Compiled Technical Peer Review Comments for *Screening Assessment and Requirements for a Comprehensive Assessment*[1] *for the* COLUMBIA RIVER COMPREHENSIVE IMPACT ASSESSMENT PROJECT[2]

JUNE 18, 1997

COMPILED BY

RENE FORMAN DEREWETZKY

[1]Pacific Northwest National Laboratory, CRCIA Management Team Representatives. April 1997. *Screening Assessment and Requirements for a Comprehensive Assessment.* DOE/RL-96-16, Revision 0, UC-630 Draft.

[2]Prepared for the U.S. Department of Energy under Contract DE-AC06-96RL13395

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Pullman, Washington 99164-3002

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for
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Rvr #	General or Specific (Section, page, paragraph, sentence)	Comment	Response
2	Fact Sheet	I was delighted to see the Fact Sheet. It's a useful supplement for the general public.	
3	General peer rev process	This document confirms three criticisms I have had of the entire technical peer review process: 1. No attempt was made to reconcile differences among reviewers or even issue majority and minority reports of the review team, nor is incorporation of peer review comments evident (although I did find it in some places). The technical reviewers were not a "team" in any sense: there was no communication among them and attempts at communication were ignored. They were simply treated like commenters, and the review was <u>not</u> an independent peer review. 2. Some review comments directly contradict other review comments. Some review comments are <u>technically</u> neither sound nor credible. 3. Some organizations (e.g., some Native American tribes, the Washington Dept. of Ecology) were represented both on the management team and on the review team, so that the technical review was not independent. I hope it will not be presented to the public as an independent peer review, but that the technical review team will be identified as individual early commenters.	
8	General audience	This document is uneven in the level of discussion and the audience to which it is aimed. For example, in Section 3 of Part I a high degree of technical sophistication on the part of the reader is required. In other sections, substantially less sophistication is required.	
4	General	It is obvious that a great deal of care has been expended on this report.	
11	General Comments, Part I	This reviewer saw many improvements that were made in this document and given the operational constraints this document was informative if not easy to read. Improvements include disucssion and interpretation, formating, and some improvements on assessing uncertainty. See comments listed below for specifics on how to continue refinement.	

5	General well-written	This document represents a tremendous amount of effort. It is a wealth of information and seems to live up to its billing as "comprehensive". The document is generally well-written, and most topics are easy to find, using the Table of contents.	
9	General TOC	Every "chapter" should have its own Table of Contents, for each section and subsection.	
3	General recc-need lines	Commenting in this type of form would be easier if lines in the document were numbered.	
6	General	My participation as a technical peer reviewer on the CRCIA project should not be taken as an endorsement of this document. Scope of my review of *Screen Assessment and Requirements for a Comprehensive Assessment.*: Unfortunately the time allowed for this review did not permit me to retrieve all the information needed to check the calculations. This is a significant weakness in my review. I have focused on the human health risk evaluation and the underlying processes and reviewed the following pages: pages iii-xc. pages I-iii to I-2.24, up to but not including section 2.3.1.4 I-2.26 to I-2.29, including sections 2.3.2.1 through 2.3.2.3 I-2.32 to I-2.2.35 including sections 2.3.3.1 through 2.3.3.3 I-2.39 to I.2.40 I-2.43 to I-2.58 I-5.1 To I.6.15 I did not review part II.	
5	General size, approach	I still find that the style of this and previous reports is to present various blocks of text two and sometime three times. This sort of redundancy leads to very voluminous documents that take a great deal of time to read. Compared to peer-reviewed scientific reports, the ratio of information/page is very low in this document.	
4	General size	The size of the report is overwhelming; no one can complain that there is not enough detail.	
4	General size	Because of the size of the report, more cross-references will be need, as will be noted below.	

2	General sidebars	The addition of the side bars with running commentaries is an excellent innovation. A non-technical person can get a good sense of what the report is about just from reading them.	
4	General boxes	The boxes of explanation are good; they will be needed by many readers. A few subjects need boxes, as will be noted below.	
7	General format and boxes	I approached this review as a technical person reviewing a technical document. I have considerable experience in reviewing scientific and engineering reports, including risk assessments. The level of the presentation and the amount detail in the report seemed reasonable and appropriate for my purposes and intent. However, the intended audience is not explicitly identified. I would imagine that readers with backgrounds or interests that are less technical could have some difficulty in reading the report. It might be useful to describe the intended audience. I found the "summary boxes" to be quite useful. In most instances, these are written using clear and concise language with relatively little jargon. A refreshing addition! It might be helpful to add a few more boxes that identify which sections or chapters readers might want to skip and which they might want to read more carefully (similar to what is done in the summary box on page I-2.1).	
1	General approach	If I were planning an assessment, I would not find this very useful. It seems to say: we want to know more things than we can list and may want to know even more in the future (Appendix A). The verbiage is vague and full of qualifiers.	
3	General tech approach	The purpose of the Columbia River Comprehensive Impact Assessment (CRCIA) is to assess the impact of operations at Hanford on the Columbia River. Throughout, therefore, distinctions must be made between data upstream from Hanford and data from the Hanford Reach and downstream. Moreover, the time of measurement and the dependence on contaminant measurement with time must be shown. This document has done a better job of identifying those contaminants whose source could be traced to Hanford runoff than preseding drafts, but the distinction is not always clear.	

