Confederated Tribes and Bands of the Yakama Nation

Established by the Treaty of June 9, 1855

October 2, 2012

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Re: Yakama Nation Comments on *River Corridor Baseline Risk Assessment, Volume II: Human Health Risk Assessment,* DOE/RL-2007-21 Rev. 0 (August 2011)

0099270

Dear Mr. McCormick, Mr. Faulk, and Ms. Hedges:

The Yakama Nation has reviewed the U.S. Department of Energy's (DOE) document DOE/RL-2007-21 Volume II Rev. 0, the River Corridor Baseline Risk Assessment (RCBRA) Human Health Risk Assessment (HHRA). Specifically, we reviewed the document to identify how our previous comments on Draft C were addressed in Revision 0. We found that the vast majority of Yakama Nation comments submitted to DOE, the U.S. Environmental Protection Agency (EPA), and Washington State Department of Ecology (Ecology) on February 28, 2011, which are posted on the Hanford Site Administrative Record and Public Information Repository,[1] were not addressed in the revised document. We agreed with many of the comments provided by Ecology on Draft C (11-NWP-023, April 4, 2011),[2] but did not see changes in Revision 0 reflective of the State's comments either. In fact, the revision appeared nearly identical to the draft. We note that the EPA National Remedy Review Board recently recommended to EPA Region 10 (letter dated June 26, 2012)[3] that decision documents clearly communicate how preferred alternatives will remediate unacceptable human health or ecological risks. Such risks must first be fully assessed.

[1] http://www2.hanford.gov/ARPIR/?content=findpage&AKey=1103070701
[2] http://www2.hanford.gov/ARPIR/index.cfm?content=findpage&AKey=1104080332
[3] http://www.epa.gov/superfund/programs/nrrb/pdfs/Hanford_100K_200UP1_300_Memo.pdf

The Yakama Nation continues to be very concerned that this document is not truly a baseline risk assessment and does not provide a complete evaluation of the risks that a Tribal member or other members of the public could encounter on the site. Limited characterization data, simplified scenarios of future use, and unrealistic assumptions about indefinite, unfailing institutional controls limit the utility of the risk assessment in making cleanup decisions. Furthermore, cleanup decisions are currently being made based on this incomplete assessment. Appropriate cleanup decisions should be made based on a complete and adequate risk assessment, which includes protection of unrestricted use by tribal members.

This letter summarizes the Yakama Nation's major concerns with the RCBRA Volume II Rev. 0. Attached to this letter, specific comments are provided that we originally submitted on the RCBRA Vol. II Draft C, with additional notation identifying whether the comment was addressed in Rev. 0 or not (or unknown). Additional specific comments on Rev. 0 have been added.

1. **Contaminant migration from the Central Plateau to the River Corridor should be evaluated.** Contamination in the Central Plateau is transported to groundwater via the vadose zone. Contaminated groundwater from the Central Plateau has already reached the Columbia River and will continue to affect the River Corridor far into the future, as shown by DOE's own modeling. DOE should consider contaminant migration in groundwater over time from the Central Plateau to the River Corridor and Columbia River, including groundwater flow rates, plume mixing, and exposure to contaminated groundwater by various exposure pathways. We agree with EPA's comment on Draft C (February 8, 2011)[4] that since only a "screening level" risk assessment was conducted for groundwater, it is unclear when a baseline risk assessment will be conducted.

2. **Anticipated institutional controls should not be assumed when assessing baseline risk.** DOE's own guidance acknowledges the EPA directive that institutional controls cannot be factored into a baseline risk assessment, stating "EPA directed that exposures that are limited by institutional controls may not be factored into a baseline risk assessment for a CERCLA RI/FS."[5] By definition, baseline risks are risks that would exist if no remediation or institutional controls are applied at a site. This information provides a foundation for determining the most appropriate remedial options.

3. **Cumulative risks for tribal residents should be fully assessed.** DOE fails to accurately and completely identify all sources of contamination, describe transport mechanisms through various environmental media, and evaluate potential risks to tribal members based on a traditional subsistence lifestyle. Inadequate data are evaluated to characterize exposure from groundwater and fish ingestion, which are both very important exposure pathways, and these pathways are not summed with other exposures. By dividing the assessment into different spatial scales, exposure assumptions associated with the Yakama scenario have been only selectively applied. For example, some exposure pathways that are applied to the non-resident are not applied to the resident and vice versa. This does not provide a complete picture of cumulative exposures to a Tribal member who might reside on the site and utilize resources throughout the site. A complete cumulative risk assessment should be conducted for a Yakama tribal "broad area" resident scenario, including exposure pathways that were omitted in the RCBRA (such as consuming traditional foods), and summing all risks.

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[4] http://www2.hanford.gov/ARPIR/index.cfm?content=findpage&AKey=1102091072

[5] DOE. 1992. *Use of Institutional Controls in a CERCLA Baseline Risk Assessment.* Office of Environmental Guidance, U.S. Department of Energy. CERCLA Information Brief. EH-231-014/1292. December.

4. **Access and exposure to the Columbia River should be considered in conjunction with the River Corridor.** The scope of the RCBRA is limited to the near shore and does not include the Columbia River itself. It is very likely that a person living or recreating at Hanford would encounter the river in addition to the upland and riparian habitats. DOE should incorporate scenarios that include access to the Columbia River from the River Corridor, and consider exposure to river water, sediments, and aquatic organisms.

5. **Sample data or locations should not be excluded for convenience.** The RCBRA excluded certain contaminants, waste sites, and non-operational areas without clear explanation or adequate justification. For example, the exclusion of thorium-232 and its decay products, thorium-228 and radium-228, is not adequately supported. Considering only those contaminants that were reported in at least one-third of the wastes sites is not protective and potentially eliminates relatively unique waste sites. Also, the 156 waste sites assessed is only a fraction of the thousands that exist. DOE should not exclude any contaminants or locations without adequate evaluation of data and clear justification.

6. **Reference and background sites should be selected from areas that are not impacted by Hanford contaminants.** DOE considers samples collected either onsite or proximal to Hanford as background and reference samples; yet, these locations have likely been influenced by releases from Hanford in the form of airborne contamination and/or movement through the environment and food web. These locations should not be considered background or reference for comparison to site data. Appropriate locations should be selected that are not on the Hanford site and clearly not influenced by Hanford contaminants.

7. **Considering only incremental risks "above background" levels is not appropriate.** All contaminant exposures at the site contribute to baseline risk and should be included in the assessment. However, DOE is making risk management decisions prior to assessing risk by excluding certain "background" exposures. DOE should consider all contaminants contributing to risk at the site, including natural and "background" concentrations, as part of determining total baseline risk. Only after such a complete, unbiased assessment is conducted can risk management decisions then be made.

8. **CERCLA and MTCA risk limits should be adopted**. The radiation dose limit of 15 millirem per year (mrem/yr) used in the RCBRA equates to a lifetime cancer risk that is 3 times above the maximum allowable value (1 in 10,000) under the federal Superfund program (and even more when other EPA risk coefficients are considered in the conversion); a dose limit of 5 mrem/yr equates to the upper-bound risk limit. It is important to recognize that the CERCLA limit for managing hazardous waste cleanup is referred to in the National Contingency Plan and EPA's directive 9355.0-30 as a target risk range of 10^{-4} to 10^{-6} for determining an "acceptable" excess lifetime cancer risk; the upper-bound risk limit of 1×10^{-4} may be determined unacceptable (i.e., not protective enough) at a site based on site-specific conditions, particularly when there are uncertainties in the assessment results, as in this RCBRA. Although Washington State's Model Toxics Control Act (MTCA) applies to all hazardous substances, DOE interprets MTCA to only regulate chemicals, excluding Hanford's extensive radionuclide contamination. Superfund and MTCA risk thresholds should be adopted for chemicals and radionuclides combined.

9. **The Treaty of 1855 should be acknowledged as an ARAR or "Must Comply."** Applicable or relevant and appropriate requirements (ARARs) are considered when making risk management decisions, and the Yakama Nation Treaty of 1855 should be acknowledged by DOE in the RCBRA as an ARAR or a "must comply" for cleanup, including Tribal uses of site resources that are protected under this Treaty.

Hanford's high-level, transuranic, low-level, and mixed radioactive wastes, nuclear facilities, proposed waste treatment operations, contaminated soil, water, and biota pose threats to the Yakama Nation, the health of our people, and the vitality of our traditional

subsistence lifeways. To protect Yakama Nation uses, all contaminant sources and hazards should be identified based on actual human behaviors and assessed together to support appropriate cleanup decisions. The Yakama Nation continues to support adopting a holistic approach to assessing risks and making cleanup decisions at the site, which incorporates interactions between multiple stressors projected over long timescales and over large areas, and integrates wellness related to the physical, mental, social, and ecologic well being of Native Peoples.

We request that this letter and attachment be entered into the CERCLA administrative record for the Hanford project. I appreciate your consideration and look forward to resolution of our concerns.

Sincerely,

Russell Jim
ER/WM Projects Manager

Attachment

cc: RHW Committee
Phillip Rigdon, YN
Gabe Bohnee, NPT
Stuart Harris, CTUIR
Ken Niles, OR-DOE
Administrative Record

Yakama Nation Comments on RCBRA Vol. II (HHRA) Draft C vs. Rev. 0.

No.	Section	Page, Figure, Table	Comment on RCBRA Vol. II Draft C (YN, 2011)	Addressed in Rev. 0?
1 - 7	Forward - Hanford Site Cleanup Completion Framework (this section was removed in Rev. 0)			NA
Executive Summary, Glossary				
8	Completion of Cleanup Actions	ES-4	The determination of cleanup actions (e.g., risk management decisions) cannot be made at this time for areas of the site. Revise the last sentence of this section to state that there are areas where cleanup decisions have not been made, rather than "cleanup actions are not anticipated."	No
9	Current Conditions in the River Corridor	ES-4	The first sentence of this paragraph should describe site characterization as "limited." Page ES-3 establishes that the characterization is limited and should be described as such here and elsewhere in the document. Revise to be consistent throughout the baseline HHRA.	No
10	Current Conditions in the River Corridor	ES-5	The determination of adverse impacts cannot be made at this time for areas of the site, including non-operational areas. Revise the description of non-operational areas in the last sentence to reflect that impacts are largely unknown because of lack of characterization. Stating that these areas are "not anticipated to be adversely affected by releases" is incorrect given the mobility of contaminants through biological or abiotic events.	No
11	Assessment of Interim Actions	ES-6, Text Box	Particular site-specific conditions that would justify the acceptability of a risk estimate "around" 1×10^{-4} are not defined. OSWER Directive 9355.0-30 states that a risk manager may decide that a baseline risk level less than 1×10^{-4} is unacceptable (i.e., still not protective enough) due to site-specific reasons and that remedial action is warranted where, for example, there are uncertainties in the risk assessment results. The text box language should be revised to more accurately reflect the full range of alternatives put forth by the OSWER directive.	No
12	Assessment of Interim Actions	ES-6 to E-7	A cumulative risk assessment is defined by EPA as "an analysis, characterization, and possible quantification of the combined risks to health or the environment from multiple agents or stressors" (EPA Cumulative Risk Assessment Framework, 2003). It is misleading to refer to "cumulative" cancer risks only for chemicals and only from remediated waste sites, as used in this baseline HHRA.	No
13	Assessment of Interim Actions	ES-7, Text Box	This section, as well as section 3.6.4, references the EPA OSWER Directive "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination" as the "origin" of a cleanup threshold of "15 mrem/yr above background." However, the referenced EPA document only refers to a value of 15 mrem/yr, not 15 mrem/yr *above background.* DOE's statement suggests that doses estimated from soil concentrations measured in background samples collected on-site will be excluded from total radiation dose used to calculate site risk – this does not include cosmic and other natural radiation dose – and is not appropriate for a baseline risk assessment. All exposures (and associated doses) measured at the site contribute to baseline risk and should be included. If IARODs included a cleanup level of 15 mrem/yr *above background*, residual risks could be higher than the 3×10^{-4} probability indicated in this section. It should also be noted that a 15 mrem/yr dose produces a cancer risk far greater than allowed under CERCLA and MTCA; EPA admits that the lifetime risk is 3 x 10-4, which is three times the maximum allowed under CERCLA. Additionally, if EPA's own risk factors (published as public information) are considered, the fatal cancer risk is 5 x 10-4 to 6 x 10-4 and the cancer incidence risk as estimated by the National Academies is about 1.1 x 10-3 (see Attachment 1). The maximum allowable dose from residual radioactivity from all pathways should be reduced to conform to CERCLA and MTCA as described in the general comments.	No

