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

10-AMCP-0127

JUN 04 2010

Mr. R. Jim, Manager
Environmental Restoration/
Waste Management Program
Confederated Tribes and Bands
of the Yakama Nation
2808 Main Street
Union Gap, Washington 98903

Dear Mr. Jim:

INTEGRATED 100 AREA REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN, ADDENDUM 3: 100-BC DECISION UNIT, DOE/RL-2008-46-ADD3, DRAFT A, AND SAMPLING AND ANALYSIS PLAN FOR THE 100-BC DECISION UNIT REMEDIAL INVESTIGATION/FEASIBILITY STUDY, DOE/RL-2009-44, DRAFT A

This letter responds to your November 30, 2009, comments regarding the Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan, Addendum 3: 100-BC Decision Unit, DOE/RL-2008-46-ADD3, Draft A, and Sampling and Analysis Plan for the 100-BC Decision Unit Remedial Investigation/Feasibility Study, DOE/RL-2009-44, Draft A.

The U.S. Department of Energy Richland Operations Office has considered your comments and the documents have been updated. Specific responses to your comments on the 100-BC Addendum and Sampling and Analysis Plan are attached.

If you have any questions, please contact me, or your staff may contact Jill Conrad, Tribal Program Manager, on (509) 376-0288.

Sincerely,

Matthew S. McCormick, Assistant Manager
for the Central Plateau

AMCP:GLS

Attachment

cc: See Page 2

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EDMC

100·BC·1
100·BC·2
100·DC·5

cc w/attach:
G. Bohnee, NPT
L. Buck, Wanapum
L. Buelow, EPA
T. Davidson, US Fish & Wildlife
S. Harris, CTUIR
J. A. Hedges, Ecology
N. Idanza, NOAA
S. L. Leckband, HAB
K. Niles, ODOE
J. B. Price, Ecology
D. Rowland, YN
P. Shaffer, ODOE
T. Stoops, ODOE
Administrative Record (100-BC-1, 100-BC-2, and 100-BC-5 OUs)
Environmental Portal

cc w/o attach:
D. T. Bignell, WCH
D. G. Black, CHPRC
J. V. Borghese, CHPRC
N. A. Bowles, CHPRC
J. M. Capron, WIND
E. T. Feist, WCH
B. H. Ford, CHPRC
D. L. Foss, CHPRC
M. N. Jaraysi, CHPRC
W. F. Johnson, WCH
K. A. Ivarson, WIND
R. E. Piippo, MSA
J. G. Vance, MSA

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1			**RI/FS data collection should incorporate River Corridor risk assessment objectives.** It is unclear how the objectives of existing risk assessments are accounted for in this work plan, and how data gaps previously identified by those studies will be addressed in the current round of data collection. Remedial investigation data collection and risk assessment are linked processes. The risk assessment uses site characterization data, including data that will be collected in accordance with this current work plan, to evaluate risk at the site. In order to properly characterize the risks present at the site, data collected per this work plan must be incorporated both the past and on-going risk assessments including those that are already being used to make remedial decisions. The work plan notes that "residual human-health risk is being evaluated for the upland waste sites cleaned up under the interim action RODs." How will risks be evaluated for areas that have not been characterized or that have not been cleaned up?	--	The 100-Area risk assessment activities are summarized in the Integrated Work Plan, so are not discussed in each addendum. RCBRA results will be available for inclusion in the 100-BC RI/FS Report. Agree. The RI/FS report will incorporate previous data and the data collected during the RI. Data collected during waste site remediation and other investigations, such as the Columbia River sampling, will also be included in the data set that is evaluated during the RI/FS process. The risk evaluation will incorporate all of these available data sets. These risks will be evaluated through the continuing authority of the interim action RODs or under the direction of the final RODs. In the case of 100-BC, nearly all of the waste sites will have been remediated under the interim action ROD authority prior to completion of the final ROD. Additional characterization at interim-closed waste sites is proposed to evaluate interim remedial action, address uncertainty regarding the nature and extent of residual contamination in soils, refine the conceptual site model (if needed), and support the determination of the final ROD.
2			**Systematically evaluate risk according to Hanford cleanup questions.** Risk assessment should be tied to the questions that must be answered for a site cleanup (NAS, 2009). For the Hanford Site, this includes the question asked by the Yakama Nation: *will the cleanup of the Hanford Site result in safe, unlimited and unrestricted use of the land,*	--	Additional characterization at interim-closed waste sites is proposed to evaluate interim remedial action, address uncertainty regarding the nature and extent of residual contamination in soil, refine the conceptual site model (if needed), and support the determination of the final ROD. The effectiveness of the interim remedial actions at waste sites and the need for additional or different remedial

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			waters, and other natural resources by Tribal people for all generations? The Comprehensive Land Use Plan EIS should not be the sole document to dictate the exposure scenarios used as part of the risk assessments. All human health scenarios, including those described specifically in the Yakama Nation Exposure Scenario, should be considered when determining the risk posed by residual contamination and when making cleanup decisions. All media, exposure pathways and use scenarios, particularly those unique to native tribes must be included in risk assessment for the evaluation to be considered complete and acceptable. The U.S. Government Accountability Office (GAO, 2009) has pointed out that DOE is not systematically evaluating whether cleanup strategies identified for the Hanford Site are commensurate with the risks posed by residual wastes. The Yakama Nation has also previously noted that a holistic risk assessment approach must be developed and followed for the entire site. This specifically includes addressing cumulative impacts from potential exposure to all radiological and chemical hazards that are being evaluated.		actions will be evaluated in the RI/FS process. The Yakama Nation Exposure Scenario was evaluated in the RCBRA. Uncertainties in the risk assessment, including understanding variability in potential exposures and understanding potentially sensitive populations, has been addressed in the RCBRA in accordance with EPA risk assessment guidelines. The RCBRA has been prepared with methods and assumptions which produce exposure estimates that achieve or exceed EPA's requirement for a Reasonable Maximum Exposure (RME) scenario; EPA requires that exposure scenarios achieve a RME for use in remedy decisions. Human health risks associated with the RME are assessed using toxicity values that are intended to protect public health including sensitive populations and are based on the most sensitive health effects associated with each contaminant. The RCBRA is currently being completed and continues to be modified with input that RL receives. RCBRA results will be incorporated in the 100-BC RI/FS Report. There is no document modification planned in response to this comment.
3			**The National Academy of Sciences (NAS, 2005) supports the policy of "zero tolerance" which is not properly addressed in existing risk assessments** The policy of zero tolerance states that exposure to even small quantities of radiation results in an incremental increase to the risk of developing cancer. Non-cancer effects (which assume a dose threshold) are often under-emphasized in the risk assessments that have been provided, but must be weighted equally to properly	R	The River Corridor Baseline Risk Assessment (RCBRA) project continues with input from state and federal regulators and stakeholders. RCBRA results will be available for inclusion in the 100-BC RI/FS Report and are expected to provide key information for residual contamination human health and ecological risks and will provide insight regarding waste sites that have not been remediated prior to final ROD determination. The RCBRA assesses cancer and noncancer health effects in accordance with EPA CERCLA risk assessment