3	General tech	**MEASUREMENT RESULTS BELOW DETECTION LIMITS ARE NOT EQUIVALENT TO HALF OF THE DETECTION LIMIT AND SHOULD NEVER BE REPORTED AS SUCH, LET ALONE BE USED TO IMPLY TRENDS! IF EPA DOES THAT, IT ONLY MEANS THEY ARE USING BAD SCIENCE AS WELL.**	
5	General approach, conclusions	The basic conclusions of this report would lead one to think that there are probably a good many problems along the Hanford reach, both in terms of ecological impact and in terms of potential human health effects. It is hard for me to believe the true impacts are likely to be as widespread and significant as the screening suggests. Of course, there seem to be many conservatisms in this analysis, not the least of which is that maximum measured concentrations were used to drive the analyses. The tremendous dilution volume and size of the ecosystem is not really factored in. Highly-localized impacts are likely insignificant when taken in the context of the system as a whole. Perhaps this is a topic for the next phase of work, but in the meantime, I would recommend a section in the executive summary and in the synthesis of results that clearly enumerates all the major conservatisms inherent in this analysis.	
5	General recco. technical risk	As a technical reviewer, I would like to be able to do an independent calculation of risk for a specific scenario and contaminant. To do this, it would be necessary to be able to find each parameter. I think all the parameter assumptions are probably in the final document, but it would require some searching. I spent a couple of hours trying to do this for the chronic ecological assessment for Cs-137, but gave up. This might be considered: In an appendix, provide an actual example calculation, showing all the equations and parameter values, and giving the pages on which such parameter values can be found. This would provide the reviewer with the feeling that the calculations can be repeated and that this set of calculations is not just a "black box" with inputs and outputs.	

6	General	The introduction (section that appears before PART I) is well done. No revision advised. The data collection has been thorough and apparently well done. This portion of the assessment stands without suggested revision. I did not review any aspect of the ecological assessment The human health assessment is unacceptable to me for it's lack of scientific foundation. Extensive revisions are needed. (see comments below) As a survey of values judgments held by the stakeholders the document is fine. However, I reviewed the document for scientific defensibility and it is my opinion that the results of the human health risk evaluation grossly misleads the public in that it implies a level of precision that is unachievable. The document defines twelve exposure scenarios that can not be distinguished from one another. The evaluation incorporates too many pathways and thus many uncertainties that severely compromise the reliable assessment of risks. Although error bars are now attached, the approach to establishing the range is not scientifically sound. This reviewer advises the CRCIA management team to revise the human health risk evaluation such: 1) that only the HSRAM residential scenario is used, without modification, 2) that only ingestion, external exposure and inhalation pathways are used and 3) that no modeling across contaminated media be conducted, 4) that external exposure include alternative geometries (other than infinite slab) and uncertainties be estimated using the alternatives. The inappropriate use of exposure assumptions, and toxicity factors instills a sense of misgiving about the document as a whole. In the context of not having time to look at all of the details and follow through calculation myself, my strong sense is that the whole of the CRCIA Human Health evaluation is scientifically unsound.	

2	Executive Summary - General	I was so favorably impressed with the Fact Sheet and the side bars that I started into the Executive Summary with great enthusiasm. I was doing just fine under I hit "technical approach." Oops. This seems to consist largely of material cut and pasted from the technical sections. Those sections that were well-written in the first place stand up just fine, but others have problems. From a writing perspective, writing the Executive Summary is not the easiest part, it's the hardest. The reason is that throughout the technical sections you've had time to explain things in some detail, so by the time you want to simply refer back to them, you can. With an Executive Summary you don't have that luxury. Everything has to be self-explanatory. You can't get away with defining something using terms that you haven't explained previously in the summary. Making all the connections between things is harder, not easier, because it has to be done more economically. The reason I'm going on about this is that the Executive Summary is the one part of the document that non-technical people might read. The goal should be that a non-technical reader of at least average intelligence -- say a Congressman -- should be able to read the Executive Summary and make sense of it. In this case I would go further and say that this mythical non-technical reader should be able to read both the Executive Summary and the side bars and make sense of them. The side bars come close, but there are parts of the Executive Summary that are not close. It needs to be re-written carefully. Give it to a non-technical employee or friend and ask him or her what doesn't make sense.	
5	Preface, p vii, para 1	The last sentence implies that contaminants and materials have affected the Columbia River. Can this be directly proven, or is this speculation?	
11	Preface, p. vii: Purpose, bullet 3	What is meant by "useful certainty?" I have no idea.	