14	Assessment of Interim Actions	ES-7	Uncertainty associated with using cleanup verification data to estimate risk should not be described as possibly overestimated because of backfill. Although perhaps not representative of surface soil concentrations, risk at these waste sites may also be considered underestimated since confirmation samples may not 1) reflect additional contamination at depth or horizontally, and 2) may be located at depths accessible by an individual (e.g., excavating for dwellings, wells, or native plants). Revise the description accordingly here, as well as in ES-17, 2-43, and other sections of the baseline HHRA.	No
15	Assessment of Groundwater	ES-8	The 331 wells used in the evaluation represent a very small fraction of available wells. It is unclear why so few wells (of the thousands of active wells) were used for the evaluation. Clarify the selection of limited wells (and hence data) for the groundwater assessment.	No
16	Broad-Area and Local-Area Risk Assessments	ES-9	It is misleading to consider the samples associated with 20 remediated waste sites "a conservative representation of average contaminant concentrations," since it is unknown if all waste sites have been identified. Revise the sentence to delete "conservative" and read "average *known* contaminant concentrations..."	Unknown (partially removed)
17	Broad-Area and Local-Area Risk Assessments	ES-10	It is stated that arsenic concentrations in upland and riparian site soils are not significantly different from background. Are background arsenic concentrations derived from locations that are impacted as a result of historic pesticide use? If so, then different, uninfluenced background locations should be selected to assess the level of impact and related risk from arsenic at the Hanford site.	No
18	Broad-Area and Local-Area Risk Assessments	ES-11	It is appropriate that the considerable uncertainty regarding edible plant contaminant concentrations and site-specific soil-to-plant uptake factors are noted. Concentrations of site contaminants in these materials, however, is a critical data gap in this risk assessment. Collection and analysis of site-specific plants should be mandatory, not just "considered" as part of the RI/FS process.	No
19	Broad-Area and Local-Area Risk Assessments	ES-12	It is incorrect to state that the three species of fish analyzed are not plausible food sources for chronic human exposure, as they are consumed by tribal members. This statement should be removed. There is, however, too much uncertainty from the limited species and limited analytes evaluated. Revise the assessment to include data from multiple species of Columbia River fish, and/or clarify how results from the Columbia River Component assessment will be combined with these results to obtain a complete assessment of risk.	No
20	Final Recommend-ations	ES-19	Only three scenarios were used to develop PRGs, none of which were based on residential scenarios. Revise the statement to reflect that only a *limited* set of the scenarios were used to develop PRGs, and explain when the PRG development process will include residential scenarios.	No
21	Glossary	xix	Reference site: the definition should not include "comparatively uncontaminated site." This is misleading. While the EPA definition allows for the possibility of "least affected or altogether unaffected" it is clear that EPA/540/F-94/012 also states that the reference site should be "unaffected by site contamination."	No
22	Glossary	xx	Uncertainty analysis: This definition should include statistical comparisons of variability as well as qualitative statements regarding lack of knowledge.	No
1.0 Introduction				
23	1.1	1-3	The first statement about characterizing "current and potential future risks" should be qualified by adding to the statement that they are posed by "current, known" releases. In the case of Hanford, where many contaminants are long-lived, decay into other hazardous substances, and are migrating from the Central Plateau to the River Corridor and into the Columbia River, transport should be considered and modeled peak concentrations throughout the site should be used to assess future risks.	No

24	1.1	1-5	We disagree with the statement that an overarching goal is to "minimize the cleanup footprint." This is inconsistent with a comprehensive and complete cleanup of Hanford contaminants.	No
25	1.2	1-6	This statement "Nonoperational areas include large portions of the River Corridor that are outside of the operation areas and are not anticipated to be impacted by Hanford Site releases" is not correct. Mobility of contaminants through biological or abiotic events may transfer contaminants to areas beyond the "operational areas." Available wind-rose data indicates that a large portion of the site, state, and Columbia River basin has been affected by Hanford air releases. Revise the last sentence of the second bullet to state that non-operational areas may be impacted, although the impacts are unknown because of lack of characterization.	No
26	1.3.2	1-7	A baseline risk assessment should not rely on land use restrictions or institutional controls. Therefore, we do not believe that "The scope of the human health and ecological risk assessment processes depend on site-specific factors such as reasonably anticipated future land use and anticipated beneficial uses of groundwater and surface water."	No
27	1.3.4	1-8	This section includes the statement "Certain protectiveness standards for WAC 173-340 are pertinent to the baseline risk assessment effort," but does not indicate what those protectiveness standards include. Section 702(10) of MTCA (WAC 173-340) states that "When evaluating cleanup actions performed under the federal cleanup law, the department shall consider WAC 173-340-350, 173-340-355, 173-340-357, 173-340-360, 173-340-410, 173-340-420, 173-340-440, 173-340-450, 173-340-700 through 173-340-760, and 173-340-830 to be legally applicable requirements under Section 121(d) of the Federal Cleanup Law." All of these requirements should be included as applicable requirements for CERCLA actions, including the maximum allowable risk thresholds of 1×10^{-6} for individual carcinogens and 1×10^{-5} for multiple carcinogens and multiple pathways. As radionuclides are considered hazardous substances under MTCA (WAC 173-340-200), they should be subject to the same risk thresholds as all other carcinogens, including the total site cancer risk threshold of 1×10^{-5}.	No
28	1.3.5	1-8	In addition to the MTCA requirements identified in this section, groundwater discharges to surface water at the Hanford site must also meet requirements included in WAC 173-340-720 (8)(d)(i), which allows for a "conditional point of compliance that is located within the surface water... where ground water flows into the surface water."	No
29	1.4.1	1-9	Clarify up front how the calculated areas for the 100 and 300 area decision units are adequate to conduct both broad-area and local-risk assessment (e.g., are any areas of the site not included?).	No
30	1.4.2	1-10	It is unclear how the Columbia River Comprehensive Impact Assessment (CRCIA) was incorporated into the RCBRA. Clarify both the aspects of the CRCIA that were used and how they were used in the baseline HHRA.	No
31	1.5	1-14	Release of RCBRA drafts has been incongruent. Draft A was released in 2007. Draft B was never released to the Yakama Nation. Draft C was released in 2010, after a 15-month delay. With the release of Draft C during year-end holidays (and a limited review period), Volume II (Human Health) was released and comments due to DOE before the release of Volume I (Ecological). Lastly, the risk assessment has been conducted before all remedial investigation activities, such as adequate site characterization and the availability of data requisite to assessing cumulative site risk.	No

2.0 Site Background and Cleanup Activities				
32	2.1.3	2-2	The accuracy of the statement "there is no longer significant artificial recharge due to operations in the 100 and 300 Areas, as disposal of liquid waste to ground has ceased" is questionable depending on the definition of the "100 and 300 Areas." At times, it is used specifically to refer to the 100 and 300 Areas, while in other instances it is used to include all river corridor ROD decision areas (see paragraph 2 of Section 3.3, Pg 3-39 as an example). There is evidence that artificial recharge may be occurring at Energy Northwest (ENW). Both mounds and depressions can be found in close, if not direct proximity to the 618-11 burial ground. There are two known outfalls for waste water at ENW, and mounding is possible. However, the largest mound occurs directly under the cooling structures. Either this statement should be qualified with respect to the ENW site, or a consistent definition of the "100 and 300 Areas" should be used throughout the document.	No
33	2.4.4.1	2-20	First paragraph: "Some of these high-priority waste sites are included in this ecological risk assessment." Please review the entire document for inadvertent text from the Ecological Risk Assessment (Volume I).	No
34	2.5.1	2-24	The text misleadingly states that the methods used to initially collect waste disposal information were "exhaustive." A significant number of waste sites have been identified since the initial discovery effort, and it is expected that additional waste sites have yet to be discovered by the orphan waste site identification and evaluation process. Delete the word "exhaustive" from the text.	No
35	2.5.2	2-24	According to the Tri-Party Agreement Appendix C, waste/release site listings are intended to be updated according to the official list of sites requiring remedial investigation/action under CERCLA §120. The current version of Appendix C, dated December 8, 2010, does not accurately reflect all of the CERCLA waste sites, or even all the sites used for RCBRA input data. Revise the text to indicate that the Hanford Site Waste Management Units Report contains a more accurate listing and status of CERCLA waste sites than does Tri-Party Agreement Appendix C.	No
36	2.5.3	2-24 to 2-25	Although the Hanford Past-Practice Strategy (HPPS) allows for limited field investigations (LFIs), focused feasibility studies (FFSs), and qualitative risk assessments (QRAs), these streamlined approaches are intended to support the RI/FS process, not substitute for it as the text incorrectly implies. Due to the scope and complexity of the River Corridor aggregate area, additional investigation and characterization is necessary to provide sufficient information for a cumulative risk assessment. Revise the text to clarify that while LFIs, FFSs, and QRAs supported the Interim Remedial Measures, they are not sufficiently comprehensive to support a final ROD.	No
37	2.5.4.4	2-26	Explain how the criteria were used to identify high-priority sites recommended for remedial action, in particular "insufficient information for conceptual model" through the Qualitative Risk Assessment process.	No
38	2.7.1	2-34	Rationale for the baseline HHRA not considering intruders into cocooned reactor buildings and structures in the 100 Area is not explained. Clarify the rationale for not considering intruders into cocooned 100 Area reactor buildings and how exposure to these sites will otherwise be addressed.	No
39	2.8	2-39 to 2-44	This screening-level assessment of residual risks at remediated waste sites seems out of place and the purpose is unclear. Although this section utilizes previous models (scenarios and parameters) that might relate to cleanup activities, it presents calculated risk results that precede an explanation of the methodology (Section 3). Consider creating a separate results section (similar to Sections 4, 5, and 6), and clarify the purpose of this section (e.g., to present past results, compare methodologies, or support additional remediation decisions).	No

40	2.8	2-41*	Clarify what the IAROD Rural Residential Scenario for defining cancer risk and noncancer hazards from radionuclides and chemicals entails.	No
41	2.8	2-41	The reader is referred to Section 7.5 for a detailed explanation of the calculations, but Section 7.5 only provides a summary of key conclusions. Revise the paragraph accordingly and reference the correct location of the calculations.	**Yes**
42	2.8.4	2-43	It is incomplete to summarize risk calculation results for residual contamination at waste sites by listing only results without arsenic. Although it is appropriate to note that arsenic is also a naturally-occurring compound, its presence at the site (natural and anthropogenic) contributes to total baseline risk similar to other naturally-occurring compounds, such as uranium. Revise the assessment to include all contaminant contributions to accurately reflect baseline risk conditions.	No
3.0 Human Health Risk Assessment Approach				
43	3	All	The discussions of data in Section 3 should clarify that not all contaminants were measured in all samples. In the summary tables, the total sample counts do not necessarily reflect the same number of data records for each analyte.	No
44	3.1	3-2	The approach should also consider <u>future</u> conditions within the upland, riparian, and near shore environments.	No
45	3.1.1.1	3-3	Risks associated with the yet-to-be remediated waste sites are noted as not being a focus of the report, indicating that while unacceptable risks at these waste sites are acknowledged, they are not added to all other baseline risks to provide a complete picture of cumulative site risk. Unremediated waste sites should be included for the assessment to be complete.	No
46	3.1.1.2*	3-4*	Waste sites remediated in accordance with requirements in the IARODs may not meet the cleanup requirements of the final RODs. Please revise the baseline HHRA as appropriate to acknowledge that additional remediation may be necessary to meet the requirements of the final RODs.	No
47	3.1.1.2	3-4	The revised baseline HHRA and remedial investigation reports should include complete integration of all media and exposure pathways, including groundwater transport of residual contamination from waste sites.	No
48	3.1.2	3-4	Examples are provided of non-CERCLA activities that may be useful for evaluating the non-operational areas, such as data collected as part of the Environmental Monitoring Program; however it is unclear what data from these sources are included in the baseline HHRA. Please clarify and use all appropriate data.	No
49	3.1.2	3-4	The extent to which non-operational areas are undisturbed is not well documented. Please revise the text to acknowledge that past practices at Hanford likely resulted in the disposal of unusual or particularly toxic waste outside of normal operational units in shallow undocumented waste sites. Accordingly, there may be many undocumented waste sites in the inter-operational areas that have not yet been discovered by the orphan waste site identification and evaluation process.	No
50	3.1.2	3-5	Past releases from operational areas likely contaminated surficial soils and plants in non-operational areas.	No
51	3.1.2	3-5	Please revise the discussion of aerial surveys to acknowledge and discuss that aerial radiological surveys are not able to detect and reliably quantify alpha radiation, which is emitted by uranium and transuranic elements. Revise the text to explain specifically how the aerial survey information was incorporated into the baseline HHRA, or specify that it was not used, if that is the case.	No

