2-25-11 Date	[✓] Approved [ ] Disapproved

A-6005-413 (REV 1)

U.S. Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

11-TPD-020

MAR 2 3 2011

Mr. Jeffrey Lyon
Tank Waste Storage Project Manager
Nuclear Waste Program
State of Washington
Department of Ecology
3100 Port of Benton Blvd
Richland, Washington 99352

Dear Mr. Lyon:

ORGANIC ANALYSES OPTIMIZATION FOR WASTE MANAGEMENT AREA (WMA) C

References:
1. *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, RPP-PLAN-39114, Revision 1," dated March 29, 2010.
2. *Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C*, RPP-PLAN-3877, Revision 2, dated October 06, 2010.

The U.S. Department of Energy, Office of River Protection (ORP) is performing soil sampling and analysis in WMA C to support a Phase 2 RCRA Facility Investigation Report. In accordance with Section 3.5.2 of RPP-PLAN-39114, Rev. 1A (Reference 1) and Section 4.1.1 of RPP-PLAN-38777, Rev. 2 (Reference 2), the suite of organic analytes has been reviewed and optimization is warranted. Five sites were identified in RPP-PLAN-39114 for organic analysis, three locations associated with Unplanned Release (UPR) 81 (Site P) and two locations associated with Single Shell Tank (SST) C-103 (Site L). Additional sites sampled for the full suites of organic constituents also include Sites E, F, G, H, I, R and U. Tributyl phosphate, the selected indicator organic for the occurrence of any organic contamination associated with tank waste, was not identified in any of the samples.

While organic constituents were detected in a number of samples, many are associated with common laboratory contaminants or corresponding detections in the blanks. Available organic data was presented at the monthly WMA C meeting in October 2010 and at the January 2011 Performance Assessment meeting. Additional data was provided to the State of Washington Department of Ecology on February 9, 2011. Based on review of this data and the process defined in the work plan, the list of analytical constituents for WMA C should be optimized to focus on the constituents of highest concern.

MAR 2 3 2011

In particular, technetium-99 and cyanide have been targeted for improved detection limits, quality control, and further investigations, as required. Additionally, the optimization of organics will make sample volume available to perform the remaining constituents with full quality control and allow for re-analyses, where necessary.

It is proposed that the organic analyses be optimized by eliminating the following methods for the remainder of the WMA C sampling activities:

- Volatile organics (VOC)
- Ethylene glycol
- Monobutyl and dibutyl phosphate
- PCB congeners
- Gasoline range organics (GRO)
- Diesel range organics (DRO)

It is also suggested that the following organics continue to be analyzed in WMA C:

- Semi-volatile organics (SVOC), including tributyl phosphate
- PCB Aroclors
- Pesticides

In addition to the organic constituents discussed above, it is recommended that sulfide be omitted from the list of chemicals of potential concern. The single-shell tank closure data quality objectives was modified to remove sulfide as a constituent associated with tank waste; therefore, sampling for sulfide in WMA C soils should also be discontinued.

It is recommended these changes be made effective for the fiscal year 2011 sampling activities in WMA C. If you agree with these recommended changes to the work plan (RPP-PLAN-39114 and sampling and analyses plan, please respond with your concurrence within 30 days of this request.

If you have further questions, please contact me or your staff may contact Mr. Robert W. Lober, Tank Farm Programs and Projects Division at (509) 373-7949.

Sincerely,

Thomas W. Fletcher, Acting Assistant Manager
Tank Farms Project

TPD:RWL

cc: See Distribution List (Page 3)

MAR 2 3 2011

cc:
Administrative Record
Environmental Portal
WRPS Correspondence

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • (509) 372-7950
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

June 1, 2011 11-NWP-053

Mr. Robert Lober
Office of River Protection
United States Department of Energy
P.O. Box 450, MSIN: H6-60
Richland, Washington 99352

Re: Organic Analyses Optimization for Waste Management Area (WMA) C

Dear Mr. Lober:

This letter is in response to your letter regarding organic analyses optimization for WMA C. We strongly agree with the need to optimize and focus on the constituents of highest concern. The State of Washington Environmental Accreditation Department conducted an on-site visit to ATL 222-S Laboratory on April 13 and 14, 2011. A member of my staff accompanied this visit. The team was favorably impressed with the analytical and technical capability of the laboratory team, responsiveness of the staff, attention to detail, and focus on quality control issues. The team made a number of recommendations to the laboratory that can be utilized in achieving this optimization.

My staff has reviewed the analytical data, associated quality control, and supporting documentation. We agree with your proposal to eliminate sampling and analyses for the six methods defined in your letter, elimination of sulfide as an analyte, and retention of the three methods. We authorize you to implement these directions immediately and acknowledge that these requirements were used for the slant push at WMA tank C-104. We further strongly encourage that all parties begin to discuss areas of further optimization. These areas include:

- The inorganic and organic analyte list
- A greater utilization and reliance on electronic records
- A review of the data requirements and needs for this project

We feel that in evaluating the data needs, we can reduce the time and effort necessary to produce the data package that will support the requirements of M-045-81. We agree with the recommended changes for organic analyses and their incorporation into the work plan (RPP-PLAN-39114) and the sampling and analyses plan (RPP-PLAN-38777). We would like to begin discussions as soon as possible.

If you have any further questions or clarifications, please contact me at 509-372-7914.

Sincerely,

Jeffery J. Lyon
Tank Waste Storage Project Manager
Nuclear Waste Program

mb/dbm
cc: see next page

Reference: Letter 11-TPD-020, dated March 23, 2011, from T. W. Fletcher, USDOE-ORP, to Jeffrey Lyon, Ecology, *Organic Analyses Optimization for Waste Management Area (WMA) C*

cc: Dennis Faulk, EPA
Stuart Harris, CTUIR
Gabriel Bohnee, NPT
Russell Jim, YN
Susan Leckband, HAB
Ken Niles, ODOE
Administrative Record:
Environmental Portal
USDOE-ORP Correspondence Control
WRPS Correspondence Control

RUTSRDT-58339-Rt of/DRAFT
U.S. Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

11-TF-153

JAN 05 2012

Mr. Jeffrey Lyon
Tank Waste Storage Project Manager
Nuclear Waste Program
State of Washington
Department of Ecology
3100 Port of Benton Blvd
Richland, Washington 99352

Dear Mr. Lyon:

SUBMITTAL OF PROPOSED CHANGE NOTICE FOR THE WASTE MANAGEMENT AREA (WMA) C PHASE 2 RESOURCE CONSERVATION AND RECOVERY ACT OF 1976 (RCRA) FIELD INVESTIGATION WORK PLAN AND SAMPLING AND ANALYSIS PLAN

References:
1. RPP-PLAN-39114, Revision 2, Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, dated January 2012.
2. RPP-PLAN-38777, Revision 3, Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C, dated January 2012.

This letter transmits proposed changes to the WMA C Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan and the associated Sampling and Analysis Plan. These documents have been previously submitted and approved in completion of Hanford Federal Facilities Agreement and Consent Order (HFFACO) milestone M-045-60. The proposed changes have been developed collaboratively in a series of meetings between the State of Washington, Department of Ecology and the U.S. Department of Energy, Office of River Protection. The meetings where the proposed changes were identified have been documented in meeting minutes and entered into the HFFACO Administrative Record.

The proposed changes are shown in red-line/strike out for each document. A HFFACO change notice is provided, explaining the changes for each document. Please respond to this notice by February 10, 2012.

JAN 05 2012

If you have any questions, please contact Robert W. Lober, Tank Farms Programs and Projects Division, (509) 373-7949.

Sincerely,

Thomas W. Fletcher, Assistant Manager
Tank Farms Project

TPD:RWL

Attachments

cc w/attachs:
S. Harris, CTUIR
M.W. Barnes, Ecology
C. L. Whalen, Ecology
D. A. Faulk, EPA
S. L. Leckband, HAB
G. Bohnee, NPT
K. Niles, ODOE
M. Hendrickson, WDOE
M. P. Connelly, WRPS
S. J. Eberlein, WRPS
J. J. Luke, WRPS
M. G. Peloquin, WRPS
R. Jim, YN
Administrative Record
Environmental Portal
WRPS Correspondence

ATTACHMENT 1

11-TF-153

***Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, RPP-PLAN 39114, Rev 1B**

Office of River Protection, State of Washington Department of Ecology
Change Notice
(Per Hanford Federal Facility Agreement and Consent Order Section 9.3)

1. Document Title and Number: *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, RPP-PLAN 39114, Rev 1B		
2. Minor Field Change: (Section 12.4 HFFACO Action Plan) ☐ Yes: (WRPS Signature Only – Attach signed form to Primary Document for record purposes) x No: Proceed to Box 3	3. Document Issue Date: 03/02/2011 4. Document Modification Notice Date: 11/28/2011	5. Notice Number: **2011-7**
6. Do proposed changes require schedule changes? (Would this extend completion of retrieval beyond 12 months from date of initiation?) ☐ Yes x No	7. Do proposed changes include specific additions, deletions, or modification to scope and/or requirements which affect the overall intent of the plan? ☐Yes x No	8. (Check only one box) ☐ Significant Modification (Check if the answer to question in either section 6 or 7 is "yes". Significant modifications require revision of the primary document.) Minor Modification Requires modification of the document x Can be accomplished with Change Notice.

9. Description and Justification of Change:

Description: A change is needed to incorporate information gained from the characterization activities already completed in Waste Management Area (WMA) C under this work plan and other characterization tasks, and to modify future characterization activities listed in this work plan accordingly. Text and figures are added with updated information. Proposed changes were discussed and documented in a series of meetings between Office of River Protection and Washington State Department of Ecology, supported by Washington River Protection Solutions. Detailed specific changes and the explanation for the changes are described below.

Explanation:

- Pp i-iii (Executive Summary) are updated to incorporate current status of WMA C characterization
- Pp iv-iX, Table ES-1 is updated to add a status column showing status of sampling through November 2011, to provide current information on Access Availability for sampling locations, to modify plans for Sites C and D based on technology advances, to delete activities deemed no longer necessary based on emerging information, to add analysis of archived soil samples from well 299-E27-20, and to add a new direct push sampling site near tank C-105
- P x, figure ES-1 is revised to match the revisions in Table ES-1
- The table of contents and lists of figures and tables have been updated to reflect changes to document
- Pp xxi-xxii are updated to clarify acronyms
- Pp 1-1, 1-3, 1-4, 1-5 text is updated to reflect the current milestones in the HFFACO
- Pp 1-6 and 1-7 show editorial corrections
- Pp 3-29 and 3-30, Table 3-1 schedule for WMA C performance assessment working sessions is updated to show actual completed and remaining working sessions
- Pp 3-43 – 3-45, the sampling optimization strategy from the DQO and its application are clarified
- Pp 3-45 - 3-49, application of the organic sampling optimization strategy, the results of sampling,

Office of River Protection, State of Washington Department of Ecology
Change Notice
(Per Hanford Federal Facility Agreement and Consent Order Section 9.3)

and decisions made for future sample analysis upon review of those results are discussed

- P 4-7, updated information from the recent leak loss re-assessment is included
- Pp 4-8 -4-10, changes describe modifications to the original plan that have been agreed upon, based on information generated as the characterization effort proceeded
- P 4-11, Figure 4-2 is updated to reflect revised plans
- Pp 4-13, 4-14 describe modified plans to address movement of contaminants down the stratographic dip
- Pp 4-15, 4-15 describe modified plans to address potential unknown leaks
- Pp 4-17 describe advances in surface geophysical exploration (SGE) technology and other results being used to modify future planning
- Table 4-1 is updated to correspond to table ES-1
- Pp 4-22 and 4-23 describe the basis for the changes to table 4-1
- Figures 4-3 through 4-5 are inserted to show comparison between gamma logging sites with different tools
- Figures 4-6 and 4-7 are updated to reflect revised plans
- Pp 4-36, 4-37, Editorial changes are made to clarify text
- P 4-38, a new section 4.5.2 is added to describe plans to analyze archived soil samples
- P 4-39 status and revisions to plans for drywell logging are described
- Pp 4-39 – 4-41, progress in application of SGE is described, and revised plans based on recent results are included
- P 6-1, 6-2 updates to the schedule are described
- Figure 6-1 shows updated schedule with completed work and current plans
- Additional editorial corrections and updates to references are included throughout
- Reference list is updated to include additional reference documents

10. Impact of Change:

Change revises remaining field characterization activities and schedule to reflect information needed to develop the Phase 2 RFI/CMS report for Waste Management Area C. Change documents revisions that have been agreed to in a series of meetings among Ecology, ORP and the tank operations contractor.

11. Additional Requirements and/or Provisions[1]:

Approvals

Washington River Protection Solutions, LLC. for Kent Smith, via email	Office of River Protection	State of Wash., Dept. of Ecology
☐ Provisional Approval[2] Date	☑ Provisional Approval[2] Date	☐ Provisional Approval[2] Date
☒ Final Approval Date 12/21/11	☒ Final Approval Date 1/4/12	☐ Final Approval Date

Notes

Office of River Protection, State of Washington Department of Ecology
Change Notice
(Per Hanford Federal Facility Agreement and Consent Order Section 9.3)

1 - For use by Ecology to identify any additional information needed to make a decision regarding the change notice. In addition, Ecology will identify actions, if any, regarding the change notice that DOE may take pending Ecology's final decision
2 – Provisional approval allows DOE and its contractors to take specific actions identified in section 10, prior to final approval of this change notice.

ATTACHMENT 2

11-TF-153

***Sampling and Analysis Plan For Phase 2 Characterization of Vadose Zone Soil In Waste Management Area C*, RPP-PLAN 3877 Rev.2A**

Office of River Protection, State of Washington Department of Ecology
Change Notice
(Per Hanford Federal Facility Agreement and Consent Order Section 9.3)

1. Document Title and Number: *Sampling And Analysis Plan For Phase 2 Characterization Of Vadose Zone Soil In Waste Management Area C*, RPP-PLAN 3877 Rev.2A		
2. Minor Field Change: (Section 12.4 HFFACO Action Plan) ☐ Yes: (WRPS Signature Only – Attach signed form to Primary Document for record purposes) **x** No: Proceed to Box 3	**3.** Document Issue Date: 2/28/2011 **4.** Document Modification Notice Date: 11/28/2011	**5.** Notice Number: **2011-6**
6. Do proposed changes require schedule changes? (Would this extend completion of retrieval beyond 12 months from date of initiation?) ☐ Yes **x** No	**7.** Do proposed changes include specific additions, deletions, or modification to scope and/or requirements which affect the overall intent of the plan? ☐ Yes **x** No	**8.** (Check only one box) ☐ Significant Modification (Check if the answer to question in either section 6 or 7 is "yes". Significant modifications require revision of the primary document.) Minor Modification Requires modification of the document **x** Can be accomplished with Change Notice.

