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STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
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May 20, 2008

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Mr. Briant L. Charboneau
Richland Operations Office
United States Department of Energy
P.O. Box 550, MSIN: A6-33
Richland, Washington 99352

0076444

Re: *Central Plateau Terrestrial Ecological Risk Assessment Report*, DOE/RL-2007-50

Dear Mr. Charboneau:

The Department of Ecology reviewed the referenced report. Enclosed are our comments to update the report. We appreciate that the United States Department of Energy completed a substantial amount of field sampling to support the report. This study includes useful data and evaluations.

Our primary critique of the report concerns the descriptions of the scope and uses of the report and the conclusions of the report. We are willing to help revise those sections of the report in cooperation with the U.S. Environmental Protection Agency (EPA). The major omission that Ecology notes is a detailed discussion of uncertainty, which is a primary element in the EPA guidance for Ecological Risk Assessment (ERAGS process).

If there are any questions, contact me at 509-372-7921. For questions regarding the comments, contact Beth Rochette at 509-372-7922 or Damon Delistraty at 509-329-3547.

Sincerely,

John B. Price

John B. Price
Environmental Restoration Project Manager
Nuclear Waste Program

br/aa
Enclosure

cc: See next page

cc w/enc:

Craig Cameron, EPA
Dana Ward, USDOE
Stuart Harris, CTUIR
Gabriel Bohnee, NPT
Russell Jim, YN
Susan Leckband, HAB
Ken Niles, ODOE
Administrative Record: 200 Area NPL Site
Environmental Portal

Washington State Department of Ecology Comments for the Central Plateau Terrestrial Ecological Risk Assessment Report, (DOE/RL-2007-50, Draft A Reissue) May 2008 – John Price

Comment Number	Section/Page/ Paragraph	Comment
1.	Executive Summary Page iii last ¶, Page iv, ¶2 Also §1.3	The Hanford 200 Area NPL site is a large (75 sq. mile) and complex site. The Site background needs to be carefully re-written to provide context for this risk assessment. For example, the 2nd ¶ on page iv describes 900 facilities, but doesn't mention the 1,679 identified waste sites in the 200 Area (as of 4-21-2008). As another example, the Site background doesn't mention the relatively large number (10 – 20) of CERCLA Records of Decision that this risk assessment will support. Figure 1-2 shows the individual decisions for the 100 Area, which this risk assessment <u>won't</u> support, but does not depict the individual decisions that this risk assessment <u>will</u> support. Ecological risk assessments in CERCLA rarely have to deal with this type of complex Site. Therefore, it's critical to re-write the Site background to help define how this risk assessment will be used in the regulatory framework for the 200 Area NPL site.
2.	§1.1	The Purpose and Scope needs to be re-written to reflect the regulatory agency (Ecology and U.S. Environmental Protection Agency [U.S. EPA]) purposes for this document. U.S. DOE was obligated to complete this risk assessment pursuant to its responsibilities as CERCLA lead agency – 40 CFR 300.430(d)(1). Ecology and U.S. EPA will use this risk assessment to fulfill their Lead Regulatory Agency obligation to draft Records of Decision – Hanford Federal Facility Agreement and Consent Order (HFFACO) Action Plan §7.3.8. This Section should describe how the Lead Regulatory Agency will use this report to support the CERCLA decision-making process.
3.	Executive Summary Page xv Also §5.0	The conclusion that "no ecological risk exists at terrestrial waste sites" is a gross over-statement, and needs to be re-written. As one of the other comments points out, this risk assessment sampled only a minor fraction of the total number of waste sites within the 200 Area NPL site. Further, this statement is contradicted by existing characterization data for individual waste sites that were not sampled for this risk assessment. This risk assessment report culminates a major technical effort for a large and complex CERCLA Site. The conclusions should be re-written to address several key points: • First, what impact does uncertainty have on the conclusions? • What can be concluded about the ecological risk at waste sites that were sampled for this risk assessment? • What can be concluded about the waste sites that were not sampled? • What can be concluded about the areas in between individual waste sites?

Washington State Department of Ecology Comments for the Central Plateau Terrestrial Ecological Risk Assessment Report, (DOE/RL-2007-50, Draft A Reissue) May 2008 – John Price

Comment Number	Section/Page/ Paragraph	Comment
4.	Executive Summary	Hanford is unique because of the preservation of a large (560-square mile) block of shrub-steppe habitat. The uniqueness makes it difficult to identify suitable ecological reference sites. Ecology, CERCLA Natural Resource Trustees, and stakeholders have noted the selection of suitable reference sites as a technical challenge throughout the development and execution of this risk assessment. Again, this risk assessment report culminates a major technical effort for a large and complex CERCLA Site. The conclusions should be re-written to address the issue of reference sites in more detail, including their impact on the uncertainty analysis.
5.	General	Uncertainty analysis is a critical element of the risk characterization step in the U.S. EPA ecological risk assessment process for Superfund. It is the step immediately preceding the risk management step. Again, Hanford is a large and complex Site. The discussion of uncertainty deserves commensurate attention in this report. The discussion of uncertainty should be expanded and should be given emphasis in Section 5 of the report.
6.	General Also §5	Under WAC 173-340, Table 749-3 ecological indicator soil concentrations protective of plants and soil biota are a CERCLA "to be considered" (TBC) criteria that could be the lowest (most stringent) cleanup goal for uranium. Note that "Exceedances of the values in this table do not necessarily trigger for cleanup action . . ." This report should provide possible conclusions about ecological risk from uranium outside of waste sites. This is an important goal for this report because the soil uranium concentration to protect plants in MTCA Table 749-3 (5 mg/kg) is lower than the soil U concentration for human direct contact (240 mg/kg or 48 mg/kg, depending on the RfD used). The 5 mg/kg could even be lower than soil value to protect groundwater or surface water (depending on Kd, Cw, and DF used).

