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

APR 30 2010

10-AMCP-0143

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

Dear Ms. Hedges:

RESPONSE TO DEPT. OF ECOLOGY COMMENTS ON THE 216-U-8 CRIB AND 216-U-12 CRIB VADOSE ZONE CHARACTERIZATION SAMPLING AND ANALYSIS PLAN DOE/RL-2009-94, DRAFT A (SAP)

This letter transmits the U.S. Department of Energy, Richland Operations Office comments to the above-referenced document for review and approval. We anticipate that we have adequately addressed all of your comments and concerns in our comment responses attached.

We appreciate Ecology's willingness to hold numerous workshops and arrive at the approvable sampling and analysis plan. We would like to discuss our comment response in the very near future in order to obtain Ecology's concurrence of our responses by mid-May 2010. Once we receive concurrence of our responses, we will incorporate these into the Revision 0 of the SAP and transmit the document to Ecology for final review and approval.

If you have any questions, please contact me, or your staff may contact, Briant Charboneau, of my staff, on (509) 373-6137.

Sincerely,

Matthew S. McCormick, Assistant Manager
for the Central Plateau

AMCP:KDL

Attachment

cc: See Page 2

cc w/attach:
G. Bohnee, NPT
L. Buck, Wanapum
S.L. Charboneau, DOE-ORP
G. P. Davis, Ecology
D. A. Faulk, EPA
L. A. Fort, Ecology
S. Harris, CTUIR
R. Jim, YN
S. L. Leckband, HAB
K. Niles, ODOE
P.N. Seeley, CHPRC
Administrative Record
Environmental Portal

cc w/o attach:
D. G. Black, CHPRC
M. H. Doornbos, CHPRC
R. H. Engelmann, CHPRC
D. L. Foss, CHPRC
M. J. Gander, CH2
M. J. Hickey, FFS
R. E. Piippo, MSA
J. G. Vance, FFS
C. B. Walker, CHPRC

REVIEW COMMENT RECORD	Date April 4, 2010	Review No. First
	Project No. U-8 & U-12 SAP Deep Vadose Characterization	Page Page 1 of 35

Document Number(s)/Title(s)	Program/Project/Building Number	Reviewers	Organization/Group	Location/Phone
216-U-8 Crib and 216-U-12 Crib Vadose Zone Characterization Sampling and Analysis Plan (DOE/RL-2009-94)	**NWP/Clean-up Section/ER Project**	**Dib Goswami, Michelle Hendrickson, Zelma Jackson, Beth Rochette, Jerry Yokel**	**Clean-up Staff**	

Comment Submittal Approval: Agreement with indicated comment disposition(s) Status:

_____ Organization Manager (Optional)	_____ Date	_____Michelle Hendrickson___ Reviewer/Point of Contact	_____ Date	_____ Reviewer/Point of Contact
		____Michelle Hendrickson__ Author/Originator		_____ Author/Originator

Item	Page #, Line #, or Section and Paragraph	Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/ problem indicated.)	Hold Point	Disposition (Provide justification if NOT accepted.)	Status
1.	General	**Comment:** It appears that very little integration has occurred in this SAP with the ongoing efforts of the Treatability Test Plan data quality objectives (DQO) effort. **Justification:** This sampling and analysis plan (SAP) is to serve several purposes. One of which is collecting deep vadose zone characterization information and the feasibility of this specific collection effort and to fill data gaps/needs for deep vadose zone treatability tests. **Modification needed:** Ensure that all of the requirements for deep vadose zone characterization and the Treatability Test Plan are included in this SAP and part of the characterization effort at the 216-U-8 and 216-U-12 Cribs. (DG)		Accept; The revised SAP provides for the collection of information necessary to select the locations to support the Treatability Test Plan. In addition, this work will also be coordinated	

				with sample collection conducted by Dr. John Zachara (PNNL) conducting research on uranium behavior in the vadose zone (for the DOE Office of Science)	
2.	General	**Comment:** While this SAP follows the EPA /R-5 and the Ecology publication 04-03-030 Guidelines for preparing Quality Assurance Project Plans; it appears to be supporting the collection of data for modeling a select group of contaminants of concern (COCs) in the vadose zone. **Justification:** This SAP is to serve several purposes including resolving comments from the United States Geological Survey (USGS). **Modification needed:** More data from a broader set of analyses needs to be collected to aid regulatory decision making for closure. (JY)		Accept Partially; The entire document will be reviewed with respect to the clarification of COPC, target constituents, detailed chemical analysis, field analysis, etc. and the specific sample collection callouts. The historic USGS comments include those from March 15, 2006 concerning the modeling of	

				vadose zone transport at the U-12 Crib; the Fluor Hanford response to those comments; the USGS's second response on July 18, 2006; and a final response from USGS on January 25, 2007. A closeout meeting with USGS was held on May 14, 2007, where USGS's comments on the U-12 modeling were resolved to the satisfaction of USGS. Additionally, on April 30, 2008, USGS provided comments on the U-8 DQO and on items discussed in the workshops that had been held previously in 2007 and 2008 regarding	