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			evaluate risks posed by residual contamination.		guidance, including *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A), Interim Final,* EPA/540/1-89/002, 1989; *Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment) Final,* OSWER 9285.7-02EP, EPA/540/R/99/005, 2004; *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment),* EPA-540-R-070-002, 2009; *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities,* OSWER Directive 9355.4-12 , EPA, 1994; *Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities,* OSWER Directive 9200.4-27, EPA/540/F-98/030; *Soil Screening Guidance: User's Guide,* EPA/540/R-96/018; *Soil Screening Guidance: Technical Background Document,* OSWER Directive 9355.4-17A, EPA/540/R-95/128 ; and *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination ,* OSWER No. 9200.4-18, August 22, 1997.
4			**Institutional controls do not protect against risk from residual waste.** DOE has stated as a remedial action objective that where remediation of contaminants to levels which allow for unrestricted use is not possible, appropriate institutional controls and long term-stewardship activities will be developed on the Hanford Site. Institutional controls are in effect mutually exclusive with unrestricted use. Allowing contamination to remain	--	Institutional controls will be evaluated during the feasibility study as a potential part of the remedial action alternatives. It is recognized that Institutional Controls (ICs) have uncertain capability for long term protection of human health and the environment, however, there may be instances where application of ICs as part of a remedy could be appropriate. This may be particularly appropriate for an interim period, as suggested by your comment (e.g. while technologies are being developed) or

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			onsite should not be considered a long-term solution, but an interim one (e.g., while technologies are developed and remedies are implemented) until the site is fully remediated to allow for unrestricted use. The projected lifespan of many of the contaminants on site exceed even the most optimistic projections for effective implementation of institutional controls. Physical restrictions cannot be expected to provide effective site control for the indefinite future and if relied upon, would require indefinite monitoring and probable expansion as residual wastes begin to be mobilized. Thus, institutional controls should not be treated as a viable long-term solution for the Hanford Site. The current DOE plan to leave high level waste at Hanford in the 200 Area in particular, which is a source of groundwater contamination to the 100 Area, has not only regulatory and political implications, but serious environmental implications. The long-lived radionuclides in this area, including uranium, plutonium and transuranics (which constitute a large amount of residual radioactivity), if not properly contained and disposed of, will require DOE to maintain institutional controls in perpetuity in conjunction with monitoring. Anything less than indefinite maintenance and monitoring to ensure the effectiveness of the controls and prevent intrusion by humans and biota would be irresponsible. To assess risk under the proposed scenario where residual contamination is allowed to remain, the risk assessment will have to consider potential exposure to all remaining contaminants, and should include pathways which account for migration through various media, relocation through biological processes (i.e. nest-building, excretion, and re-uptake), and potential exposure based		during natural attenuation of short term risks such as tritium contamination in groundwater. As part of the development of an overall understanding of risk, the ongoing River Corridor Baseline Risk Assessment (RCBRA) is addressing potential exposures associated with hypothetical future site uses that are not currently envisioned. These include future residential use in addition to exposure pathways associated with future subsistence lifeways based on exposure scenario information provided by the Yakama Nation. DOE is engaging in a site-wide evaluation of the nature and extent of contamination, including areas associated with waste sites and areas between waste sites. This activity is intended to evaluate the Fate and Transport mechanisms associated with contaminants at the soil surface, including stack emissions, windblown dust, and biotransport. DOE will be evaluating methods to communicate risks across the site using this site-wide nature and extent information.

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			on future site uses that are not currently envisioned. Because future failure of institutional controls is essentially guaranteed, planning should consider unrestricted use of natural resources by Tribal people. Contamination left on site may result in unacceptable risk.		
5			**Develop a complete and adequate risk assessment problem formulation.** The basic concept of risk assessment involves four steps – hazard identification (and development of a problem formulation), dose-response (toxicity) assessment, exposure assessment, and risk characterization. For an adequate characterization of risk, there must be adequate site characterization data to assess in the process, which should be used to determine cumulative risks from exposure to both chemical and radiological contaminants found in all media. DOE site investigations have been focused on remedial actions at specific waste sites. At present the full nature and extent of the site contamination has not been characterized; therefore, any risk assessment which is performed will be both limited and incomplete in its scope. Returning to the four basic steps of risk assessment, the National Academy of Sciences (NAS, 2009) and EPA (EPA, 2003) recommend that greater attention be paid to the design of a risk assessment during the formative stages, specifically on planning, scoping, and problem formulation. It is understandable that DOE intends to increase the pace of the cleanup activities, but if important steps are not taken, such as adequate and long-term planning for the entire site, the intended "fast-track" will likely result in an incomplete and inadequate	R	The River Corridor Baseline Risk Assessment (RCBRA) project continues with input from state and federal regulators and stakeholders. RCBRA results will be available for inclusion in the 100-BC RI/FS Report and are expected to provide key information for residual contamination human health and ecological risks and will provide insight regarding waste sites that have not been remediated prior to final ROD determination. Risk assessment in support of remedial responses at the Hanford Site is an ongoing, cumulative process based on providing risk characterization information at appropriate times to support cleanup decisions for discrete areas of the site (e.g. River Corridor, Central Plateau). In addition to evaluating risk associated with waste sites and the contiguous operational areas, DOE will be evaluating the nature and extent of contamination that could potentially be present in the areas between waste sites areas (non-operational areas) as a result of reasonable disposal or dispersal actions (e.g. undocumented disposal, windborne dispersal, biological activity).

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			cleanup.		
6			**Collection of additional data should include as a basic objective the reduction of uncertainty in evaluating tribal risk.** Uncertainty is inherent in any measurement, and in all scientific data. Although unavoidable, uncertainty can be reduced by expanding the data set with additional and/or high quality measurements. Variability is an inherent characteristic of a population (considering exposure potential, susceptibility, etc.) that cannot be reduced with additional measurement or data, but often can be better characterized. Tribal people comprise a critical subset of the general population because they have higher contaminant exposure due to their lifestyle and diet. Within the tribal population there are individuals (children, pregnant/nursing women, elderly, and immune-compromised) with even greater susceptibility to developing cancer or experiencing non-cancer effects. The final risk assessment should collect enough data of high quality so as to minimize the uncertainty that is associated with variability of susceptibility among tribal people.	--	The Yakama Nation Exposure Scenario was evaluated in the RCBRA. There are no plans to collect additional data for this scenario. Uncertainties in the risk assessment, including understanding variability in potential exposures and understanding potentially sensitive populations, has been addressed in the RCBRA in accordance with EPA risk assessment guidelines. The RCBRA has been prepared with methods and assumptions which produce exposure estimates that achieve or exceed EPA's requirement for a Reasonable Maximum Exposure (RME) scenario; EPA requires that exposure scenarios achieve a RME for use in remedy decisions. Human health risks associated with the RME are assessed using toxicity values that are intended to protect public health including sensitive populations and are based on the most sensitive health effects associated with each contaminant. The RCBRA is currently being completed and continues to be modified with input that RL receives. RCBRA results will incorporated in the 100-BC RI/FS Report
7			**Remediate groundwater to highest beneficial uses.** Groundwater should be remediated to the highest beneficial uses, for drinking water and for protection of aquatic life.	A/m	The beneficial groundwater uses noted will be a key consideration in determining the final ROD. 40 CFR 300.430(a)(1)(iii)(F) will quoted as appropriate. 40 CFR 300.430(a)(1)(iii)(F): "EPA expects to return usable groundwaters to their beneficial uses wherever practical, within a period that is reasonable given the particular circumstances of the site. When restoration of groundwater to beneficial uses is not practical, EPA expects to prevent further migration of the plume, prevent