Washington State Department of Ecology Comments for the Central Plateau Terrestrial Ecological Risk Assessment Report, (DOE/RL-2007-50, Draft A Reissue) May 2008 – Beth Rochette

Comment Number	Section/Page/ Paragraph	Comment
1.	General	Overall, the main body of the report stays at a summary level. The presentation relies heavily on references to former data quality objective (DQO) and sampling and analysis plan (SAP) documents. In each chapter, the report should take the reader through the purpose of the associated aspects of the assessment, the methods used to collect the data (especially highlighting deviations from the DQO and SAP), the methods used to evaluate the data, the data themselves, interpretation of the data, and how the report can be used for remedial decision making. The report especially requires more details about the methods used and the data themselves. The risk assessment report should be a stand-alone document giving sufficient background so that the reader can put the results and conclusions in perspective relative to the methods used to obtain the results and conclusions. BR
2.	General	The contaminant screening process is not considerate of synergistic, additive and antagonistic effects of contaminants. For example, comparisons with benchmarks are given in Appendix CB. Frequently it is observed that benchmarks are exceeded for mammals and birds for barium, zinc, vanadium, thallium, and arsenic. All of these target the GI tract (some of the contaminants have multiple target organs). Though the metals listed above are often present near background levels, a variety of contaminants were screened out of the risk assessment. Some of the contaminants screened out may also target the GI tract; the combination of contaminants may be a source of risk. Please discuss how synergistic, additive, and antagonistic effects have been considered by the risk assessment. BR
3.	Executive Summary, General	Some statements made in the document are more definitive than possible given the study design and data. Please rephrase such statements to state only what is truly possible to conclude. For example, in the Executive Summary, Page xiii, last paragraph: "Therefore, because the reasonable worst-case concentration of carbon tetrachloride in burrow air is well below the applicable ecological screening level, the dispersed carbon tetrachloride plume does not present an ecological risk." Yet, there is no associated statistical significance level provided for this statement. It would be more scientifically defensible to state that minimal evidence of ecological risk was found from the assessment. BR
4.	Exec. Summary Page vii, Figure ES-2, Section 1.0, Page 1-2, and Figure 1.2, Page 1-3	Section 1.0, Page 1-2 states: "Corrective measures studies for tank farms also will include an ERA with methods and data coordinated with the Central Plateau ERA." Please add clarifying text that explains what is meant by 'coordinated.' The tank farms were specifically excluded from this risk assessment. BR

Washington State Department of Ecology Comments for the Central Plateau Terrestrial Ecological Risk Assessment Report, (DOE/RL-2007-50, Draft A Reissue) May 2008 – Beth Rochette

Comment Number	Section/Page/ Paragraph	Comment
5.	Section 2.1.1, Page 2-2	The document states that "all contaminants identified or suspected to be at the site were considered and this list is refined to retain those contaminants with the greatest potential to pose adverse ecological effects." Ecological Risk Assessment Guidance for Superfund (ERAGS) covers refinement of preliminary contaminants of concern as involving screening against conservative benchmarks, then further refinement by considering assumptions and hazard quotients. Include in this section a summary of comparisons with screening levels, discussion of the assumptions and how using less conservative assumptions would affect the contaminant list, and discuss hazard quotients for contaminants. Please do not defer to the appendix entirely for these discussions. BR
6.	Section 2.1.1.1, Page 2-2 – 2-3	The contaminants of potential ecological concern (COPEC) refinement process requires significantly more support or should be abandoned. Please provide a table with all of the initial contaminants and reason for exclusion of each. Also provide in the document or appendix, in a single table • summary statistics for each contaminant, including number of samples • minimum concentrations • maximum concentrations • lognormal and normal 95% UCLs • number of detects • detection limits • benchmarks used for comparison. BR
7.	Section 2.1.2, Page 2-5, 1st paragraph and bullets	Please give more detail regarding selection of waste sites. For instance, the main objective was to encompass a gradient. What was the process used to identify sites within a gradient? Sites with large inventories or volumes of waste were selected. How large? Sites with potential exposure to ecological receptors were selected. What criteria define potential exposure? Sites with a minimum of surface stabilization were chosen. What amount of stabilization is considered minimum? A flow diagram may be a concise way to summarize this process. BR
8.	Section 2.1.2, Page 2-6, 3rd paragraph	The text states: "Nine locations, including three locations in the BC Controlled Area, were selected for assessment of ecological risks in accordance with site-selection decision logic presented in discussions with the Tri-Parties, and participant feedback from stakeholder workshops." Please provide the decision logic in this document. BR
9.	Section 2.1.3.2, Page 2-11, 1st paragraph of section	Please change the last sentence of the paragraph to state: The pathway from groundwater to terrestrial receptors is incomplete because groundwater does not discharge to the surface in the Central Plateau, <u>except at West Lake</u>, and soil-dwelling biota are not capable of reaching groundwater. BR

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Comment Number	Section/Page/ Paragraph	Comment
10.	Section 2.1.3.2, Page 2-11, 2nd paragraph of section	Please change the second sentence of the paragraph to state: There is no complete pathway from deep soils to ecological receptors <u>except via leaching to the groundwater that upwells at West Lake</u>. BR
11.	Section 2.2.1.1, Page 2-19	Summarize in this section how the 1-ha areas were selected for use in this study. BR
12.	Section 2.2.2.1, Page 2-21, General	Explain in this section how plants were selected for sampling. Was this a random sampling design? BR
13.	Section 2.3.1, Page 2-28, 2nd paragraph	Explain in this paragraph how the locations of the pitfall traps and drift fences were selected. Was this a random design? BR
14.	Section 2.4.1, Page 2-33, General	Include diagrams with the study design and relative trap locations for the small mammal and lizard trapping. BR
15.	Section 5.0, General	Please revise this section considering all comments submitted for this assessment. BR
16.	Section 5.1, Page 5-1	Please delete the statements: "Although there is evidence of exposure, no evidence exists for ecological effects based on field measures and based on comparison to ecological effect levels. These results indicate minimal risk to ecological receptors from Hanford Site COPECs at surface-stabilized waste sites, the BC Controlled Area, and the diffuse CCl_4 plume." The appendices show some potential effects that have not been discussed. Also, only a small number of surface stabilized waste sites were sampled for this assessment; they do not allow for a general conclusion that there is minimal risk at surface-stabilized waste sites. BR
17.	Section C1.1, Page C1-1, last paragraph of page; and Section C3.1, Page C3-1, last paragraph of page	The Wilcoxon Rank Sum test assumes that the samples are independent random samples from two populations. The assumptions should be stated in these paragraphs. In section 1.1 add text discussing the sample designs for soil, plants, invertebrates, small mammals and lizards with respect to randomness. For soil, the multi-increment sampling (MIS) design provides randomness for the 1-ha plot, but the locations of the 1-ha plots appear not to have been selected at random. It is not clear that the biota sampling is random. BR
18.	Appendix C1, Page C1-6, Figure C1-1	Please provide the source of the area background values for antimony in a footnote. The Hanford background documents do not provide a value for antimony. BR