52	3.1.2	3-5 to 3-6	Risks associated with the non-operational areas are noted as not being a focus of this baseline HHRA, indicating that both the known and the unidentified risks potentially associated with these areas remain as a data gap. Evaluation of non-operational area data should be addressed in the baseline HHRA. At the very least, remedial investigation reports should include complete integration of operational and non-operational areas.	No
53	3.1.3	3-6	The discussion of the framework for assessing the riparian environment is very limited, focusing only on the 100-D island. Revise this section to include discussion of the overall methodology used for evaluating riparian areas potentially affected by contaminants.	No
54	3.1.3	3-7	Although Co-60 may not be detected in sediment downstream of the 100-D island at elevated concentrations, there is no mention of any other contaminants of potential concern. A search of the GiSdT database shows many more contaminants were detected in these samples. Revise the data summary to include risks estimated from potential exposure to other contaminants.	No
55	3.1.4	3-7 to 3-8	The discussion of the framework for assessing the nearshore environment is too limited, focusing only on the effluent pipelines. Revise this section to describe the overall methodology used for evaluating the nearshore areas potentially affected by contaminants, including groundwater seeps and aquatic biota (such as fish).	No
56	3.1.4.1	3-10	Risks associated with the nearshore pipelines are noted as not being a focus of the report (based on previous investigations), indicating that these data are not included in the baseline HHRA. Revise the baseline HHRA to include all available nearshore data, including those associated with pipelines, to estimate total baseline risk.	No
57	3.1.4.1	3-10	The baseline HHRA indicates that if portions of river effluent pipelines become dislodged and wash ashore, there may be elevated human health risk. However, the nature of the elevated human health risk is not mentioned. Expand the text to more fully explain the nature and magnitude of the associated risks under this scenario.	No
58	3.1.4.1	3-10	The baseline HHRA incorrectly indicates that the river effluent pipelines will be discussed again in Section 7.0 (Conclusions and Recommendations); however, river effluent pipelines are not mentioned again in the remainder of the document. Please revise the appropriate sections to include discussion the river effluent pipelines.	**Yes**
59	3.2.1	3-11	Examination of uranium-238 data provided in the GiSdT indicates a very large percentage of uranium data that was collected after 1998 that is >2 pCi/g was rejected from use in the RCBRA on the basis of the type of analytical method used. Further examination reveals that of the 2,596 *unusable* results, 1,690 were >1 pCi/g, while of 2,517 *usable* results, only 172 were >1 pCi/g. This evaluation was performed across all environments and sample categories using DOE provided data. The results suggest a strong bias in the uranium data that was ultimately used in the baseline HHRA. Please see our general comment on this topic. Review, rescreen, and revise the data used in the baseline HHRA using criteria that provides unbiased data reflective of the observed site conditions.	No

60	3.2.1.1	3-11	In reference to the statement "It is the incremental risk above background levels that is of primary concern...," it should be noted that comparisons to background should only be considered during the feasibility study when selecting appropriate cleanup actions and making risk management decisions. EPA guidance, cited in the document, (EPA 540-R-01-003, Appendix B) states specifically that all substances present at a site that exceed risk thresholds concentrations should be included in the risk assessment. Although it is true that naturally-occurring compounds can contribute to site risk, no distinction should be made from Hanford-related contaminants in a baseline risk assessment. As defined by EPA, "baseline risks are risks that might exist if no remediation or institutional controls were applied at a site" regardless of source (EPA 540/1-89/002), and it is not correct to consider only "incremental risk above background levels" to assess baseline conditions. Revise the baseline HHRA to consider all sources of risk to estimate baseline risks. Risks from man-made and Hanford-origin contaminants should be identified and evaluated in this context. Background or reference concentrations can be considered more specifically in the risk management part of the cleanup process.	No
61	3.2.1.1	3-11	EPA/540/1-89/002 is cited as the basis for using reference data to select COPCs for the site. However, the document and section only discuss using statistics to identify site-related versus non-site related substances. This guidance document as well as much newer guidance are clear that COPCs are all substances posing risk, whether site-related or not.	No
62	3.2.1.1	3-14 to 3-15, Figure 3-2	It is inappropriate to consider samples collected from the Hanford Site as "background" or "reference" as the term is used in a baseline risk assessment because no area of the site can be considered as "absent contamination" (considering air, ground, or biota dispersion). The background or reference site should not be within the Hanford Site boundaries or downwind of predominant winds. Revise the baseline HHRA to consider background samples as only those collected off the Hanford Site and outside of the influence of Hanford-derived releases. Background or reference concentrations can be considered more specifically in the risk management part of the cleanup process.	No
63	3.2.1.1	3-15	The number of reference sites, particularly for the 300 area, and the proximity of the reference sites to contaminated sites seems significantly inadequate to provide appropriate, and uninfluenced data.	No
64	3.2.1.1	3-16, Tab. 3-3	Upland reference sites have likely been impacted by emissions from operational areas, including long-lived radionuclides.	No
65	3.2.1.1	3-18	In reference to the statement "...have heterogeneous, or patchy, contamination...," the inclusion of contaminated references sites in the assessment is not protective and should not be used.	No
66	3.2.1.1	3-20	In reference to the statement "each location was characterized with a single sample of sediment and surface water," a single sample is not sufficient to characterize these sites. Please revise the data analysis to include a larger data set.	No
67	3.2.1.1	3-22	The Yakama Nation has previously raised concerns regarding large radioactive exposure doses at reference sites in the RCBRA Draft A. In particular, significant concentrations of americium-241 (a man-made radionuclide known to be of Hanford origin) were found in soil and biota at reference locations that could result in large doses of radiation to individuals based on the Yakama Nation exposure scenario. Review of available reference data indicates that americium remains present at several reference locations, indicating anthropogenic contamination at these sites. Revise the baseline HHRA to include reference sites that are not influenced by Hanford-derived contamination.	No
68	3.2.1.4	3-25	This section indicates characterization of groundwater exposures is "currently under development." Revise the baseline HHRA to include this important and potentially significant source of additional exposure.	No

69	3.2.1.4 and 3.3.1	3-25 and 3-44	Using only present day groundwater data does not account for future migration of groundwater contamination from the Central Plateau. The migration of this contamination has already been observed and is expected to continue into the foreseeable future. An analysis of Central Plateau contamination movement was performed as part of the Tank Closure / Waste Management (TC/WM) Environmental Impact Statement (EIS) and should be acknowledged and incorporated into the baseline HHRA for the River Corridor. Even if, as DOE contends, CERCLA actions in the Central Plateau will be protective of groundwater, a baseline HHRA should reflect potential risks absent remediation. Please revise the text to either include groundwater exposure and dosage or to acknowledge this important data gap and the difference between the generally accepted purpose of a baseline risk assessment and what has been presented here.	No
70	3.2.1.4	3-25	It is unclear what criteria are used to define "representative" samples. The process for selecting the "representative" wells should be discussed. For example, what specific criteria were used; what data from which wells were not used and why; were data from multiple samplings of a well combined and how; etc.?	No
71	3.2.1.5	3-25	Although current and appropriate, not all Environmental Monitoring Program and Surface Environmental Surveillance Program (SESP) data appear to be included as data sources, and it is unclear why. Please revise the baseline HHRA to include all available and relevant data.	No
72	3.2.2	3-29	The opening paragraph of this section is another example of where the authors misunderstand or misrepresent the purpose of a risk assessment. The baseline HHRA needs to identify the sum total of all risks from all substances. A risk management document or a feasibility study is the correct place to determine the contributions to the overall risk from natural or anthropogenic background concentrations, which may or may not need to be remediated to meet clean-up goals.	No
73	3.2.2	3-29	The document cites DOE/RL-2005-42 as the accepted guidance for selecting COPCs. The process described in this paragraph was not found in the cited document. The citation stated only that "indicator contaminants" had been identified as those exceeding interim clean-up goals. A companion document cited in 2005-42, BHI-01757 (dealing primarily with the ecological risk assessments), states that for human health, all contaminants contributing "substantially" to human health risks would be included as COPCS. No process for "refinement" of the human health contaminants was found in either document. The process and agreements indicated on this page for the selection of COPC is poorly documented and requires better justification.	No
74	3.2.2	3-29	The statement "...comparing mean concentrations at study sites to background or reference..." is not acceptable. The comparison should use a range of concentrations with a statistical measure of uncertainty.	No
75	3.2.2	3-29	Despite previous workshops and discussions, it is inappropriate to selectively exclude data or COPCs in a baseline risk assessment. Revise the baseline HHRA to include all sources of risk, including substances that are naturally-occurring, ubiquitous, or otherwise considered background, to accurately reflect baseline risk conditions.	No
76	3.2.2.1	3-30	A citation to the Tri-Party agreement excluding some contaminants from consideration in the baseline HHRA should be provided, as should adequate justification.	No

77	3.2.2.1	3-30	Thorium-232 should not be excluded from the COPC list without further consideration and more detailed justification. See general comments and Attachment 1 for more details. Thorium-232 was known to be handled in very large quantities at the Hanford Site during periods of uranium-233 production, which utilized a thorium-232 reactor target. However, very few data points were identified in the GiSdT. We are concerned that the failure to find any residual Th-232 represents a failure to adequately sample potential source areas. Revise the COPC list to incorporate thorium-232 and other naturally occurring radionuclides used in large quantities at the site.	No
78	3.2.2.2	3-30, Tables 3-7 to 3-8	Revise the COPCs to include americium-241. Currently this radionuclide is neither included nor excluded from the baseline HHRA. This man-made radionuclide has a half life of 430 years and a relatively high specific activity for an alpha emitting isotope, making it particularly dangerous. Furthermore, americium-241 has been identified in high concentrations at many locations within the Hanford site, including several background and reference sampling sites, artificially implying that remediated waste sites are actually cleaner than uncontaminated locations. Finally, americium-241 is present in waste sites not considered in the baseline HHRA, for example the 116-N-1 site, in concentrations that exceed those found in waste sites considered in the baseline HHRA.	No
79	3.2.2.2	3-30	A "meaningful and effective regulatory document" requires a holistic evaluation of the total risks to human receptors at the waste sites and in all areas of the Hanford Site.	No
80	3.2.2.2	3-30	The COPC selection criteria eliminate compounds not found in at least one third of the waste sites in the 100 Area. Because different reactors had different auxiliary missions, such as the production of special nuclear materials, this methodology allows for removing COPCs from consideration that may be present in large quantities at only a few sites (e.g., COPCs present in the K-reactor fuel basins or the 618 burial grounds). Revise the COPC selection process and the list of accepted COPCs in the baseline HHRA to include contaminants of this nature so that these unique sites are not overlooked. This concern would also be corrected by including all of the substances posing risk, as is appropriate for a baseline risk assessment.	No
81	3.2.2.2	3-31	The requirement that a contaminant needs to be reported at one-third of the wastes sites is not protective. This screen potentially eliminates relatively unique waste sites, as well as adds to the problem of not including all contaminants in the risk evaluation. Similarly, the 300 Area sites should be screened on their own merit. The activities in the two operational areas were not the same. No justification is provided for not attempting to identify the "worst-case" sites, rather than artificially generating some sort of "representative" exposure.	No
82	3.2.2.4	3-32	Provide justification for the decision to use Hanford Site background data in preference to Washington State Yakima Basin Region background data when performing statistical evaluations for whether an inorganic analyte should be included as a COPC. Both have similar geologic histories, and where possible, preference should be given to data collected from sites outside the area of influence of Hanford-derived contaminants and away from the Hanford Site.	No
83	3.2.2.4	3-37	This section indicates no background or reference data are available for groundwater. Explain why, and identify and incorporate into the baseline HHRA a site which will allow groundwater to be sampled, analyzed and evaluated to establish background and reference data for selection of COPCs.	No