				deep vadose zone characterization in the vicinity of the U-8 Crib; Fluor Hanford provided written responses to these comments as well. Throughout the DQO process, Ecology provided input on the COPC's. Other data, outside the COPC's, will be reported as part of the analytical suite.	
3.	General	**Comment:** Previous characterization data and figures including the groundwater contour map, geophysical logging, and spectral gamma logging that were developed for 216-U-8 and 216-U-12, are not in the SAP. **Justification:** This information and data are needed to support the proposed sampling effort. **Modification needed:** Include these data, information, and figures in the SAP. (DB &BR)		Reject; Previous characterization data and figures, including the groundwater contour map, geophysical logging, and spectral gamma logging that were developed for the 216-U-8 and 216-U-12 Cribs are not	

				included in the SAP. DOE-RL can provide this information to Ecology upon request. The appropriate document for this type of information is the RI Report. The SAP typically contains three sections: 1) a summary of the DQOs from the DQO summary report or systematic planning process; 2) a quality assurance project plan; and 3) a field sampling plan. In addition, we will include in the RI report, geophysical work planned for this summer.	
4.	General and p. 1-1, 2-20, 2-25, 3-1, 3-4, etc.	**Comment:** The SAP discusses the parameters need for various modeling efforts. However, it is silent on integration aspects with the ongoing efforts of the Treatability Test Plan effort and resolution of the USGS comments.		Accept Partially; As noted in responses #1 and	

		Justification: This sampling and analysis plan (SAP) is to serve several purposes. One of which is collecting deep vadose zone characterization information and the feasibility of this specific collection effort and to fill data gaps/needs for deep vadose zone treatability tests as indicated in Appendix B of the Deep Vadose Treatability Test Plan. Also, both EPA and Ecology have agreed the USGS comments are applicable and requested that USDOE incorporate these data needs in the supplemental characterization effort occurring at the 216-U-8 and 216-U-12 Cribs. **Modification needed:** Add or ensure that all of these requirements for deep vadose zone characterization respective to the Treatability Test Plan technologies listed in Appendix B and the data gap needs being developed with the ongoing DQO effort. Also, address and resolve the comments from USGS and include a discussion of these in the SAP; including: • Stratigraphy parameters of the deep vadose zone (thickness, dip angle, texture, structure, etc). • Hydraulic parameters of the Cold Creek Units (CCU) and their potential impacts on lateral spreading of the contaminants • Results of boiling effluent discharges with high concentrations of nitric acid on geochemistry parameters of various vadose stratigraphies including the CCU • Resolution of the proposed conceptual site models regarding the cause of lateral spreading • Explanation regarding the increased concentration of nitrate found sorbed to the soils under the cribs with uranium, especially when Tc-99 is (same mobility constant) is absent • Boundaries and lateral spreading • Results of water table fluxing Draft language may include, "Data collected by this effort will meet the needs to sufficiently characterize the deep vadose zone below the 216-U-8 and 216-U-12 Cribs to that all USGS comments can be fully resolved,		#2, Treatability Test Plan sampling requirements will be addressed, and the various sets of USGS comments have been addressed. Note that the DQO was written to address specific deep vadose zone (DVZ) characterization needs that were identified and agreed to in the workshops. The DQO was not created to address specific Treatability Test Plan needs. However, CHPRC is working closely with DOE and Ecology to insure that Treatability Test Plan needs will be met to the extent practicable	

		deep vadose zone treatability test plan DQOs and data needs can be met, and a remedial alternative can be chosen for these cribs which can be agreed to by Ecology and EPA."(MH)		within the framework of the existing SAP, and these details will be documented in the Treatability Test Plan work plan (under construction). A limited amount of additional language will be added to summarize the salient details of stratigraphy parameters of the deep vadose zone (DVZ); hydraulic parameters of the Cold Creek Unit; and results of high temperature effluent discharges to the cribs However, full discussions of these issues (and nitrate sorption, lateral spreading and water table	

				fluxing) have been addressed in other referenced documents and will not be repeated here. We can provide Ecology these documents upon request. Did Ecology mean "results" of water table fluxing or impacts from water table fluxing? In regard to the absence of TC-99, this COPC may have been absent from some of the last discharges to the crib. Boundaries of lateral spreading were addressed in the multiple shallow-boreholes (<50') that were drilled back in 2005-2006.	
5.	General	**Comment:** Insufficient information is provided in the SAP to address the high amounts in contaminant concentrations (uranium and nitrate) immediately		Accept; At present,	