9. Description and Justification of Change:

Description: : A change is needed to incorporate information gained from the characterization activities already completed in Waste Management Area (WMA) C under this sampling and analysis plan (SAP) and other characterization tasks, and to modify future characterization activities listed in this SAP accordingly. Changes to the governing work plan (RPP-PLAN-39114) are flowed into this revision of the SAP. Text and figures are added with updated information. Proposed changes were discussed and documented in a series of meetings between Office of River Protection and Washington State Department of Ecology, supported by Washington River Protection Solutions. Detailed specific changes and the explanation for the changes are described below.

Explanation:

- P 1-1, objectives are updated to summarize changes based on integration of results to date, derived from the modified work plan
- P 2-1, editorial corrections and clarification of acronyms are added
- P 3-1, text added to clarify sequence of events
- Table 3-1, p 3-3 and following, updates provided to match the completed and planned characterization events as described in RPP-PLAN-39114
- Pp 3-11, 3-12, clarifications to better describe direct push activities, with additional information regarding the performance of slant direct push
- P 3-13, editorial corrections
- P 3-14, revised plan for characterization near C-203 is described, as in the revised work plan
- P 3-14 additional detail is added on the handling of radioactive soil samples
- Figure 3-1 is updated to reflect the revised plan
- Figure 3-2 is updated to reflect the revised plan
- Figure 3-3 is updated to reflect the revised plan
- Pp 3-20, 3-21 editorial changes are made

Office of River Protection, State of Washington Department of Ecology
Change Notice
(Per Hanford Federal Facility Agreement and Consent Order Section 9.3)

- P 4-1, first paragraph clarifies detection limits
- P 4-1, section 4.1, describes current application of optimization approach
- Figure 4-1, optimization approach application is clarified in the figure
- P 4-6, editorial changes and acronyms defined
- P 4-7, changes to analysis resulting from the integration of sample results to date are documented
- Table 4-1 is revised to incorporate additional information on methods, holding time, and detection limits, previously spread across multiple tables. In addition, the analytes previously listed in table 4-2 are incorporated into table 4-1
- Tables 4-2, 4-3, 4-4 and 4-5 are deleted because information has moved into Table 4-1
- P 4-23, reporting of TICs into HEIS is clarified
- Tables 4-6 and 4-7 are deleted because the information has moved into Table 4-1
- Pp 5-1, 5-2 QA requirements are clarified
- Table 5-1, Quality assurance acceptance criteria are described by constituent class, rather than by analytical method
- P 5-5, inclusion of detection limits in Tables 5-2 and 5-2 is better described
- Tables 5-2, 5-3 , 5-4, 5-5 are modified to delete columns that are redundant with Table 4-1, and to update required analytic methods as appropriate
- Page A-8, Table A-1, information is added to show prioritization of analyses
- Table A-2 (formerly A-1) is updated to combine appropriate categories of sample analyses
- Minor editorial corrections, specification of acronyms, and addition of references occur throughout the document

10. Impact of Change:

Change revises remaining field characterization activities and schedule to reflect information needed to develop the Phase 2 RFI/CMS report for Waste Management Area C. Change documents revisions that have been agreed to in a series of meetings among Ecology, ORP and the tank operations contractor.

11. Additional Requirements and/or Provisions[1]:

Approvals

Washington River Protection Solutions, LLC. for Kent Smith via Email	Office of River Protection	State of Wash., Dept. of Ecology
☐ Provisional Approval[2] Date	☒ Provisional Approval[2] Date	☐ Provisional Approval[2] Date
☒ Final Approval Date 12-21-11	☒ Final Approval Date 1/4/12	☐ Final Approval Date

Notes

1 - For use by Ecology to identify any additional information needed to make a decision regarding the change notice. In addition, Ecology will identify actions, if any, regarding the change notice that DOE may take pending Ecology's final decision

2 – Provisional approval allows DOE and its contractors to take specific actions identified in section 10, prior to final approval of this change notice.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • (509) 372-7950
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

May 8, 2012 12-NWP-071

Mr. Christopher Kemp
United States Department of Energy
Office of River Protection
P.O. Box 450, MSIN: H6-60
Richland, Washington 99352

Re: Proposed Changes to RPP-PLAN-39114 and RPP-PLAN-38777

Dear Mr. Kemp:

The Department of Ecology (Ecology) has reviewed the proposed changes for both the *Phase 2 Resource Conservation and Recovery Act (RCRA) Facility Investigation/Corrective Measures Study (RFI/CMS) Work Plan for Waste Management Area C* (RPP-PLAN-39114) and the *Sample and Analysis Plan for Phase 2 Characterization of Vadose Zone in Waste Management Area C* (RPP-PLAN-38777). We approve the proposed changes in both documents. The information obtained from these RFI/CMS activities is important in the completion of the Waste Management Area (WMA) C Performance Assessment.

Ecology appreciates the cooperative and collaborative development for these documents. However, we remain concerned that the United States Department of Energy (USDOE) has suspended the discussions on development of the RFI/CMS Report identified in Milestone M-045-61, which is due 12/31/2014. Continuing that collaboration, to ensure that the agencies are in agreement on content, would provide a more efficient review period. Our hope is to be able to respond and resolve comments in a timely manner so that we can support Hanford Federal Facility Agreement and Consent Order Milestones, M-045-62, "*Submit a Phase 2 Corrective Measures Implementation Plan for WMA-C*", due 06/30/2015 and M-045-82, "Submit a permit modification to support final closure requirements for WMA-C", due 9/30/2015.

Ecology acknowledges that the field work and laboratory analysis work for the RFI/CMS has been stopped and some analytical activities were left incomplete. We want to emphasize the importance of completing the validation, documentation, and evaluation of the field work data (RPP-39114, Section 5). We strongly urge its completion. These efforts will enable all parties to understand the purpose and importance of the remaining work that is planned (RPP-39114, Section 4.5).

Ecology anticipates that the following actions are necessary to support the completion of the RCRA RFI/CMS Study work:

1) USDOE Office of River Protection (ORP) will release a final revision of these two documents as approved
2) Complete work identified in work plan

3) Provide the date for submittal and completion of:
   a) The validation, documentation, and evaluation of the analytical data from FY2010 and FY2011
   b) The following reports:
      i) Tc-99 laboratory interferences
      ii) Evaluation of the organic detects in WMA C groundwater wells
      iii) Latest trending of groundwater contaminants at WMA C groundwater wells
      iv) Evaluation of the Quality Assurance/Quality Control and holding time issues associated with the 222-S shutdown in summer of 2011
4) Submit the revised *Hanford C-Farm Leak Assessment Report* (RPP-ENV-33418)

With the completion of these actions, USDOE-ORP and Ecology can discuss the information and agree to any needed changes or actions to complete the field work, or determine that USDOE-ORP has completed the necessary field work for the work plan. These actions will allow for immediate and final implementation of the work plan when available funding can be obtained to support Milestone M-045-61, which is due 12/31/2014.

If there are any questions, please contact Michael Barnes at 509-372-7927.

Sincerely,

Jeffery J. Lyon
Project Manager
Tank System Operations and Closure

mb/dbm

cc:

Dennis Faulk, EPA	Gabriel Bohnee, NPT
Scott Samuelson, USDOE	Russell Jim, YN
Bruce Sullivan, LMSI	Isabelle Wilder, Wanapum
Jennifer Ollero, MSA	Susan Leckband, HAB
Rob Piippo, MSA	Ken Niles, ODOE
Judy Vance, MSA	John Martell, DOH
Janet Badden, WRPS	Administrative Record: Tank Waste Storage M-45-101
Susan Eberlein, WRPS	Environmental Portal
Steve Killoy, WRPS	USDOE-ORP Correspondence Control
Jeff Luke, WRPS	WRPS Correspondence Control
Stuart Harris, CTUIR	

Office of River Protection, State of Washington Department of Ecology
Change Notice
(Per Hanford Federal Facility Agreement and Consent Order Section 9.3)

1. Document Title and Number: *Sampling And Analysis Plan For Phase 2 Characterization Of Vadose Zone Soil In Waste Management Area C*, RPP-PLAN 3877 Rev.2A		
2. Minor Field Change: (Section 12.4 HFFACO Action Plan) ☐ Yes: (WRPS Signature Only – Attach signed form to Primary Document for record purposes) x No: Proceed to Box 3	3. Document Issue Date: 2/28/2011 4. Document Modification Notice Date: 11/28/2011	5. Notice Number: **2011-6** RECEIVED JUN 29 2012 EDMC
6. Do proposed changes require schedule changes? (Would this extend completion of retrieval beyond 12 months from date of initiation?) ☐ Yes x No	7. Do proposed changes include specific additions, deletions, or modification to scope and/or requirements which affect the overall intent of the plan? ☐ Yes x No	8. (Check only one box) ☐ Significant Modification (Check if the answer to question in either section 6 or 7 is "yes". Significant modifications require revision of the primary document.) Minor Modification Requires modification of the document x Can be accomplished with Change Notice.

9. Description and Justification of Change:

Description: : A change is needed to incorporate information gained from the characterization activities already completed in Waste Management Area (WMA) C under this sampling and analysis plan (SAP) and other characterization tasks, and to modify future characterization activities listed in this SAP accordingly. Changes to the governing work plan (RPP-PLAN-39114) are flowed into this revision of the SAP. Text and figures are added with updated information. Proposed changes were discussed and documented in a series of meetings between Office of River Protection and Washington State Department of Ecology, supported by Washington River Protection Solutions. Detailed specific changes and the explanation for the changes are described below.

Explanation:

- P 1-1, objectives are updated to summarize changes based on integration of results to date, derived from the modified work plan
- P 2-1, editorial corrections and clarification of acronyms are added
- P 3-1, text added to clarify sequence of events
- Table 3-1, p 3-3 and following, updates provided to match the completed and planned characterization events as described in RPP-PLAN-39114
- Pp 3-11, 3-12, clarifications to better describe direct push activities, with additional information regarding the performance of slant direct push
- P 3-13, editorial corrections
- P 3-14, revised plan for characterization near C-203 is described, as in the revised work plan
- P 3-14 additional detail is added on the handling of radioactive soil samples
- Figure 3-1 is updated to reflect the revised plan
- Figure 3-2 is updated to reflect the revised plan
- Figure 3-3 is updated to reflect the revised plan
- Pp 3-20, 3-21 editorial changes are made

WMA-C

Office of River Protection, State of Washington Department of Ecology
Change Notice
(Per Hanford Federal Facility Agreement and Consent Order Section 9.3)

- P 4-1, first paragraph clarifies detection limits
- P 4-1, section 4.1, describes current application of optimization approach
- Figure 4-1, optimization approach application is clarified in the figure
- P 4-6, editorial changes and acronyms defined
- P 4-7, changes to analysis resulting from the integration of sample results to date are documented
- Table 4-1 is revised to incorporate additional information on methods, holding time, and detection limits, previously spread across multiple tables. In addition, the analytes previously listed in table 4-2 are incorporated into table 4-1
- Tables 4-2, 4-3, 4-4 and 4-5 are deleted because information has moved into Table 4-1
- P 4-23, reporting of TICs into HEIS is clarified
- Tables 4-6 and 4-7 are deleted because the information has moved into Table 4-1
- Pp 5-1, 5-2 QA requirements are clarified
- Table 5-1, Quality assurance acceptance criteria are described by constituent class, rather than by analytical method
- P 5-5, inclusion of detection limits in Tables 5-2 and 5-2 is better described
- Tables 5-2, 5-3 , 5-4, 5-5 are modified to delete columns that are redundant with Table 4-1, and to update required analytic methods as appropriate
- Page A-8, Table A-1, information is added to show prioritization of analyses
- Table A-2 (formerly A-1) is updated to combine appropriate categories of sample analyses
- Minor editorial corrections, specification of acronyms, and addition of references occur throughout the document

10. Impact of Change:

Change revises remaining field characterization activities and schedule to reflect information needed to develop the Phase 2 RFI/CMS report for Waste Management Area C. Change documents revisions that have been agreed to in a series of meetings among Ecology, ORP and the tank operations contractor.

11. Additional Requirements and/or Provisions[1]:

Approvals

Washington River Protection Solutions, LLC. for Kent Smith via Email	Office of River Protection	State of Wash., Dept. of Ecology
☐ Provisional Approval[2] Date	☐ Provisional Approval[2] Date	☐ Provisional Approval[2] Date
☒ Final Approval Date 12-21-11	☒ Final Approval Date 1/4/12	☒ Final Approval Date 6/6/12

Notes

1 - For use by Ecology to identify any additional information needed to make a decision regarding the change notice. In addition, Ecology will identify actions, if any, regarding the change notice that DOE may take pending Ecology's final decision

Office of River Protection, State of Washington Department of Ecology
Change Notice
(Per Hanford Federal Facility Agreement and Consent Order Section 9.3)

2 – Provisional approval allows DOE and its contractors to take specific actions identified in section 10, prior to final approval of this change notice.

1215065

Office of River Protection, State of Washington Department of Ecology
Change Notice
(Per Hanford Federal Facility Agreement and Consent Order Section 9.3)

1. Document Title and Number: *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, RPP-PLAN 39114, Rev 1B		
2. Minor Field Change: (Section 12.4 HFFACO Action Plan) ☐ Yes: (WRPS Signature Only – Attach signed form to Primary Document for record purposes) x No: Proceed to Box 3	3. Document Issue Date: 03/02/2011 4. Document Modification Notice Date: 11/28/2011	5. Notice Number: 2011-7 RECEIVED JUN 29 2012 EDMC
6. Do proposed changes require schedule changes? (Would this extend completion of retrieval beyond 12 months from date of initiation?) ☐ Yes x No	7. Do proposed changes include specific additions, deletions, or modification to scope and/or requirements which affect the overall intent of the plan? ☐Yes x No	8. (Check only one box) ☐ Significant Modification (Check if the answer to question in either section 6 or 7 is "yes". Significant modifications require revision of the primary document.) Minor Modification Requires modification of the document x Can be accomplished with Change Notice.

9. Description and Justification of Change:

Description: A change is needed to incorporate information gained from the characterization activities already completed in Waste Management Area (WMA) C under this work plan and other characterization tasks, and to modify future characterization activities listed in this work plan accordingly. Text and figures are added with updated information. Proposed changes were discussed and documented in a series of meetings between Office of River Protection and Washington State Department of Ecology, supported by Washington River Protection Solutions. Detailed specific changes and the explanation for the changes are described below.