84	3.3	3-39	The text alludes to "many waste sites" as having been remediated. The baseline HHRA should be explicit in identifying whether data are available from other remediated waste sites not included in this assessment, and, if so, how the sites are used and selected, and why other sites (including non-remediated sites) were not used.	No
85	3.3	3-39	Similar to Draft A, the exposure scenarios evaluated are again referred to as "hypothetical," suggesting that DOE does not intend to clean up to unrestricted use. Revise the text to replace "hypothetical" with "potential future" exposure scenarios.	No
86	3.3	3-41, Figure 3-13	This conceptual site model of contaminant sources demonstrates contaminant transport from the Central Plateau and other upland areas to the River Corridor and into the river itself (including the pipelines). The conceptual model should also depict contaminant pathways from the vadose zone and subsurface surrounding or under the reactors to groundwater and the river. Revise the document to include a combined evaluation of all of these areas that will provide a complete picture of baseline risks.	No
87	3.3	3-41, Figure 3-13	The cross-section cuts Gable Mountain without acknowledging the underlying basalt layer. Redraw the cross-section line to accurately account for the basalt layer and/or acknowledge its presence in the text.	No
88	3.3	3-41, Figure 3-13	This figure lacks depiction of bioturbation (e.g., rabbits burrowing, moles digging, ants making colonies) as potential contaminant transfer pathways. These animals are an important part of the food chain and potential vectors of contaminants.	No
89	3.3.1	3-43	It is true that present day workers are under surveillance and are managed under health and safety plans. However, accidents happen and workers may be contaminated with residual chemicals. "*Because potential exposures and associated risks are monitored for these workers, they are not considered potential receptors for the HHRA.*" There is no way to ensure that a worker will not be contaminated. It must be assumed that an accidental exposure could occur. The purpose of the risk assessment is to calculate potential risks from contaminant exposure to people, including workers, without institutional controls, surveillance or monitoring. The current beryllium program, for example, shows that workers can still be exposed. Please revise to include this scenario for workers.	No
90	3.3.1.3	3-44	The statement "...cancer risk and radiation dose will be calculated using present-day radionuclide activities in soil and with radionuclide activities in soil decayed to the years 2075 and 2150" is not adequate. Consider not only decayed concentrations, but future estimated concentrations due to migration.	No
91	3.3.2	3-45	As applied in the RCBRA, the Yakama Resident scenario inappropriately assumes that an individual contacts soil only within a limited area surrounding a home. This does not necessarily provide the most conservative assumption for contaminant exposure. While exposure may exist within a limited area (e.g., residing on a former waste site), exposure should also include other pathways, e.g., hunting, gathering, fishing and consuming the resulting foodstuffs; contacting seeps, springs, sediment and surface water in the Columbia River to determine total risk.	No
92	3.3.2	3-45	Please clarify these statements "...likely to be exposed over much broader areas...:" "... a residential component that pertains to localized exposure..."	No
93	3.3.2.1	3-46	Regarding the second paragraph in this section, it is unreasonable to assume that activities by humans and small animals will be limited to a depth of 6 inches. For instance, bioturbation from insects, worms, trees, mammals and other biota may mix soil, and digging for wild plant roots may occur at depths of approximately 6 feet below ground surface. Please change this assumption as it will change the input data for the baseline HHRA.	No

94	3.3.2.1	3-46	The Resident Monument Worker scenario should be revised to include exposure to upland and riparian contaminants through plants and animals, or provide adequate justification for why these exposure pathways are not included.	No
95	3.3.2.1	3-47	The statement "*Because the volume of drill cuttings will be very small relative to the volume of soil encountered by receptors when averaging exposure over many years, the potential contribution of drill cuttings to chronic health risks from soil exposures is likewise small*" may not be true. If a resident or worker handles contaminated cuttings, exposure to elevated concentrations may occur. The assumption cannot be made that chronic health risks would be small via this exposure pathway. Please include this pathway in the baseline HHRA or provide better justification for its exclusion.	**Yes**
96	3.3.2.1	3-47	The protectiveness of using the backfilled soil data depends on the assumption that the exposure to the side wall concentrations is small and does not extend beyond the remediated footprint of the site. More importantly, there are numerous realistic scenarios of future activities at the site wherein natural or anthropogenic activities would expose those currently buried soils. In addition, if such an event occurred, the exposure area of contaminated surface soils could be much greater that the waste-site footprint.	No
97	3.3.2.1	3-48	If, as stated in the last paragraph, the problem with using measured concentrations in upland vegetation is only related to organic contaminants, then at least use the data for inorganic substances and radionuclides.	No
98	3.3.2.2	3-49	In the first paragraph: "...soil data because residual contaminant concentrations are generally higher than in the sediment data..." Is this based on theory or empirical evidence of variation in upland soils from the Columbia River Basin and sediments from the riverbed?	No
99	3.3.2.2	3-49	The explanations provided for excluding Surface Environmental Surveillance Program (SESP) sediment data are not adequate (e.g., simply because other data are available?). Are the results comparable to RCBRA data? Clarify the data quality issues that compromise this data set.	No
100	3.3.2.2 and 3.3.3.3	3-49 and 3-59	It is incomplete to assume that only the recreational and nonresident tribal scenarios have potentially complete exposure pathways to surface water and sediment. A tribal resident would certainly use and contact surface water from the Columbia River to drink, swim, fish, and sweat, while also contacting and inadvertently ingesting sediment. Please revise the baseline HHRA to include potential exposure to surface water and sediment as part of the Yakama Nation resident scenario.	No
101	3.3.2.2	3-49	It is incorrect to assume that chronic exposure to seep water is unlikely because of seasonal flows. A Tribal resident or non-resident could access a nearshore area with seeps over a lifetime. It is also incorrect to assume that porewater is not a potential human health medium, as a Tribal member could contact sediment and therefore porewater. Revise the baseline HHRA to include estimating risks from exposure to seeps and porewater for all Tribal scenarios.	No
102	3.3.2.2	3-49	Explain how the Resident Monument Worker and Industrial Worker scenarios interface with the Recreational Use scenarios. It would be very likely that the Resident Monument Worker, in particular, would also be exposed via pathways similar to the Recreational User.	No
103	3.3.2.3	3-49	The statement that "Groundwater in the River Corridor areas...flows in the direction of the Columbia River" is incomplete. Groundwater also flows inland locally during periods of high water in the River.	No

104	3.3.2.3	3-50 and 3-52, Figure 3-15	In assessing future risks, it is appropriate to evaluate future groundwater concentrations due to leaching of soil contaminants and migration from up gradient sources. Revise the assessment to include groundwater as a complete pathway for all scenarios, and to include future groundwater concentrations (for example, those estimated in the Draft TC/WM EIS). Also, current and future groundwater concentrations should be evaluated via the vapor intrusion and irrigation pathways, as these are plausible future uses.	No
105	3.3.2.3 and 3.3.3.2	3-50 and 3-56	The baseline HHRA fails to assess risk from groundwater to Industrial Workers. Justify this omission, including what water source industrial workers will use for drinking, washing, and industrial operations in this desert environment each work day. Include risks of exposure through ingestion, absorption, and inhalation of potential contaminants.	No
106	3.3.2.3	3-50	The baseline HHRA omits the exposure pathways of irrigating a garden, and it is unclear if risk is assessed for providing water to livestock. These pathways are present in the exposure scenario and should be included in the risk assessment.[1]	No
107	3.3.3.1	3-51 to 3-53, Tables 3-11 to 3-13	These three tables do not provide a sufficient view of actual exposure pathway scenarios that may be encountered at the site. For example, given the nature of activities that children participate in, a casual user child would be expected to have a complete exposure pathway to soil. Also, groundwater could be used for residential purposes, including dermal exposure and inhalation during showering. These exposure scenarios should be revisited to ensure that they represent realistic behaviors and pathways.	No
108	3.3.3.1	3-51 to 3-53, Table 3-11	The exposure of young children to contaminants via the sweat lodge pathway should be evaluated. Revise the assessment to assume child exposure of at least one hour per day.	No
109	3.3.3.1	3-51 to 3-53, Table 3-11	There is no evaluation of exposure and doses to the embryo/fetus and to young children from the breast milk pathway. Revise the assessment to include potential exposures to the embryo/fetus and to young children from the breast milk pathway for the Tribal resident and other scenarios to ensure that the most vulnerable members are adequately protected.	No
110	3.3.3.1	3-54, Table 3-11	It is incomplete to assume that the nonresident Tribal scenario has a potentially complete soil exposure pathway only to the top 6 inches. An intermittent Tribal site user could access deeper soil to dig roots, build a ground oven or temporary shelter. Revise the nonresident Tribal scenario to include deeper soil, e.g., waste site samples collected below ground surface similar to the resident scenarios.	No
111	3.3.3.1	3-54, Table 3-11	Upland surface soil (0-6 inches) is not used for casual user (adult or child) or avid angler (adult or child). Users would be exposed to more categories than described here. For example, children that crawl, play on the ground, and inadvertently eat dirt. Please consider these exposure pathways.	No
112	3.3.3.1	3-54	Tribal children should be considered in a consistent manner with non-Tribal children, starting at the age of 1 year, not 2 years old.	No
113	3.3.3.3	3-57, Figure 3-17	The Yakama Resident residential scenario should include and show complete pathways for sediments (inadvertent ingestion, dermal absorption, and external irradiation); river water (ingestion); wild plants and wild game (ingestion, traditional uses).	No
114	3.3.3.2*	3-56*	It is unlikely that a Resident Monument Worker would never engage in gardening, raising livestock, or fishing from the Columbia River. Please consider these exposure pathways.	No

115	3.3.3.3	3-59	It is incorrect to assume that Native American residents would only use plants and animals raised domestically. Similar to fishing in the nearby river, a Yakama resident (living on a waste site) would also hunt in the nearby upland and riparian areas. Although it may be appropriate to assume that wild plants and game have taken up contaminants from a waste site, revise the statement from "assumed to be domestically raised" to more accurately reflect the collection of wild plants and game. Concentrations should not only be modeled from remediated waste site soils, but also modeled from unremediated waste site soils as well as measured directly.	No
116	3.3.4	3-59	It is not only "desirable" but correct methodology to calculate cumulative risks for all exposure pathways for each scenario. By dividing the assessment into spatial scales, exposure assumptions associated with the Yakama scenario have been only selectively applied. For example, some exposure pathways that are applied to the non-resident are not applied to the resident and vice versa. This does not provide a complete picture of cumulative exposures to a Tribal member. Revise the baseline HHRA to consider a more complete "broad-area" evaluation of risk to Yakama residents and other scenarios that reflect potential exposures site-wide, including soil (surface and subsurface), groundwater (seeps, porewater, and future migration), surface water, sediment, and upland, riparian, and aquatic biota.	No
117	3.3.4	3-60	Fish ingestion risk estimates should be directly summed with risks from other exposure pathways. The limited fish data have resulted in an incomplete fish consumption analysis. Risk estimates for ingesting these surrogate fish species (which actually are consumed by Tribal members) and other species should be included in a cumulative risk assessment.	No
118	3.4.1	3-61	The EPA guidance "Methods for Evaluating the Attainment of Cleanup Standards" does not describe the Reasonable Maximum Exposure (RME), but presents sampling and analysis methods to verify remediation activities using *average* concentrations. Please revise the statement, and assessment as needed, to accurately reflect the intent of the RME in risk assessment, which is to estimate a conservative exposure case (i.e., well above the average case).	No
119	3.4.3.2	3-70	Regarding the statements "...Migration of gas phase VOCs upward through vadose zone soil and into a residential..." and "...risks related to this exposure pathway are not quantified..." Explain how this affects risk estimates in the uncertainty section.	No
120	3.4.3.4	3-72	The failure to collect edible plant samples for analysis is a data gap that introduces significant uncertainty into the data set. The baseline HHRA should address edible plant measured data and site-specific uptake factors.	No
121	3.4.3.5	3-73	"...chicken feed is store-bought..." explain in uncertainty section how store bought chicken feed versus on-site harvested chicken feed affects the risk estimates.	No
122	3.4.3.7	3-74	"Riparian plant tissue EPCs are calculated for each individual ROD decision area because there are adequate riparian soil data in each area..." The sites were pre-selected and do not represent exposures to individuals or communities. The statement that it may bias risk estimates is correct. The effect of this bias should be more thoroughly discussed in the uncertainty section.	No
123	3.4.4	3-75 to 3-76	"The inclusion of both RME and CTE...semiquantitative measure..." What does semiquantitative mean in this context?	No