		below the cribs. **Justification:** To address the Principal Study Questions (PSQ) in the DQO (SGW-42772, Rev. 0) regarding uranium and nitrate's threat to groundwater, the geochemistry and stereochemistry of these contaminants need to be determined. **Modification needed:** Modify the SAP to include soil sample collection immediately below the cribs in known areas of high nitrate and uranium contamination below the cribs and include various additional analyses to determine the geo- and stereochemistries of these contaminants (i.e. presence of organic and ligands that may cause the contaminants to bind to the soil particles immediately below the cribs). Enough information should be obtained from these samples to update the conceptual site models (CSMs), mobility constants (k_d values) and determine an appropriate surface remedial action at these sites. Also, these results can be compared with the deep vadose zone characterization results to determine if the geochemistry of the contaminants and resulting physical properties including k_d change with depth. (MH)		the SAP clearly states that continuous soil samples will be collected from ground surface throughout the entire vertical length of the respective boreholes. The SAP will be modified to include additional analyses to determine the geochemistry of these contaminants.	
6.	General, Figure 3-2 and related text	**Comment:** Is borehole #2 near the 216-U-8 Crib far enough away from the crib to determine extent of contamination in the shallow and deep vadose zone in order to choose a remedial alternative? **Justification:** Based on previous characterization data present in 2007, 2008, and 2009 to Ecology including figures and modeling efforts, and the USGS comments, it appears that this location may be too close to the crib to determine an actual extent of contamination from the crib. **Modification needed:** Reconsider the location for Borehole #2 and either change the location of this borehole and update the SAP or provide additional justification as to the selection of this specific location. (MH)		Accept; A statement will be added to the text stating that Ecology will be consulted when determining the location for Borehole 2. Additionally, the text describing the rationale for the	

				exact location of this borehole will be expanded to make clear that this borehole needs to be advanced very close to former well 299-W19-2, where hot water was encountered while drilling during crib operations. No chemical analysis was completed on soils from this borehole, and it is essential that continuous sampling and the requisite analytical work be completed on vadose zone soils to assist in properly characterizing the nature and lateral extent of effluent discharge. As mentioned in response #4, lateral	

				spread in the upper 50 was delineated by a 2005-2006 drilling campaign around the perimeter of most U-Plant cribs.	
7.	General	**Comment:** No information is provided in the DQO or SAP how the results from the sampling, indirect data sources (as noted in the DQO) and subsequent modeling efforts will be presented to both Ecology and EPA. Nor is there any discussion how these activities will affect updating conceptual site model. Will the Remedial Investigation (RI) and Feasibility Study (FS) reports be updated with this information? **Justification:** Both Ecology and EPA will be responsible parties to sign a Record of Decision for these waste sites. And while the lead agency for these cribs may become EPA, Ecology will be responsible for the Deep Vadose Zone Operable Unit. **Modification needed:** Include information regarding the follow-up reporting of these SAP results, indirect data collection efforts, and subsequent modeling in this SAP. And include both Agencies on distribution. (MH)		Accept; A statement similar to the following will be made in Chapter 1.0 of the SAP: "Results of the sampling from implementation of this SAP, indirect data sources, and subsequent modeling efforts, will be presented in the forthcoming RI/FS documents."	
8.	p. v Line 3	**Comment:** The phrase "of plant-related contaminants of concern (COCs) is not accurate or appropriate given the listing that is presented. **Justification:** This phrase would be appropriate if all the COCs listed in DOE/RL-2000-60, Rev. 0 were used. **Modification needed:** Change phrase to "select contaminants of concern based on previous characterization results and data gaps". (MH)		Accept; The statement "of plant-related contaminants of concern" will be replaced with, "select contaminants of	

				concern based on previous characterization results and data gaps."	
9.	p. xi	**Comment:** The definition for "RME" is missing from the acronym list. **Justification:** All acronyms should be defined in the document. **Modification needed:** Include this acronym and definition. (MH)		Accept; The acronym RME, or "reasonable maximum exposure" will be added to the acronym list.	
10.	p. 2-3 Lines 14&15	**Comment:** Is this statement referring to the utilization of an adaptive sampling and analysis plan (ASAP)? If it is a dynamic work plan then what technical/ administration position will manage refinement of the conceptual site model? **Justification:** A combination of Bayesian analysis and geostatistics will be necessary to guide ASAP design and implementation **Modification needed:** Indicate if this SAP is an ASAP and if so describe how it will be impact the conceptual site models. (ZJ)		Reject; The statement refers to the administrative task of configuration control. The Project Manager is responsible for ensuring that the latest revision of the SAP is provided to the personnel assigned to convert the field sampling plan into work packages (or equivalent) providing specific	

				direction for field activities. This SAP is not an adaptive sampling and analysis plan (ASAP).	
11.	p. 2-4 Line 36	**Comment:** What laboratory was contracted for this work? **Justification:** A Washington State accredited laboratory is required to analyze the samples to produce defensible data for regulatory decision making. **Modification needed:** Ensure that all samples will be sent to an accredited laboratory for analyses or obtain a waiver from Ecology's Chemist. (JY)		Accept; A statement will be added to Section 2.1.1.3 stating that contracted laboratories will be Washington State-accredited.	
12.	p. 2-4&5 and Section 1.5of the DQO (SGW-42772, Rev.0)	**Comment:** Ecology is not able to determine remedial action lacking data regarding organic constituents. **Justification:** Using data from only one sample to make the decision to not test for organics is not statistically defensible. **Modification needed:** Include organic constituents in the SAP. (JY)		Accept Partially; This comment pertains to the DQO. The DQO will be reviewed with respect to the clarification of COPCs, target constituents, detailed chemical analysis, field analysis, etc. and the specific sample collection callouts. VOCs were previously	