Explanation:

- Pp i-iii (Executive Summary) are updated to incorporate current status of WMA C characterization
- Pp iv-iX, Table ES-1 is updated to add a status column showing status of sampling through November 2011, to provide current information on Access Availability for sampling locations, to modify plans for Sites C and D based on technology advances, to delete activities deemed no longer necessary based on emerging information, to add analysis of archived soil samples from well 299-E27-20, and to add a new direct push sampling site near tank C-105
- P x, figure ES-1 is revised to match the revisions in Table ES-1
- The table of contents and lists of figures and tables have been updated to reflect changes to document
- Pp xxi-xxii are updated to clarify acronyms
- Pp 1-1, 1-3, 1-4, 1-5 text is updated to reflect the current milestones in the HFFACO
- Pp 1-6 and 1-7 show editorial corrections
- Pp 3-29 and 3-30, Table 3-1 schedule for WMA C performance assessment working sessions is updated to show actual completed and remaining working sessions
- Pp 3-43 – 3-45, the sampling optimization strategy from the DQO and its application are clarified
- Pp 3-45 - 3-49, application of the organic sampling optimization strategy, the results of sampling,

WMA-C

Office of River Protection, State of Washington Department of Ecology
Change Notice
(Per Hanford Federal Facility Agreement and Consent Order Section 9.3)

and decisions made for future sample analysis upon review of those results are discussed

- P 4-7, updated information from the recent leak loss re-assessment is included
- Pp 4-8 -4-10, changes describe modifications to the original plan that have been agreed upon, based on information generated as the characterization effort proceeded
- P 4-11, Figure 4-2 is updated to reflect revised plans
- Pp 4-13, 4-14 describe modified plans to address movement of contaminants down the stratographic dip
- Pp 4-15, 4-15 describe modified plans to address potential unknown leaks
- Pp 4-17 describe advances in surface geophysical exploration (SGE) technology and other results being used to modify future planning
- Table 4-1 is updated to correspond to table ES-1
- Pp 4-22 and 4-23 describe the basis for the changes to table 4-1
- Figures 4-3 through 4-5 are inserted to show comparison between gamma logging sites with different tools
- Figures 4-6 and 4-7 are updated to reflect revised plans
- Pp 4-36, 4-37, Editorial changes are made to clarify text
- P 4-38, a new section 4.5.2 is added to describe plans to analyze archived soil samples
- P 4-39 status and revisions to plans for drywell logging are described
- Pp 4-39 – 4-41, progress in application of SGE is described, and revised plans based on recent results are included
- P 6-1, 6-2 updates to the schedule are described
- Figure 6-1 shows updated schedule with completed work and current plans
- Additional editorial corrections and updates to references are included throughout
- Reference list is updated to include additional reference documents

10. Impact of Change:

Change revises remaining field characterization activities and schedule to reflect information needed to develop the Phase 2 RFI/CMS report for Waste Management Area C. Change documents revisions that have been agreed to in a series of meetings among Ecology, ORP and the tank operations contractor.

11. Additional Requirements and/or Provisions[1]:

Approvals

Washington River Protection Solutions, LLC. for Kent Smith, via email	Office of River Protection	State of Wash., Dept. of Ecology
☐ Provisional Approval[2] Date	☒ Provisional Approval[2] Date	☐ Provisional Approval[2] Date
☒ Final Approval Date 12/21/11	☒ Final Approval Date 1/4/12	☒ Final Approval Date 6/6/12

Notes

Office of River Protection, State of Washington Department of Ecology
Change Notice
(Per Hanford Federal Facility Agreement and Consent Order Section 9.3)

1 - For use by Ecology to identify any additional information needed to make a decision regarding the change notice. In addition, Ecology will identify actions, if any, regarding the change notice that DOE may take pending Ecology's final decision
2 – Provisional approval allows DOE and its contractors to take specific actions identified in section 10, prior to final approval of this change notice.

U.S. Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

12-TF-0035

SEP 0 7 2012

Mr. Jeffrey Lyon
Tank Waste Storage Project Manager
Nuclear Waste Program
State of Washington
Department of Ecology
3100 Port of Benton Blvd
Richland, Washington 99352

Dear Mr. Lyon:

TRANSMITTAL OF DOCUMENT REVISIONS FOR WASTE MANAGEMENT AREA (WMA) C CLOSURE ACTIVITIES AND ONGOING SOIL MEDIA WORK

References:

1. ORP letter from T. W. Fletcher to J. Lyon, Ecology, "Submittal of Proposed Change Notice for the Waste Management Area (WMA) C Phase 2 Resource Conservation and Recovery Act of 1976 (RCRA) Field Investigation Work Plan and Sampling and Analysis Plan," 11-TF-153, dated January 5, 2012.

2. Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C, RPP-PLAN-39114, Revision 2, dated June 13, 2012.

3. Sampling and Analysis Plan for Phase 2 Characterization of Vadose Zone Soil in Waste Management Area C, RPP-PLAN-38777, Revision 3, dated June 7, 2012.

4. Ecology letter from J. J. Lyon to C. J. Kemp, ORP, "Proposed Changes to RPP-PLAN-39114 and RPP-PLAN-38777," 12-NWP-071, dated May 8, 2012.

In January 2012, Hanford Federal Facility Agreement and Consent Order (HFFACO) change notices 2011-6 and 2011-7 were transmitted to the Washington State Department of Ecology (Ecology) via Reference 1. These change notices proposed revisions to the WMA C Phase 2 Resource Conservation and Recovery Act of 1976 (RCRA) Field Investigation Work Plan (Reference 2) and Sampling and Analysis Plan (SAP) (Reference 3). Ecology responded with approval of the proposed changes (Reference 4). This letter transmits the released document revisions (Attachments 1 and 2). This letter is also providing information and status on the ongoing soil media work ongoing at WMA C.

SEP 0 7 2012

Per 12-NWP-071 (Reference 4), Ecology anticipates the following actions are necessary to support the completion of the RCRA Field Investigation (RFI) and Corrective Measures Study (CMS) work for WMA C:

1. The U.S. Department of Energy, Office of River Protection (ORP) has released the approval of two documents, RPP-PLAN-39114 Revision 2 and RPP-PLAN-38777 Revision 3. Both are attached to this letter.

2. ORP will complete work identified in the work plan. The work planning process has begun for Fiscal Year (FY) 2013, and the work identified in the Work Plan and SAP is included in the priority list for planning.

3. ORP has completed the final analytical report for soil samples from WMA C in 2010, 2011 and 2012. These reports are attached (RPP-RPT-49050, RPP-RPT-49185, RPP-RPT-49238, RPP-RPT-49902, RPP-RPT-50378, RPP-RPT-50443, RPP-RPT-50185, RPP-RPT-50615, and RPP-RPT-51759). The data validation process on the final samples from core holes C8104, C8102, and C2106 is underway, and will be completed by November 2012. The final data validation information will be transmitted later when it becomes available.

Below is a status of the following reports:

a. Tc-99 laboratory interferences:
A report on the Tc-99 laboratory interferences is being planned as part of the FY 2013 work scope, and will be provided by March 31, 2013.

b. Evaluation of the organic detects in WMA C groundwater wells:
An evaluation of the organic detects in groundwater wells, including the wells near WMA C, has been completed and is attached to this letter (Attachment 3).

c. Latest trending of groundwater contaminants at WMA C groundwater wells:
This information is provided in the Hanford Site Annual Groundwater Monitoring Report. The Report for 2011 is currently being finalized and will be provided to Ecology upon its release.

d. Evaluation of the Quality Assurance/Quality Control and holding time issues associated with the 222-S shutdown in summer of 2011:
A report on the Tc-99 laboratory interferences is being planned as part of the FY 2013 work scope, and will be provided by March, 31, 2013.

SEP 0 7 2012

4. ORP will submit the revised Hanford C-Farm Leak Assessment Report (RPP-ENV-33418). An update to the Hanford C-Farm Leak Assessment Report has been performed and released for purposes of public review. This report is attached (Attachment 4). Please provide this report to any stakeholders, members of the public, or others who may be interested in this topic. Any written comments that are provided to ORP by September 30, 2012, either directly or through Ecology, will be addressed in a further update to this document planned for FY 2013.

If you have any questions, please contact me, or your staff may contact Joanne F. Grindstaff, Federal Project Director, Retrieval and Closure Projects, (509) 376-6202.

Sincerely,

Thomas W. Fletcher, Assistant Manager
Tanks Farms Project

TF: CJK

Attachment (CD)

cc w/attach:
S. Harris, CTUIR
J. A. Hedges, Ecology
J. B. Price, Ecology
D. A. Faulk, EPA
S. L. Leckband, HAB
R. E. Piippo, MSA
G. Bohnee, NPT
K. Niles, ODOE
L. Buck, Wanapum
R. Jim, YN
Administrative Record
Environmental Portal, LMSI
WRPS Correspondence

cc w/o attach:
J. F. Ollero, MSA
J. G. Vance, MSA
A. M. Hopkins, WRPS
R. E. Gregory, WRPS
C. R. Watson, WRPS
J. J. Whitcomb, WRPS

ATTACHMENT - CD

12-TF-0035

ITEMS LISTED ON CD:

RPP-ENW-33418 - REV-02A
RPP-PLAN-38777 - REV-03
RPP-PLAN-39114 - REV-02
RPP-RPT-49050 - REV-00 SITE C7472
RPP-RPT-49185 – REV-00 SITE C7670
RPP-RPT-49238 – REV-00 SITE C7668
RPP-RPT-49902 – REV-00 SITE C7672
RPP-RPT-50185 – REV-00 SITE C7680
RPP-RPT-50378 – REV-00 SITE C7676
RPP-RPT-50443 – REV-00 SITE C7682
RPP-RPT-50615 – REV-00 SITE C8100
RPP-RPT-51759 – REV-00
SGW-52194 – REV-00 GW ORGANIC REPORT
VSR 11-015 C7472
VSR 11-035 C7670
VSR 11-044 C7668
VSR 11-045 C7672
VSR 11-046 C7680
VSR 11-047 C7682
VSR 11-048 C7676

APPENDIX I

WMA C PHASE 2 RCRA FACILITY INVESTIGATION MEETING NOTES

This page intentionally left blank.

APPENDIX I
WMA C PHASE 2 RCRA FACILITY INVESTIGATION MEETING NOTES

This appendix contains the meeting notes from fourteen meetings held in calendar years 2010 and 2011 to discuss the planning, field work, and results of the Phase 2 RCRA Facility Investigation of WMA C. The meeting notes were signed by representatives of the DOE and Ecology and are also available in the HFFACO Administrative Record.

MEETING MINUTES – Waste Management Area C Work Plan Revision Process Discussion

Meeting Date: August 4, 2010

Location: Ecology Offices, Room 31

Purpose: Discuss the process for providing updates to Waste Management Area (WMA C) RFI/CMS Work Plan.

Attendees: Jeff Lyon (Ecology), Mike Barnes (Ecology), Julie Robertson (WRPS), Jeff Luke (WRPS), Susan Eberlein (WRPS)

Background:

Characterization of WMA C is proceeding per the RFI/CMS Work Plan (RPP-PLAN-39114, Rev. 1). New information is being obtained that should lead to a revision to the Work Plan. A process is required to identify and provide updates to the plan (a TPA primary document) in a timely manner.

Discussion:

- In March 2010 Ecology approved RPP-PLAN-39114, Rev. 1 as a TPA primary document. In the approval letter, Ecology requested that ORP revise the document to update the schedule. The parties met in April 2010 and agreed on a specific set of changes that would be made to the work plan. The parties agreed that the changes would be processed under a TPA change control form (CCF) and transmitted to Ecology by July 31, 2010.
- In June 2010, Ecology informally transmitted a request for additional changes to the work plan.
- In July 2010, ORP informally transmitted to Ecology a TPA CCF and redlined changes to the work plan, incorporating changes agreed to in April. Ecology expressed a concern that their June request for additional changes was not addressed in the document redlines they received in July.
- WRPS explained that the full process to incorporate changes into a TPA primary document takes several months, and that there had not been time to incorporate the changes requested in June into the deliverable due in July. WRPS further explained that it is open to addressing the Ecology concerns raised in June, but that it might be advisable to consider incorporating only one set of changes at a time to ensure the proper TPA processes are followed and proper document configuration control is maintained.
- The attendees discussed a need to hold periodic (perhaps monthly) meetings of the project managers and technical staff to review new information generated as a result of the WMA C investigation and determine whether the information could drive changes to the characterization plans and/or the work plan. The meeting would also be used to discuss comments and questions forwarded by EPA to Ecology. It was proposed that meeting minutes would be recorded and signed by the project managers and entered into the Administrative Record.
- The attendees were uncertain whether the CCF transmitted in July had been signed. It was agreed that if the majority of the redlines transmitted in July were deemed acceptable, the preferred path forward would be to resolve any concerns associated with those redlines, then finalize the document revisions under the existing CCF. The concerns expressed in June would then be addressed in a subsequent revision transmitted under a TPA change notice.
- The parties noted that a meeting is scheduled for August 11 to review the latest Ecology concerns in greater detail so that the affected work plan text can be identified and redlines developed to address the concerns.

Actions:

- Jeff Luke will determine if a proposed set of changes to RPP-PLAN-39114 has been formally provided to Ecology with a signed TPA CCF. (Following this meeting, Bob Lober [ORP] clarified that TPA CCF M-45-10-2 had been signed by ORP and provided to Ecology at the July 2010 Project Manager Meeting.)
- Mike Barnes will review the draft set of redline changes that he received and identify any that are of concern.
- If the majority of the proposed set of changes are acceptable, any concerns associated with the redlines (e.g., Quality Assurance requirements) will be addressed, and the existing (draft or signed) TPA CCF will be processed.
- A meeting with Ecology, ORP, and WRPS will be held to discuss additional future changes (meeting set for August 11).
- A date for developing a future TPA change notice will be determined based on the number and scope of additional changes identified.

APPROVED:

R. W. Lober, ORP Project Manager — 9/27/2010 Date

J. J. Lyon, Ecology Project Manager — 9/27/2010 Date

MEETING NOTES – Waste Management Area C Work Plan Revisions

Meeting Date: August 11, 2010

Location: 1200 Jadwin, Room 3-C4

Purpose: Discuss Ecology requests for updates to the Waste Management Area (WMA C) RFI/CMS Work Plan.