124	3.4.4.4	3-80, Table 3-18	The nonresidential Tribal scenario exposure parameters do not accurately represent a Tribal unrestricted use scenario. Please revise the broad-area assessment to include the Yakama resident scenario, reflecting an individual residing on the site (possibly on a former waste site) and using all of the resources available on a broad scale: hunting game and collecting plants found in different areas of the site, harvesting fish from the river, sweating and participating in cultural activities in different areas. Accordingly, revise the exposure parameters to reflect a Tribal resident, including collecting 100% of wild plants from onsite.	No
125	3.4.4.4	3-80, Table 3-19	Some of the Yakama Resident exposure parameter values are not appropriate. Activity-specific soil adhesion factors (AF), for example, used for an adult farmer and child playing in wet soil are based on EPA's geometric mean rather than the 95th percentile (per RAGS, Part E). Also, the sweat lodge exposure duration only represents adults, and should be at least 70 years to include child exposure. Revise the exposure parameters to represent all upper-bound estimates.	No
126	3.4.4.6	3-82 and 101* Equations 3-12 and 3-24, Tables 3-19 and 3-30	The equations provided for calculating external radiation dose used in conjunction with the values provided in Table 3-19, Table 3-30, Appendix D, and Waste Site CVP confirmation sampling do not yield equivalent dose rates to those provided in the text of the baseline HHRA. Independently-calculated values are not even of the same order of magnitude. More information is required to replicate these calculations, in particular the residual levels of radionuclides, since it is not clear which values are taken from the CVP for each site. Please revise the baseline HHRA to present the calculation of present radiation doses in a format that is readable, repeatable, and consistent with the text of the document, and provide example calculations for review.	No
129	3.5.3	3-87	Paragraphs 2 and 3 are inconsistent. Both refer to PAHs listed in EPA/630/R-03/003F. However, they appear to be inconsistent as to the COPCs. Paragraph 2 indicated that 4 chemicals identified as mutagens in the EPA document may be COPCs. Paragraph 3 indicates that just 2 of these same chemicals are risk assessment COPCs. Revise to provide better clarification.	No
130	3.5.6	3-89	The equations presented for calculating dermal toxicity do not take into account the mode of absorption (water or soil) for which the Dermal Risk Assessment Guidance for Superfund document provides. If the appropriate information was not available as the text suggests, then specify exactly what values were not available and why the water absorption and soil absorption values could not be calculated. Also, it does not appear that age increments were calculated.	No
131	3.5.7	3-90	The first full paragraph suggests that surrogate chemicals may be used for determining toxicity criteria. Identify clearly both in a table and text, what chemical surrogates were used, for what calculations, what values were used, and provide peer reviewed justification for their use.	No
132	3.5.9	3-93	The use of Aroclor data rather than a full PCB congener analysis will affect the risk estimates. This should be discussed in the uncertainty section.	No
133	3.5.9	3-93	The text lists the TEFs as referenced from WHO 2003, however, Table 3-32 lists 12 PCB congener TEFs from the 2005 re-evaluation. Please correct the text.	No
134	3.5.10	3-94*	The 1993 Technical Baseline Report for the 100-D Area (cited in Table 2-1 as WHC-SD-EN-TI-181) states on page 2-6 that sources of contamination at the 100-D Area include Calcium-41, an activated element in reactor cooling water, which is called a "notable exception" to the other short-lived radionuclides, with a half-life of 103,000 years. Please address potential calcium-41 contamination and risk, and differentiate calcium-41 from calcium the essential nutrient.	No

135	3.5.10	3-95	Lithium data were not included in the risk assessment, but this section states that lithium was detected in cleanup verification shallow zone soil data from 100-D/100-H and 100-B/C areas. Please provide and evaluate these data.	No
136	3.6	3-98 to 3-102	Despite the fact that determining synergistic or antagonistic effects is difficult, it should be attempted when such effects between certain compounds are known. For example, consider the potential for synergistic interactions between radiation and certain types of hormonally-active agents and heavy metals.	No
137	3.6.4	3-101	The statement included in this section "The origin of this threshold was in guidelines published by the EPA for establishing cleanup levels for radionuclides under CERCLA that stated that 15 mrem/yr above background levels should generally be the maximum dose limit for humans" is attributed to OSWER 9200.4-18, "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination", but is inaccurate and should be deleted. This cited guidance indicates that 15 mrem/yr, and not 15 mrem/yr above background, is a "minimally acceptable dose limit", and further states that EPA has "explicitly rejected levels above 15 mrem/yr as being not sufficiently protective."	No
138	3.7	3-103	This section indicates that PRGs for radionuclides were developed based on a target cancer risk level of 1×10^{-4}. This risk level is inconsistent with EPA Risk Assessment Guidance for Superfund Part B, Chapter 4, titled "Risk-Based PRGs for Radioactive Contaminants," which states "calculate risk-based PRGs for each carcinogen corresponding to a pre-specified target cancer risk level of 10^{-6}." To be consistent with EPA guidance and with the risk requirements of MTCA (WAC 173-340), PRGs for all carcinogens, including radionuclides, should be developed based on a target risk level of 1×10^{-6}.	Unknown (partially removed)
4.0 Broad-Area Risk Assessment Results				
139	4.0*	All	From the first few sections of Chapter 4, it is unclear exactly what the COPCs are for any area of the Hanford site. Clearly state, at the beginning of the chapter, what COPCs are applicable to what areas.	No
140	4.0*	All	After reviewing the chapter, it does not appear that the following two questions have been adequately answered: 1) Are residual conditions for cleanup actions under the IARODs protective of human health and the environment? 2) What are the uncertainties associated with the risk results and conclusions? Provide clear and justified answers.	No
141	4.1	4-2 to 4-3	It is inappropriate that exposure to contaminants from groundwater seeps and fish consumption are evaluated separate from exposure to soils, river water and sediment. Revise the baseline HHRA to combine all exposure media, not just limited to the 100-K Area, to determine total risk, including deeper soils, groundwater, seeps, and other fish species throughout the reach.	No
142	4.1	4-2	For the Avid Hunter and Nonresident Tribal exposure scenarios, it appears no game species such as deer, elk, or duck were sampled and analyzed for this risk assessment. It appears that "deer" and "elk" contaminant concentrations were modeled from soil data. Provide adequate sampling for a quality risk assessment, for both broad and local areas.	No
143	4.1.1	4-2	Nonresident Tribal risk should not be based solely on modeled plant concentrations. Wild plants, particularly roots and other plant tissues harvested by tribal members, should be better characterized.	No
144	4.1.1	4-2	This section includes many generalizations and speculative statements that do not appear to be supported by data or references. For example, the text states that exposure scenarios "are generally protective of human health." Provide justification or reference data calculations supporting such statements.	No

145	4.1.1	4-3	Since this section is a "broad area" risk assessment, explain why so much emphasis is placed on many specific decision units, particularly since Chapter 5 already addresses individual decision units. This chapter should focus more thoroughly on addressing the risk *throughout* the entire Hanford River Corridor site, pulling in (and identifying) where local data are used.	No
146	4.2	4-5	No clear description or explanation is given as to why more representative sampling was not conducted throughout the River Corridor region. Provide statistically sufficient data to eliminate this data gap.	No
147	4.2	4-6, Figure 4-1	This figure is inadequate to show specific sampling locations for the Broad Area Risk Assessment. Sampling areas should be clearly identified as to location, media sampled, and parameters analyzed. Also provide a table summarizing this information. A statistically defensible number of samples that adequately represents the site should be used for the broad area.	No
148	4.2.1.1	4-7	Soil sampling collection is inadequate. Multi-increment sampling is better to characterize a relatively small area for known contamination, as it may miss "hot spots." An area 2.47 acres with only 50 samples is not adequate to characterize the area. This is only one sample per 2100 square feet. The depth of sampling is also inadequate at 0-15 cm. Please provide additional soil characterization.	No
149	4.2.1.1	4-7	Water level fluctuations between riparian area multi-increment sampling events result in sampling grid dimension variations and introduce uncertainty into the MIS analytical data. Address uncertainty in riparian area MIS analytical data introduced by variations in sampling grid dimensions between sampling events.	No
150	4.2.1.1	4-7	How many river sediment samples were taken in 2007 to replace unusable data from 2006? Were 35 new samples taken from the same 17 locations? Explain this additional data and show how the replacement data adequately addresses the gap.	No
151	4.2.1.1	4-8, Table	The unlabelled table on this page indicates that plants were sampled, but only the leaves of upland and riparian vegetation. Roots are vegetation and an important food source for tribal members and must also be sampled. Additionally, no game animals were sampled. No rabbits or other small mammals other than mice were sampled. It is not specified if the mice sampled were native species or European-introduced *Mus musculus*. Please fill these data gaps.	No
152	4.2.1.1	4-9	The third paragraph states the reason for not sampling more fish or plant tissue was that it was simply too difficult and soil sampling was easier. This reasoning does not justify why critical and substantial sampling and analyses were not conducted. Please collect, analyze, and include the necessary samples.	No
153	4.2.1.2	4-10	It is unclear if additional sampling for the broad area analysis was conducted at the five remediated waste sites or the same data was used as for the local area risk assessment. Please provide clarification.	No
154	4.2.1.2	4-11	The number of samples, in many cases, is insufficient to provide adequate certainty of analysis. For example, sampling for the 100-B/C pilot project lists only two sediment samples. Of the 5 to 8 clam tissue samples, only one was analyzed for beta- and gamma-emitting radionuclides. Of the 5 to 8 sculpin tissue samples, only one was analyzed for beta- and gamma-emitting radionuclides. This also raises another concern: why a definitive number of samples is not listed for clam or sculpin. Please sample, analyze, and provide statistically defensible data.	No

155	4.2.1.3 to 4.2.2	4-11 to 4-15	Much of Chapter 4 is vague regarding where samples were collected, what contaminants were analyzed where, and expectations of contaminant behavior. For example, the text states that "processes also affect concentrations of groundwater-related contaminants in the seep water." Please clarify what and how these processes will affect seeps and associated contamination. Also, please provide more details (or citations to appropriate references) regarding the COPC refinement process in general.	No
156	4.2.2	4-12	On this page, and several others, statements are made regarding the use of statistical tests to analyze River Corridor data. However, no discussion is provided describing what statistical methods or parameters were employed or exactly what data were used. Additionally, no statistical results are provided. When providing definitive statements, provide either peer reviewed justification or statistically defensible data to back up the statement.	No
157	4.2.2.2	4-14, Table 4-7	The broad area data tables list Aroclor 1262 as being found in all five of five samples, but no information was provided in the main report as to where that substance was detected. Please provide clarification regarding this inconsistency.	No
158	4.4	4-27	It is unclear why 50% of wild plants are considered from upland and 50% from riparian environments; a distinction should not be necessary. Revise the baseline HHRA to utilize all available plant data from all habitat areas to determine the exposure point concentrations and reasonable maximum exposures for a Tribal member consuming wild plants.[2]	No
159	4.4	4-27	It is inappropriate to only present child hazard index (HI) results. Although the adult HI results may be different (in this case "generally" lower than the child), they are equally important to present in the baseline HHRA. Revise the reporting to include chemical hazard results for both the child and adult receptors.	No
160	4.4	4-28*	It is incomplete to present risk results from fish ingestion for only limited species. Cleanup decisions in the River Corridor cannot be made without a complete understanding of potential risks to Tribal residents who will be fishing for all species from the river. Please revise the baseline HHRA to include Columbia River Component data, and sum the risks from fish ingestion with other exposures.	No
161	4.4	4-31	It should be noted that radiation dose results that are based on RESRAD modeling will underestimate the risk to a Tribal member because exposure assumptions in the RESRAD model do not account for a Tribal subsistence lifestyle.	No
162	4.4	4-32	The hazard index (HI) approach was developed to "assess the overall potential for noncarcinogenic effects posed by more than one chemical" (EPA 540/1-89/002). It assumes simultaneous exposure over a comparable timeframe (e.g., chronic) and a proportional magnitude of adverse effect, but not necessarily similar target organs. Segregating hazard indices by effect and mechanism of action, such as was done with arsenic and cadmium, requires a very complex toxicological analysis to identify all of the major effects and target organs / mechanisms of action. If not done carefully, segregating hazard indices can underestimate the true risk. Revise the non-cancer hazard index analysis of arsenic and cadmium by removing the statement about being "biased high by approximately 10%."	No
163	4.4	4-32	It is not appropriate to make comparisons of "representative" sample concentrations to those considered "reference areas" when the reference samples were collected onsite.	No