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					exposure to the contaminated groundwater and evaluate further risk reduction"
8			**Final Records of Decision remain outstanding at this time.** In its current form, the statement: "As remedial actions under interim action RODs are completed, verification sampling and laboratory analysis are performed to document the extent to which remedial action goals established under the interim action RODs have been met. This information will be essential to supporting the final ROD." suggests that the information collected as part of verification sampling during interim remedial actions will justify the final ROD, and perhaps more specifically a "no action" ROD on the basis that the site has already been remediated. It is important to be clear and consistent that depending on the results of the RI/FS studies and the requirements of the final ROD, additional remediation may be required. Therefore, it should be stated that the data in gathered will be used to help *determine* the final ROD, rather than support it. It should be made clear throughout the work plan that interim closed out sites have not been closed out on a permanent basis since final RODs have not been issued. These sites may require additional remedial action in the future in order to come into compliance with the final ROD's remedial action objectives.	A	The Integrated Work Plan and addenda acknowledges that waste sites have been dispositioned in several ways (e.g., no action, not accepted, closed, and interim closed). Waste sites remediated since the mid-1990s have primarily been addressed under the authority of interim action RODs. Additional characterization at interim-closed waste sites is proposed to validate interim remedial action, address uncertainty regarding the nature and extent of residual contamination in soils, refine the conceptual site model (if needed), and support the determination of appropriate actions in the final ROD.
9			**Site characterization should be expanded to fully identify the nature and extent of contamination on**	R	Additional characterization at interim-closed waste sites is proposed to validate interim remedial action, address

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			site. The site characterization of each decision unit is inappropriately narrow and focused on implementation and optimization of (already decided) remedial actions. As is noted in EPA/540/G-89/004; "the final objective of the field investigation is to characterize the nature and extent of contamination such that informed decisions can be made as to the level of risk presented by the site and the appropriate types of remedial response." As it is currently formulated, the planned sampling and analysis does not appropriately characterize the full nature and extent of contamination, but remains focused on further defining previously identified zones of contamination or identified waste sites. This can (and has) lead to areas of high contamination being overlooked and not appropriately remediated. Initial characterization activities in the 100 Area were conducted to support early response actions to clean up specific waste sites, demolition of buildings, and cocooning of reactors. The characterization was limited to the waste sites/facility areas only, and did not include areas outside the waste sites/facilities where the contamination could have migrated. For example, waste site cleanup involved excavation removal to a depth of 15-20 feet. The Yakama Nation is concerned that no or very limited characterization was done for the vadose zone underneath or adjacent to the waste sites where contamination could have migrated. Thorough characterization of the vadose zone and groundwater in the 100 Areas and all areas along the Columbia River corridor are incomplete. The strategy for closure ignores the current failures of the groundwater		uncertainty regarding the nature and extent of residual contamination in soils, refine the conceptual site model (if needed), and support the determination of the final ROD. This includes seven soil borings as described in the revised Chapter 4. The selection of these waste sites for further characterization is also described. Vadose zone sampling conducted during waste site remediation is documented in the Cleanup Verification packages (CVPs) and Waste Site Reclassification Forms (WSRFs). Expanded groundwater characterization is included in each addendum to better-define contaminant plume locations/concentrations and to address spatial and temporal uncertainties identified in RCBRA human health risk results. The Columbia River upwelling sample results will be available for inclusion in the RI/FS report and are expected to provide further insight regarding contaminant levels entering the river. Continued waste site remediation under the current interim RODs will remove contamination from the river corridor and provide contaminant data gathered during remedial activities. Risk assessments will support regulatory decisions for waste sites and facilities, and cleanup decisions. In addition to evaluating risk associated with waste sites and the contiguous operational areas, DOE will be evaluating the nature and extent of contamination that could potentially be present in the areas between waste sites areas (non-operational areas) as a result of reasonable disposal or dispersal actions (e.g. windborne dispersal, biological activity). DOE will be evaluating

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			technologies that are being demonstrated, and the current hydrogeologic characterization of the Hanford sediments lacks geologic definition and the associated hydrogeologic influences. There is currently no mention of the relationship between the unconfined aquifer and recharge of the confined aquifer. Another omission is any discussion of the relationship between the interaction of the groundwater and the exchange of contaminants discharging into the river. Also, unidentified waste sites (orphan/discovery sites) may still exist in the decision unit outside of the walkdown areas, and must be identified as potential sources of contamination. The nature and extent of contamination in the unconfined aquifer above cleanup standards (drinking water levels and aquatic water quality criteria) has yet to be defined in select areas.		methods to communicate risks across the site using this sitewide nature and extent information. The orphan site identification process will continue until all portions (including the "inner areas") are addressed. The discovery site process will continue until remediation is complete. Sites identified under these processes will be remediated according to the final ROD as they are identified.
10			**Provide detailed characterization of background levels of contamination, both natural and anthropogenic.** Detailed information regarding background contamination on the site should be included in each addendum. In particular each addendum should address 1) naturally occurring background substances in the decision units of interest that are not influenced by human activity and 2) natural and human-made substances present within the decision unit as a result of human activities not related to Hanford operations. Background contaminant information is not currently included in either the work plan or in any of the addenda provided to date. Characterizing background is a necessary part of the CERCLA process, and provides an important comparative tool when evaluating	A/m	The characterization tasks suggested are outside the scope of the RI/FS work plan. An updated Hanford Site background report is being prepared and is expected to be available to support the preparation of the RI/FS Report. Particular interest has been expressed regarding antimony, boron, molybdenum, and selenium due to their potential human health and ecological risk. Background information is being gathered and addressed as part of the RCBRA and other supplemental investigations. These investigations are discussed in Section 5.3 of the Integrated Work Plan (DOE/RL-2008-46, Rev.0). Information collected from these reports will be included and discussed as part of the RI/FS Report.