Attendees:

Mike Barnes (Ecology)	Joe Caggiano (Ecology)
Mike Connelly (WRPS)	Dwayne Crumpler (CEES)
Susan Eberlein (WRPS)	Les Fort (WRPS)
Bob Lober (ORP)	Julie Robertson (WRPS)
Beth Rochette (Ecology)	Harold Sydnor (WRPS)
Cynthia Tabor (WRPS)	Andrew Templeton (WRPS)

Background:

- In March 2010 Ecology approved the WMA C RFI/CMS Work Plan RPP-PLAN-39114, Rev. 1 (*Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*). This document and Appendix A of the document (*Sampling and Analysis Plan for the Collection of Soil Samples*) are managed in accordance with Milestone M-045-60 as primary documents under the *Hanford Federal Facility Agreement and Consent Order* (TPA). The document is under revision to update the schedule and incorporate a few technical changes. A TPA change control form has been developed to document these revisions (M-45-10-2).
- Characterization of the WMA C site is proceeding in accordance with the approved Work Plan. The investigation is generating new information about WMA C. This information has the potential to drive further changes to the approved Work Plan. On August 4, 2010, Ecology and ORP agreed to hold monthly meetings of the project managers and technical staff to review information generated as a result of the investigation, and to determine whether the information could drive changes to the characterization plans and/or the Work Plan. The meeting would also be used to discuss comments and questions forwarded by EPA to Ecology. It was proposed that minutes from these monthly meetings would be recorded, signed by the project managers, and entered into the Administrative Record. If the parties agree that changes to the Work Plan are appropriate, the TPA change control process will be used to document Work Plan changes.
- This August 11, 2010, meeting is the first of the agreed-to monthly interface/status meetings. At this meeting, Ecology provided a list of specific topics to be considered for future Work Plan revisions.

Discussion and Actions:

See attached table. The listed Topics for Discussion were provided by Ecology. A date-based numbering system has been introduced to aid tracking the topics to closure.

Robert Lober		9/20/2010
DOE Project Manager (print)	DOE Project Manager (signature)	Date
Jeffery J. Lyon		9-20-2010
Ecology Project Manager (print)	Ecology Project Manager (signature)	Date

Discussion and Actions

Item No.	Topic for Consideration	Action required	Actionee	Impact on WP	Status
08-11-10-1	EPA disclaimer language	Track to resolution with lawyers	B. Lober	Possible future WP change	
08-11-10-2	Test well within WMA C – from C200s (Well is between E-27-7 and C-200 tanks, inside fence.)	Research available information and recommend whether additional investigation is needed. Reflect conclusions in WP.	J. Field	Possible future WP change	
08-11-10-3	Conceptual model for spare inlet overflow – important for C-105	Impact and locations of potential overfill spills should be evaluated near C-101, -105, and -110 and text included in WP.	L. Fort	Include info in next WP revision	
08-11-10-4	Brief description of where we are with SGE both physical deployment line length and data evaluation and usage	Develop work plan text providing info on status of SGE deployment. Include in next WP revision	D. Myers	Include info in next WP revision	
08-11-10-5	Organic issue and status what has been agreed to on the 5 locations for organics… any TIC data?	Provide Ecology with detailed status of organic results to support evaluation of need to continue sampling. Modify WP as appropriate.	A. Templeton	Possible future WP change	
08-11-10-6	Twinning of the groundwater boreholes is this good idea?	Evaluate whether PRC borehole E-27-24 was contaminated. Provide data to Ecology and jointly determine whether twinning should occur. (Well is at 100-ft boundary.) TY farm may have completion report with relevant info. No WP change at this time.	C. Tabor (PRC communication), and Harold Sydnor (well completion report)	Possible future WP change	
08-11-10-7	Retrieval activities and pushes for C-101	Vertical rather than angle push planned, assuming equipment is moved. Retrieval program may request additional characterization.	N/A	None at this time	
08-11-10-8	C-200s proposal for SGE and logging E27-7…	Proposal is to place several deep electrode strings/do SGE near C-200 tanks, in later FY11. Not currently in budget. Separate from this effort, updates are required to WP text regarding specific wells to be logged.	H. Sydnor/D. Myers (define scope); B. Lober/S. Eberlein (obtain budget); J Field (redlines on logging)	Include info in next WP revision regarding known in-scope changes to logging efforts.	
08-11-10-9	What is planned for E27-23	There is a well on SW side of C Farm near transfer line. Need to investigate a Tc-99 increase. Need follow-up discussion on scope of investigation.	H. Sydnor and M. Connelly to develop proposal.	Possible future WP change	
08-11-10-10	Status of SGE and resolution – standardization reproducibility	Ecology asked to be advised when data evaluation process is standardized; at that time, Ecology will review the process.	D. Myers	None	
08-11-10-11	Status of availability of C-111 push	Revise WP to change designation of Access Availability in tables from "good" to "constrained by retrieval operations." Similarly update other access information to reflect current state.	J. Robertson	Include info in next WP revision.	
08-11-10-Q1	How to document Results from UPR-81 [resistivity work to]	Item 08-11-10-4 above provides description of recent resistivity advances. Item 08-11-10-8	See items 08-11-10-4 and 08-11-	Include info in next WP revision	

Item No.	Topic for Consideration	Action required	Actionee	Impact on WP	Status
	serve as the basis for looking for retrieval leaks under C-200s and to look to see if uranium in groundwater at well E27-7 is from pipeline/C-200 leak. The specific pushes and locations are to be determined.	above will provide alternative to current C-200 direct push plan if appropriate.	10-8 above.		
08-11-10-Q2	Any data from the twinning borehole?	Twinning has not occurred; therefore, no data is available. No action.	N/A	None	
08-11-10-Q3	Is there a plan in case there are vapor issues during retrieval this winter? Are there any suspect organic vapor tanks left to be retrieved?	Stacks are being raised, which will carry vapors to fence line. Measurements of vapors during retrieval show concentrations well below acceptable long term exposure levels outside of a few feet from stack outlets. Calculations indicate that vapor concentrations will be much further reduced at the fence line. Odor may still be smelled at fence line, but concentrations will be within safe levels. Therefore, work stoppage should be minimized. Note that voluntary respirator use continues to be an option.	N/A	None	
08-11-10-Q4	Do you want to update the analyte list based on changes to RPP-23403, Rev. 4 (sulfide)?	SST DQO has been modified to remove sulfide. Need to evaluate removal of sulfide from C Farm DQO and if appropriate revise analytes in WP.	C. Tabor	Possible future WP change	
08-11-10-Q5	Interim barrier data and its release	Results from characterization of sites for potential future interim barriers will be provided to Ecology as the reports are produced. Ecology will continue to be included in meetings to select sampling depth for direct push characterization of potential interim barrier sites, where preliminary information is reviewed.	N/A	None	
08-11-10-Q6	Borehole Tc in moisture versus non moisture zone What does the sulfate mean?	At borehole by C-104 & C-105, Tc-99 was ~7 pCi/g in low moisture zone and ~9 pCi/g in high moisture zone above, so it appears to be getting through. Current selection of sampling location anticipates that although Tc may be found in lower moisture zones, higher moisture zones are most likely to retain the highest concentrations of mobile contaminants. All data collected to date is consistent with this approach. Ecology will continue to be included in meetings to select sampling depth for direct push characterization of the C farm locations.	N/A	None	
08-11-10-Q7	Depth discrete sampling shows Tc-99 concentration is variable with depth of the aquifer (from PNNL report)	See item 08-11-10-9.	H. Sydnor and M. Connelly to develop proposal.	Possible future WP change	

MEETING NOTES – Waste Management Area C Work Plan Revisions

Meeting Date: September 21, 2010

Location: 1200 Jadwin, Room 3-C4

Purpose: Discuss Ecology requests for updates to the Waste Management Area (WMA C) RFI/CMS Work Plan.

Attendees:

Heather Anastos (WRPS)	Dave Myers (WRPS)
Mike Barnes (Ecology)	Dan Parker (CHPRC)
Dwayne Crumpler (CEES)	Julie Robertson (WRPS)
Mike Connelly (WRPS)	Beth Rochette (Ecology)
Susan Eberlein (WRPS)	Harold Sydnor (WRPS)
Jim Field (WRPS)	Andrew Templeton (WRPS)
Les Fort (WRPS)	Greg Thomas (CHPRC)
Bob Lober (ORP)	Mark Triplett (PNNL)
Jeff Lyon (Ecology)	

Background:

- This meeting is the second in a series of monthly meetings of the Ecology and ORP project managers and technical staff. The meetings provide an opportunity for the attendees to review information generated as a result of the WMA C RFI, and to determine whether the information could drive changes to the characterization plans and/or the Work Plan. The meetings can also be used to discuss comments and questions from EPA and Ecology. Notes from these monthly meetings are signed by the project managers and entered into the Administrative Record. If the parties agree that changes to the Work Plan are appropriate, the TPA change control process will be used to document Work Plan changes.

Discussion:

- The meeting notes from the August 11, 2010 meeting were approved.
- *Hanford Federal Facility Agreement and Consent Order* (TPA) Change Control Form M-45-10-2, revising the WMA C RFI/CMS Work Plan (RPP-PLAN-39114) and the WMA C Soil SAP (RPP-PLAN-38777) is with Ecology, awaiting signature. Ecology technical staff have reviewed the package and are satisfied with the contents. This Change Control Form will be a topic later this month at the September Project Managers' Meeting.
- Status of ongoing field investigation:
  - The attendees discussed characterization needs near the C-101 tank and whether the currently planned field actions will provide sufficient information to support both tank retrieval work and the corrective measures study. Two direct pushes are currently planned, and Ecology asked whether a third push might be necessary to support additional HRR monitoring. An early FY11 activity will be to complete ground penetrating radar scans of the area around C-101 to determine where drilling can safely occur. An action was taken to report the results of the scans at a future meeting, as a basis for further discussion about follow-on drilling and monitoring.
  - Greg Thomas presented information about ^{99}Tc levels in groundwater at the south-eastern end of C Farm. The data were generated during drilling or vertical profiling of wells 299-E27-4, -21, -22, -23, and -24. The data indicate that ^{99}Tc levels increase with depth in the aquifer, from near the top of the aquifer, to about 30 feet into the aquifer. Nitrate and sulfate also increase downward in the aquifer. Low levels of cyanide may also increase with depth. However, ^{3}H concentrations are fairly stable with depth. CHPRC suggested that because levels at 299-E27-23 are in the range of 20,000 pCi/L ^{99}Tc, that well may be located near a source, and flow is believed to have been from

the northeast – from the direction of C farm. A lengthy discussion about possible sources ensued. An action was taken for a smaller group of the meeting's attendees to meet separately on the topic. See actions 08-11-10-9 and 08-11-10-Q7.

Actions:

See attached table. A date-based numbering system is used to aid tracking the topics to closure. Topics/actions will be deleted from the list after ORP and Ecology agree to close them.

DOE Project Manager (print)	Robert W. Laber DOE Project Manager (signature)	11-1-2010 Date
Jeffery J. Lyon Ecology Project Manager (print)	Ecology Project Manager (signature)	11-1-2010 Date

RECEIVED
NOV 18 2010
EDMC

Discussion and Actions

Item No.	Topic for Consideration	Action required	Actionee	Impact on WP	Status
08-11-10-1	EPA disclaimer language	Track to resolution with lawyers	B. Lober	Possible future WP change	In process.
08-11-10-2	Test well within WMA C – from C200s (Well is between E-27-7 and C-200 tanks, inside fence.)	Research available information and recommend whether additional investigation is needed. Reflect conclusions in WP.	J. Field	Possible future WP change	Closed. The topic was discussed with Ecology at a meeting on 08-03-2010. No contamination was found at the test well; therefore, the team concluded that it is unlikely that the Uranium and Cyanide in well 299-E27-7 was from spare inlet leaks from the C-200 tanks. See item # 08-11-10-8 regarding future characterization near C-200s.
08-11-10-3	Conceptual model for spare inlet overflow – important for C-105	Impact and locations of potential overfill spills should be evaluated near C-101, -105, and -110 and text included in WP.	L. Fort	Include info in next WP revision	Evaluating where to include new text.
08-11-10-4	Brief description of where we are with SGE both physical deployment line length and data evaluation and usage	Develop work plan text providing info on status of SGE deployment. Include in next WP revision	D. Myers	Include info in next WP revision	Closed. Status of SGE deployment was provided as part of a separate discussion. WP text modification is not necessary.
08-11-10-5	Organic issue and status what has been agreed to on the 5 locations for organics… any TIC data?	Provide Ecology with detailed status of organic results to support evaluation of need to continue sampling. Modify WP as appropriate.	A. Templeton	Possible future WP change	Data evaluation is in progress. Separate meeting will be set up to discuss further.
08-11-10-6	Twinning of the groundwater boreholes is this good idea?	Evaluate whether PRC borehole E-27-24 was contaminated. Provide data to Ecology and jointly determine whether twinning should occur. (Well is at 100-ft boundary.) TY farm may have completion report with relevant info. No WP change at this time.	C. Tabor (PRC communication), and Harold Sydnor (well completion report); D. Crumpler (follow-on review of WP)	Possible future WP change	Data from 299-E27-24 have been reviewed. Well was sampled at 248-262 ft bgs, which is almost certainly deeper than push rig can go. Geophysical log of well did not indicate contamination. Twinning at this location would be of little value. Relevant text in Section 4.5 of the WP will be reviewed to determine if further action is required.
08-11-10-7	Retrieval activities and pushes for C-101	Vertical rather than angle push planned, assuming equipment is moved. Retrieval program may request additional characterization.	N/A	None at this time	Closed. Field activities are proceeding.
08-11-10-8	C-200s proposal for SGE and logging E27-7…	Proposal is to place several deep electrode strings/do SGE near C-200 tanks, in later FY11. Not currently in budget. Separate from this effort, updates are required to WP text regarding specific wells to be logged.	H. Sydnor/ D. Myers (define scope); B. Lober/ S. Eberlein (obtain budget); J Field (redlines on logging)	Include info in next WP revision regarding known in-scope changes to logging efforts.	(1) Scope/budget discussions are ongoing. (2) Redlines on known scope changes will be incorporated into next revision.
08-11-10-9	What is planned for E27-23	There is a well on SW side of C Farm near transfer line. Need to investigate a Tc-99 increase. Need follow-up discussion on scope of investigation.	D. Myers, G. Thomas, M. Barnes	Possible future WP change	Evaluation of need for further investigation is in process.