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Comment Number	Section/Page/ Paragraph	Comment
19.	Appendix C1, Page C1-6 – C1-40, Figures C1-1 – C1-35	The following contaminants are present in environmental media at concentrations above those found in reference sites. In some cases the elevated results are non-detects. Because of the elevated concentrations, include the following contaminants in the risk assessment: • antimony (lizards and mice) • arsenic (invertebrates) • boron (lizards and mice) • total uranium (lizards) • chromium (mice) • copper (lizards) • lead (lizards and mice) • mercury (mice), silver (mice) • thallium (lizards) • vanadium (invertebrates, lizards and mice) • zinc (lizards and mice) • Cs-137 (soil, invertebrates, lizards and mice) • plutonium-239/240 (invertebrates, lizards, and mice) • radium-226 (lizards and mice) • radium-228 (invertebrates) • strontium-90 (soil, invertebrates, lizards, and mice) • uranium-233/234 (lizards) • uranium-235 (lizards and mice) • uranium-238 (lizards and mice) • total PCB congeners (lizards and mice) • gamma-chlordane (invertebrates and mice). BR
20.	Appendix C1, Page C1-11 and C1-24, Figures C1-6 C1-19	The figures show a disagreement between total uranium and inorganic uranium results. This suggests potential analytical problems with the samples. Check the results and explain the discrepancy between the two uranium measurements. BR
21.	Appendix C1, Page C1-14, Figure C1-9	No cyanide data are shown for the soil or biota. There had been considerable concern about cyanide presence in invertebrates in the course of this risk assessment. Include the cyanide data on the figures. BR
22.	Appendix C1, Table C1-3, Page C1-43, footnote b, #2	The footnote states "test whether a significant number of site results exceed max detect in background (via slippage test)." Using the maximum detect in background is not conservative. It is more conservative to use the 90th percentile for lognormally-distributed data, and the 80th percentile for normally-distributed data, as specified in WAC 173-340-709, than to use the maximum detect in background. Please re-evaluate the data by comparing against percentiles as described in WAC 173-340-709(3). BR

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Comment Number	Section/Page/ Paragraph	Comment
23.	Appendix C1, Table C1-7, Page C1-52 and Page C1-55	The information in the table affirms the need to include boron and thallium in the risk assessment. Statistical differences between reference sites and waste sites were observed, and there were detections of these contaminants in biota. Include boron and thallium in the risk assessment. Sources may include borates, boric acid, and boron surfactants that were used in operations; thallium is a constituent associated with tank farm processes. BR
24.	Appendix C1, Table C1-7, Page C1-52 – C1-59, General	Based on Figures C1-1 – C1-35 the following contaminants dismissed in this table as COPECs should be added back in: antimony, arsenic, boron, mercury, silver, thallium, vanadium, radium-226, radium-228, strontium-90, uranium-233/234, uranium-235, uranium-238, and total uranium. BR
25.	Appendix C1, Table C1-7, Page C1-54	Cyanide cannot be ruled out using the logic that it was only used in the tanks. Furthermore, the tank farms are in the Central Plateau and could have impacted biota captured for this assessment. This assessment should conclude that cyanide is a potential threat to biota, but its effects could not be determined conclusively because analytical methods were not available for detecting it in biota. BR
26.	Appendix C2, Figures, General	For scatter plots provide correlation or regression information on the figures. It appears that there are several that would show reasonably good correlation between the x and y variables (examples: Fig. C2-23, C2-44, C2-48, C2-51, C2-63, and C2-72). BR
27.	Appendix C4, Section C4.2, Page C4-3;	The text states: "There were eight COPECs in soil (antimony, cadmium, mercury, molybdenum, selenium, silver, thallium, and tin) that have significant relationships with plant diversity, based on the Central Plateau data. Excepting silver, none of these are refined COPECs (based on comparison to background or reference site in Section C1.0)." And "Antimony and mercury were two COPECs that occurred two or more times among the significant regression analyses; neither of these analytes are refined COPECs (greater than reference site or background concentrations; see Section C1.0)." And "There was one COPEC in invertebrates (americium-241) that had a significant relationship with invertebrate relative abundance (Table C4-3), americium-241 is not a refined COPEC. There were three COPECs in lizards (cesium-137, radium-226, and one PCB congener) that had significant relationships with lizard relative abundance (Table C4-4); cesium-137 and PCBs are refined COPECs and radium-226 is not a refined COPEC." And "There are six other COPECs (americium-241, barium, chromium, copper, mercury, and nickel) that occurred more than once among the various mammal measures for the Central Plateau data or for the pooled data." Because of these observations, include all of the contaminants listed above in the risk assessment. BR

Washington State Department of Ecology Comments for the Central Plateau Terrestrial Ecological Risk Assessment Report, (DOE/RL-2007-50, Draft A Reissue) May 2008 – Beth Rochette