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			contamination on the Site. As is noted by the EPA (EPA/540/G-89/004), samples from a reference location are needed when existing data is inadequate to characterize the background contamination. Due to Hanford's long operational history, spotty records of disposal for many chemicals of concern, and acknowledged widespread contamination that has yet to be fully characterized, establishing credible background contaminant concentrations with off site reference locations is warranted.		See also the response to comment #9.
11			**Address data gaps.** While data gaps are said to be addressed for individual decision units, the list of data gaps provided is the same for all currently available addenda despite differences in operating processes, geology, topography and location. If the data gaps that are going to be evaluated are the same for all decision units, they should be included in the primary RI/FS Work Plan document for evaluation over the entire River Corridor.	A	Initial data gaps were identified with input from DOE/RL and the regulatory agency. The Rev. 0 version of the addenda have varying data gaps due to the differences noted in your comment plus area-specific concerns expressed by the regulatory agency and DOE/RL.
12			**Provide Data Quality Objectives.** Data Quality Objectives should be included or at a minimum summarized in the body of the Integrated 100-Area RI/FS Work Plan and each addendum so that they can be reviewed in light of the proposed work.	A	Initial data gaps were identified with input from DOE/RL and the regulatory agency. This process has continued through addenda development, where data gaps have been revised due to area-specific concerns. The final data gaps, data needs and characterization planned are summarized in Chapter 4 of the 100-BC Addendum. The data quality objectives for the characterization proposed are reflected in the "Description" and "Justification" columns of Table 4-4 of the Rev. 0 100-BC Addendum.
13			**Include a plan for feasibility study analyses.** The work plan addenda lack a proper analysis of remedial	A	The general analyses planned for the RI/FS Report are presented in the Integrated Work Plan. The RI/FS evaluations (technology screening and alternatives

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			alternatives and technological options. Inclusion of this type of analysis is generally described in the work plan but does not seem to be incorporated within the addenda. Will such an analysis be conducted as part of the EPA RI/FS process for each decision unit and released subsequently in a separate document? If not, then this document in its current form is both inadequate and incomplete. If DOE intends to release this alternatives analysis for each decision unit as a separate document, there should still be discussion of the intended process of identification and screening of technologies and analysis of alternatives that will be performed along with a schedule of release dates for the associated documentation.		analysis) will follow established CERCLA practices and will be included in the RI/FS report. There is no document modification planned in response to this comment.
14			**Current groundwater treatment processes are ineffective.** The majority of groundwater treatment processes that DOE has implemented for chromium and strontium-90 removal have not been effective. The technologies in use are pump-and-treat, in-situ (isolation) and chemical transmutations (barriers) that chemically change the contaminant. DOE continues "sole-source" use of PNNL for groundwater treatment technologies. DOE needs to evaluate all current and past groundwater treatment technologies used throughout the United States to help develop possible technologies for dealing with chemical and radiological groundwater contamination. Unsuccessful treatment is due in part to the lack of a thorough characterization of the areas to identify and remediate the primary sources of contaminants. Characterization thus far seems to have been focused to	--	The feasibility study will include evaluation of new technologies for their potential application on river corridor groundwater plumes. The DOE relies on technologies developed in many different areas, including Los Alamos, and other DOE facilities, as well as various National Laboratories and private firms. This feasibility study will include an evaluation of technologies from all available identified sources.

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			support removal, treat and dispose actions. For example, monitoring evaluations have shown that chromium is still a major contaminant of concern and the pump-and-treat systems are not very effective in removing it. An expert panel assessed the chromium contamination and determined that more thorough characterization is needed to locate chromium sources and that river monitoring needs to be improved.		
15			**RI/FS characterization should include all Contaminants of Concern.** The Integrated 100 Area RI/FS Work Plan and Addenda primarily focus on hexavalent chromium contamination, with limited consideration of other radiological and chemical contaminants. Large volumes of contaminated wastes were discharged or buried within the 100 Area contaminants released to the vadose zone and groundwater from reactor cooling water. The contaminants included tritium, carbon-14, cobalt-60, cesium-137, strontium-90 and plutonium-239/240.The RI/FS does not provide appropriately detailed characterization data for each waste site and associated contaminants of concern. Relevant data from the limited field investigations should be included in the RI/FS. Further, the information on movement of contaminants is based on modeling and not actual vadose zone characterization. Gathering actual chemical data from sampling and analysis of site information is preferable to reliance on mathematical modeling for characterization. Also, the decision to limit contaminants for groundwater analysis is based on past monitoring analysis at specific well where concentrations were below drinking water standards. This does not ensure that long-lived	A	DOE/RL will be working in concert with the regulatory agency and stakeholders to define the final list of contaminants of potential concern for the river corridor. It is expected that the RCBRA results plus the planned groundwater, soil, and river upwelling characterization results will be key to area-specific COC determinations. Data from previous investigations is included and discussed under Chapter 3 of the revised document. In the Rev. 0 100-BC Addendum, the process for developing the groundwater COPCs and the soil target analytes are included in Section 4.2.1 and 4.2.2. The COPCs include both chemical and radiological constituents. Additional sampling of both the vadose zone and groundwater is included in the revised 100-BC addendum (Rev 0). The list of target analytes and COPCs has been expanded in Rev 0 from what was included in Draft A. The current list of analytes to be sampled and analyzed for includes uranium and plutonium, in addition to other radionuclides. The revised document provides a significant amount of additional information regarding COPC and TAL development in Appendix D.

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			radionuclides and chemicals are not present in within the vadose zone (where movement of these contaminants may be outside the influence of the groundwater monitoring system–or the movement of these contaminants is extremely slow). DOE needs to ensure long-lived contaminants sources have been identified and actions taken to either remove or isolate them to prevent future human health and environmental impacts. DOE plans seem to assume that some radionuclides, such as uranium and plutonium, are not mobile in groundwater. This has been disproven by the uranium plume in the 300 Area, uranium groundwater movement in the Central Plateau and depth of plutonium in the plutonium waste sites in the 200 West Area. It is extremely important for DOE to conduct radiological analysis of potential contaminants in the 100Areain order to built confidence in the cleanup actions.		
16			**There is insufficient information on previous recommendations in the CSM.** There is insufficient information regarding how DOE will be addressing the following recommendations that were made in the Technical Evaluation of the Interaction of Groundwater with the Columbia River at the DOE Hanford Site 100-D Area (SGW-39305): • Developing a three-dimensional model that would provide more detailed representation of the river and groundwater flows, and their interactions – including lateral groundwater flows through the old near-surface river channels, groundwater discharges into the river (influenced by water hydraulics), and contaminant impacts on sediments and aquatic	--	A 2-D model for chromium movement in groundwater has been developed for 100-D/H and a 3-D model is under consideration. Similar models may be developed for 100-BC.