Item No.	Topic for Consideration	Action required	Actionee	Impact on WP	Status
08-11-10-10	Status of SGE and resolution – standardization reproducibility	Ecology asked to be advised when data evaluation process is standardized; at that time, Ecology will review the process.	D. Myers	None	Closed. Data evaluation process is continually being modified and improved. Ecology will be apprised as work continues. Ecology has UPR-86 report (RPP-RPT-47486, Rev 0).
08-11-10-11	Status of availability of C-111 push	Revise WP to change designation of Access Availability in tables from "good" to "constrained by retrieval operations." Similarly update other access information to reflect current state.	J. Robertson	Include info in next WP revision.	In process.
08-11-10-Q1	How to document Results from UPR-81 [resistivity work to] serve as the basis for looking for retrieval leaks under C-200s and to look to see if uranium in groundwater at well E27-7 is from pipeline/C-200 leak. The specific pushes and locations are to be determined.	Item 08-11-10-4 above provides description of recent resistivity advances. Item 08-11-10-8 above will provide alternative to current C-200 direct push plan if appropriate.	See items 08-11-10-4 and 08-11-10-8 above.	Include info in next WP revision	Closed. UPR-81 SGE results were provided in report RPP-RPT-41236. See items 08-11-10-4 and 08-11-10-8 above.
08-11-10-Q2	Any data from the twinning borehole?	Twinning has not occurred; therefore, no data is available. No action.	N/A	None	Closed.
08-11-10-Q3	Is there a plan in case there are vapor issues during retrieval this winter? Are there any suspect organic vapor tanks left to be retrieved?	Stacks are being raised, which will carry vapors to fence line. Measurements of vapors during retrieval show concentrations well below acceptable long term exposure levels outside of a few feet from stack outlets. Calculations indicate that vapor concentrations will be much further reduced at the fence line. Odor may still be smelled at fence line, but concentrations will be within safe levels. Therefore, work stoppage should be minimized. Note that voluntary respirator use continues to be an option.	N/A	None	Closed.
08-11-10-Q4	Do you want to update the analyte list based on changes to RPP-23403, Rev. 4 (sulfide)?	SST DQO has been modified to remove sulfide. Need to evaluate removal of sulfide from C Farm DQO and if appropriate revise analytes in WP.	C. Tabor	Possible future WP change	Evaluation and development of recommendation are in progress.
08-11-10-Q5	Interim barrier data and its release	Results from characterization of sites for potential future interim barriers will be provided to Ecology as the reports are produced. Ecology will continue to be included in meetings to select sampling depth for direct push characterization of potential interim barrier sites, where preliminary information is reviewed.	N/A	None	Closed.
08-11-10-Q6	Borehole Tc in moisture versus non moisture zone What does the sulfate mean?	At borehole by C-104 & C-105, Tc-99 was ~7 pCi/g in low moisture zone and ~9 pCi/g in high moisture zone above, so it appears to be getting through. Current selection of sampling location anticipates that although Tc may be found in lower moisture zones, higher moisture zones are most likely to retain the highest	N/A	None	Closed.

Item No.	Topic for Consideration	Action required	Actionee	Impact on WP	Status
		concentrations of mobile contaminants. All data collected to date is consistent with this approach. Ecology will continue to be included in meetings to select sampling depth for direct push characterization of the C farm locations.			
08-11-10-Q7	Depth discrete sampling shows Tc-99 concentration is variable with depth of the aquifer (from PNNL report)	See item 08-11-10-9.	H. Sydnor and M. Connelly to develop proposal.	Possible future WP change	Closed. Resolution of this item will be carried out under item 08-11-10-9.

MEETING NOTES – Waste Management Area C Work Plan Revisions

Meeting Date: October 27, 2010

Location: 1200 Jadwin, Room 3-C4

Purpose: Discuss Ecology requests for updates to the Waste Management Area (WMA C) RFI/CMS Work Plan.

Attendees:

Heather Anastos (WRPS)	Bob Lober (ORP)
Mike Barnes (Ecology)	Dave Myers (WRPS)
Marcel Bergeron (WRPS)	Julie Robertson (WRPS)
Joe Caggiano (Ecology)	Beth Rochette (Ecology)
Dwayne Crumpler (CEES)	Harold Sydnor (WRPS)
Mike Connelly (WRPS)	Andrew Templeton (WRPS)
Les Fort (WRPS)	

Background:

- This meeting is part of a series of monthly meetings between Ecology and ORP project managers and their associated technical support staff. The meetings provide a forum to review information generated as a result of the WMA C RFI, and to determine whether changes to the characterization plans and/or the Work Plan are necessary. The meetings may also be used to discuss comments and questions from EPA and Ecology. Meeting notes will be approved by the project managers and entered into the Administrative Record. If the parties agree that changes to the Work Plan are appropriate, the TPA change control process will be used to document Work Plan changes.

Discussion:

- The August 11, 2010 meeting notes were provided to the attending Ecology staff for the Ecology project manager approval.
- **Status of the Work Plan:**
  - *Hanford Federal Facility Agreement and Consent Order* (TPA) Change Control Form M-45-10-2, revising the WMA C RFI/CMS Work Plan (RPP-PLAN-39114) and the WMA C Soil SAP (RPP-PLAN-38777) was signed by Ecology and ORP and submitted to the Administrative Record.
  - Appendix B of RPP-PLAN-39114, *Sampling and Analysis Instructions for Small Mammal Sampling in WMA C*, is being redlined to incorporate final revisions prior to initiation of sampling activities. Revisions include minor changes to the sampling transect locations, corrections, and clarifications. The draft revisions were shared with Ecology earlier in the day. Project Manager approval of the revisions will ultimately be documented on a TPA change notice form.
- **New topics:**
  - **Detection limits**: In September, Ecology asked whether the laboratory soil samples analyzes were having difficulties meeting the required detection limits. Available analytical information is being reviewed to determine if there are issues. There appear to be some difficulties associated with selenium and uranium. The required detection limit for selenium, in particular, may need to be modified in the work plan. An action item was taken to track the matter to closure.
  - **Review of volatile organic compound (VOC) data**: RPP-PLAN-38777 documents the approach to analyzing soil samples for organic contaminants. Five WMA C sites deemed most

likely to be contaminated with organic contaminants are to be sampled and analyzed for the full suite of analytes. Analytical results from these 5 sites will be used to determine whether organic analytes are to be removed from the list of COPCs. Tributylphosphate (TBP) is the designated indicator organic; if TBP is not found at any of the 5 selected sites, then it is projected that other organic tank waste contaminants will not be in WMA C vadose zone samples.

WRPS presented available analytical results from VOC sampling performed in fiscal years 2009 and 2010. FY09 data are published in reports RPP-RPT-44557 and RPP-RPT-46241; FY10 sample results are preliminary. Final analytical results from four of the five organic sample sites, preliminary sample results from the fifth site, and data from three additional sites were reviewed at the meeting.

In summary, TBP was not detected in any of the samples. The majority of the detected VOCs are also detected in blanks, are common laboratory contaminants, and/or are detected at concentrations near the analytical detection limit. In addition, due to the absence of high levels of VOCs in any of the samples, high concentration VOC (methanol) sampling was not necessary.

WRPS recommended that high concentration VOC sampling be eliminated immediately for all future sampling events. Ecology agreed to this recommendation, and their acceptance is acknowledged by signing these meeting notes.

WRPS also recommended that once the FY10 analytical results for the fifth selected site are released, future sampling for organic tank waste contaminants be reevaluated. ORP accepted an action to formally document the results of its reevaluation in a letter to Ecology, following receipt of the final FY10 analytical results. WRPS estimated that the validated analytical results should be available in February 2010.

- **Data reporting and requests for additional characterization work**: ORP and Ecology intend to share RCRA facility investigation results as they become available, to support open communications and timely decision making. ORP and Ecology recognize the potential for data and information to prompt re-evaluation of actions described in the investigation work plan, and timely evaluation of such information will afford more efficient conduct of the investigation.

  There are many requests for release of data and information as a part of ongoing meetings with the public and stakeholders regarding the WMA C investigation. ORP agreed that preliminary data (that which has not undergone verification and validation) should be shared informally and discussed with Ecology as early as possible, thereby promoting proper consideration in the context of the overall investigation. The parties agreed that data cannot be shared with external groups until after undergoing proper verification and validation, at which time the data is considered final.

  Review of existing WMA C investigation data (final and preliminary) together with new groundwater monitoring data (in particular sample results from well 299-E27-23) is indicating the need to evaluate performing additional characterization in two areas of WMA C:

  - The south end of the farm around well E27-23 and its associated pipelines
  - The southeast section of the farm near sites G and L2, near tank C-103 and the Cs load-out facility and associated pipelines.

- **Status of ongoing field investigation**:
  - RPP-PLAN-39114, Rev 1A, Figure 6-1 identifies that in FY 11, four direct push locations will be completed. This commitment is expected to be completed by doing angle pushing at the following locations:

    - Location J (upper C-Farm beneath C-104 Tank)
    - Location A (upper C-Farm beneath C-101 Tank)
    - Locations C1 and C2 (lower C-Farm below C-200 Tanks)

  - Work continues at Location Q (UPR 82/cesium pile). As of 10/27/2010, installation of four direct pushes and logging were complete. A deep electrode was placed in one of the four probe holes (C7942), and decommissioning was initiated on this hole.

- WRPS reported that well E27-23 was sampled in September 2010. Analytical results showed a Tc-99 level of 17,000 pCi/L, continuing a downward trend from the high of 20,800 pCi/L measured in April 2010.

Actions:

See attached table. A date-based numbering system is being used as an aid in tracking the topics to completion. Topics/actions will be removed from the list after ORP and Ecology have agreed to their completion.

Robert Lober		1/27/2011
DOE Project Manager (print)	DOE Project Manager (signature)	Date
Jeff Lyon		1/27/2011
Ecology Project Manager (print)	Ecology Project Manager (signature)	Date

Discussion and Actions

NEW:

Item No.	Topic for Consideration	Action required	Actionee	Impact on WP	Status
08-11-10-1	EPA disclaimer language	Track to resolution with lawyers	B. Lober	Include info in next WP revision.	Closed. Text will be changed to "Consistent with paragraph 19 of the TPA, this plan addresses all aspects of contamination, including AEA material. However, the inclusion of AEA materials in the plan does not confer RCRA or HWMA authority over otherwise exempt AEA spent, byproduct, and special nuclear material."
08-11-10-3	Conceptual model for spare inlet overflow – important for C-105	Impact and locations of potential overfill spills should be evaluated near C-101, -105, and -110 and text included in WP.	L. Fort	Include info in next WP revision	In process.
08-11-10-5	Organic issue and status what has been agreed to on the 5 locations for organics… any TIC data?	Provide Ecology with detailed status of organic results to support evaluation of need to continue sampling. Modify WP as appropriate.	A. Templeton	Possible future WP change	VOC results were presented at 10/27/2010 meeting, along with recommendations. ORP will prepare letter documenting recommendations and requesting response.
08-11-10-6	Twinning of the groundwater boreholes is this good idea?	Evaluate whether PRC borehole E-27-24 was contaminated. Provide data to Ecology and jointly determine whether twinning should occur. (Well is at 100-ft boundary.) TY farm may have completion report with relevant info. No WP change at this time.	C. Tabor (PRC communication), and Harold Sydnor (well completion report); D. Crumpler (follow-on review of WP)	Possible future WP change	Closed. Data from 299-E27-24 have been reviewed. Well was sampled at 248-262 ft bgs, which is almost certainly deeper than push rig can go. Geophysical log of well did not indicate contamination. Twinning at this location would be of little value. Relevant text in Section 4.5 of the WP was reviewed and discussed. The intent of Section 4.5 has been met.
08-11-10-8	C-200s proposal for SGE and logging E27-7…	Proposal is to place several deep electrode strings/do SGE near C-200 tanks, in later FY11. Not currently in budget. Separate from this effort, updates are required to WP text regarding specific wells to be logged.	H. Sydnor/ D. Myers (define scope); B. Lober/ S. Eberlein (obtain budget); J Field (redlines on logging)	Include info in next WP revision regarding known in-scope changes to logging efforts.	(1) Scope/budget discussions are ongoing. (2) Redlines on known scope changes will be incorporated into next revision.
08-11-10-9	What is planned for E27-23	There is a well on SW side of C Farm near transfer line. Need to investigate a Tc-99 increase. Need follow-up discussion on scope of investigation.	D. Myers, G. Thomas, M. Barnes	Possible future WP change	Archive samples from drilling of E27-20 are available for investigation. Funding requirements are being

RPP-RPT-58339, Rev. A [DRAFT]

Item No.	Topic for Consideration	Action required	Actionee	Impact on WP	Status
					investigated.
08-11-10-11	Status of availability of C-111 push	Revise WP to change designation of Access Availability in tables from "good" to "constrained by retrieval operations." Similarly update other access information to reflect current state.	J. Robertson	Include info in next WP revision.	In process.
08-11-10-Q4	Do you want to update the analyte list based on changes to RPP-23403, Rev. 4 (sulfide)?	SST DQO has been modified to remove sulfide. Need to evaluate removal of sulfide from C Farm DQO and if appropriate revise analytes in WP.	C. Tabor	Possible future WP change	Evaluation and development of recommendation are in progress.
10-23-10-1	Detection limits	Evaluate whether detection limits identified in WP are appropriate.	D. Crumpler	Possible future WP change	Evaluation and development of recommendation are in progress.

MEETING NOTES – Waste Management Area C Work Plan Revisions

Meeting Date: November 17, 2010

Location: 1200 Jadwin, Room 3-C4

Purpose: Discuss the Status of the Waste Management Area (WMA C) RFI/CMS Investigation and Work Plan.

Attendees:

Heather Anastos (WRPS)	Dave Myers (WRPS)
Mike Barnes (Ecology)	Julie Robertson (WRPS)
Marcel Bergeron (WRPS)	Virginia Rohay (CHPRC)
Mike Connelly (WRPS)	Harold Sydnor (WRPS)
Dwayne Crumpler (CEES)	Andrew Templeton (WRPS)
Les Fort (WRPS)	

Background:

- These monthly meetings provide a forum for Ecology and ORP project managers and their associated technical support staff to review information generated as a result of the WMA C RFI, and to determine whether changes to the characterization plans and/or the RFI/CMS work plan (RPP-PLAN-39114) are necessary. The meetings may also be used to discuss comments and questions from EPA and Ecology. Meeting notes will be approved by the project managers and entered into the Administrative Record. If the parties agree that changes to the Work Plan are appropriate, the *Hanford Federal Facility Agreement and Consent Order* (TPA) change control process will be used to document Work Plan changes.