Comment Number	Section/Page/ Paragraph	Comment
28.	Appendix C2, Page C2-1 – C-106, Page C2-6 – C2-29	The following observations, based on the graphs, suggest potential impacts that have not been discussed: 216-B-63 Ditch: Correlation between plant and soil gamma (Fig. C2-44); correlation between ant and soil gamma (Fig. C2-72); soil gamma higher than reference (ref) (Figure C2-92); soil beta higher than ref (Fig. C2-99); mammal beta higher than ref (Fig. C2-103); mammal gamma higher than ref (Fig. C2-104) 216-S-10 Ditch: ant gamma higher than ref (Fig. C2-100); mammal beta higher than ref (Fig. C2-103); mammal gamma higher than ref (Fig. C2-104) 2607-E6 Septic: ant gamma higher than ref (Fig. C2-100); mammal beta higher than ref (Fig. C2-103); mammal gamma higher than ref (C2-104) BCCA High A: soil beta higher than ref (Fig. C2-1); plant beta higher than ref (Fig. C2-2); soil gamma higher than ref (Fig. C2-93); soil beta higher than ref (Fig. C2-94); mammal beta higher than ref (Fig. C2-105); mammal gamma higher than ref (Fig. C2-106) BCCA High B: mammal burrow beta correlates with soil beta (Fig C2-23); mammal burrow gamma correlates with soil gamma (Fig. C2-63); plant gamma correlates with soil gamma (Fig. C2-49); mammal gamma higher than ref (Fig. C2-106) BCCA Medium: soil beta higher than ref (Fig. C2-1); plant gamma correlates with soil gamma (Fig. C2-51) Gable Mtn Pond: ant gamma higher than reference (Fig. C2-100); mammal gamma higher than ref (Fig. C2-104) Please discuss these relationships in the document. BR
29.	Section C4.2, PageC4-3 – C4-8, General	All significant relationships are important, whether or not the contaminants are considered refined COPECs. They may indicate that some combination of factors, including the associated contaminants, are impacting biota. Include text discussing all significant relationships shown on the tables. BR
30.	Section C4.2, PageC4-3, 3rd full paragraph; and Tables C4-3 and C4-4	The text states "There were three COPECS in lizards (cesium-137, radium-226 and one PCB congener) that had significant relationships with lizard relative abundance (Table C4-4);…" Please change (Table C4-4) to (Table C4-3). BR
31.	Figure C4-19, Page C4-21 (original version of document)	Provide a revised graph of female reproductive frequency plotted against lead. Ecology would like to see how the revised data analysis has changed this relationshiPage Provide the associated statistics. BR

Washington State Department of Ecology Comments for the Central Plateau Terrestrial Ecological Risk Assessment Report, (DOE/RL-2007-50, Draft A Reissue) May 2008 – Beth Rochette

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32.	Table C4-3, Revised Page C4-34 – C4-35	Discuss in the text the negative relationships between frequency of female mammals and copper and nickel. The relationships have very low p values (0.006 and 0.008). Also discuss the relationship between americium-241 and mammal female reproductive frequency correlated with both mouse tissue and soil Am-241 (p values approximately 0.005). BR
33.	Table C4-4, Revised Page C4-35 – C4-36	Discuss in the text the significant negative relationships for • plant diversity and soil mercury (p = 0.0034) • plant richness and soil antimony (p = 0.004) and soil mercury (p = 0.004) • frequency of female mammals and the following: • mouse tissue Aroclor-1260 (p = 0.0085) • mouse Cs-137 (p = 0.005) • soil mercury (p = 0.0004); • mammal relative abundance and the following: • mouse antimony (p = 0.001) • mouse barium (p = 0.0015) • mouse boron (p = 0.001), mouse chromium (p = 0.009) • mouse mercury (p = 0.0017) • mouse vanadium (p = 0.002). Consider analyzing the relationships between the (1) frequency of female mammals and a combination of the metals in mouse tissue, and (2) mammal relative abundance and a combination of the metals in the mouse tissue. Some options include multiple regression analysis, factor analysis and multivariate analysis considering all of the metals in mouse tissue. BR

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Comment Number	Section/Page/ Paragraph	Comment
34.	Section C6.2.2, Page C6-4, 2nd paragraph of section and Tables C6-8 and C6-9, Page C6-44	Regarding the higher values for measured tissue whole body concentrations when compared with calculated tissue flesh values at the BCCA site, the text states: "These results seem to indicate that in general the screening model underestimated transfer of COPECs from soil into the tissue of mammals and reptiles at both sites; however, one reason for the differences seen could be an issue of non-linear uptake of metals, which is dependent on the bioavailability of metals in the soil, as well as the actual concentration of COPEC in the soil. In non-linear uptake of metals, low concentrations of metals can result in increased uptake by biota…Another reason for the differences seen are likely due to differences in the composition of the tissue samples measured versus calculated. The site-measured samples represent whole body concentrations while the modeled concentrations represent flesh only." The second explanation may be the better explanation. There is more of a discrepancy for Sr-90 than for Cs-137. The measured Sr-90 levels are up to four orders of magnitude greater than the modeled Sr-90 levels. The bone was included in the samples, and Sr-90 would be expected to be elevated in bones relative to flesh. Please add text discussing possible Sr-90 accumulation in the bones of the receptors in the BCCA site and consider modeling Sr-90 in bones (rather than flesh) for comparison with the measured Sr-90 values. BR
35.	Appendix CB tables	Include the units in the column headings for the tables (for instance, what are the units for dose?). BR
36.	Appendix D2, Section D2.1, Page D2-2, last paragraph; Table D2-2, Page D2-8	The text states: "Specific conductance ranged from 30.3 mS/cm during November to 26.2 mS/cm with a dilution ratio (DI:lake water) of 10:1 in June…Salinity ranged from 1.82% in November to 1.61% with a dilution ratio (DI:lake water) of 10:1 in June (Table D2-2)." Please indicate in the text if the conductance and salinity values have been corrected for dilution or not. It is hard to tell based on the text as written. If standard curves were generated during analysis of the samples, they should be used to correct the results for dilution. BR
37.	Appendix D3, Section D3.0, Page D3-1, 2nd paragraph	The media of interest listed are shallow soils, surface water, pore water, sediment, and lake mineral deposits. Please indicate in the text how groundwater seeps are included (i.e. are they considered surface water?). BR

Washington State Department of Ecology Comments for the Central Plateau Terrestrial Ecological Risk Assessment Report, (DOE/RL-2007-50, Draft A Reissue) May 2008 – Beth Rochette