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			life. • Geologic mapping of the river bed characteristics and topography will provide a template to target bed geochemical sampling. DOE needs to design and install a remote retrievable samplers and/or sensors that can be installed at a few selected locations to examine the transient nature of exposure of biota to the contaminants of concern – the data to help planning and implementing remedial actions. • Assessing the impact of nitrate and sulfate on the In Situ Redox Manipulation barrier and evaluate if nitrate /sulfate removal needs to be done to increase the efficiency of the process.		River bed mapping and comparisons to RUM elevations is planned for all river corridor areas. In addition, an expansion of groundwater upwelling sampling is being conducted by DOE/RL as part of the RI field effort. ISRM use at 100-BC, including the possible need for nitrate/sulfate control, will be considered during the RI/FS process.
17			**Associated studies in the River Corridor should be incorporated into the RI/FS Work Plan.** As part of the River Corridor Remedial Investigation, a groundwater upwelling study is being conducted in the hyporheic zone of Columbia. This work relates directly to the Integrated 100 Area RI/FS Work Plan and associated addenda and should be referenced and discussed where appropriate. Observed upwelling of chromium offshore in the river documents a completed groundwater pathway between source areas in the 100 Area and the river that is not being addressed in the Work Plan/Addenda. Also, the upwelling study is limited in scope and does not include: 1) an evaluation of a full suite of 100 Area contaminants; 2) physical and chemical characterization of the stratigraphy within the river and its relationship to 100 Area stratigraphy; or 3) evaluation of specifics of the groundwater pathway, including overall fate and transport as well as preferential flow paths. A complete	A	The results of the ongoing upwelling study will be available for inclusion in the RI/FS Report, and additional upwelling sampling is being planned for the 100-BC area. The various ongoing projects and programs that will be incorporated into the RI/FS Report are presented in the Integrated Work Plan. These projects include the RCBRA, the RI of the Hanford Site Releases to the Columbia River, the RI/FS for the 200-PO-1 area and 200-BP-5 (both of which contributes contaminants to the 100 area), In addition, there is ongoing remediation occurring at waste sites throughout the 100 area and 100-BC.

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			hydrogeologic/hydrogeochemical study of this system by qualified scientists should be made a high priority.		
18			**The various investigation activities should be integrated.** There is some confusion as how the current work being conducted by the Columbia River sampling and characterization, and previous work done in the River Corridor Baseline Risk Assessment (RCBRA) will be integrated with this work plan. This document and the other work plans need to clearly indicate how all these efforts and the proposed risk assessments feed into development of the Remedial Action Objectives (RAOs) and Remedial Actions Goals (RAGs) of the Final Records of Decision (RODs) for the 100 areas and 300 Areas. For example, detailed geologic characterization needs to be conducted and documented. This work plan in its current form does not represent a true integration of cleanup for the 100 Areas because it does not include all aspects of cleanup at all sites, including demolition of contaminated structures, cleanup of contamination underneath demolished or existing structures, and the incorporation of the risk assessments already performed within the river corridor.	A	See response to #17 The general analyses planned for the RI/FS Report are presented in the Integrated Work Plan. The RI/FS evaluations (technology screening and alternatives analysis) will follow established CERCLA practices and will be included in the RI/FS report. The Integrated Work Plan (DOE/RL-2008-46) describes the development of the RAOs and RAGs. Chapter 4 in the revised document presents the status at each of the waste sites. It also outlines the current level of knowledge and which waste sites were targeted for additional analysis.
19			The document lacks plan for a proper analysis of alternatives and feasibility study specific to this decision unit. It is therefore incomplete in its current state.	A	See response to #13

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20			Specific sections of the 100 Area RI/FS Work Plan (DOE/RL 2008-46) are indicated as being incorporated by reference in this addendum. However, there are several inconsistencies between this addendum and other addendum associated with this work plan in terms of what has been incorporated by reference. Instead of incorporation by reference, applicable standards, objectives, remedial action goals, applicable regulatory requirements and remedial actions should be included in the addendum where applicable.	A	The Integrated Work Plan has been approved by DOE/RL and the regulatory agencies. It will continue to document the general information that is common to all the100-Areas with area specific information being provided in the individual addenda. The format of the BC addendum has been changed in Rev 0, including how the integrated work plan is referenced and adding the preliminary remedial action objectives.
21			Appendix B: 100-BC Area and 100-BC-2/BC-6 Operable Unit Maps were not included with the PDF document in full. These documents need to be made available electronically.	A	These maps will be available electronically. In addition to hard copies, electronic copies (on CD) are planned to be provided with the Rev 0 distribution.
22	v	17	This work plan is part of the process through which a final Record of Decision will be issued, not "final remediation decisions." This wording should be adjusted appropriately throughout the document.	A	The addendum has been revised as suggested.
22a	vi	3	"Substantive work" should be quantified if it is being used as a source of data or information in this work plan so that the appropriate references can be reviewed.	A	Modify sentence to read: In the 100-BC area, groundwater monitoring, contaminated soil removal, and facility demolition and removal have been completed over the past decade or is planned over the next few years.
23	vii	23-26	Interim remedial actions satisfy the interim ROD, but may not satisfy the requirements of the final ROD. The language should be adjusted accordingly.	A	Modify sentence to read: While the "interim closed out" remedial actions satisfied the interim action RODs, they may not satisfy final ROD requirements. Delete the next sentence ("CERCLA remediation and/or RCRA corrective action…")

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24	viii	17-20	The vadose zone should be included as a secondary source of contamination. Liquid wastes were not confined to the immediate base of infiltration structures. Upon release into the environment, they spread out and contaminated large volumes of the subsurface as they migrated vertically and horizontally with changing water levels.	A	Insert "(i.e., vadose zone) " on line 19 in the sentence noted: "Wastes released to the environment… in the subsurface (i.e., vadose zone) and released over long…."
25	viii	32-33	It is misleading to state that the 100-BC area groundwater has not been "substantially affected by releases from the 100-BC facilities." As is noted in the fiscal year 2008 Ground Water monitoring report and later in Addendum 3 of the work plan, chromium has been found in groundwater throughout the area, although not always at concentrations above the screening level.	A	This paragraph has been revised to address this comment as follows: The historical records show that dissolved Cr(VI) was primarily released into the environment in two types of solutions: the stock solutions used to make reactor coolant, and the reactor coolant itself. There are known releases of concentrated sodium dichromate to the soil at the 100-BC Area (Chapter 2), but the extent of the contamination in groundwater is not well defined.
26	ix	10	Provide specifics when discussing waste disposal, and avoid statements such as "various burial grounds." The intention of the site characterization is to identify source locations and the resulting nature and extent of contamination.	A	This paragraph has been revised to address this comment as follows: Sr-90 was also present in solid waste disposed at 100-BC area waste sites (e.g., 100-B-11 and 118-B-2) and contamination appears to be limited to the upper part of the unconfined aquifer. Continued relatively slow dispersion and migration of Sr-90 in groundwater occurs because of its moderate adsorption to aquifer soil. The plume may continue to persist in groundwater due to Sr-90 sorbed to soil within the re-wetted zone.
27	ix	17	State what solid waste residue from tritium production includes, and where it was disposed of. Provide specific sites and estimated total activity.	A	This paragraph has been revised to address this comment as follows: Tritium is present as a result of implementation of the P-10 Tritium Separation Project at the 105-B and 108-B facilities. Tritium waste streams, in the form of decontamination fluids, encapsulated tritium gas, and contaminated process equipment, were disposed primarily to the 116-B-9 Crib, 118-B-1 Burial Ground,