Discussion and New Topics:

- The October 27, 2010 meeting notes were provided to the attending Ecology staff for Ecology project manager approval.
- **Status of the Work Plan:**
  - WRPS has initiated additional revisions to the WMA C RFI/CMS work plan and WMA C soil sampling and analysis plan (RPP-PLAN-38777) incorporating changes discussed in previous meetings of this group. Changes to the soil SAP will specify the priority of laboratory sample analyses should insufficient sample volume be available to perform all analyses called out in the SAP.
  - Appendix B of RPP-PLAN-39114, *Sampling and Analysis Instructions for Small Mammal Sampling in WMA C*, is being marked up to incorporate final revisions before initiation of sampling activities. The draft revisions were shared with Ecology at a meeting on October 27, 2010. At that meeting, Ecology requested that ORP include polychlorinated biphenyl (PCB) congeners in the analyte list and questioned the proposed deletion of dioxins and furans from the analyte list. WRPS is working to identify a laboratory that can perform the requested congener analysis. Dioxins and furans were not identified as contaminants of potential concern in the WMA C data quality objectives summary report (RPP-RPT-38152) and, therefore, were not included in the list of analytes in the main body of the WMA C work plan or in the soil SAP. WRPS contacted the subcontractor that prepared Appendix B of the work plan, and the subcontractor indicated that the inclusion of dioxins and furans in Appendix B was a mistake. WRPS/ORP will schedule a separate meeting to address the Ecology concerns. Approval of the revisions will be documented per the TPA change notice process.

- **Technetium 99 at C-108**: During a recent WMA C performance assessment (PA) working group meeting, an attendee gave a presentation that documented a theory that up to 110 Ci of ^{99}Tc could have leaked to the soil in WMA C. Ecology pointed out that the bounding assumption in the tank closure environmental impact statement is that 57 Ci of ^{99}Tc are in the soil at WMA C, and the work plan assumes only 8 Ci. Meeting attendees noted that the calculations presented at the PA meeting were based on worst-case assumptions about the contaminants in the waste that were processed through C Farm. WRPS took an action to review the calculations and report back to the group.
- **Request**: Ecology noted that Rebecca Gerhart (EPA) will be in town for the January PA working group meeting and has asked to observe WRPS direct push work.
- **Status of ongoing fieldwork**:
  - RPP-PLAN-39114, Rev 1A, Figure 6-1 identifies that in FY 11, four direct push locations will be completed. This commitment is expected to be completed by doing angle pushing at the following locations:
    - Location J (upper C-Farm beneath Tank C-104)
    - Location A (upper C-Farm beneath Tank C-101)
    - Locations C1 and C2 (lower C-Farm below C-200 Tanks, near C-203).

    Planning is underway for these push locations.
  - WRPS reported that it is evaluating accelerating work at RFI Location B. Physical interferences in the farm may necessitate adjusting the location. Ecology noted the need to coordinate possible location changes with Retrieval Operations.
  - At Location Q (UPR 82/cesium pile), WRPS is in the field installing surface electrodes and preparing for equilibration testing.
- **Data Reporting**
  - C Farm well-to-well surface geophysical exploration data are being reanalyzed to take advantage of advancements in data processing capabilities that will allow results to be viewed and evaluated in a more holistic manner.
  - Laboratory reports for Locations F and L2 have been received for internal verification.

Actions:

See attached table. A date-based numbering system is being used as an aid in tracking the topics to completion. Topics/actions will be removed from the list after ORP and Ecology have agreed to their completion.

Robert Lober		1/10/2011
DOE Project Manager (print)	DOE Project Manager (signature)	Date
Jeffery J. Lyon		1/11/2011
Ecology Project Manager (print)	Ecology Project Manager (signature)	Date

Discussion and Actions

Item No.	Topic for Consideration	Action required	Actionee	Impact on WP	Status
08-11-10-3	Conceptual model for spare inlet overflow – important for C-105	Impact and locations of potential overfill spills should be evaluated near C-101, -105, and -110 and text included in WP.	L. Fort	Include info in next WP revision	In process.
08-11-10-5	Organic issue and status what has been agreed to on the 5 locations for organics… any TIC data?	Provide Ecology with detailed status of organic results to support evaluation of need to continue sampling. Modify WP as appropriate.	A. Templeton	Possible future WP change	VOC results were presented at 10/27/2010 meeting, along with recommendations. Additional organic results will be presented in near future. ORP will prepare letter documenting recommendations and requesting response.
08-11-10-8	C-200s proposal for SGE and logging E27-7…	Proposal is to place several deep electrode strings/do SGE near C-200 tanks, in later FY11. Not currently in budget. Separate from this effort, updates are required to WP text regarding specific wells to be logged.	H. Sydnor/ D. Myers (define scope); B. Lober/ S. Eberlein (obtain budget); J Field (redlines on logging)	Include info in next WP revision regarding known in-scope changes to logging efforts.	(1) Redlines on known scope changes already added to the baseline will be incorporated into next revision. (2) Funding not available this fiscal year for adding additional investigation scope.
08-11-10-9	What is planned for E27-23	There is a well on SW side of C Farm near transfer line. Need to investigate a Tc-99 increase. Need follow-up discussion on scope of investigation.	D. Myers, G. Thomas, M. Barnes	Possible future WP change	Archive samples from drilling of E27-20 are available for investigation. Funding requirements are being investigated.
08-11-10-11	Status of availability of C-111 push	Revise WP to change designation of Access Availability in tables from "good" to "constrained by retrieval operations." Similarly update other access information to reflect current state.	J. Robertson	Include info in next WP revision.	In process.
08-11-10-Q4	Do you want to update the analyte list based on changes to RPP-23403, Rev. 4 (sulfide)?	SST DQO has been modified to remove sulfide. Need to evaluate removal of sulfide from C Farm DQO and if appropriate revise analytes in WP.	C. Tabor	Possible future WP change	Closed. RPP-RPT-42294 indicates that sodium sulfide was added to some waste batches in the 244-CR Vault to promote ^{60}Co precipitation. Therefore, sulfide will remain on the analyte list in RPP-23403.
10-23-10-1	Detection limits	Evaluate whether detection limits identified in WP are appropriate.	D. Crumpler	Possible future WP change	Evaluation and development of recommendation are in progress.
11-17-10-1	Tc-99 at C-108	Review Tc-99 calculations for area near C-108 to determine if there is validity to the assertion that there may be contamination present at levels higher than estimated in the tank closure EIS.	Les Fort	None at this time.	

MEETING NOTES
Waste Management Area C Work Plan Revisions

Meeting Date: January 27, 2011

Location: Ecology Office, Richland

Purpose: Discuss the Status of the Waste Management Area (WMA C) RFI/CMS Investigation and Work Plan.

Attendees:

Heather Anastos (WRPS)	Jeff Lyon (Ecology)
Mike Barnes (Ecology)	Dave Myers (WRPS)
Mike Connelly (WRPS)	Julie Robertson (WRPS)
Dwayne Crumpler (CEES)	Beth Rochette (Ecology)
Jim Field (WRPS)	Virginia Rohay (CHPRC)
Les Fort (WRPS)	Harold Sydnor (WRPS)
Rebecca Gerhart (EPA)	Andrew Templeton (WRPS)
Bob Lober (ORP)	

Background:

- These monthly meetings provide a forum for Ecology and ORP project managers and their associated technical support staff to review information generated by the WMA C RFI, and to determine whether changes to the characterization plans and/or the RFI/CMS work plan (RPP-PLAN-39114) are necessary. The meetings may also be used to discuss comments and questions from EPA and Ecology. Meeting notes will be approved by the project managers and entered into the Administrative Record. If the parties agree that changes to the Work Plan are appropriate, the *Hanford Federal Facility Agreement and Consent Order* (TPA) change control process will be used to document Work Plan changes.

Discussion and New Topics:

- **Prior meeting notes:** The October 27, 2010 meeting notes were signed by the Ecology and ORP Project Managers.

- **Status of the work plan:**

  - WRPS is revising the WMA C RFI/CMS work plan and WMA C soil sampling and analysis plan (RPP-PLAN-38777) to incorporate changes discussed in previous meetings of this group. Changes to the soil SAP will specify the priority of laboratory sample analyses should insufficient sample volume be available to perform all analyses called out in the SAP.

  - WRPS is revising Appendix B of RPP-PLAN-39114, *Sampling and Analysis Instructions for Small Mammal Sampling in WMA C*, to provide corrections and clarifications needed before sampling begins. The proposed text revisions have been reviewed and informally approved by Ecology staff. A TPA Change Notice Form is being drafted for Project Manager approval. The revision will be a Class 3 change. A figure was distributed that illustrates where live traps have been placed. Trapping will not begin until the change notice is approved.

  - A TPA Class 3 Change Notice Form is being prepared to incorporate a cyanide detection limit into the WMA C SAP.

- **EPA Comments on the Work Plan:** In December 2010, EPA provided comments on the WMA C RFI/CMS work plan. Attachment A details the comments, discussion, and actions relevant to the EPA concerns.

- **Additional topic for future meetings**: On November 24, 2010, Ecology requested by email that future monthly meetings include a discussion of the RFI report content and format. The meeting participants agreed to add this topic to future meeting agendas.

- **Status of ongoing fieldwork**:

  - RPP-PLAN-39114, Rev 1A, Figure 6-1 identifies that in FY 11, four direct push locations will be completed. This commitment is expected to be completed by doing angle pushing at the following locations:

    - Location J (near Tank C-104)
    - Location A (near Tank C-101)
    - Location B (near Tank C-101)
    - Location C1 (near C-203).

    The angle push at C-104 is underway. The next planned push will be at C-101.

  - At Location Q (UPR-82/cesium pile), resistivity data is being collected.

  - Live traps have been set out for collection of small mammals to support the ecological risk assessment. WRPS distributed a map of the trap locations. The traps will not be opened for use until the applicable TPA change notice form is signed by the Project Managers.

- **Data reporting**

  - WRPS received three fiscal year 2010 reports for verification since this group's last meeting. A total of five of 11 expected 2010 reports have been submitted for verification.

  - WRPS expects FY2009 data to be loaded into HEIS next week. A process modification has been made to reduce the lag time between completion of analyses and data loading into HEIS. In the future, data will be loaded into HEIS with the initial report, prior to verification and correction. Corrections will then be made as necessary after verification. WRPS will continue to provide updates at future meetings on data reporting and HEIS uploads.

  - WRPS reported conducting a management assessment of the vadose zone sample analysis process at 222-S. The assessment resulted in 4 findings and 13 observations. Integration of analytical priorities was identified as the most significant of the findings.

  - WRPS reported that the MAPEP Tc-99 results for Series 23 are expected soon. Ecology asked to be notified when the results become available.

- **Cesium release from C-105**: A concern was raised at a recent WMA C Performance Assessment meeting that the volume of the leak from C-105 and the amount of Cs released might have been higher than previously estimated. The meeting participants discussed the possible need for additional data to address this concern. WRPS stated that angle pushes planned for this fiscal year may provide relevant information. Installation of temperature probes in dry wells near C-105 might be a way to gain additional data relatively easily. There is no funding this fiscal year for additional work near C-105. An action was taken to evaluate pursuing additional investigation (installation of a temperature probe in dry wells) near C-105 as a part of the WMA C RFI.

Actions:

See attached table. A date-based numbering system is being used as an aid in tracking the topics to completion. Topics/actions will be removed from the list after ORP and Ecology have agreed to their completion.

Robert W. Lobes		3/24/2011
DOE Project Manager (print)	DOE Project Manager (signature)	Date
Jeffery J. Lyon		3/24/11
Ecology Project Manager (print)	Ecology Project Manager (signature)	Date

Discussion and Actions

Item No.	Topic for Consideration	Action required	Actionee	Impact on WP	Status
08-11-10-3	Conceptual model for spare inlet overflow – important for C-105	Impact and locations of potential overfill spills should be evaluated near C-101, -105, and -110 and text included in WP.	L. Fort	Include info in next WP revision	In process.
08-11-10-5	Organic issue and status what has been agreed to on the 5 locations for organics… any TIC data?	Provide Ecology with detailed status of organic results to support evaluation of need to continue sampling. Modify WP as appropriate.	A. Templeton	Possible future WP change	VOC results were presented at 10/27/2010 meeting, along with recommendations. Additional organic results will be presented in near future. ORP will prepare letter documenting recommendations and requesting response.
08-11-10-8	C-200s proposal for SGE and logging E27-7…	Proposal is to place several deep electrode strings/do SGE near C-200 tanks, in later FY11. Not currently in budget. Separate from this effort, updates are required to WP text regarding specific wells to be logged.	H. Sydnor/ D. Myers (define scope); B. Lober/ S. Eberlein (obtain budget); J Field (redlines on logging)	Include info in next WP revision regarding known in-scope changes to logging efforts.	(1) Redlines on known scope changes already added to the baseline will be incorporated into next revision. (2) Funding not available this fiscal year for adding additional investigation scope.
08-11-10-9	What is planned for E27-23	There is a well on SW side of C Farm near transfer line. Need to investigate a Tc-99 increase. Need follow-up discussion on scope of investigation.	D. Myers, G. Thomas, M. Barnes	Possible future WP change	Archive samples from drilling of E27-20 are available for investigation. Funding requirements are being investigated.
08-11-10-11	Status of availability of C-111 push	Revise WP to change designation of Access Availability in tables from "good" to "constrained by retrieval operations." Similarly update other access information to reflect current state.	J. Robertson	Include info in next WP revision.	In process. On 1/27/11 Ecology asked that constraints be re-evaluated, given slow progress on retrieval actions.
10-23-10-1	Detection limits	Evaluate whether detection limits identified in WP are appropriate.	D. Crumpler	Possible future WP change	Evaluation and development of recommendation are in progress. Appear to be problems meeting U-total (chemical), Se, Cn, and I-129. However, U isotopic info is available.
11-17-10-1	Tc-99 at C-108	Review Tc-99 calculations for area near C-108 to determine if there is validity to the Nez Perce assertion that there may be contamination present at levels higher than estimated in the tank closure EIS.	Les Fort	None at this time.	Reviewed Tc-99 calculations for the area near C-108 and concluded that release (overflow) volumes may have been greater than previously estimated, but estimate of Tc-99 released to vadose zone remains at <8 Ci. The Nez Perce evaluation used a different conceptual model based on SX farm waste rather than C farm waste, which skewed their

RPP-RPT-58339, Rev. A DRAFT

Item No.	Topic for Consideration	Action required	Actionee	Impact on WP	Status
					radionuclide release estimates. After peer review, the new estimates will be documented as updates to the leak assessment report.
01-27-11-1	MAPEP results	MAPEP Tc-99 results for Series 23 are due to be released soon. Ecology to be notified when findings are available.	Heather Anastos	None at this time.	<new>
01-27-11-2	Data reporting and HEIS loading status	Provide status on data reporting and HEIS loads at monthly meetings.	Heather Anastos	None at this time.	<new>
01-27-11-3	Cs at C-105	Evaluate installation of a temperature probe in dry wells near C-105 to gain information about the volume of releases from C-105 and the amount of Cs released.	Susan Eberlein	None at this time.	<new>
01-27-11-4	Resolution of EPA comments on RFI/CMS work plan	See Attachment A.	See Attachment A.	See Attachment A.	<new>

ATTACHMENT A
EPA Comments on the Work Plan

Background:

- In December 2010, EPA provided comments on the WMA C RFI/CMS work plan. The table below details the comments and discussion relevant to the EPA concerns. Actions were identified as necessary to track closure of these comments.
- In addition to the comments below, the meeting participants discussed the path forward for pipeline remediation/corrective action. **ACTION**: Ecology took an action to provide EPA with a copy of the document RPP-PLAN-47559, which evaluates some of the possible measures that could be implemented for pipelines.