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38.	Appendix D3, Section D3.1, Page D3-1, 1st paragraph of section	Please delete the text: "All contaminated wastewater discharges to the 200 Areas holding ponds ceased in 1995, so it is assumed that the 200 Areas are not a continuing source of chemical constituents to groundwater and West Lake." Though discharges have stopped, there is likely to be residual contamination in the vadose zone as a result of the releases. The residual contamination will migrate to groundwater over time and will likely be a continuing source to groundwater and West Lake. BR
39.	Appendix D3, Table D3-1, Page D3-2	Some exposure pathways are listed more than once. Dermal contact is listed three times, root uptake twice, incidental ingestion 4 times, etc.). The table can be consolidated by listing each pathway only one time. BR
40.	Appendix D4, General	Discuss in the text the potential exposure of small mammals, which are relied upon in other evaluations, at West Lake. It appears that they have not been considered for West Lake exposure modeling. BR
41.	Appendix D4, Table D4-3, Page D4-15	The uranium concentration given is 68.8 mg/kg, which is somewhat above the toxicity reference value (TRV) given in Table D4-9 (15 [mg/kg; units not given on the table]). The soil TRVs should be applied for ingestion of mineral crusts. Contaminants in mineral crusts would generally be at least as bioavailable when consumed as would contaminants in soil. BR
42.	Appendix D4, Sections D4.3.7 and D4.3.8, Page D4-16, and Tables D4-4 and D4-5, Page D4-17 – D4-22 and elsewhere including exposure modeling	In Section D4.3.7 the text states: "Hazard quotients for radium-228, uranium-234, and uranium-238 and the SOF for all radionuclides indicate potential risk to ecological receptors from radionuclides in West Lake surface water." However, in Section D4.3.8, regarding inorganics, uranium is not mentioned as a potential source of toxicity. Uranium is also not listed with the inorganics (given in mg/kg) on Table D4-4, while U-238 is given as having an activity of 1900 pCi/L in Table D4-4 with a screening value of 223 pCi/L. The uranium concentration in pore water at West Lake is 5420 µg/L (Table D4-5), while the activity there for U-238 is 1400 pCi/L, which is less than that in surface water; so it is reasonable to assume that the uranium concentration in West Lake surface water is greater than 5420 µg/L. This is very high (more than 100x the MCL for humans). Since it exceeds benchmarks as a radionuclide it is very possibly toxic to mammals and other biota that consume water at West Lake (for humans, uranium toxicity is generally of greater concern than uranium radioactivity). Include discussion of uranium toxicity in Section D4.3.8 and Section 4.5. It is acknowledged that mammal tracks are preferentially associated with the seeps that have a uranium activity about 50 times lower than in West Lake surface water (according to Section D2.1, Page D2-5). Could the same be said about birds? BR
43.	Appendix D4, Table D4-9, Page D4-30	Include the units for the TRVs on this table. BR

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44.	Appendix D5, Table D5-1, Page D5-3 and Section D5.0, General; and Section 4.5, Page 4-5	Frequently the modeled doses appear to be below benchmarks, while the corresponding measured media concentrations exceed benchmarks. Discuss this discrepancy in the synopsis. BR

Washington State Department of Ecology Comments for the Central Plateau Terrestrial Ecological Risk Assessment Report, (DOE/RL-2007-50, Draft A Reissue) January 2008 (with April 2008 revisions) – Damon Delistraty

Comment Number	Section/Page/ Paragraph	Comment
1.		The document is imbalanced with separate chapters dedicated to, respectively: a single operable unit (the CCl4 plume), a single waste site (West Lake, and all other operable units and waste sites combined. Consideration should be given to restructuring the report to correct this imbalance. For example, the chapters on the CCl4 plume and the West Lake might be better treated as appendices, so that they could be lifted in total to support the final RODs for the CCl4 plume and West Lake.
2.	General	Although uncertainty is addressed throughout the document (e.g., Tables 2-7 to 2-10; Sections 1.4.3, 3.5.3, B2-3, C2.4, D5.6), most of this text relates to identification of sources of uncertainty. There is little quantitative analysis of uncertainty, making it difficult to effectively interpret an overall conclusion of no unacceptable risk. DD
3.	General	In Chapter 2, please make references to Appendix C more specific (i.e., refer to specific figures or tables, instead of generically referring to "Appendix C"). Otherwise, it is very difficult to relate text to data, and the transparency of the report is compromised. DD
4.	General	Please refer to PCB congeners by their International Union of Pure and Applied Chemistry (IUPAC) number (e.g., Table C4-8 presents a mix of names and numbers). DD
5.	General	Be more realistic with proper use of significant figures (e.g., 8 significant figures for an intercept in a linear regression in Table C4-3?). DD
6.	Page ix, Paragraph 2	Although it is stated that relative weights for lines of evidence (LOEs) were developed with interested parties, note that consensus was not necessarily achieved. DD
7.	Page xi, Paragraph 3	Provide a brief discussion and a reference to Appendix C1.0 for an explanation of "refined contaminants." It is nonconservative to dismiss the lack of correlation between COPECs in soil or tissue (e.g., PCBs, Sr-90) vs. measures of effect, as supporting a conclusion of no unacceptable risk. Measures of effect may not linearly track soil or tissue contaminant concentrations but may be indirect (e.g., predator/prey relationships) or more complex (e.g., synergistic interaction among multiple COPECs). Moreover, dismissing correlations of field measures vs. several COPECs, as a result of nondetects or outliers (e.g., see Table ES-1 for small mammals, lizards, birds), may not be justified (since outliers may be real and nondetected COPECs may actually be present at their detection limits). DD
8.	Page xii, Table ES-1	The first column lists taxonomic entities (not "Endpoint"). DD