				analyzed in borehole 299-W19-94 (total depth = 80 meters and drilled within the U-8 Crib). Kerosene-range hydrocarbons and tributyl phosphate were previously detected in borehole 299-W19-94 and these constituents will be tested as noted in the SAP. Testing for volatile organic compounds (VOCs) will be included in those vertical intervals (between 0-100 feet bgs) with high tributyl phosphate concentrations and coincidently high VOC detection limits in borehole 299-W19-94. VOCs will be continuously tested	

				for between 0-100 feet bgs in the U-12 Crib, and these results will compared to the VOC results at similar depths in the U-8 Crib. Additionally, in both the U-8 and U-12 Cribs boreholes, VOCs will be tested for below the Cold Creek Unit.	
13.	p. 2-4&5 and Section 1.5of the DQO (SGW-42772, Rev.0)	**Comment:** The contaminant of Concern selection needs to be summarized in the DQO. **Justification:** Step 3 of the EPA 7 Step DQO Process creates a list of contaminants of interest based on characteristics of the matrix, data usability and how the data describe the conceptual site model. Ecology assumes the document "Technical Memorandum Summary of Data and Document Review for Development of a Conceptual Site Model for the 216-U-12 Crib" found in appendix A of the DQO is the Department of Energy's (DOE) basis for contaminants of potential concern (COPC) selection. **Modification needed:** Outlined this process in section 1.5 of the DQO as a logic diagram and include this information in the SAP. For example since the process which created this contaminated site was from the tributyl phosphate (TBP) process used at U-Plant to recover uranium from tank waste why is TBP and breakdown chemicals not listed as COPC's? (JY)		Accept Partially; This comment pertains to the DQO. The DQO will be reviewed with respect to the clarification of COPCs, target constituents, chemical analysis, field analysis, etc. and the specific sample collection callouts. Based on subsequent review	

				of historical analytical results from 216-U-8, tributyl phosphate and kerosene-range hydrocarbons will be added to the COPC list. Additionally, VOCs including butanol will be added to the COPC list.	
14.	p. 2-4&5 and Section 1.5 and page A-46 of the DQO (SGW-42772, Rev.0Page A-46	**Comment:** It is not apparent what COCs the beta results in Table A 4-2 of the DQO represents. **Justification:** These constituents should be reflected in the SAP, but Ecology is unable to determine if they are. **Modification needed:** Specify what COCs the beta results in the DQO represent and how they are carried through to the SAP. (JY)		Accept; The downhole geophysics beta/gamma results are not typically radionuclide specific. However, radiochemical analysis of samples from the same borehole will be used to determine the presence of specific radionuclides. This has been done for the borehole	

				shown in Table 4-2. The target radionuclide list will be clarified in the SAP and the rationale for analyte selection will be also be clarified.	
15.	p. 2-5 Lines 23 and 24	**Comment:** Will the gamma spectroscopy and soil sample analyses provide a speciation of uranium isotopes? **Justification:** The speciation of uranium should be reflected in the SAP, but Ecology is unable to determine if they are. **Modification needed:** Specify if speciation of uranium will occur. (MH)		Accept; The gamma borehole geophysics will not provide uranium speciation. However, detailed laboratory chemical analysis of samples in accordance with this SAP will include uranium isotopic analysis. This will be clarified in the SAP.	
16.	p. 2-5 – 2-6, Section 2.1.4.1	**Comment:** There are additional contaminants of concern for these cribs. **Justification:** At least 3 different, though partially overlapping, lists of COCs can be found in DOE/RL-2003-51, DOE/RL-2003-24, and Table 2-7 of this document. All pertain to these cribs.		Accept; Please refer to response to Comment #14 for more information.	

		Modification needed: To encompass the various COCs for these cribs, analyze samples for the following chemical contaminants/contaminant groups: anions, ICP metals, mercury (by cold vapor), PAHs, tri-butyl phosphate, semi-volatile organics, volatile organics, kerosene (or TPH), and uranium. (BR)			
17.	p. 2-7 Section 2.1.5	**Comment:** There is little mention of previous characterization and results for these cribs. **Justification:** A summary of this information is needed to help establish what data gaps/needs remain and how they are being addressed by the methods presented in this SAP. **Modification needed:** Add this information. (MH)		Reject; Previous characterization and results are not typically included in a SAP. The appropriate document for this type of information is an RI Report, which was never completed per se for the 200-UW-1 Operable Unit. For these cribs and the immediate vicinity, there are six documents that describe previous characterization: DOE/RL-91-52, Rev. 0, *U Plant Source Aggregate Area Management Study Report*; BHI-00174, *U Plant Aggregate Area Management*	