No.	EPA Comment	Response	Status
1	Section 2.2, p. 2-6, Paragraph six states that herbicides and pesticides are used on a regular basis to keep plant and wildlife out of WMA C boundary. Given the degree of detail involved in modeling geochemical interactions of COCs in the vadose zone, EPA would like to know if interactions between COCs and herbicide/pesticide molecules have been considered. If this has been evaluated and no significant interaction has been found, please state this in the appropriate section.	Interactions between COCs and herbicide/pesticide molecules were not considered. An agricultural representative from Spokane has indicated that herbicides and pesticides break down in 2 to 5 years in this climate. Very little in the way of herbicides/ pesticides, such as commonly used arsenic, have been detected. Therefore, further investigation is considered unwarranted.	No text change required.
2	Section 3.2.1.1, p. 3-6 and 3-7. It is understood that water-leachable constituents in the vadose zone are of highest interest for cleanup because they are the contaminants that have the potential to impact groundwater. But, while we are trying to refine our conceptual site model and identify release points and migration pathways, would it be valuable to look at non-water-leachable COC compounds in the vadose zone as well? Are there any reasonably anticipated insoluble precipitates that would occur under the given geochemical conditions? And, if we were to look for these and identify them, wouldn't they help us in understanding where/what kind of releases took place and explain the cation/anion distributions that we are finding?	The investigation includes analysis for Tc-99 and acid digest for metals. The DQO and SAP called for investigating constituents that are in tank waste, including likely precipitates in tank waste.	No text change required.
3	Section 3.2.2, p.3-14 The occurrence of cyanide in groundwater monitoring wells around WMA C is puzzling since intentional discharges following the In-Farm scavenging did not take place at or nearby WMA C. In fact, the highest and most consistent cyanide concentrations are found in upgradient monitoring well	Cn presence in upgradient groundwater could be due to use in tank-related processes. Bedding in the area dips to the northeast. Groundwater flow is to the southwest. However, to date, all analyses of vadose zone samples for Cn have been non-detect. EPA has lingering questions about a dry well just southeast of	**ACTION**: WRPS to provide information regarding Cn levels in wells near WMA C.

No.	EPA Comment	Response	Status
	299-E27-7 (northeast side). Although this workplan does not address groundwater remediation, this information strongly suggests a waste source that is impacting the vadose zone as well. Please ensure that areas of known high cyanide concentration are adequately sampled in an effort to identify the source and evaluate a vadose zone impact.	E27-7.	
4	Section 3.4.1, page 3-30. Please remove the section on EPA anticipated Central Plateau exposure scenarios as we have had no discussion with DOE on exposure scenarios in regard to this document.	EPA will provide replacement text for discussion and incorporation.	**ACTION**: EPA will provide suggested replacement text.
5	Section 3.5.2, p. 3-46 states that (for polychlorinated biphenyls) three vadose zone samples will be in the region of 0-15 ft. Emphasis on sampling soil in the 0-15 ft. range is reiterated elsewhere in the document. Please ensure that this data is sufficient to meet the multiple exposure scenarios listed on p.3-30.	PCB is a known contaminant in tank waste. The sampling program includes sampling for all PCB arochlors at each sampling location in the first 15 feet and the more sensitive congeners analysis. To date, the highest arochlor analysis out of 42 samples has a concentration of 25 ppb for Arochlor-1260, with only 2 detected values. Of the PCB congeners loaded into HEIS, there are approximately 48 samples evaluating approximately 209 congeners representing 8574 analyses. The highest concentration of a PCB congener found to date is less than 0.5 ppb, except for one sample which has values above 10.0 ppb. This one sample is being evaluated further. We believe the data we are collecting on PCB is sufficient for the multiple exposure scenarios.	No text change required.
6	Figure 3-7, p 3-15 Needs compass.	Acknowledged.	**ACTION**: Compass will be added to figure, assuming the addition does not present a document clearance and public release issue.
7	To date, what percent of the work described in this workplan has been completed?	It was estimated that roughly 40% to 50% of the work has been completed.	No text change required. A summary table will be developed as an aid to communicate the status of the investigation.
8	Is the Phase II RFI/CMS Report for WMA C still due to Ecology on 12/31/2010? Will this be available to EPA?	Under revised TPA milestone M-45-61, the Phase 2 RFI/CMS report for WMA C is now due to Ecology for review and approval as an Agreement primary document on 12/31/2014. However, baseline planning calls for earlier submittal. The document will be available to EPA.	No text change required.
9	What is the depth limit of SGE?	The depth of investigation for resistivity techniques is	No text change required.

No.	EPA Comment	Response	Status
		directly tied to the distance between electrodes. The farther apart, the deeper the investigation. A parallel challenge is that the deeper the investigation, the lower the resolution of that investigation. This reduction in resolution is being addressed by installing strings of electrodes in direct push holes as those holes are decommissioned. The depth of investigation for the 3-D surveys run to date is on the order of 50 to 70 meters.	
10	Has there been any indication of clastic dikes or preferential pathways via SGE data? (3-D?)	There is no indication of clastic dikes or preferential pathways indicated by SGE data.	No text change required.
11	Do holes from direct push investigations lead to preferential flow paths in the future? How many years ago were the first direct push investigations done in WMA C and have they led to channeled infiltration?	Boreholes from direct push investigations do not create preferential flow paths. Boreholes are decommissioned per requirements of Washington Administrative Code (WAC) 173-160. Any exceptions must be reviewed and approved by Ecology as a part of a variance filing process. Direct push investigations at WMA C were initiated in July 2005.	No text change required. **ACTION**: Ecology will provide EPA with information on borehole decommissioning requirements.
12	Section 4.5.5, p. 4-29 Has the Tc^{99} sensor described in this section been developed and tested?	The Tc-99 sensor has been taken though the proof-of-principle stage. The prototype tool was able to detect Tc-99 at the 1 pCi/g level in the presence of K-40 typical of Hanford soils. There is no funding for further development of this tool by WRPS/ORP.	**ACTION**: WRPS to provide a status.
13	As sampling efforts may have evolved through the execution of this workplan, these are a few specific spots I had questions about: (a) Two valve boxes, located on the south side of C-111 and C-112, are known to have drained directly to soil. Samples taken here? (b) Section 3.2.1, p. 3-6 (d) Anomalous resistivity zone centered around C-104 and a smaller zone around C-108 and C-109. Confirmation sampling done here? (c) Section 3.2.2, p. 3-11 and 3-12 describes Tc^{99} concentration that have "generally increased" since the late 1990s and are currently in excess of 2000pCi/L, which "suggests a tank waste source near monitoring well 299-E27-4". Adequate sampling in this area? (d) Section 4.3.2, p. 4-8 (c) Site 200-E-115 Are there plans to use SGE in this area?	(a) The valve boxes were not identified as a location to investigate during the DQO process: therefore, no samples are planned at C-111 and C-112. (b) Reanalysis of well-to-well resistivity data, implementing recent advancements in analytical capabilities, indicates that the anomaly around C-108 and C-109 was an artifact of having to parse the data to perform the original analysis. The reanalysis also indicated that the anomaly in the vicinity of C-104 is more closely focused on the region near the spare inlet ports on C-101. Direct push investigation at Sites J and K is intended to provide additional information about the anomalies. (c) The planned investigative work is believed adequate to address the Tc-99 issue. Work at UPR 81 and 86, which were believed to have	No text change required.

No.	EPA Comment	Response	Status
		been potential sources, indicates these UPRs are not likely to be sources. Well 299-E27-4 is in the vicinity of UPR-200-E-82. To further assess potential vadose zone contribution to the Tc-99 present in groundwater at 299-E27-4, the site will be assessed using 3-D SGE, plus three long 2-D lines in 2011. Numerous direct push sampling holes around this UPR have been advanced; only one of those pushes resulted in a positive analysis for Tc-99, and that hole was an angle push directly beneath the UPR site (radiological concerns precluded a vertical push through the center of the UPR). The SGE survey is intended to assess the distribution of resistivity impacting features. (d) Investigation at sites H and I is intended to provide information in this vicinity. There is no indication of contamination at these locations with sampling completed thus far. Planning includes conducting SGE surveys in this area after retrievals are complete.	

MEETING NOTES
Waste Management Area C Work Plan Revisions

Meeting Date: February 25, 2011

Location: 1200 Jadwin, Richland

Purpose: Discuss the Status of the Waste Management Area (WMA C) RFI/CMS Investigation and Work Plan.

Attendees:

Heather Anastos (WRPS)	Bob Lober (ORP)
Mike Barnes (Ecology)	Jeff Lyon (Ecology)
Marcel Bergeron (WRPS)	Dave Myers (WRPS)
Mike Connelly (WRPS)	Julie Robertson (WRPS)
Dwayne Crumpler (CEES)	Beth Rochette (Ecology)
Kathi Dunbar (WRPS)	Virginia Rohay (CHPRC)
Jim Field (WRPS)	Maria Skorska (WRPS)
Les Fort (WRPS)	Harold Sydnor (WRPS)
Rebecca Gerhart (EPA)	Andrew Templeton (WRPS)

Background:

- These monthly meetings provide a forum for Ecology and ORP project managers and technical support personnel to review information generated by the WMA C RFI, and to determine whether changes to the characterization plans and/or the RFI/CMS work plan (RPP-PLAN-39114) are necessary. The meetings are also used as a forum to discuss comments and questions from EPA and Ecology about the WMA C RFI workscope. Meeting notes will be approved by the project managers and entered into the Administrative Record. If the parties agree that changes to the Work Plan are appropriate, the *Hanford Federal Facility Agreement and Consent Order* (TPA) change control process will be used to document Work Plan changes.

Discussion and New Topics:

- **Status of the work plan:**
  - WRPS is revising the WMA C RFI/CMS work plan and WMA C soil sampling and analysis plan (RPP-PLAN-38777) to incorporate previously discussed changes. Changes to the soil SAP will specify the priority of laboratory sample analyses should insufficient sample volume be available to perform all analyses called out in the SAP. Both documents also will incorporate recent agreements that reduce the number of analytical methods to be run on WMA C soil samples and increase sample volume available for the remainder of the analytical methods.
  - The Project Managers signed TPA-CN-382, a Class 3 TPA Change Notice revising Appendix B of RPP-PLAN-39114, *Sampling and Analysis Instructions for Small Mammal Sampling in WMA C*, to provide corrections and clarifications needed before sampling begins.
  - The Project Managers signed TPA-CN-422, a Class 3 TPA Change Notice revising RPP-PLAN-38777 to incorporate a cyanide detection limit.
- **Status of ongoing fieldwork:**
  - RPP-PLAN-39114, Rev 1A, Figure 6-1 identifies that in FY 11, four direct push locations will be completed. This commitment is expected to be completed by doing angle pushing at the following locations:
    - Location J (near Tank C-104)

- Location A (near Tank C-101)
- Location B (near Tank C-101)
- Location C1 (near C-203).

The angle push at C-104 is underway. Paperwork and planning are in process for the planned pushes at C-101.

- At Location Q (UPR-82/cesium pile), 3-D SGE field work is complete; 2-D SGE will be undertaken next.
- Logging work has been on hold for approximately 1.5 months pending resolution of equipment issues. Reanalysis of C Farm well-to-well data continues. Results may be available by the end of March 2011.
- Collection of small mammals to support the ecological risk assessment can proceed now that TPA-CN-382 has been approved by the Project Managers.
- Ecology requested information regarding the recent groundwater sampling stop work order. WRPS noted that electrical issues had been identified with the Grundfos pumps. An extent-of-condition check is being performed at each potentially affected well. WRPS took an action to work with CHPRC to develop an understanding of the CHPRC priorities for recovery from the stop work to determine impacts on tank-related groundwater monitoring requirements.

- **Data Status:** Two data reports have been received from the lab since the January monthly WMA C work plan status meeting. Five of seven reports have been verified and are entering the data validation step. The last of the Fiscal year 2010 data is expected from the lab any day. All fiscal year 2009 data and 50% of fiscal year 2010 data are in HEIS.

- **New Topics:**

  - Ecology letter of accreditation of ATL/222-S Laboratory: The laboratory accreditation for 222-S has been delayed at the Department of Ecology. The 222-S Laboratory has requested a formal extension of accreditation due to the four-month delay in the release of the final accreditation. WRPS and Ecology have reviewed the recent performance evaluation sample results and the latest HASQARD audit for the lab. No major issues were identified. WRPS has recently completed a management assessment of the laboratory, which was also satisfactory. It was agreed that the 222-S Laboratory demonstrates the ability to support vadose work scope and that use of the laboratory should be continued regardless of the current accreditation delay.

    A similar delay in the issuance of the accreditation letter for WSCF may also occur. A CHPRC representative took an action to relay information about this discussion to the appropriate personnel at RL and CHPRC, to encourage advance planning to minimize delays to the degree possible.

  - Summary of January 2011 Performance Assessment (PA) Workshop: A Hanford Advisory Board (HAB) representative has prepared and distributed meeting notes from the January 2011 WMA C PA Workshop on numeric codes and models. The notes identify a significant concern regarding DOE efforts to date to understand the presence and movement of Tc-99 in WMA C soils. The attendees of this monthly WMA C work plan status meeting were dismayed that the expression of concern seems to indicate a failure by the project to communicate adequately the full scope of WMA C soil characterization work. ORP accepted the lead on several actions intended to improve communications:

    - Check with HAB Tank Waste Subcommittee Chair to obtain clarification regarding whether the distributed notes express an individual's opinion or are accurate and reflective of a HAB position,
    - Develop a plan for sharing characterization information directly with the HAB,
    - Develop a process for communicating directly with Tribes.

- **RCRA Facility Investigation (RFI) Report Content and Format**: WRPS provided a briefing on the status of the development of the WMA C RFI report. The briefing included background information, as well as information on the RFI report development schedule and current progress against that schedule. There was considerable discussion about the potential use of Hydro-Geo Analyst software for presentation of RFI data, and WRPS committed to providing Ecology with additional information about this software as appropriate for the project. The meeting attendees also discussed the timing and level of commitment that would be needed from Ecology and EPA to support RFI report development. WRPS took an action to develop clear process expectations for the RFI report to help the agencies plan support efforts. The attendees agreed that routine discussion of the RFI development effort is needed.