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Comment Number	Section/Page/ Paragraph	Comment
9.	Page xiii, Paragraph 3	Generalizing (or extrapolating) the finding of no unacceptable risk to the entire CCl4 plume is invalid, given nonstatistical (i.e., nonrandom) and limited sampling. DD
10.	Page xiv, Paragraph 1	Please clarify why ERA at West Lake is divided between this effort vs. the 200-UR-1 Operable Unit CERCLA process. DD
11.	Page xv, Paragraph 2	An acknowledgment and estimate of uncertainty should accompany the stated conclusion, given the limited sampling and large spatial area. DD
12.	Page 1-2, Paragraph 2, bullet 1	Please clarify how indirect exposure from groundwater units (e.g., irrigated garden produce) will be evaluated in the RCBRA 100/300 Area Component, since this was excluded in the RCBRA 100/300 Area risk assessment report (see Page 2-25 in DOE/RL-2007-21, Draft A). DD
13.	Page 1-4, Paragraph 1	Re Central Plateau waste sites, please describe RI/FS human health risk assessments (as shown in Figure 1-2). DD
14.	Page 1-6, Paragraph 4	Please describe how "the more than 700 waste sites grouped into operable units were integrated in a comprehensive assessment to determine the potential for adverse effects on terrestrial biota." DD
15.	Page 1-11, Paragraph 2	Although based on home range and dispersal distance for small mammals, it is important to acknowledge that the terrestrial investigation area size selected (1 ha) may not have been optimal for evaluating other receptors via either field measurements (e.g., plants, soil invertebrates, lizards) or modeling methods (e.g., mammals, birds). DD
16.	Page 1-11, Paragraph 4	Because sites were placed to maximize homogeneity of habitat, variation in habitat structure and function (including associated biota and their interactions) may not have been adequately represented. DD
17.	Page 1-14, Paragraph 3	In lieu of a reference site, it may be possible to evaluate a concentration gradient in the CCl4 plume. DD
18.	Page 1-15, Paragraph 4	Reference to Appendix A should be to Appendix B (for reference sites). DD
19.	Page 1-16, Paragraph 4	Embedded in the four sources of uncertainty listed are COPEC identification, as well as Paragraphmeter and model uncertainty in exposure and toxicity assessments. DD
20.	Page 2-2, Paragraph 4	When using HQ>1 as a criterion for retaining COPECs, this does not adequately consider potential additivity among COPECs with a similar mode of action. For example, HQ may be <1 for several individual nephrotoxic COPECs (e.g., metals in general), but their HQ sum (=HI) may be >1. DD
21.	Page 2-4, Table 2-1	"PCBs" should consist of four distinct refined COPECs: Aroclor 1254, Aroclor 1260, summed PCB congeners, and dioxin-like toxicity equivalent (TEQ). DD
22.	Page 2-5, Paragraph 2	Criteria for selecting waste sites should include statistical representation. DD

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Comment Number	Section/Page/ Paragraph	Comment
23.	Page 2-6, Paragraph 3	Please acknowledge that <1% (10/1500) of 200 Area waste sites were evaluated. This clearly limits the ability/credibility to spatially extrapolate results across the entire Central Plateau.
24.	Page 2-11, Paragraph 4	The top 15 cm is about 6 in (not 2 in). DD
25.	Page 2-14, Paragraph 1	Note that for organic COPECs (e.g., PCBs), bioaccumulation is likely, placing higher trophic levels at increased risk. DD
26.	Page 2-15, Paragraph 2	It is important to recognize that growth, survival, and reproduction are assessment endpoint attributes, while actual field measures (e.g., abundance, gender ratios) relate only indirectly (and imperfectly) to these assessment endpoint attributes (i.e., population level effects). Consequently, there is uncertainty introduced between measured effects vs. assessment endpoints. DD
27.	Page 2-19, Paragraph 2	Looks like referral to Figure 1-1 should be to Figure 1-5 (ERAGS). DD
28.	Page 2-19, Paragraph 3	Note that burrowing mammals can be exposed to subsurface soils which are not typically characterized with surficial MIS methods. DD
29.	Page 2-21, Paragraph 6	Please list plant cover measures evaluated for bunchgrass vs. shrub sites. DD
30.	Page 2-22, Paragraph 1	List pros and cons of pooling plant measure data across survey dates and sources. For example, although sample size is increased, pooling increases variability, making it more difficult to identify differences in exposure or effects for waste vs. reference sites or across COPEC gradients. DD
31.	Page 2-23, Paragraph 5	Based on Table C4-2 gradient analysis, there are more significant differences with unrefined COPECs than refined COPECs. This may indicate a problem with the refinement process (e.g., reliance on comparison to reference/background). DD
32.	Page 2-24, Paragraph 6	The text states, "Radionuclide concentrations in soil were divided by BCGs to calculate dose." This ratio is a unitless HI (sum of fractions), not a dose. HI=1 (or HQ=1) corresponds to a dose of 1 rad/d, the USDOE dose limit for terrestrial plants. DD
33.	Page 2-27, Table 2-7	In addition to literature TRVs and lack of time series data, additional uncertainty is derived from biased sampling, small sample numbers, and suitable identification of reference areas and COPEC gradients. DD
34.	Page 2-28, Paragraph 2	Note that hand collection of invertebrates introduces sampling bias and uncertainty in data analysis. DD
35.	Page 2-32, Table 2-8	Text indicates a lack of toxicity info for silver in soil. Note that ORNL (ES/ER/TM-126/R2) provides a silver screening benchmark of 50 mg/kg for soil invertebrates. DD

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Comment Number	Section/Page/ Paragraph	Comment
36.	Page 2-38, Paragraph 4-6	If statistically significant relationships are to be dismissed as biologically not significant, there should be a set of a priori criteria (e.g., handling of non-detects, low frequency of detects, outliers) established for these evaluations. DD
37.	Page 2-42, Paragraph 1	Because HQ<1 for dioxin-like TEQ in mammals (based on LOAEL), but HQ>1 for TEQ (based on NOAEL), this should be investigated further. Please refer to Table C5-4 for values and references for the mammalian TRVs for TEQ, based on LOAEL and NOAEL. DD
38.	Page 2-43, Paragraph 1	It could be argued that "a general lack of concordance of results for various measures" suggests uncertainty, rather than "no risk." Inconsistent results in exposure vs. effects increase uncertainty. For example, soil Pb, Cs-137, Pu-239/240, and Sr-90 were greater at waste sites vs. reference sites, but plant richness was not correlated to contaminant gradients (Table 2-11). DD
39.	Page 3-3, Table 3-1	Please show the conversion between TRV (mg/kg-d) and ESL (mg/m3). DD
40.	Page 3-3, Paragraph 3	Note that the pocket gopher is the taxonomic entity (which is only part of the assessment endpoint). DD
41.	Page 3-16, Paragraph 3	As explained, please refine the CCL4 TRV for relevance to the Hanford site (i.e., by assessing only data relevant to the pocket gopher) and incorporate this revised TRV into the ERA.
42.	Page 4-4, Table 4-2	Please explain why this table is missing several COPECs, relative to Table D5-1 (i.e., Cr and U-234 in surface water; Cr, As, Mo in tissue). DD
43.	Page 5-1 to 5-4	The Chapter 5 summary fails to communicate the uncertainty in results. Many factors contribute uncertainty, e.g., the small number of waste sites evaluated, biased sampling (lack of a randomized sampling design), the COPEC refinement process, exclusive use of univariate/bivariate methods (lack of multivariate methods which can evaluate relationships among multiple variables simultaneously), and dismissal of statistically significant effects (e.g., Table C4-3 and 4-4). DD
44.	Page C1-1, Paragraph 1	By combining results from waste sites (in the comparisons to background/reference sites), variability is increased, making it more difficult to obtain statistically significant differences and to identify specific contaminated waste sites. DD
45.	Page C1-41 to C-1-59, Tables C1-1 to C1-7	Please clarify if waste site results (for soil and biota) are derived from Central Plateau waste sites only (and not from combined Central Plateau and RCBRA waste sites), if this is the case. DD