				Study Technical Baseline Report; BHI-00034, *Borehole Summary Report for the 200-UP-2 Operable Unit, 200 West Area*; DOE/RL-95-13, *Limited Field Investigation for the 200-UP-2 Operable Unit*; DOE/RL-96-33, *Limited Field Investigation for the 200-UP-1 Operable Unit*; and D&D-27783, *200-UW-1 Field Summary Report for Fiscal Years 2004 and 2005* . In addition, unpublished supplemental field characterization data or characterization published after these reports will	

				be included in either the RI report or supplemental information that will be entered into the administrative record. These references will be included in the revision. A SAP typically contains three sections: 1) a summary of the DQOs from the DQO summary report or systematic planning process; 2) a quality assurance project plan; and 3) a field sampling plan.	
18.	p. 2-9, Table 2-2	**Comment:** The soil screening concentration for total uranium is given as 480 µg/kg, which is 0.48 mg/kg. However, Hanford site background for uranium is roughly 3.2 mg/kg. **Justification:** WAC 173-340-747 Method B (the 3-phase model) gives a cleanup value for uranium of 1.3 mg/kg. Using Hanford site background for total uranium would be reasonable in this case. **Modification needed:** Modify the soil screening concentration to 3.2 mg/kg for		Accept; The soil screening concentration for total uranium will be changed from 0.48 mg/kg to 3.2 mg/kg, and a footnote will be	

		total uranium and footnote that it is based on Hanford site background. (BR)		added stating that this value is based on Hanford Site background concentrations.	
19.	p. 2-13, Figure 2-2	**Comment:** The second decision diamond asks "Do the data represent the RME and/or appropriately conservative or bonding conditions?" The text requires modification. **Justification:** In order to answer this the RME scenario must be defined. It is not, and RME is not on the acronym list. Also, the last part of the question is very subjective. Finally, this describes risk assessment, which is an activity to occur in the RI and FS, along with many other activities that are not discussed in the summary logic. **Modification needed:** Change the text in the second decision diamond to "Are the data adequate for use in RI/FS risk assessments?" (BR)		Accept; The text in the second diamond in the figure will be changed to read, "Are the data adequate for use in RI/FS risk assessments?"	
20.	p. 2-13, Figure 2-2	**Comment:** The box on the bottom left makes reference to a technical memorandum rather than an RI/FS document. **Justification:** The risk evaluation for the new data belongs in a revised feasibility study document. The existing FFS was not approved by Ecology. The documentation for these waste sites is not complete. **Modification needed:** Change the text in the box on the bottom left to: Prepare and issue a revised feasibility study to include the results of supplemental characterization, risk analysis and alternatives analysis for U-8 and U-12 cribs. (BR)		Accept; The text in the box in the lower left of the figure will be changed to read, "Prepare and issue a revised feasibility study as part of the forthcoming RI/FS document."	
21.	p. 2-18, Table 2-4	**Comment:** The table lists EPA Method 8141B. Is this method intended for tributyl phosphate? **Justification:** This method is for organophosphorus pesticides.		Accept; The EPA Test Method 8141B was listed in error. This	

		Modification needed: Provide a footnote listing the contaminants of concern that will be investigated with this method. (BR)		method will be changed to EPA Method 8270 for tributyl phosphate.	
22.	p. 2-20, Section 2.2.2 and elsewhere	**Comment:** The Sampling Process Design does not have a strong tie to the data gaps/needs previously identified and discussed in the DQO and during the workshops. **Justification:** SAPs are primary documents that "stand alone". This information from the DQO that was subject to many workshops and several hours where USDOE, Contractors, and Regulatory Agency staff discussed and decided the data gaps/needs in-depth must be included. **Modification needed:** Add this information into the SAP and provide a stronger tie to the DQO and workshop efforts. (MH)		Accept; The data gaps identified during the DQO workshops will be summarized and added to Section 1.0 of the SAP.	
23.	p. 2-20, Line 2 and lines 10 - 11	**Comment:** Though the additional boreholes are critically needed for remedy selection and appreciated, they will not provide the quantity and distribution of contaminants in the vadose zone, since only 2 boreholes will be drilled in crib U-8 and 1 in crib U-12. **Justification:** In order to fully know the distribution and amount of contamination a statistically-based investigation would be required. **Modification needed:** Modify the text in line 2 to: The requirements of this study are to obtain more information about selected contaminants.... Also, modify line 10 to: short distance from the crib; this location will provide additional information about the magnitude and location within..... (BR)		Accept; The nature and extent will indeed be better understood after generation of the data per this SAP. The text will be modified as requested.	
24.	p. 2-21 – 2-25, Table 2-5	**Comment:** There is insufficient effort described for determining concentrations of contaminants of concern. **Justification:** The table describes a great deal of sample characterization, including selective extractions and TOC analysis. However, the table is vague and incomplete for COC concentration measurements. It mentions carbon		Accept; Please see response to Comment #14 for additional information.	