164	4.5	4-33	The fourth paragraph states that calculating chronic health risks from intermittent seeps for the Avid Angler and Nonresident Tribal scenarios is not feasible, yet the scenarios presumes exposure "will occur between 30 and 60 days per year for many years." Please clarify the statement, and calculate the risk for chronic exposure to seeps for these scenarios.	No
165	4.5	4-34	In addition to the "six key contaminants," list any other contaminants that have been identified in groundwater seeps. Determine if any of these exceed any ARARs and include them in the baseline HHRA.	No
166	4.5.1	4-35	The third paragraph in this section states that seep water samples were "analyzed for either total chromium or hexavalent chromium." Describe why a sample was designated for one or the other of these analyses. Please clarify whether total chromium is assumed to be a surrogate for hexavalent chromium, or vice versa (e.g., for comparison to the drinking water standard), and include a statistically sufficient number of data points for analyzing the risk to human health.	No
167	4.5.1	4-36 to 4-38, Figures 4-2 to 4-7	The number of sites varies from box plot to box plot. Some box plots have sites that others do not. Please clarify the number of samples associated with each box plot and explain how sites were chosen.	No
168	4.5.1	4-39, Figure 4-8	Only five seep water samples are represented in the figure. The text states that "There is a decreasing trend shown in these data." Clearly this is not enough data to show any type of trend, particularly considering the short time frame represented and the effects of river stage on seep concentrations. Please include all available data to determine if a trend exists. If sufficient data are not available, this is a data gap and a trend cannot be determined.	No
169	4.5.2	4-41	The first sentence in the section states "For the majority of the shoreline springs for which data have been made available, there is negligible risk related to exposure to key groundwater contaminants being released to the Columbia River at these locations." The quoted statement is too vague to accurately convey results of a risk calculation. Define what "negligible risk" means. Clearly, some seeps show contaminants above drinking water criteria, particularly for tritium, total uranium, total chromium, and strontium-90. Determine the chronic risk of these seeps to all of the exposure scenarios, particularly avid angler and nonresident tribal.	No
170	4.5.2	4-42	No risk calculations appear to have been conducted for shoreline springs or seeps. In the summary, the text states "one may conclude there is minimal risk from occasional use of the water, particularly for adults." Please estimate the risk from potential exposure to shoreline springs for adults and children using, at a minimum, avid angler and nonresident tribal scenarios. "One may conclude..." is not an appropriate or defensible method of quantifying risk. Also, the summary continues, "caution is appropriate if young children might be exposed..." This provides no information to protect young children from contaminants at these locations. Define "caution" and "young children" and appropriate measures to take.	No
171	4.5.2	4-43	Summary point 5 states "it is possible that short-term risks may exist for uranium exposures at the Spring 42-2." By conducting a thorough risk assessment, risks for uranium exposures should be much better understood, assisting in a safer and more thorough cleanup.	No

172	4.7	4-50	This section is vaguely written with no or little justification given for most assumptions made. In addition, it does not include an analysis of the uncertainties one would expect to see in a risk assessment, such as uncertainty associated with each type of sample, analyte, or media, but instead focuses on "third-party" uncertainty, such as from reference dose calculations and EPA's designation of mutagenic or nonmutagenic carcinogens. Please include more transparent information regarding assumptions (primarily from the actual sampling and analyses conducted and exposure scenario parameters) and provide reasonable justification for those assumptions.	No
173	4.7.1.2	4-53	Detection limits for toxaphene, 2,4,6-trichlorophenol, and pentachlorophenol should have been specified in the DQO process at concentrations below any ARARs. Relying on the conceptual site model to conclude that these chemicals pose no threat to groundwater is inappropriate. The uncertainty analysis section is for discussing uncertainties. Conclusions about groundwater contamination should be moved to another section with analytical data provided to justify why these chemicals should not be a threat to groundwater.	No
174	4.7.1.3	4-54	The first paragraph discusses background reference samples. It states "the other reference site selection criteria ensure that these sites are applicable as reference areas..." State what the criteria are in the guidance, what was used to determine the reference or background sites in this baseline HHRA, and how the sites met or did not meet these criteria, including a table with the discussion.	No
175	4.7.1.3	4-54	The statement "Because the COPC identification process was systematic, it is unlikely that Hanford site related analytes could contribute..." is misleading. While the methodology may have been systematic, it is not clear how it was applied to individual chemicals nor does it seem to be protective since many chemicals were eliminated based on limited data. Stating that "it is unlikely that Hanford Site-related analytes that could contribute to significant health risks were eliminated in this process" is a significant overstatement. Provide a clear description of how each COPC was determined, including all data considered and a thorough discussion of decisions.	No
176	4.7.1.3	4-55	When and where were these orchards in operation? Please define the aerial extent of the orchards relative to the 100 Area, and explain how to propose separating site related contaminants from past practices.	No
177	4.7.1.3	4-55	The first two paragraphs on this page discuss arsenic and its source on the Hanford site. Please explain how this information is used appropriately in the uncertainty analysis (and consider moving it to the appropriate uncertainty section).	No
178	4.7.1.4	4-55	Using less than five samples (actually, using less than 30 samples) is not statistically robust. Additional sampling should be conducted for plants and tissues. When less than five samples are used in representative calculations, always provide the full range of values in addition to the average.	No
179	4.7.1.4	4-56	Nowhere in chapter 4 is there a description of statistics used for any section or calculation. Please provide detailed descriptions, assumptions, and examples of statistics used; at the very least, cite the appropriate documentation where that information is provided.	No
180	4.7.2.2	4-57	The uncertainty analysis should include identifying all data gaps for foods such as plants (for example, no roots appear to have been sampled or modeled) and game animals. The GiSdT database does show concentration data for some game animals, so it is unclear why these data were not used. More data should be obtained to fill data gaps and provide a basis for calculating uptake factors.	No

181	4.7.2.2	4-58	The third paragraph states, "Because nonvolatile contaminants have no vapor pressure, this equation is physically implausible..." However, the vapor pressure of a solution of a non-volatile solute is equal to the vapor pressure of the pure solvent at that temperature multiplied by its mole fraction. Try recalculating using Raoult's Law.	No
182	4.7.2.2	4-59	The baseline HHRA does not include an analysis of risk for nonresident tribal use of Columbia River water for sweat lodges. Water would be used for producing steam as well as for drinking, usually over several hours. The sweat lodge scenario must be re-evaluated using appropriate numbers, and a risk analysis of Columbia River surface water and groundwater must be conducted.	No
183	4.7.3	4-59	While uncertainty is definitely associated with dose extrapolation, modeling, cancer slope factor calculations, and reference dose calculations, the emphasis given on these items seems out of proportion with what should have been addressed in this chapter. The purpose of the uncertainty section is to identify those uncertainty issues *specific to the particular assessment*, not discuss at length uncertainty theory inherent to any risk assessment.	No
184	4.7.3.1	4-59	The statement regarding cadmium that "...the three fold change in the PPRTV will not affect the results..." is misleading. Since risks are summed for systemic chemical affects, the change in one may result in a hazard quotient that exceeds 1.0. Please remove the misleading statement.	No
5.0 Local-Area Risk Assessment Results				
185	5.1	5-1	It is incomplete to assess risks to a resident living only (on) a single remediated waste site. There is no rational provided for how a subset of remediated waste sites was selected for evaluation. It is not appropriate to calculate risks based on a select few remediated waste sites (or select depths), when the risk from other waste sites, other depths, and other areas may be greater. The assessment should include data from all of these areas of the site to obtain a complete understanding of baseline conditions and potential risk absent remediation.	No
186	5.1	5-1, Table 3-13	The Local Area Risk Assessment omits risk from COPCs in soil beyond 15 feet below ground surface (bgs), despite known contamination in the vadose zone. Soil contaminant characterization and assessment of risks below 15 feet bgs is omitted from the Broad Area and Groundwater Risk Assessments as well, which fails to provide a comprehensive and cumulative risk assessment in this baseline HHRA. Also, no consideration is give to migration of contamination in the vadose zone to groundwater, which will result in an increase in risk via exposure to groundwater contaminants. Furthermore, it is speculative to assume institutional controls will prevent excavation beyond 15 feet bgs (such as to install a drinking water well) in a residential scenario.	No
187	5.1	5-1	The Resident Monument Worker scenario is for adults only. What provision would prevent the worker from sharing residence with their family and children, and thus potentially exposing children in this scenario? Please include children in this scenario.	No
188	5.1.1.1	5-6	Explain further and provide specific details on the differences between the calculation methods for determining representative concentrations in soil during the cleanup verification process versus the RCBRA process.	No

189	5.1.1.2	5-6	The uncertainty presented regarding residual subsurface contamination does not overestimate risk (e.g. present a conservative bias) as stated for the scenarios considered in this baseline HHRA. Although there is uncertainty associated with the CVP samples, in some cases they may not reflect more contaminated areas in the deep zone of the remediated waste site. Contaminated soil from the shallow and deep vadose zone may easily be brought to the surface through any number of natural or human activities, including construction of basements or foundations, burrowing animal transport, drilling wells, surface erosion or collection of borrow material. Revise the text of this section and elsewhere to acknowledge that the proposed characterization may also underestimate the risk posed by residual contamination, particularly with even modest erosion or activities such as gravel mining or other resource extraction activities that may occur after institutional controls are no longer effective.	No
190	5.2.1*	5-7, Table 5-8	In the 100-B/C local area summary table, the maximum detected value for gross beta in soils is listed as 33.7 pCi/g; however, Ni-63, a beta emitter, has a maximum detected value of 78.9 pCi/g. Please provide clarification regarding this inconsistency.	No
191	5.2	5-7	Revise the baseline HHRA to specifically include criteria for inclusion or exclusion of identified waste sites in each decision unit. Examination of CVPs from adjacent waste sites in the 100-N area found that waste sites, such as 116-N-1, were excluded from consideration despite having similar levels of contamination as other sites, such as 116-N-3, that were included. Furthermore, known sites with elevated levels of contamination, such as the 618 burial grounds, do not appear to have been included in this HHRA. Regardless of future cleanup plans, some residual contamination will remain at these sites, as the CVPs for 116-N-1 and 116-N-3 demonstrate. Revise the baseline HHRA to include these sites, and others with similar levels of contamination.	No
192	5.2	5-8 to 5-16, Figures 5-1 to 5-8	Revise the baseline HHRA to include complete exposure pathways to the reactor cores and associated contamination left in interim safe storage. Loss of institutional knowledge or failure of institutional controls makes direct exposure to the cores a real possibility within the time periods evaluated by this HHRA. The cores are housed in large, high profile buildings that could provide obvious shelter or other utility to people unaware of the contamination risk inside.	No
193	5.2.1	5-8 to 5-14, Figures 5-1 to 5-8	It is not appropriate that only remediated waste sites be included in the assessment. For example, contaminated wastes such as the 318-10 and 318-11 burial grounds, which would contribute significantly to overall site risk, are not included. Revise the baseline HHRA to include unremediated sites as well.	No
194	5.2.2.1	5-17, Table 5-21	Justify omitting the important Hanford contaminant uranium-235 from the COPC list for 100-K Shallow Zone soil, other than percentage of censored data (see general comments), and clarify the process for handling non-detected values.	No
195	5.2.2.1	5-17, Table 5-24	Justify omitting the important Hanford contaminant uranium-235 from the COPC list for 100-F/100-IU-2/100-IU-6 Shallow Zone soil, other than percentage of censored data (see general comments), and clarify the process for handling non-detected values.	No