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					and 118-B-6 Burial Ground.
28	ix	21-26	It is unclear how 6 boreholes into the top 5 feet of the water table and 10 new characterization wells into the Ringold Upper Mud will be able to address CSM hypotheses 1 through 5 given the complexity of the site, lateral heterogeneity of subsurface units and variability between past waste site disposal practices. Additionally it appears that no characterization will be conducted for contamination beyond identified waste sites and pipelines despite measured contamination being found up gradient adjacent to Gable Butte (Well 699-65-83) and in Gable Gap (Well 699-65-72).	A/m	Additional boreholes are now included to address EPA and DOE/RL concerns. Completed RTD at 100-B-27 (and other waste sites) and planned RTD at 100-C-7 include removal of contaminated soil laterally from the original site boundaries. As outlined in the CVPs, the excavation of numerous waste sites extended beyond the waste site boundaries to ensure excavation to a depth where analytical testing indicated that the interim action ROD requirements were met. New wells are proposed to better-define groundwater plume boundaries and concentrations. This includes drilling to the first water bearing unit in the RUM. Soil samples around the rewetted zone will be collected to determine the presence of vadose zone contamination. Contamination up gradient of 100-BC has been determined to be associated with the 200 area. The ongoing RI work being conducted in those groundwater OUs is intended to evaluate the nature and extent of that contamination. Information gathered from those evaluations will be considered during the RI/FS Report and subsequent remedial actions, but is not part of this work plan. See Rev 0 Chapter 4

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29	x	1	Because the final remedial actions and the ROD have not been issued, it is premature to identify "potential effects of residual soil contamination following remedial action" as a Data Gap. The level and type of residual contamination has neither been set nor accepted under a final ROD.	A	Additional characterization at interim-closed waste sites is proposed to evaluate the interim remedial action, address uncertainty regarding the nature and extent of residual contamination in soils, refine the conceptual site model (if needed), and support the determination of the final ROD.
30	1-2	11-14	The description of CSM meetings included here is inadequate. Provide detailed information regarding the soil target analyte discussion, groundwater contaminants of potential concern and any information resulting from discussion regarding both the Remedial Action Objectives and Data Quality Objectives.	A	Initial data gaps were identified with input from DOE/RL and the regulatory agency. This process has continued through addenda development, where data gaps have been revised due to area-specific concerns. The final data gaps, data needs and characterization planned are summarized in Chapter 4 of the 100-BC Addendum. The data quality objectives for the characterization proposed are reflected in the "Description" and "Justification" columns of Table 4-4 of the Rev. 0 100-BC Addendum. General RAOs for the river corridor are documented in the Integrated Work Plan. Area-specific RAOs will be considered during RI/FS Report development. See response to #12
31	1-7	1-2	This work plan should not be addressing the final disposition of sites in general since this will be determined in the final ROD. The purpose of the RI/FS work plan is to outline the field activities that will be performed in order to appropriately characterize the nature and extent of contamination on the site, and to describe the process for selection of appropriate remedial alternatives.	A	Agree. The sentence noted states "the status of these sites has not been determined at this time and their disposition will not be addressed in this work plan." The sentence was deleted from the text. The text now reads "The status of these sites has not been determined at this time."
32	2-8	8	Appendix B: 100-BC Area and 100-BC-2/BC-6 Operable Unit Maps was not included with the electronically-	A	See response to #21

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			posted version of Addendum 3.		
33	2-11	22-29	This paragraph should be revised. Depending on location, the vadose zone may include either the Hanford Formation or the Ringold Upper Coarse or both (this is noted in the following paragraph).	A	Sentence was revised to read: Vadose (unsaturated) zone: depending on location, the vadose zone may include either the Hanford formation gravels or the Ringold Fm Unit E gravels. The vadose zone is 2 m to 30m (6.5 ft to 98 ft) thick beneath the 100-BC.
34	2-15	9	The water table does not define the base of the unconfined aquifer; it defines the top of the unconfined aquifer.	A	This sentence was changed to read: The water table defines the top of the unconfined aquifer.
35	2-15	43-44	There is no "Basalt Ringold Formation." Revise accordingly.	A	This sentence has been revised by deleting "basalt."
36	2-16	17	What was the unit each well was screened in, and what was the hydraulic conductivity for each? This information should be included.	A	Additional information was added to the text, including available information on well construction and conductivity results.
37	2-22	22-24	The size of the waste site is not relevant as much as is the volume and type of waste disposed at each site. A single infiltration structure can accept millions of gallons over the course of its operational lifetime. This statement downplays the importance of evaluating all waste sites thoroughly to determine the type of contamination and its extent.	A	Our use of "magnitude" refers to the size of the facilities, not the volume of waste the facilities received. You are correct in noting that facility size has no bearing on the amount of waste received. The sentence noted will be combined with the previous sentence as follows: Liquid and solid waste disposal locations were constructed and waste management practices were developed to handle these materials consistently. Facilities and waste sites used for discarding non-radioactive materials (e.g.,

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					solvents, chemicals) were relatively small in magnitude.
38	2-30	16	The detected radionuclides should be included for each borehole in this table.	R	Summary information regarding the radionuclides tested-for and detected are included in the text following Table 3-1 in Rev 0.
39	2-33	20	Interim Remedial Actions: No actual soil sampling and analysis was done prior to excavation of these sites. Instead, review of past "limited" analysis and process knowledge (document review) was conducted. Following excavation, limited shallow soil sampling was conducted at the waste site (sides and bottoms) to ensure residual contamination met cleanup goals (which are not specified in the RI/FS). At no time were soil samples taken to any depth below the waste site to determine if contaminants had leached deeper into the vadose zone. Also, no deep soil sampling was done outside – but adjacent to the waste site – to see if the contaminants may have moved laterally through the vadose zone. There is a potential that high concentrations of radiological and/or chemical contaminants may still present underneath and/or adjacent to these waste sites.	A	The first sentence of this paragraph was changed as follows: Remediation and characterization of the waste sites began in 1996 under the authority provided by the interim action RODs and monitoring plans. This is now in section 3.3 of Rev 0. Chapter 4 in the revised document presents the status at each of the waste sites. It also outlines the current level of knowledge and which waste sites were targeted for additional analysis. The process for evaluating the waste site verification data to determine if more characterization should be conducted is also provided. Based on this process sites are identified for further characterization under the RI/FS work plan.
40	2-34	4-7	Include the Remedial Action Objectives which were specified in the interim ROD.	A	Preliminary RAOs are now included in section 4.1 of the revised document.
41	2-34	24-26	While removing contaminated material does reduce the inventory of contaminants in the specified range of depth for excavation, the LFI and other previous information	A	The paragraph noted has been revised to address this comment. While contaminant concentrations in 116-B-1 generally decrease with depth, both Tc-99 and U-238