		tetrachloride and degradation products, though other tables (such as Table 2-2) do not include these contaminants. **Modification needed:** Focus efforts on COC concentrations. Analyze samples for the following chemical contaminants/contaminant groups: anions, ICP metals, mercury (by cold vapor), PAHs, tri-butyl phosphate, semi-volatile organics, volatile organics, kerosene (or TPH), and uranium. (BR)			
25.	p. 2-25, Section 2.2.2.4, p. 3-8, Section 3.3.2, and p.3-13, Figure 3-12	**Comment:** There is insufficient information presented describing the indicators and criteria associated with collecting soil samples for laboratory analyses during the sampling effort. **Justification:** While various portions of the SAP and DQO allow one to "piece together" this information; it should be clearly discussed and described. **Modification needed:** Add this information to the sections specified and re-work the figure. (MH)		Accept; Please see response to Comment #40 for additional information.	
26.	p. 2-25 and 2-26, Sections 2.2.2.4 and 2.2.3, and various text after these sections	**Comment:** Organic Vapor Monitoring (OVM) and gross gamma/passive neutron logging were not included as field measurement methods for this SAP. **Justification:** According to previous DQO efforts, organics and plutonium, while not present in large quantities, are still COCs of concern for these cribs. OVM and gross gamma/passive neutron logging are field measurement techniques, which are relatively inexpensive and reliable. **Modification needed:** Consider adding these field measurement techniques and update the SAP or provide additional justification why these measurements will not be included in this effort. (MH)		Accept; Please refer to response to Comment #14 for more information.	
27.	p. 2-26, Section 2.2.2.4, 2nd bullet on pg., and p. 2-27, Section 2.2.5, Table 2-7	**Comment:** Measurements of oxidation-reduction potential are not likely to provide meaningful data unless the samples are saturated with vadose zone water, sampled without contacting the atmosphere, stored to prevent contact with the atmosphere, measured in their field-saturated condition in an atmosphere of inert gas (such as N_2 or argon). **Justification:** Any contact with the atmosphere or introduction of laboratory		Partially Accept; Please refer to response to Comment #45 for more information.	

		water will alter the redox potential such that the results mainly reflect the redox potential of the laboratory water. Measurements will not provide redox potentials representative of those in the subsurface environment. **Modification needed:** Focus on contaminant concentrations and omit redox potential measurements. (BR)			
28.	p. 2-28, Table 2-7	**Comment:** The detection limit goal for arsenic is too high. **Justification:** Arsenic cleanup levels are all below site background, so the detection limit goal should be at least as low as Hanford site background. **Modification needed:** Reduce the detection limit for arsenic to the Hanford site background value of 6.5 mg/kg. (BR)		Accept; The detection limit in Table 2-7 for arsenic will be changed to a concentration below the Hanford Site background value of 6.5 mg/kg, and the analytical technique will be changed to Induced coupled plasma/mass spectroscopy (ICP/MS) to obtain a detection limit at or near an order of magnitude below 6.5 mg/kg.	
29.	p. 2-28, Table 2-7 – 2-9	**Comment:** The table is not complete. **Justification:** See other comments regarding contaminants of concern. **Modification needed:** Analyze samples for the following chemical		Accept; Please refer to response to Comment #14 for more information.	

		contaminants/contaminant groups: anions, ICP metals, mercury (by cold vapor), PAHs, tri-butyl phosphate, semi-volatile organics, volatile organics, kerosene (or TPH), and uranium. Add these to the table. (BR)			
30.	p. 2-28, Table 2-7 – 2-9	**Comment:** Sorption should be assessed by measuring isotherms, rather than simple individual partition coefficients. **Justification:** Isotherms indicate the extent of non-linearity and provide data that can be used in modeling (Freundlich and/or Langmuir coefficients). These results can also be used for determining individual partition coefficients at various concentrations. **Modification needed:** Include isotherm analyses instead of individual partition coefficient measurements. (BR)		Reject; The intent of the data collection is to provide additional understanding of the in-situ behavior of residual vadose zone contamination. Determination of distribution coefficients at selected locations and varying contaminant concentrations should provide useful information without performing detailed isotherm determinations on discrete samples. Additionally, the differential leaching analysis will provide supplemental information regarding	

				contaminant mobility similar to information that would be otherwise derived from isotherm development.	
31.	p. 2-32 – 2-33, Table 2-9	**Comment:** Several of the required quantitation limits are too high. **Justification:** Several of the required quantitation limits exceed MCLs or risk-based thresholds. **Modification needed:** Reduce the quantitation limits to the following: Antimony to 6 µg/L based on the MCL Arsenic to 10 µg/L based on the MCL Cadmium to 1 µg/L based on the MCL Mercury to 2 µg/L based on the MCL Thallium to 1 µg/L based on WAC 173-340-720 Method B (the MCL is 2 ug/L) Fluoride to 940 µg/L based on WAC 173-340-720 Method B (BR)		Reject; Porewater contaminant concentrations in arid vadose soils should not be compared to drinking water standards. Porewater concentrations are not being measured to compare results to applicable human health and ecological receptors actions levels. Rather, porewater concentrations are being measured to better understand the geochemical behavior of COCs	