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Comment Number	Section/Page/ Paragraph	Comment
46.	Page C2-5, Paragraph 7	Re the first sentence in the Paragraph (on uncertainties), it looks like "relative" should be "relate." An uncertainty (not mentioned) in the radiation survey data is measurement of gamma/beta but not alpha radiation. DD
47.	Page C3-17, Table C3-1	In general, these results provide more justification for pooling measures across site type, rather than survey dates and data sources (as stated in the text), since there are fewer differences across site type. Although pooling data increases sample size (and raises statistical power), useful information on spatial and temporal variability may be lost. DD
48.	Page C4-2, Paragraph 2	Combining Central Plateau and RCBRA data (for plants and mammals) compromises spatial specificity and increases variability, sometimes making it more difficult to observe differences for waste vs. reference sites and across COPEC gradients. DD
49.	Page C4-2, Paragraph 5	There were 9 (out of 55) significant bivariate correlations among the 11 field ecological measures (Table C4-1). Therefore, these correlated variables do not provide an independent assessment of effects. This argues for a multivariate approach. Advantages of a multivariate analysis include control of the Type 1 error rate, incorporation of correlations (via the covariance matrix), and jointly evaluating all of the variables (Stevens, 1986). DD
50.	Page C4-2, Paragraph 6	Please clarify why average values of the ecological measure and COPEC were used for gradient analyses. Are these average values per investigation area (1 ha)? Were multiple values taken for each ecological measure, and was MIS employed to derive average COPEC concentration? Please provide a clear example, showing all data input into a linear regression for a typical gradient analysis. DD
51.	Page C4-3, Paragraph 3	Reference to Figure C4-2 should be to Figure C4-3. DD
52.	Page C4-4, Paragraph 5	Please present results for calculated TEQ for biota (based on 12 WHO dioxin-like PCB congeners). DD
53.	Page C4-8, Figure C4-1	This scatter plot matrix is a very busy figure. It could be simplified by deleting half of the figure (without loss of information), since the matrix is comprised of mirror images. Also, label axes and define the distinction between "x" vs. "+" symbols. DD

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Comment Number	Section/Page/ Paragraph	Comment
54.	Page C4-5, Paragraph 4	Although significant correlations for linear regressions (Tables C4-3 and C4-4) of ecological measures (lizard abundance, mouse relative abundance, mouse female frequency) vs. PCBs (Aroclor 1254, Aroclor 1260, and two PCB congeners) were based largely on nondetects (Figures C4-10 to C4-14), the nondetects may have been present at their detection limits. Moreover, the detected values (albeit few) do confirm the presence of PCBs in these biota with an associated potential for adverse effects. DD
55.	Page C4-6 Paragraph 3	Text states that Table C4-4 shows a negative correlation of mammal male reproductive frequency vs. Cs-137 in mouse tissue, although Table C4-4 shows this correlation with Am-241 (not Cs-137). Please clarify. DD
56.	Page C4-26, Table C4-3	Re footnote for r2, r2=coefficient of determination (r=correlation coefficient). DD
57.	Page C5-1, Paragraph 1	Note that groundwater is also a potentially affected medium, although not typically an eco concern at soil sites (except at West Lake). DD
58.	Page C5-1, Paragraph 2	Note that an inhalation pathway may be important for burrowing mammals and subsurface VOCs (e.g., CCl4 plume). DD
59.	Page C5-1, Paragraph 4	Include lack of toxicity and modeling data for reptiles, as a source of uncertainty. DD
60.	Page C5-3, Paragraph 3	NOECs (NOAELs) are more conservative than corresponding LOECs (NOAELs). EPA recommends use of a chronic NOAELs over LOAELs (for ecologically relevant endpoints), as well as use of uncertainty factors when extrapolating across test endpoints (e.g., LOAEL to NOAEL) or exposure durations (e.g., subchronic to chronic) in their hazardous waste combustion SLERA guidance (see Page 5-26 to 5-29 in: http://www.epa.gov/epaoswer/hazwaste/combust/eco-risk/volume1/chap5.pdf). MTCA also recommends use of TRVs based on NOAELs, use of uncertainty factors, and use of HI when substitute receptor species have been used (as in the CPERA here) to account for uncertainties in the level of protection (WAC 173-340-7943[7][f]). DD
61.	Page C5-4, Paragraph 1	More recent TEFs have been proposed for mammals (Van den Berg et al. 2005. Tox Sci 93:223-241). Please use these revised TEFs for mammals (and revise mammal TEFs in Table C5-5), and use the Van den Berg et al (1998) TEFs for birds, to re-calculate TEQs. DD
62.	Page C5-6, Paragraph 2 and 3	Please acknowledge the uncertainty in the badger risk to TEQ. HQ<1 (based on LOAEL) and most likely AUF<1. However, HQ>1 (based on NOAEL), and LOAEL is likely not the true lowest effect level (since this level is derived somewhat arbitrarily). DD