196	5.2.2.2	5-17	Revise the baseline HHRA to include complete exposure pathways to contamination in the deep vadose zone that is beyond the diffusion of VOCs to the surface. This HHRA acknowledges that the "applicability of any specific exposure scenario to future conditions" is a significant uncertainty in the exposure assessment (Table 5-141), and scenarios such as mining are considered possible at the site. It is entirely possible that significant erosion or human intrusion will result in direct contact with the contaminated media below a 15-foot depth. Additionally, such a depth is not a particularly large obstacle for transport to the surface under natural conditions where deep penetrating roots and biota may cause bioturbation and subsequent exposure to humans. Contamination in the deep zone of the 116-N-3 trench includes 4,900 pCi/g cesium-137, 1,460 pCi/g strontium-90, and 5,580 pCi/g cobalt-60 as well as other radionuclides (CVP-2002-00002). Similar or higher levels of contamination were observed at the 116-N-1 trench (CVP-2001-00021), which was not included in this baseline HHRA.	No
197	5.2.2.2	5-18	Previous concerns have been raised by the Oregon Department of Energy in 2009 regarding the use of the single partition coefficient (K_d value) for modeling contaminant leaching and transport in the subsurface (Niles, 2009). K_d-based models have frequently demonstrated unreasonable results (100-Area RI/FS Work Plan Addendum 5 discussion of K_d values). The value of K_d is thought to change with a variety of environmental variables including temperature, pH and geochemistry. Revise the discussion to include a greater explanation regarding the K_d values assigned and the implications of each value for overall exposure that is presented. As noted previously, the results of groundwater exposure should be included as part of the total dose considered.	No
198	5.2.2.2	5-18	Tetrachloroethane (TCE) is omitted from the Deep Zone COPC list without explanation. This is an important contaminant that should be better characterized, including addressing the problem of well screening depths not being adequate to measure TCE in groundwater.	No
199	5.3.1.1	5-23	The statement that europium-152, europium-154, and cobalt-60 have half lives of 13.5 years or less and thus would not pose excessive risk in 2075 is misleading regarding the risk to site users today and before 2075 – what is the magnitude of risk in the near future?	No
200	5.3.2	5-24	How is risk calculated for a Resident Monument Worker who would eat fish from the Columbia River? It is unreasonable to assume that these workers would not ingest fish recreationally. Please include this exposure pathway in the risk assessment scenario.	No

201	5.3.5, 5.4.5, 5.5.5, 5.6.5, 5.7.5, and 5.8.5	5-40, 5-62, 5-74, 5-94, 5-119, and 5-143	The Yakama Nation developed an exposure scenario and requested that it be correctly incorporated into the RCBRA, assuming broad-area, site-wide residential use. The Yakama Nation's consideration of this document and all other similar documents at Hanford is governed in the first instance by compliance with the Treaty of 1855 (12 Stat. 951), which should be considered as an applicable or relevant and appropriate requirements (ARAR). The Treaty of 1855 between the Yakama Nation and the United States of America reserved specific rights and resources. These rights listed in Article 3 of 12 Stat. 951 include "...the right of taking fish at all usual and accustomed places...together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon and unclaimed land." The U.S. Constitution in Article VI states, "...all Treaties made, or which shall be made, under the Authority of the United States, shall be the supreme Law of the Land..." The U.S. government has a fiduciary responsibility to the Yakama Nation to protect our Treaty rights and resources, our culture, health, and welfare. The Hanford Site is a portion of the Yakama Nation's homeland ("front yard"). In light of these facts, 12 Stat. 951 must, at a minimum, be identified as an ARAR in the CERCLA Remedial Investigation/Feasibility Study cleanup process (40 CFR 300.430(b)(9) and at (d)(3). It has not been recognized as such in this effort or under other CERCLA actions undertaken at the Hanford Site. A full analysis of the risks to Yakama Treaty resources and our peoples' health has yet to be performed. The risk assessment is deficient without this complete analysis.	No
202	5.3.5.3	5-45	Similar to the broad-area assessment, the local area assessment inappropriately reports only child hazard index results. Revise the reporting to include both child and adult hazard index results for the Yakama resident (and other scenarios) for every decision unit.	No
203	5.4.3.3 and 5.4.5.3	5-57 and 5-66	Regarding mercury as a risk driver in the 100-K area, please explain more clearly the difference between the linear and non-linear models (e.g., using sensitivity analysis) to better support the assumption of overestimating risk.	No
204	5.4.3.3	5-58	Whereas the large difference between the HI values for the Resident Monument Worker scenario and the Subsistence Farmer scenario does indicate the importance of modeling mercury accurately, the fact remains that the models are unreliable and assumptions are being made. Furthermore, it is unreasonable to assume a Resident Monument Worker would never grow or consume farm-raised food from the area.	No
205	5.4.3.3	5-58	The level of protective bias, or lack thereof, in the 100K area related to not excavating the 116-KE-5 and 116-KW-4 waste sites is not clear – please clarify.	No
206	5.4.5.1	5-64	The baseline HHRA states that remediated waste sites with Subsistence Farmer RME cancer risks above $1x10^{-4}$ (from the presence of short-lived radionuclides) were generally excavated to a significant depth. Identify those radioactive waste sites that do not fall into this "general" category and were excavated to shallower depths. Explain how this affects the assumed significant protective bias.	No
207	5.4.5.2	5-65, Table	Please clarify how the modeling for beef ingestion differs from that for wild game, which is a more accurate food source and exposure pathway for the Yakama Nation subsistence lifestyle.	No
208	5.5	5-67	How many remediated (and unremediated) waste sites in the 100-N area are not included this baseline HHRA? It seems unlikely that there are only two remediated waste sites in the 100-N Area.	No
210	5.5.5.2	5-75	Please clarify why the waste site 116-N-1 was eliminated from consideration, and provide an analyte-by-analyte evaluation for soil and groundwater matrices between accepted and eliminated waste sites in each decision unit for direct comparison.	No

211	5.8.1*	5-127	Why were the important 618-10 and 618-11 burial grounds in the 300 Area not included as waste sites? Although they are scheduled to be remediated, their current status should be included in the assessment of baseline risk. Similarly, combined risks from chemical and radiological exposure should be evaluated for the multiple 316 remediated waste sites.	No
212	5.8.5	5-143	Update the scenario to include soil mixing deeper than 6-inches below ground surface. What is the combined cancer risk for both chemical and radionuclides? They are currently only presented individually.	No
213	5.9.1.1	5-149	Regarding the statement "...because of focused target analyte lists that were used for some waste sites, it is possible that some site related contamination was not captured in the analytical results for the HHRA and therefore total cumulative risks may be underestimated for those sites." This statement should be discussed further, perhaps in a separate uncertainty section of the document, since it contradicts other statements in the report regarding the "protective bias" of the waste site samples.	No
214	5.9.1.2	5-151	There is not adequate justification for using only "statistical" soil sample results and no "focused" sample results. This approach may not characterize isolated areas of elevated contamination (hot spots), which are not the same as outlying data, despite results of a sensitivity analysis. Revise the assessment to include composite as well as grab sample results.	No
215	5.9.1.2	5-152	"It is reasonable to assume...MIS samples would be biased low relative to what might be observed using discrete samples." How does this statement support the decision to use composite samples?	No
216	5.9.1.2	5-152	Similar to the broad-area assessment, samples collected from the site are incorrectly considered reference site data. These samples cannot be assumed to be absent site contamination. Revise the baseline HHRA accordingly.	No
217	5.9.3.3	5-165	Please add a reference for the table of toxicity uncertainty and modifying factors.	No
6.0 Screening-Level Groundwater Risk Assessment				
218	6.1	6-1	Please clarify why monitoring well data are limited to between 1998 and 2008, and why the well subset is limited. For example, based on known wells, only 15 to 20% of available wells were used for the baseline HHRA. The last sentence about the data "not adequately representing present-day exposure concentrations" requires further explanation.	No
219	6.1	6-3	The discussion of the proposed RI/FS work does not explain how additional data results will be integrated with the baseline HHRA to assess overall risk. Please clarify how the HHRA will fully incorporate the additional groundwater evaluations cited as part of the RI/FS reports to evaluate baseline risk and make risk management decisions.	No
220	6.2.2 and 6.2.3	6-7 and 6-10	Present day COPCs selected for groundwater by decision unit do not consider migration of contaminants from the Central Plateau. Revise the baseline HHRA to include and consider contamination from the Central Plateau in the River Corridor Decision Units. Incorporate the groundwater transport modeling performed as part of the Draft TC/WM EIS.	No
221	6.2.2.1	6-8	In the explanation of 100-KR-4, aluminum, iron, and manganese are omitted from the COPC list because of the "possibility that their occurrence may be related to well construction and, therefore, not representative of groundwater conditions." This contradicts the definition of assessing baseline conditions, which includes all contaminants despite their origin. These contaminants should not be prematurely excluded from the COPC list.	No
222	6.2.2.3	6-10	Provide an explanation as to why reference or background data are not available for groundwater. Revise the baseline HHRA to consider a plan for identifying reference groundwater sites for future risk management decisions.	No

223	6.2.2.3	6-10	This section states that COPCs were identified based on groundwater concentrations with reference to Appendix C-11. Appendix C-11 contains the contaminant concentrations in the shallow and deep soil, not the groundwater concentrations. The correct reference is Appendix C-12.	**Yes**
224	6.2.3	6-10	Protocol for risk assessment is to protect the maximally exposed individual. The selection of 50th and 90th percentile values for representative groundwater concentrations does not represent the reasonable maximum exposure. Provide additional justification for this decision and either demonstrate that it does not artificially reduce the risk calculated for groundwater exposure or select higher percentiles.	No
225	6.2.3	6-11	This section states that the values for the 50th and 90th percentiles represent general conditions both within and outside groundwater contamination plumes. The average values should not represent the condition outside the contaminant plumes.	No
226	6.3	6-14, Figure 6-2	The RCBRA used 140 samples to derive nitrate RME and CTE values for the 100-B/C Operable Unit (OU). How many of these samples were from different wells? How were the concentrations averaged in each well? Do all of the wells shown in this figure have nitrate data or only some? What are the contaminant sources of the plumes shown in this figure? This also applies to Figures 6-3 through 6-8.	No
227	6.3 to 6.7	6-14 to 6-49, Figures 6-2 to 6-8	It is difficult to distinguish the plumes from one another in this graphic. One figure for each contaminant and for each OU should be provided (instead of one figure per OU showing all the contaminants at once). The wells used in delineating each contaminant plume should be clearly identified. The number of samples used in each well and average concentration in the well should be provided. A discussion of sources of these plumes should also be provided in the text. Otherwise, an evaluation of these results is not possible.	No
228	6.3 to 6.7	6-14 to 6-49, Figures 6-2 to 6-8	The shapes of the contaminant plumes shown in these figures seem to be an artifact of the data used (taken at different times and depth intervals). The mixing and dispersion in the aquifer should have resulted in a more smooth distribution of the contaminant concentrations.	No
229	6.3.1.1	6-15	This section states that "Although future trends in groundwater concentrations have not been quantified in this assessment, natural radioactive decay of tritium (12.3-year half-life) and strontium-90 (28.8-year half-life) will result in a decrease of risk from these COPCs over time compared to present-day groundwater conditions." This is only the case if there are no other sources of these contaminants either within the OU or outside of the OU upgradient. The DOE's own calculations in the Draft TC/WM EIS show that strontium-90 from non-tank sources will remain at concentrations above drinking water standards (8 picocuries per liter in the absence of any other radionuclide and less if other contaminants are present, which will be the case here) in the River Corridor until about the year 2500. See Figure U-3 Appendix U, Volume 2 of the Draft TC/WM EIS.	No
230	6.4	6-22, Figure 6-3	The chromium plume shown in this figure was assumed to have a CTE of 47 µg/L and an RME of 97 µg/L. Simulation of the Cr plume (Figure O-11 in the Draft TC/WM EIS) shows the Cr plume in this area with 100 µg/L to 500 µg/L, which is more consistent with the values in the well 199-K-109A (CTE of 117; RME of 544 µg/L). If this is the case, then this well should have been considered in the main risk analysis, not in the supplemental risk analysis.	No
231	6.5	6-31, Figure 6-4	Sr-90 concentration in the well 199-N-67 (excluded from the main risk analysis) seems to be the center of mass of the plume delineated in this figure. If so, it should have been included in the main risk analysis, not the risk supplemental analysis.	No