				in the vadose zone; support 2-dimensional numerical modeling; and support additional evaluation of mobile COCs in the vadose zone. Due to the inherent difficulty in extracting porewater from arid vadose zone samples, detection limits in Table 2-9 are not unreasonable.	
	p. 2-36, sub bullets on last bullet	**Comment:** Why are hexavalent chromium and mercury excluded from the metals listing? **Justification:** These are important metals to include in analyses, are present at the Hanford site in large quantities, and influence risk assessments. **Modification needed:** Include these metals in the analysis or provide a justification why they are not included. (MH)		Accept; The statement "excluding hexavalent chromium and mercury" will be deleted from the text in this section.	
32.	p. 3-1, Section 3.1	**Comment:** The text states "The vadose zone characterization at the 216-U-8 and 216-U-12 Cribs is intended to fill data needs…" However, the data needs are not provided.		Accept; A list of data needs derived from the DQO report will be	

		Justification: A clear list of data needs is not given in the document. **Modification needed:** Provide the data needs here or on Section 2.2.2. If they are included in Section 2.2.2, add a reference to that section in Section 3.1. (BR)		added to Section 2.2.2.	
33.	p. 3-3, Section 3.2	**Comment:** Field observations and descriptions of the geologic media should be recorded during sampling. **Justification:** Field observations provide valuable information that is useful in data interpretation and correlation of borehole data, as well as indicating certain chemical conditions in the media. For instance, visible signs of iron depletions and concentrations help discern which units have reducing or periodically reducing conditions. **Modification:** Add a bullet for field observations and descriptions of geologic media during sampling. (BR)		Accept; A bullet will be added to the list for the recording of field observations and descriptions of geologic media during sampling.	
34.	p. 3-4, Section 3.3.1.1, 3rd paragraph of section	**Comment:** The text states "The result of the soil resistivity survey will be evaluated and considered in final borehole placement, specifically for location of Borehole 2, outside the crib footprint." Ecology requests that we be consulted for choosing a location for this borehole. **Justification:** The borehole will be expensive and should be located based on the judgment and needs of all parties. **Modification needed:** Consult Ecology when choosing the location for Borehole 2 and include a statement in this document that Ecology will be consulted for locating Borehole 2. (BR)		Accept; A statement will be added to the text stating that Ecology will be consulted when determining the location for Borehole 2 (see response to Comment #6).	
35.	p. 2-18, Table 2-4	**Comment:** The table lists EPA Method 8141B. Is this method intended for tributyl phosphate? **Justification:** This method is for organophosphorus pesticides.		Accept; The EPA Test Method 8141B was listed in error. This method will be	

		Modification needed: Provide a footnote listing the contaminants of concern that will be investigated with this method. (BR)		changed to EPA Method 8270 for tributyl phosphate.	
36.	Page 3-4 Lines 6-8	**Comment:** Cable tool drilling may have demonstrated satisfactory performance at the Hanford Site but it does have some disadvantages. **Justification:** The rate of penetration is very slow and there are problems with "heaving sands", just as with the hollow-stem auger. **Modification needed:** Consider this drilling method and potential for "heaving sands" and plan accordingly for this event in the field during characterization. – or - disregard this comment if cable tool drilling is not deployed in drilling any of the three boreholes. (ZJ)		Accept; Comment noted.	
37.	Pages 3-4 to 17 and page 7-6 of the DQO (SGW-42772, Rev.0)	**Comment:** It appears that the SAP does not sample or provide an adequate basis for sampling at the "high uranium" depths below ground surface as noted by Figure 7-2 in the DQO. **Justification:** Figure 7-2 of the DQO is the 216-U-8 crib vertical distribution of uranium based on previous characterization data. **Modification needed:** The SAP needs to direct some sampling efforts for the new boreholes in relation to the contaminant distribution as shown in this figure for "high uranium" levels. (JY)		Accept; The SAP will be revised to include sampling in the high uranium depths below ground surface, as noted in Figure 7-2 of the DQO.	
38.	p. 3-7, lines 9 to 17	**Comment:** This paragraph is inappropriate for this SAP. **Justification:** The entire point of the SAP is to provide further characterization so that a remedial alternative can be chosen from the data gathered directly and indirectly, and subsequent modeling efforts to be performed after characterization is completed. No remedial alternative will be selected during the sampling effort. Thus, it is inappropriate to not complete characterization should contamination be encountered at moderate depths. Also, care in drilling should be taken to avoid any contamination of the deep vadose zone from this		It is assumed that the reviewer is referring to page 3-8, lines 9-17, not page 3-7. The paragraph will be modified substantially;	

		characterization effort. **Modification needed:** Strike this paragraph. (MH)		language referring to the selection of a barrier will be removed. Based on conditions observed during drilling, it may not be appropriate to complete boreholes 1 and 3 as groundwater monitoring wells. In this event, a variance will be requested to allow for construction of a vadose zone monitoring well.	
39.	p. 3-12 – 3-13, Figures 3-8 and 3-9	**Comment:** The sample preparation process appears to allow contact of the sample with the atmosphere (especially during splitting). If so, analysis of ORP is not meaningful. **Justification:** See prior comment describing conditions needed for meaningful determination of ORP. **Modification needed:** Omit ORP determination. (BR)		Partially Accept; Please refer to response to Comment #45 for additional information. The sample collection and immediate preservation process will be modified, and this modification will	