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			remains relevant. Consider trench 116-B-1 where the depth of significant contamination was recorded at 30 feet below ground surface (20 feet below the bottom of the structure), more than twice the depth of remediation. Impacts to the environment remain after remediation activities if residual contamination is left in place.		increase with depth. It should be noted, however, that the remaining Tc-99 concentrations are below the RAG of 0.46 pCi/g and U-238 concentrations are below the background levels of 1.1 pCi/g. This is now in section 3.2.2 of Rev 0. The figures have been edited to the correct units, and the corresponding text has been revised accordingly.
42	2-34	41-45	Why is the chrome leach testing addressed in this section and then again in Section 2.4.15? These texts should be consolidated and re-written.	A	The document re-organization addressed this comment.
43	2-39	20	This Section is incomplete and disjointed. The purpose of treatability studies is to test the feasibility and use of relevant technology on remediating the site. Of the text present, only the paragraph on vitrification meets these criteria. Geophysical surveys do not remediate sites, and the pilot risk assessment text is not relevant in this section. Furthermore, because treatability studies are intended to test remedial actions, the target contaminants should be identified.	Am	Section was revised for clarification.

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44	2-40	33	The previous hexavalent chromium leach test studies appear inconclusive. The studies are additionally not analogous to the vadose contamination in the 100-BC area where the vadose zone may be inundated for days or occasionally weeks at a time during high river stages allowing for remobilization and deposition of contaminants. Furthermore, the volume of liquid waste and subsequent infiltration in terms of "pore volumes" is, by the study's own admission unknown. The conclusion in the last sentence (on 2-41, 1) is that additional studies are needed to make a meaningful conclusion -- invalidating the previous paragraph's statement "the contaminant chemical behavior is well quantified with regard to 100 Area soils." Finally, even if the contaminant behavior was well quantified, neither the extent of the contamination, nor the subsurface geology is characterized well enough to have any significant degree of certainty as to where contaminants have come to be located at present.	R	This section was substantially revised and is now section 3.2.5 in Rev 0. Additional, detailed information on the previous leach tests can be found in PNNL-17674, *Geochemical Characterization of Chromate Contamination in the 100 Area Vadose Zone at the Hanford Site.* Site specific leach tests will be conducted during the field investigations. These tests are specified in the Sampling and Analysis Plan, with multiple leach tests being conducted in the 100-BC area to ensure a good understanding of the Cr(VI) behavior in that area.
45	2-42	13	Hexavalent chromium in the 100-BC area is more widespread than is shown in this section. This has been well established by ground water monitoring which demonstrated that much of the site still has extensive groundwater contamination <20 µg/L. Additional, more highly contaminated soils may also be present which have not yet been found.	--	The text and accompanying figures do not imply that no contamination is present beyond the 20 ug/L contour. Note that the plume map posts data for individual wells, including those <20 ug/L. The section has been revised in response to comments from other reviewers. The revised section also discusses the fall 2009 pore water Cr6 results, pointing out that there is uncertainty in chromium distribution. Data needs have been revised to emphasize the need to better characterize groundwater contaminant distribution laterally and vertically.

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46	2-47	1	Delineation of the tritium plumes is very narrow. The data provided suggests that that contamination is present throughout much of site. This was confirmed with the addition of "two new wells in which tritium concentrations were unexpectedly high." When discussing contamination the precautionary principal should be applied regarding the total extent.	--	The text and accompanying figures accurately present current knowledge of tritium distribution. The plume map includes data for each well, and contours at a level 10x below the DWS. We acknowledge uncertainty due to a lack of monitoring points, and that is portrayed by dashed contour lines on the map.
47	2-49	19-20	Because of their importance in the formation of the work plan, the Data Quality Objectives should be included or at a minimum summarized rather than simply referenced in the text.	A	See response to #12
48	4-2	32	**Data Gap #1**: Neither the RI/FS Addendum or the Sampling and Analysis Plan provide any description on how characterization will be conducted for "unremediated" waste sites. These documents only provide characterization for six "remediated" waste sites and groundwater. DOE needs to incorporate how "unremediated" waste sites will be characterized during excavation and underneath the waste site once contaminated soils are removed to the cleanup goals (residual concentration levels)	A	Remediation and cleanup verification process discussions are included in Integrated Work Plan. Data gap #1 has been revised.
49	4-2	38-39	In order to properly characterize the site, environmental contamination data should be collected from sites other than identified waste sites. It has already been established there were unplanned releases and extensive contamination throughout the site which are not necessarily associated with a specified operational waste site.	R	UPRs, orphan sites, and discovery sites are included in waste site evaluations. Excavation during remediation frequently includes "chasing contamination" that extends beyond the WIDS footprint established. In addition to the RCBRA and 100 Area RI/FS, DOE has initiated an evaluation termed a non-operational properties evaluation. This program will use existing data from waste sites and areas between waste sites to statistically evaluate and communicate the nature and extent of contamination

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					across the site. This program will also identify areas where we do not have sufficient information to make decisions. Data to be used in this program include. results from existing background soil sampling studies, aerial and land-based radionuclide surveys, environmental monitoring data, air emissions studies, results from orphan sites evaluations, monitoring performed as part of permitting and compliance activities, as well as technical baseline reports and other historical studies. DOE will be evaluating methods to communicate risks across the site using this sitewide nature and extent information.
50	4-12	28	The term "substantially thick" is inappropriately vague. In most of the 100-BC area the vadose zone is estimated to be between 50 and 100 feet but contaminants obviously reached ground water in these areas.	A	Delete sentence "Adverse impacts to groundwater from these sources are not expected where the vadose zone is substantially thick." (in re-organized document, this is in Section 3.5.1)
51	4-13	1	The current rate of infiltration is not representative of the infiltration which occurred during active production. The large volumes of liquid waste disposed of would have resulted in much greater infiltration and contaminant mobility. Presently there may still be many highly contaminated fine grained lenses which have not been discovered.	A	Nature and extent discussion in Chapter 3 addresses distribution during operations. Additional soil and groundwater characterization proposed to better-define current groundwater and soil contaminant distribution. Delete the sentences "Mobility is relative to infiltration at the site. The current infiltration rate suggests impeded contaminant mobility." The preceding portion of the paragraph states that contamination "may also continue at elevated levels through the vadose zone to groundwater…"