232	6.6	6-40, Figure 6-5	The groundwater flow direction based on the nitrate plume shown in this figure is not consistent with the flow direction of the Cr plume in the north east part of the figure where these two plumes partially overlap each other. Please correct this inconsistency.	No
233	6.6	6-40, Figure 6-5	Cr and nitrate concentrations in the wells 199-D5-41, 199-D5-99, and 199-D5-104 (excluded from RME and CTE analysis) seem to be the center of mass of the plumes delineated in this figure. If so, they should have been included in the main risk analysis, not the supplemental risk analysis.	No
234	6.8.2.1 to 6.8.2.2	6-67 to 6-69	The results provided in this section state that inhalation of uranium in sweat lodges is not considered for the Yakama Resident scenario, but is considered in the CTUIR Resident scenario. No justification is given for the elimination of exposure to an identified COPC. Removal of this pathway from one exposure scenario (versus another tribal one) is not appropriate and significantly reduces the total exposure to Yakama Residents and distracts from the serious danger posed by uranium as a result of its long half life and large quality. The Yakama Exposure Scenario did not eliminate any pathways or COPCs as part of the scenario, and the removal of this particular pathway, and exposure to other nonvolatile COPCs should not have occurred on a selective basis in the Yakama Resident scenario for this or any other Decision Unit. Revise the baseline HHRA to include all COPCs in groundwater through the dermal adsorption, inhalation, and ingestion pathways. Specifically, include all radionuclides present in groundwater now and modeled to be present in the future. Identify the risk posed by each contaminant individually as well as the cumulative risk posed by all contaminants present.	No
235	6.9	6-71	Significant uncertainty regarding the timing, volume, nature, and toxicity of contamination from the Central Plateau reaching the River Corridor should be addressed and included in this section. Use of the RME and CTE parameter values as outlined in previous sections does not factor this contamination into total exposure. Revise the baseline HHRA to include this additional contamination and associated uncertainties and address them both qualitatively and quantitatively.	No
236	6.9.1.2	6-73	Refer to previous comments regarding the representativeness of the data used to perform this baseline HHRA. The assessment performed does not evaluate the total risks posed by the site, but does perform an analysis of the risks posed by current conditions at selected waste sites. The assertion that radioactive decay will result in ultimately lower concentrations of contamination in the future fails to acknowledge migration of contamination from the Central Plateau which will reach the River Corridor within the period analyzed. Revise the HHRA to evaluate all the risks posed by the site including all waste sites, groundwater contamination in the Central Plateau, and reactor cores over the period of analysis.	No
237	6.9.3.2	6-79	Revise the baseline HHRA discussion of groundwater cancer risks for the Yakama Resident (and CTUIR Resident) to include alpha radiation emissions such as those produced by uranium and thorium. Further revise this text to explain and justify whether application of linear dose-response factors applied to chronic radiation exposure under-predict, or over-predict the carcinogenic risk.	No

7.0 Conclusions and Recommendations				
238	7.2.2	7-7	Note that the OSWER Directive 9200.4-18 states, "Guidance that provides for cleanups outside the risk range (in general, cleanup levels exceeding 15 millirem per year which equates to approximately 3 x 10^{-4} increased lifetime risk) is similarly not protective under CERCLA and generally should not be used to establish cleanup levels." This baseline HHRA inconsistently identifies both 15 millirem per year and 15 millirem per year above background as remedial action goals. Not only is this inconsistent, but these represent two very different numbers. Per the guidance, revise the HHRA to state that no dose greater than 15 millirem per year, including doses from background samples, will be the remedial action goal, at a minimum. See comment #13 and general comments for more details.	No
239	7.3	7-14	Particular site-specific conditions that would justify the acceptability of a risk estimate around 1 x 10^{-4} are not defined. OSWER Directive 9355.0-30 states that a risk manager may decide that a baseline risk level less than 1 x 10^{-4} at a site is unacceptable (i.e., risks below this upper limit are still considered unacceptable and must comply with a more protective limit) due to site-specific reasons and that remedial action is warranted where, for example, there are uncertainties in the risk assessment results. Revise the text box language to more accurately reflect the full range of alternatives from the OSWER directive.	No
240	7.3.2.1	7-20	The result of the broad-area risk assessment for the nonresident tribal scenario does not include risk from Columbia River water, either ingestion or sweat lodge use. This needs to be calculated and included.	No
241	7.3.2.2	7-22	It is inaccurate to say that a risk assessment was conducted for seeps. A few data points (with significant data gaps, particularly for chromium) were compared to drinking water criteria. However, no risk assessment using any of the exposure scenarios was described in Chapter 4. The summary statement that "one can assume" is not a calculation of risk.	No
242	7.4	7-32	In the Introduction (page 1-16), PRGs are described as "levels of contaminants that may remain onsite and still be adequately protective of human health." However, since PRGs were not developed for any tribal scenarios they do not represent levels that are protective of tribal health.	No
243	7.4	7-33	Based on EPA guidance (Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination and Risk Assessment Guidance for Superfund Part B), there does not appear to be any rationale for using different target risk levels for calculating PRGs for radiological and non-radiological contaminants. Risk-based PRGs for both chemical and radiological carcinogens should be calculated using a target risk of 1 x 10^{-6}.	No
244	7.5	7-37	The Conclusions and Recommendations chapter summarizes the document's results and uncertainties. However, it does not provide a comprehensive conclusion. While some recommendations are made for each section of the document, there are no comprehensive recommendations or next steps provided for the Hanford Site and human health risk assessment as a whole.	No
Appendices				
245	Appendix A	A-1	The text incorrectly states that Appendix A contains meeting notes from workshops held between August 2006 and May 2007. Revise the text to indicate that Appendix A contains notes from workshops held between August 2006 and January 2008.	No

246	Appendix A	A-1	The hyperlink (http://www.washingtonclosure.com/Projects/EndState/risk_library.html#100Area) for the Washington Closure Hanford End States and Final Closure internet web site address (URL) is outdated and cannot be found. Correct the document text with the current web site URL hyperlink.[3]	No
247	Appendix B	B-4	We have commented previously on the problems with the reference site selection used for this risk assessment. Those comments are still valid and can be summarized by the following concerns:	No
			1) Both EPA and MTCA define a CERCLA "site" as all locations where site-related contamination is present. In this case, due to air releases as well as dust from many operations, the entire Hanford Reservation is (a) CERCLA site. According to the EPA guidance cited in Appendix B, reference sites are intended to be locations that are similar in habitat but have no site-related contamination. The citation is correct (Page B-5) that one EPA guidance suggests that reference "targets" for contamination can be derived from an evaluation of the contaminant gradient on a site, selecting the lowest concentrations as the suitable reference concentration. DOE did not complete such a gradient analysis to select the lowest concentrations from the reference data set. Besides being located close to non-site specific sources of contamination from human activities, the data presented in this appendix readily demonstrate that relatively high concentrations of many substances are present at some of the reference sties. In addition, this same citation noted that the risk assessment for the Rocky Flats Arsenal used a reference site 50 miles away from the site itself for biota samples, and five miles away for soil samples.	No
			2) The reference site data are used inappropriately to eliminate risk factors present at waste sites before those risks are calculated. The risk assessment should identify the total risk presented by exposure to the waste sites as the first step. If properly selected, the reference and background data have a place in risk management decisions in further steps in the evaluation. Only then can incremental risks posed by sites above and in addition to all the other risks present be evaluated.	No
			3) The RCBRA misinterprets EPA guidance with regard to reference sites as locations for comparing resource use and conditions as an indicator of impacts and the appropriate reference "target" for contamination. EPA guidance is clear that the reference target for contaminants are the lowest concentrations that can reasonably be associated with the general area off the CERCLA site, not the average of all of the concentrations of reference sites selected for the more holistic evaluations.	No
248	Appendix B	B-20	It would be helpful to include more detailed information regarding the sampling and analytical procedures used in collecting the reference data. As noted in the text, methods can affect the comparability of the results, but the limited presentation does not allow a reader to discern how differences in results may be impacted. In addition, other factors, such as grain size in soils, are also known to affect the concentrations observed. Because of the predominately coarse nature of the soils at Hanford, grain size may be an important factor and should be discussed.	No
249	Appendix B	B-20	Many substances have no background data for comparison, or use only the Hanford Area Background data for comparison. This lack of data means that the degree of contamination on the site cannot be assessed.	No
250	Appendix B	B-20	Many substances were noted to have much higher concentrations in at least some of the on-site reference areas compared to other sites or to the background data. As per EPA and MTCA guidance these data are inappropriate for use as representing a reference condition for the risk assessment. If suitable off-site reference data cannot be found, EPA guidance suggests that these data should be screened out of the data set using a gradient analysis.	No

251	Appendix C	All	Overall it was not possible to determine which of the data presented in the various data trend appendices were chosen for inclusion in the HHRA. It is unclear what data from the data groups were used to create the box plots, the reasonableness of this data selection, and how the data were used after the box plots were created. In many cases neither the sample means nor the number of samples seemed to match between the various data summaries. Appendix C should be drafted to stand alone and provide more examples and transparency on how and what data were ultimately used to create the box plots. The data groups used provide a limited number of contaminants, a limited amount of monitoring data, a limited number of species, and a limited number of scenarios. The use of such data has more than likely biased the results of the risk assessment	No
252	Appendix C-1	C.1-44	Please provide the algorithm for computing "calculated total uranium."	No
253	Appendix C-1	C.1-45	The exclusion of data simply because it was collected with a "less-preferred analytical method" is too subjective a reason for rejection. The data should be considered valid unless there is some documented reason to believe they are inaccurate or unacceptably imprecise.	No
254	Appendix C-3	NA	The H-3 concentrations are one order of magnitude higher in the supplemental risk assessment calculations for 100-F Operable Unit. The number of samples used in the supplemental analysis is more than 10% of the number of samples used in the main analysis. It raises the question of whether this well should have been included in the main analysis.	No
255	Appendix C-3 to 4	NA	This appendix does not provide the actual data used to derive RME and CTE for each OU. Only the summary of the results for each OU are presented. Without the actual data, the results cannot be evaluated.	No
256	Appendix C-5	NA	The introduction to Appendix C-5 should make it clear that the CVP data presented in this section include both the shallow and deep soil, or as a potentially better solution, eliminate Appendix C-5 in favor of retaining only Appendix C-11. The high concentrations of some substances noted in Appendix C-5 can cause confusion in determining what data were used in the HHRA.	No
257	Appendix C-5, C-11	All	It is surprising that fairly high concentrations of Pu-241 were measured in the IU2/IU6 decision unit, while it's decay product, Am-241, was not. The different numbers of samples given for each radionuclide would seem to indicate that these data are from different locations. Sampling the same areas might give different results. In addition, even though the concentrations of Pu-241 were high, Pu-241 was not included as a COPC. Further, no Pu-241 sampling was apparently performed at most of the CVP sites, even though Pu-239/140 was measured. Please clarify and correct these inconsistencies.	No
258	Appendix C-5, C-11	All	The soils data presented in these appendices show that at least in the 100-N decision unit, very high concentrations of radionuclides, e.g., Pu-239/240 and Sr-90, remain in the deeper soils. The risks of these high concentrations should be discussed.	No
259	Appendix D-5	Tables	Please add a column for sample size (N) next to exposure point concentrations.	No
260	Appendix E	E-8	This comment addresses the following statement, "Based on the results of the 1998 risk evaluation, there is no requirement under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) to remediate the river effluent pipelines." The pipelines should be considered for removal because they may pose a risk to humans, the environment, and could expose the population to contamination. Revise and include the pipelines in the assessment and potential removal action.	No

Yakama Nation Comments on RCBRA Vol. II (HHRA) Draft C vs. Rev. 0.

NEW COMMENTS SPECIFIC TO REV. 0				
261	2.7.3	2-36	The reader may infer that Figure 2-9 from Draft C, Orphan Site Evaluations Completed or in Progress in the River Corridor, was removed from Revision 0 because of the fact that orphan site evaluations "have been completed." It is important to note here that "observation based discovery of new waste sites" that will continue during cleanup will also result in new sites being added to the WIDS inventory and the development of ROD amendments and additional cleanup, as necessary.	NA
262	2.75	2-37	We agree with EPA in their comments on Draft C (Enclosure 2) that new proposed text be inserted in Rev. 0: "The varied exposure scenarios presented in this risk assessment and the calculated risks are approprirate information to consider to ensure remedies selected by EPA and Ecology are protective of reasonably anticipated future land uses."	No

Notes

* Updated from original comment letter to reflect correct section and/or page number of Draft C.

1. Clarification on comment number 106: refers to exposure pathways associated with groundwater.
2. Clarification on comment number 158: refers to the scenario assumption of tribal plant gathering.
3. Web link was changed in Revision 0, but the link was still broken.