Actions:

See attached table. A date-based numbering system is being used as an aid in tracking the topics to completion. Topics/actions will be removed from the list after ORP and Ecology have agreed to their completion.

Robert Lober		4/28/2011
DOE Project Manager (print)	DOE Project Manager (signature)	Date
Jeffery J. Lyon		4/28/2011
Ecology Project Manager (print)	Ecology Project Manager (signature)	Date

Discussion and Actions

Item No.	Topic for Consideration	Action required	Actionee	Impact on WP	Status
08-11-10-3	Conceptual model for spare inlet overflow – important for C-105	Impact and locations of potential overfill spills should be evaluated near C-101, -105, and -110 and text included in WP.	L. Fort	Include info in next WP revision	In process.
08-11-10-5	Organic issue and status what has been agreed to on the 5 locations for organics… any TIC data?	(1) Provide Ecology with detailed status of organic results to support evaluation of need to continue sampling. Modify WP as appropriate. (2) Provide EPA with copy of Ecology authorization dated 02/11/2011.	A. Templeton, M. Connelly, H. Anastos; M. Barnes	Update WP and SAP as necessary to reflect revision of analyte list.	VOC results were presented at 10/27/2010 meeting, along with recommendations. Additional results were provided in Feb 2011, and on 02/11/2011, Ecology provided authorization by email to optimize sampling by discontinuing sampling for VOCs, ethylene glycol, mono and di butyl phosphate, PCB congeners, and gas and diesel range organics. The reduction will result in additional sample material being available for improved analysis of the remaining analytes. ORP will prepare letter documenting recommendations and requesting a response.
08-11-10-8	C-200s proposal for SGE and logging E27-7…	Proposal is to place several deep electrode strings/do SGE near C-200 tanks, in later FY11. Not currently in budget. Separate from this effort, updates are required to WP text regarding specific wells to be logged.	H. Sydnor/ D. Myers (define scope); B. Lober/ S. Eberlein (obtain budget); J Field (redlines on logging)	Include info in next WP revision regarding known in-scope changes to logging efforts.	(1) Redlines on known scope changes already added to the baseline will be incorporated into next revision. (2) Carry additional characterization proposal for consideration.
08-11-10-9	What is planned for E27-23	There is a well on SW side of C Farm near transfer line. Need to investigate a Tc-99 increase. Need follow-up discussion on scope of investigation.	D. Myers, G. Thomas, M. Barnes	Possible future WP change	Archive samples from drilling of E27-20 are available for investigation. Carry additional characterization proposal for consideration.
08-11-10-11	Status of availability of C-111 push (Site V)	Revise WP to change designation of Access Availability in tables from "good" to "constrained by retrieval operations." Similarly update other access information to reflect current state.	J. Robertson	Include info in next WP revision.	In process. On 1/27/11 Ecology asked that constraints be re-evaluated, given slow progress on retrieval actions. On 2/25/2011, parties agreed that access remains constrained.
08-11-10-Q4 **REOPENED**	Do you want to update the analyte list based on changes to RPP-23403, Rev. 4 (sulfide)?	SST DQO has been modified to remove sulfide. Need to evaluate removal of sulfide from C Farm DQO and if appropriate revise analytes in WP.	M. Connelly, H. Anastos	Update WP and SAP as necessary to reflect revision of analyte list.	On 02/11/2011, Ecology provided authorization by email to optimize sampling by discontinuing sampling for sulfide. The reduction will result in additional sample

RPP-RPT-50339, Rev. A DRAFT

Item No.	Topic for Consideration	Action required	Actionee	Impact on WP	Status
					material being available for improved analysis of the remaining analytes. ORP will prepare letter documenting recommendations and requesting a response.
10-23-10-1	Detection limits	Evaluate whether detection limits identified in WP are appropriate.	D. Crumpler, H. Anastos	Possible future WP change	Evaluation and development of recommendation are in progress. Appear to be problems meeting U-total (chemical), Se, Cn, and I-129. However, U-total can be calculated from other available values.
11-17-10-1	Tc-99 at C-108	Review Tc-99 calculations for area near C-108 to determine if there is validity to the Nez Perce assertion that there may be contamination present at levels higher than estimated in the tank closure EIS.	L. Fort	None at this time.	Reviewed Tc-99 calculations for the area near C-108 and concluded that release (overflow) volumes may have been greater than previously estimated, but estimate of Tc-99 released to vadose zone remains at <8 Ci. The Nez Perce evaluation used different conceptual model based on SX farm waste rather than C farm waste, which skewed their radionuclide release estimates. After peer review, the new estimates will be documented as updates to the leak assessment report. <CLOSE>
01-27-11-1	MAPEP results	MAPEP Tc-99 results for Series 23 are due to be released soon. Ecology to be notified when findings are available.	H. Anastos	None at this time.	Results have been released and are under evaluation. <CLOSE>
01-27-11-2	Data reporting and HEIS loading status	Provide status on data reporting and HEIS loads at monthly meetings.	H. Anastos	None at this time.	Provision of data status information is listed on the monthly agenda. <CLOSE>
01-27-11-3	Cs at C-105	Evaluate installation of a temperature probe in dry wells near C-105 to gain information about the volume of releases from C-105 and the amount of Cs released.	S. Eberlein	None at this time.	Carry additional characterization proposal for consideration.
01-27-11-4	Resolution of EPA comments on RFI/CMS work plan	See Attachment A.	See Attachment A.	See Attachment A.	See Attachment A.
02-25-11-1	Groundwater sampling stop work order impact on required tank-related monitoring requirements.	Work with CHPRC to develop an understanding of the CHPRC priorities for recovery from the stop work related to Grundfos pump electrical issues, to determine impacts on tank-related	D. Myers	None.	<new>

RPP-RPT-58339, Rev. A DRAFT

Item No.	Topic for Consideration	Action required	Actionee	Impact on WP	Status
		groundwater monitoring requirements.			
02-25-11-2	Possible WSCF lab accreditation letter delay	Notify appropriate personnel at RL and CHPRC about the potential that Ecology issuance of the WSCF lab accreditation letter may be delayed, to encourage advance planning to minimize delays to the degree possible.	V. Rohay	None.	<new>
02-25-11-3	HAB summary of January 2011 PA Workshop	(1) Check with HAB Tank Waste Subcommittee Chair to obtain clarification regarding whether the distributed notes express an individual's opinion or are accurate and reflective of a HAB position, (2) Develop a plan for sharing characterization information directly with the HAB, (3) Develop a process for communicating directly with Tribes.	B. Lober	None.	<new>
02-25-11-4	RFI report development	Develop clear process expectations for the RFI report to help the agencies plan support efforts. Establish opportunity for routine discussion of RFI development effort.	M. Skorska	None.	<new>

ATTACHMENT A
EPA Comments on the Work Plan

Background:

- In December 2010, EPA provided comments on the WMA C RFI/CMS work plan. The table below details the comments and discussion relevant to the EPA concerns. Actions were identified as necessary to track closure of these comments.
- In addition to the comments below, the meeting participants discussed the path forward for pipeline remediation/corrective action. **ACTION**: Ecology took an action to provide EPA with a copy of the document RPP-PLAN-47559, which evaluates some of the possible measures that could be implemented for pipelines.

No.	EPA Comment	Response	Status
1	Section 2.2, p. 2-6, Paragraph six states that herbicides and pesticides are used on a regular basis to keep plant and wildlife out of WMA C boundary. Given the degree of detail involved in modeling geochemical interactions of COCs in the vadose zone, EPA would like to know if interactions between COCs and herbicide/pesticide molecules have been considered. If this has been evaluated and no significant interaction has been found, please state this in the appropriate section.	Interactions between COCs and herbicide/pesticide molecules were not considered. An agricultural representative from Spokane has indicated that herbicides and pesticides break down in 2 to 5 years in this climate. Very little in the way of herbicides/ pesticides, such as commonly used arsenic, have been detected. Therefore, further investigation is considered unwarranted.	No text change required. <CLOSE>
2	Section 3.2.1.1, p. 3-6 and 3-7. It is understood that water-leachable constituents in the vadose zone are of highest interest for cleanup because they are the contaminants that have the potential to impact groundwater. But, while we are trying to refine our conceptual site model and identify release points and migration pathways, would it be valuable to look at non-water-leachable COC compounds in the vadose zone as well? Are there any reasonably anticipated insoluble precipitates that would occur under the given geochemical conditions? And, if we were to look for these and identify them, wouldn't they help us in understanding where/what kind of releases took place and explain the cation/anion distributions that we are finding?	The investigation includes analysis for Tc-99 and acid digest for metals. The DQO and SAP called for investigating constituents that are in tank waste, including likely precipitates in tank waste.	No text change required. <CLOSE>
3	Section 3.2.2, p.3-14 The occurrence of cyanide in groundwater monitoring wells around WMA C is puzzling since intentional discharges following the In-Farm scavenging did not take place at or nearby WMA C. In fact, the highest and most consistent cyanide concentrations are found in upgradient monitoring well	Cn presence in upgradient groundwater could be due to use in tank-related processes. Bedding in the area dips to the northeast. Groundwater flow is to the southwest. However, to date, all analyses of vadose zone samples for Cn have been non-detect. EPA has lingering questions about a dry well just southeast of	**ACTION**: WRPS to provide information regarding Cn levels in wells near WMA C. Information was provided by email on 2/23/2011. <CLOSE>

No.	EPA Comment	Response	Status
	299-E27-7 (northeast side). Although this workplan does not address groundwater remediation, this information strongly suggests a waste source that is impacting the vadose zone as well. Please ensure that areas of known high cyanide concentration are adequately sampled in an effort to identify the source and evaluate a vadose zone impact.	E27-7.	
4	Section 3.4.1, page 3-30. Please remove the section on EPA anticipated Central Plateau exposure scenarios as we have had no discussion with DOE on exposure scenarios in regard to this document.	EPA will provide replacement text for discussion and incorporation.	**ACTION**: EPA will provide suggested replacement text.
5	Section 3.5.2, p. 3-46 states that (for polychlorinated biphenyls) three vadose zone samples will be in the region of 0-15 ft. Emphasis on sampling soil in the 0-15 ft. range is reiterated elsewhere in the document. Please ensure that this data is sufficient to meet the multiple exposure scenarios listed on p.3-30.	PCB is a known contaminant in tank waste. The sampling program includes sampling for all PCB arochlors at each sampling location in the first 15 feet and the more sensitive congeners analysis. To date, the highest arochlor analysis out of 42 samples has a concentration of 25 ppb for Arochlor-1260, with only 2 detected values. Of the PCB congeners loaded into HEIS, there are approximately 48 samples evaluating approximately 209 congeners representing 8574 analyses. The highest concentration of a PCB congener found to date is less than 0.5 ppb, except for one sample which has values above 10.0 ppb. This one sample is being evaluated further. We believe the data we are collecting on PCB is sufficient for the multiple exposure scenarios.	No text change required. <CLOSE>
6	Figure 3-7, p 3-15 Needs compass.	Acknowledged.	**ACTION**: Compass will be added to figure, assuming the addition does not present a document clearance and public release issue.
7	To date, what percent of the work described in this workplan has been completed?	It was estimated that roughly 40% to 50% of the work has been completed.	No text change required. A summary table will be developed as an aid to communicate the status of the investigation.
8	Is the Phase II RFI/CMS Report for WMA C still due to Ecology on 12/31/2010? Will this be available to EPA?	Under revised TPA milestone M-45-61, the Phase 2 RFI/CMS report for WMA C is now due to Ecology for review and approval as an Agreement primary document on 12/31/2014. However, baseline planning calls for earlier submittal. The document will be available to EPA.	~~No text change required.~~ **ACTION**: The next revision of the work plan will reflect the revised TPA milestone date for M-45-61.
9	What is the depth limit of SGE?	The depth of investigation for resistivity techniques is	No text change required.

No.	EPA Comment	Response	Status
		directly tied to the distance between electrodes. The farther apart, the deeper the investigation. A parallel challenge is that the deeper the investigation, the lower the resolution of that investigation. This reduction in resolution is being addressed by installing strings of electrodes in direct push holes as those holes are decommissioned. The depth of investigation for the 3-D surveys run to date is on the order of 50 to 70 meters.	<CLOSE>
10	Has there been any indication of clastic dikes or preferential pathways via SGE data? (3-D?)	There is no indication of clastic dikes or preferential pathways indicated by SGE data.	No text change required. <CLOSE>
11	Do holes from direct push investigations lead to preferential flow paths in the future? How many years ago were the first direct push investigations done in WMA C and have they led to channeled infiltration?	Boreholes from direct push investigations do not create preferential flow paths. Boreholes are decommissioned per requirements of Washington Administrative Code (WAC) 173-160. Any exceptions must be reviewed and approved by Ecology as a part of a variance filing process. Direct push investigations at WMA C were initiated in July 2005.	No text change required. **ACTION**: Ecology will provide EPA with information on borehole decommissioning requirements.
12	Section 4.5.5, p. 4-29 Has the Tc^{99} sensor described in this section been developed and tested?	The Tc-99 sensor has been taken though the proof-of-principle stage. The prototype tool was able to detect Tc-99 at the 1 pCi/g level in the presence of K-40 typical of Hanford soils. There is no funding for further development of this tool by WRPS/ORP.	**ACTION**: WRPS to provide a status. Information was provided by email on 2/23/2011. <CLOSE>
13	As sampling efforts may have evolved through the execution of this workplan, these are a few specific spots I had questions about: (a) Two valve boxes, located on the south side of C-111 and C-112, are known to have drained directly to soil. Samples taken here? (b) Section 3.2.1, p. 3-6 (d) Anomalous resistivity zone centered around C-104 and a smaller zone around C-108 and C-109. Confirmation sampling done here? (c) Section 3.2.2, p. 3-11 and 3-12 describes Tc^{99} concentration that have "generally increased" since the late 1990s and are currently in excess of 2000pCi/L, which "suggests a tank waste source near monitoring well 299-E27-4". Adequate sampling in this area? (d) Section 4.3.2, p. 4-8 (c) Site 200-E-115 Are there plans to use SGE in this area?	(a) The valve boxes were not identified as a location to investigate during the DQO process: therefore, no samples are planned at C-111 and C-112. (b) Reanalysis of well-to-well resistivity data, implementing recent advancements in analytical capabilities, indicates that the anomaly around C-108 and C-109 was an artifact of having to parse the data to perform the original analysis. The reanalysis also indicated that the anomaly in the vicinity of C-104 is more closely focused on the region near the spare inlet ports on C-101. Direct push investigation at Sites J and K is intended to provide additional information about the anomalies. (c) The planned investigative work is believed adequate to address the Tc-99 issue. Work at UPR 81 and 86, which were believed to have	No text change required.