				be detailed in the revision. The revision will remove Figures 3-8 and 3-9; Figures 3-10 and 3-11 become 3-8 and 3-9; and two new figures will be added that detail sample handling and collection of short-term field measurements.	
40.	p. 3-12, Figure 3-8	**Comment:** The figure should be re-titled "Sample Measurement or Initial Assessment" and a new Figure added before it that describes the criteria to collect a sample. **Justification:** The decision logic employed to collect a soil sample interval from the continuous soil column collect has not been adequately defined or presented. **Modification needed:** Change the title of Figure 3-8 and include a new figure prior that includes the following decision logic soil sample collection criteria: 1. Noted increase in field measurements for gamma, beta, alpha, OVM, etc. 2. Texture change 3. Known depth of contamination based on previous characterization and logging data 4. Change in physical properties 5. General interest, etc. (MH)		Accept; A new figure and descriptive text will be added to Section 3 that includes the decision logic for when soil samples will be analyzed.	
41.	p. 3-13, Figure 3-9	**Comment:** The sample preparation quantities are missing in the white boxes.		Accept; The soil sample preparation	

		Justification: Soil sample quantities are needed to ensure all analyses can be performed on the sample collected. **Modification needed:** Add appropriate sample quantities needed. (MH)		quantities will be added to Figure 3-9 as requested.	
42.	p. 3-15, Figure 3-11	**Comment:** The third and fourth boxes make reference to detailed analysis for only some segments of the borehole. Contaminant analysis is needed for all sections of these expensive boreholes. **Justification:** Given the expense of drilling boreholes, all segments of the boreholes should be analyzed for all contaminants of potential concern. **Modification needed:** Analyze all segments of the boreholes for the following chemical contaminants/contaminant groups: anions, ICP metals, mercury (by cold vapor), PAHs, tri-butyl phosphate, semi-volatile organics, volatile organics, kerosene (or TPH), and uranium. (BR)		Accept; Please refer to response to Comment #40 for additional information.	
43.	p. 3-15, Figure 3-11	**Comment:** The third box from the bottom on the right side of the figure should be modified to list sorption isotherms. **Justification:** See prior comment on the value of sorption isotherms over individual partition coefficient measurements. **Modification needed:** Modify the third box from the bottom on the right side of the figure to list sorption isotherms. (BR)		Accept; Figure 3-11, third box from the bottom on the right side will be modified to include "sorption isotherms."	
44.	Page 3-16 Lines 3-7	**Comment:** Clarify drilling and screening methods in the SAP. **Justification:** Technology and industry practices have changed in the use of long-screened only in monitoring wells. Screens are being installed with intervals as short as 2 or 3 feet. The primary drilling method selected, rotary sonic drilling usually is continuous and relatively undisturbed samples can be obtained with the split spoon attached. This method has the ability to drill easily at any angle in unconsolidated areas in a formation. **Modification needed:** Include language describing the potential use of shorter		Accept; Drilling and screening methods will be clarified in the SAP. Regarding well screen interval, a relatively longer screened interval is	

		screen length in preventing lost of representative samples at depth below the water table in the unconsolidated formation. (ZJ)		being called for due to the known decline of the water table in the 200W area over the upcoming years. The practical necessity of having to design a well that will continue to produce water over a reasonable period of time requires a relatively longer screened interval. Secondarily, the precise location of a smaller screened interval may not accurately intercept the target contaminated interval, which may change elevation over time. Thirdly, except for some near-source locations, there has not been severe	

				stratification of contamination observed within UP-1 wells.	
45.	p. 3-16, Section 3.3.2, lines 35-36	**Comment:** Visual observations of iron depletions and concentrations should be substituted for measurement of ORP. **Justification:** Retaining the field ORP during sampling and analysis is challenging. Redox depletions/concentrations are visual indicators that will be retained after sampling. **Modification needed:** Substitute visual indicators of redox conditions for ORP measurements. (BR)		Accept; The text will be modified to add visual observations for iron depletions and concentrations. Further precautions will be taken to insure as high a degree as possible of sample integrity regarding the analysis of redox potential. The intent of the redox analysis is not to determine exact reduction/oxidation conditions in the vadose soil. Rather, the intent is to provide additional context regarding the variability over the full thickness of	

				the vadose zone.	
46.	p. A-1	**Comment:** The Kd assumed for uranium is questionable and not representative of the range for uranium sorption values. Sorption isotherms should be measured to assess uranium sorption in these samples. Also, the units for Kd are L/kg or mL/g, rather than μg/L. **Justification:** See prior comments about the value of measuring sorption isotherms. Measured values should be used rather than assumed values for Kd. **Modification needed:** Measure uranium sorption isotherms rather than using an assumed Kd value for uranium. (BR)		Accept; Please refer to response to Comment #30 for additional information.	