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52	4-13	9	**Data Gap #2**: The RI/FS Addendum and SAP state that only chemical analysis will be conducted for these boreholes – this is unacceptable. The analysis must include the radiological contaminants that were released to these waste sites.	R	The term "contaminant" refers to both radioactive and non-radioactive analytes. The soil master target analyte list and the groundwater COPC list include chemical and radionuclide contaminants.
53	4-13	11-12	Only one of the reactor buildings has been placed in interim safe storage. Revise accordingly.	A	The text will be revised to indicate that only the C Reactor has been put into ISS.
54	4-13	23	**Data Gap #3**: The RI/FS and SAP do not provide sufficient information on the document review process that will be conducted to determine if additional sampling is needed. In the past these types of document reviews have been proven not be totally reliable.	A/m	Boreholes to address B- and C-Reactor contamination uncertainties are now proposed to provide the data needed to fill Data Gap #3.
55	4-16	14-19	Identifying 2 separate tritium plumes in the southwest portion of the site appears premature given the sparse well density in the area and the fact that while there are currently only 4 wells that exceed drinking water standards, virtually every well sampled in the area -- including those up gradient such as 699-65-83 -- contain tritium at some concentration.	--	See response to comment #46.
56	4-16	21-23	If contaminant concentrations are still rising episodically and new wells find unexpectedly high concentrations of tritium then it is reasonable to assert that additional unidentified sources are still contributing to the groundwater. This should be acknowledged.	A	Data gap #4 has been revised and addresses uncertainty in groundwater contaminant distribution.
57	4-26	1	The Current Field Characterization Summary (Section 4.4.2) seems oddly imbalanced with two specific investigations into the 100-C-7 structure and no discussion of any other portions of the site.	A	Document revision addressed this comment.

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58	4-26	7-13	Provide the analytical results of the ground water sampling conducted at the C4947 borehole adjacent to the 100-C-7. Excavation to a depth of 18 feet below the bottom of the trench (33' below ground surface) with hexavalent chromium concentrations still at 1,620 mg/kg suggests that significant contamination extends beyond the depth of remediation.	A	This groundwater result was added to the discussion noted. Groundwater Cr(VI) was 13.9 ppb (filtered) and 46.9 ppb (unfiltered). This is in section 3.3.5 of Rev 0. The 100-C-7 waste site is scheduled for remediation using RTD. The analytical results noted are from the initial excavation. The additional excavation planned will remove Cr(VI) to the groundwater or acceptable levels.
59	4-27	36-38	The groundwater clearly has been substantially affected by reactor coolant and dichromate stock handling practices. The previous paragraph acknowledged that enough dichromate was disposed of in the area to push contamination up gradient 2 miles inland. The current plume map appears to be confined by the available data, additional characterization, particularly to the east and west outside of the operational unit boundary is necessary before such sweeping conclusions can be drawn.	--	The intent of the sentence is to address the fact that observed Cr(VI) concentrations in 100-B/C groundwater are orders of magnitude lower than in the 100-D Area. The text has been revised to place less emphasis on the tentative conclusion that 100-B/C Cr was pushed inland 2 miles, and to clarify. The text will be revised as follows: Some of the dissolved Cr(VI) was pushed inland by the growing groundwater mound. Water-level data from Well 699-65-72 suggest the hydraulic effects from the mound extended as much as 3.2 km (2 mi) inland. Low levels of total chromium (ranging from below detection limits to 13 µg/L) suggest that chromium contamination may have migrated to that well. Cr(VI) contamination observed in groundwater at the 100-BC Area is present in a broad plume at relatively low concentration (i.e., less than 60 ug/L, compared to the 100-D Area where concentrations are over 6,000 ug/L in some areas). There are known releases of concentrated sodium dichromate to the soil at the 100-BC Area (Section 2.X). For example, Cr(VI) concentrations up to 1,620 mg/kg were detected soil samples from a borehole drilled to groundwater beneath the 100-C-7 Waste Site at a depth of 10 m (33 ft). Concentrations in soil below that depth generally decreased to a concentration of 2.9 mg/kg just above the water table. Groundwater concentrations in this

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					area have been <20 ug/L except for a single sampling event when the concentration was approximately 50 µg/L . Cr(VI) was detected at another waste site, 100-B-27 sodium dichromate 1 spill, located in the northwestern 100-BC Area, (WCH-225, *Sampling and Analysis Instruction for Evaluation of Residual Hexavalent Chromium Contamination in the Subsurface Soil at 100-B-27*). See section 3.4.1 of Rev 0.
60	4-29	9-10	"Sr-90 in groundwater wells near the burial grounds has not been detected above the DWS." Please provide the names of the wells this is in reference to and the actual measurements from these sites. While the concentrations may be below the drinking water standard, they still may be significant. Additionally the proximity of the wells sampled to the burial grounds should also be provided as this can significantly impact the measured concentration.	A	Will add this detail to the section on "Nature and Extent" for Sr-90 (revised Sec. 3.4.2). "Wells down gradient of solid waste burial grounds detect little or no Sr-90. Well 199-B8-6, down gradient of the 118-B-1 Burial Ground, has never detected any Sr-90. Wells 199-B9-2 and 199-B9-3 monitor groundwater down gradient of the 118-C-1 Burial Ground. Only one sample from 199-B9-2 detected strontium-90 (0.43 pCi/L in 2008)."

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61	4-30	10-21	There are several problems within these two paragraphs. First, when describing source removal actions, the sites to which this applies should be listed specifically. Second the sentence beginning with "Sr-90, being much less..." is highly speculative given that the same sentence acknowledges that during the period of maximum potential migration the geochemistry and groundwater gradients were conducive to substantially deeper penetration than at present. Third, the previous paragraph acknowledges that much of the strontium may have moved deeper into the vadose zone and in particular may be concentrated in the hyporheic zone. Thus it is premature to conclude that "there does not appear to be a large Sr-90 inventory remaining in the 100-BC Decision Unit" since there hasn't been a concerted effort to characterize contamination outside of waste units.	R	This section was substantially revised. See section 3.4.2 and section 3.8.1.1 in Rev 0. The two paragraphs referred to include information specific to the contaminant site model and were moved to that section of the document. Waste sites where Sr-90 has been identified as a primary contaminant are presented in section 2.2.4.3 of Rev.0, along with a discussion of the Sr-90 sources. The discussion of Sr-90 migration and the contaminant site model reflects the current state of knowledge and will be re-evaluated during the RI/FS process.
62	4-46	5-6	Verification data collected during remediation is not adequate for characterizing the nature and extent of contamination in the vadose zone surrounding reactor structures. The remedial activities in this area should be guided by a proper characterization of the site contamination. Site contamination should not be characterized through limited interim remedial actions.	A	See response to comment #54 regarding additional characterization specific to the area around the two reactor structures. Characterization is planned under this RI/FS near both reactor structures. Verification data from waste sites near reactors can provide important information. Chapter 4 of the revised document provides the description of how verification data was evaluated to assist in determining where additional characterization is needed.

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63	4-51	23-24	The remedial investigation process does not include cleanup actions at the site. Groundwater contamination has already been identified and confirmed; therefore this should not be a hypothetical, and potential groundwater remedial technologies should be evaluated for potential implementation as part of the RI/FS.	A	Cleanup actions are addressed following the completion of the RI portion of the work, as part of the Feasibility Study. Remediation technologies that may be appropriate are to be researched as part of this RI/FS, as additional scope of work.
64			For all Comments RE: Treatment Study for In Situ Hexavalent Chromium Treatment at 100-C-7	A	The Treatability Study at 100-C-7 is no longer being pursued by DOE.