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Comment Number	Section/Page/ Paragraph	Comment
63.	Page C5-18, Table C5-1	Exposure models for Plant BCG and Wildlife BCG should account for both internal and external dose. BCG units are pCi/g for terrestrial biota. DD
64.	Page C5-19, Table C5-2	In the "Notes" column, it is stated, "wet intake=dry intake/(1-%moisture)." "%moisture" should be "fraction moisture." DD
65.	Page C5-25 to C5-33, Table C5-4	Please specify units for toxicity values. DD
66.	Page C6-2, Paragraph 4	For transfer factors, it looks, like reference to WAC "Table 749-3" should be to "Table 749-5." DD
67.	Page C6-2, Paragraph 6	Please explain the equation ("Calc Flesh") for nonrads, and define all terms with units. There appears to be a fw/dw discrepancy, re the left vs. right hand sides of this equation. It is not clear why "TF_flesh_dw" is defined in terms of beef and invertebrate TFs. Please clarify. DD
68.	Page C6-4, Paragraph 5	Note that nonlinear uptake of metals can occur for nutrient metals (e.g., K, Na, Ca, Mg), as well as nutrient metal analogs (e.g., Cs-137, Sr-90) (Beeby, 1991). Beeby, A. 1991. Toxic metal uptake and essential metal regulation in terrestrial invertebrates: A review. PPage 65-89 in: Newman, MC and AW McIntosh (eds.), Metal ecotoxicology: Concepts and applications. Lewis Pub., Chelsea, MI. DD
69.	Page C6-5, Paragraph 2	Although HQs<1 for both modeled and measured tissue COPEC concentrations (Tables C6-10 and C6-11), it is nonetheless unexpected that measured concentrations (and their corresponding HQs) exceeded modeled concentrations (and their corresponding HQs), considering that screening models are typically more restrictive than site-specific measurements. This is especially surprising, since failing screening usually serves as a trigger to employ more site specific methods in a tiered risk assessment strategy. Overall, this observation (i.e., measured results>modeled results) highlights the uncertainty inherent in modeling and the need for model validation via ground truthing with field measurements. DD
70.	Page C6-41 to C6-42, Tables C6-2 to C6-5	Please provide units for TF and I values. DD
71.	Page D2-7, Table D2-2	Please clarify if these data have been corrected for dilution with DI water. Provide units for turbidity. DD

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Comment Number	Section/Page/ Paragraph	Comment
72.	Page D3-2, Table D3-1	Looks like abiotic media (i.e., sediment, surface water, soil, mineral salts) were inadvertently left off the Table. Is exposure to pore water included? In a figure, please provide a more standard conceptual exposure model (e.g., sources, transport mechanisms, media, pathways, receptors). DD
73.	Page D4-1, Paragraph 3	For surface water, pore water, sediment, and mineral crust, there are other screening values listed in Tables D4-2 to D4-5 that are not mentioned in this discussion (e.g., LA-UR-05-7424; ES/ER/TM-95/R4). Please explain. Because NAWQC for surface waters (EPA, 2006, http://www.epa.gov/waterscience/criteria/wqctable/nrwqc-2006.pdf) represent more of a consensus than SQUIRT values (Buchman, 1999), NAWQC values should be used for surface water. DD
74.	Page D4-2, Paragraph 4	If no screening value is available, the contaminant should be retained as an uncertainty in the ERA. DD
75.	Page D4-3 to D4-19, Tables D4-1 to D4-4	Add units to screening values. DD
76.	Page D4-21, Table D4-5	I could not locate the listed screening value for uranium (40000 ug/L) in ES/ER/TM-95/R4. Other benchmarks are much lower. For example, Suter (1996) lists a freshwater Tier II secondary chronic value of 1.87 ug/L and Sheppard et al (2005) list a freshwater benchmark (PNEC) of 5 ug/L for plants. Use of these lower benchmarks would result in HQ>1 for uranium in surface water. Suter, GW. 1996. ETC 15:1232-1241. Sheppard et al. 2005. J Environ Rad 79:55-83. DD
77.	Page D4-7, Paragraph 4	If no marine sediment benchmarks are available for organics, please compare nonrad organics to freshwater sediment benchmarks and provide references. Also, use a lower freshwater sediment benchmark for di-n-butylphthalate (0.11 mg/kg) provided by Buchman (1999), rather than the LANL value provided here (11 mg/kg). DD
78.	Page D4-13, Paragraph 2 and 4	It may be appropriate to compare mineral crust rads and nonrads to both sediment and soil benchmarks, since mineral crusts may share exposure pathways with both of these media. DD
79.	Page D4-16, Paragraph 5	Although Fe, Mg, K, and Na are typically dismissed (as essential nutrients), Sb should be retained as an uncertainty. DD
80.	Page D4-23, Paragraph 2	HQ for Cr appears to be in error in Table D4-4 (i.e., HQ=1960/50=39, not HQ=0.62). Therefore, add Cr to the list of contaminants in surface water (or pore water) with HQ>1. DD

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Comment Number	Section/Page/ Paragraph	Comment
81.	Page D4-25, Paragraph 1	Please explain why insectivore modeling was completed for birds/bats but not rodents. Note that Equation 1 is for nonrads. DD
82.	Page D4-30, Table D4-9	Provide units for TRVs (i.e., mg/kg-d). Also, TRVs listed for Hg, Mo, Ni, Ba, and Zn are for the vole, not the shrew (WAC Table 749-5). Please correct. DD
83.	Page D4-32 and D4-34, Tables D4-10 and 4-12	Please include uranium, since it was shown to have a maximum concentration of 5420 ug/L in surface water. DD
84.	Page D4-39 to D4-41 and Page D4-44, Tables D4-16 to D4-18 and D4-20	Please explain more clearly why these tables each have headings "Surface Water (rad/day)" and "Pore Water (rad/day)." For example, in the upper block which lists rad/d for surface water, sediment, tissue, and their sum, why is this all under the heading "Surface Water (rad/day)" (while there are also sediment and tissue doses listed)? DD
85.	Page D4-42, Paragraph 2	The summed ratio (HI=3.38) is only for pore water (not surface water) for the riparian animal (Table D4-14). DD
86.	Page D5-1, Paragraph 5; Page D5-2, Paragraph 1 and 5	The USDOE/BCG rad dose threshold for birds is 0.1 rad/d (not 0.01 rad/d). DD
87.	Page D5-3, Table D5-1	Please explain the discrepancy and associated uncertainties between the results of [media dose>benchmark] vs. [modeled dose>TRV] for all COPECs listed for abiotic media. Presumably, the interpretation is that modeled dose results have less uncertainty than media dose results, due to the incorporation of more site specific information in modeled dose estimates (although both employ site specific media COPEC concentrations). However, it had previously been shown in Appendix C6 that modeled tissue concentration underestimated measured tissue concentration by up to three orders of magnitude (e.g., Table C6-10), lowering confidence in modeled concentration (and dose) results. Therefore, the uncertainty of modeled dose results remains high, and this should be acknowledged here. DD