11	Executive Summary	Essential information from the report did not get transferred to Executive Summary. For example, on page xiv in the executive summary, paragraph 1 introduces the concept of study domain and spatial scale yet the definition of segmentation is not clearly given. Pulling a single sentence from the text forward-- (pg. I-3.3, second paragraph, lines 2-3) "A segment is a section of the river over which contaminant conditions can be expected to be similar and which captures the major influences to the Columbia River" would help this summary. This chapter needs to be carefully revised so it can stand alone without forcing the reader to wade through the entire impact statement. Tables and Figures should be self-explanatory with sufficient detail so the average reader can understand what the issues are and how conclusions were drawn. Everything must be transparent. Because of the use of too many significant figures, a naive reader might assume a greater degree of accuracy from Table S-1 than warranted. Please reduce the numbers. Bottom line is almost missed among the details and qualifications. Can any format changes improve this?	
2	Executive Summary, p. xiii, sentence above the bullets	The "is summarized through" is so passive my grammar checker would have a psychotic break. How about: "The screening assessment included the following steps:"	
11	Executive Summary, p. xiv	The section on contaminants of interest does not give an indication that both acute and chronic human toxicity was considered, only acute and chronic aquatic toxicity. Was this the correct impression? Reword.	
4	Exec. Summary, p. xiv, first paragraph	Where are the seeps that are carrying contaminated groundwater plumes into the river? A map would be useful.	
2	Executive Summary, Page xiv, 1st para, second sentence	Our beloved average reader has had no introduction to the term "operable units" and probably doesn't even know that remedial actions mean "cleaning up the place." So if they can get past "segmentation provides" which is also terminally passive, they are suddenly hit with two more terms they don't understand. The result is linguistic overload.	

2	Executive Summary, p. xiv, 2nd para, first and second sentences	First, it's not immediately obvious that the first sentence is a definition of "contaminants of interest." How about making it obvious by adding a phrase to the first sentence like: "which are referred to as 'contaminants of interest'". "Source term data collection activity" is a brand-new term, with no introduction. It's not a man-on-the-street type term.	
2	Executive Summary, p. xv, fungi	Any point in defining what a taxon is? Everything else seems to be a type of critter or plant. Is a taxon also a critter or plant?	
5	Executive Summary, p xv	Does "trout" include steelhead trout?	
4	Executive Summary, p. xvi	Could risk be more concisely defined as the sum of exposures x effect. The references to the whole models are cumbersome.	
11	Executive Summary, p. xvi	This reviewer still has difficulty understanding why such a narrow search for data was done. Especially when in paragraph 2, extrapolation techniques had to be used to fill in data gaps. Wouldn't it have been easier to use earlier data than extrapolate across media?	
11	Executive Summary, p. xvi	Ecological and human health assessment. What does "computer code application" mean? Should this be written as "a computer program in existence" was used to calculate human health risks? Perhaps even mentioning name of computer modeling program here would be useful (i.e., MEPAS)?	
2	Executive Summary, p. xvi, para 2, 3rd sentence	Instead of "surrogation and extrapolation rules," how about "rules for when it was acceptable to use surrogate data, or extrapolate from existing data." Or just leave "surrogation and extrapolation" out in that sentence, since the next two sentences give you the same information.	
2	Executive Summary, p. xvi, last para, 4th sentence	I was almost keeping my nose above water until I hit "Transfer factors in human health models were derived from the ecological model results." What's a "transfer factor"? The three terms, one right after another, are just overwhelming. Again, I suspect that in the full text, there was a more leisurely explanation of this, so that you weren't so snowed when you hit this cold. But with just a cut and paste, things you assumed were understood are no longer present to explain things, so the sentence just sits there undigestible.	
5	Executive Summary,p. xvi, last line	How were the models tested?	
11	Executive Summary, p. xvii	Define EHQ.	

11	Executive Summary, Results and Discussion, p. xvii, paragraph 1, line 3	Define elevated. Over background levels? Over regulatory action levels? Over what?	
11	Executive Summary, Results and Discussion, p. xvii, line 5	What do you mean here? "Risk" is always evident. Is it "unacceptable levels of risk?" Using what definition? I think what you mean is that with the exposure scenarios you considered risk levels exceeded generally accepted risk levels. This needs to be carefully re-worded. May want to use comments from Fig. S.1.	
5	Executive Summary, p xvii, 3rd line from bottom	what does "high-level" mean?	
2	Executive Summary, p. xviii, Figure S1	This doesn't make too much sense without Figure 3.1, which should be shown here. Can the legend be made more obvious? It takes some searching before you discover there is a legend.	
11	Executive Summary, Results and Discussion, p. xviii, Figure S.1.	This is a very important figure. Enough definition is needed here so the figure can stand alone. Do not just say definition of ecological risks is buried in section 6.3. Also, what do #'s 1-27 refer to ? Label river segments for new reader. Put shading key into footnotes for figure.	
4	Executive Summary, p. xix	Hyalella, and Daphnia magna are scientific names and should be italicized.	
11	Executive Summary, Results and Discussion, p. xix, paragraph 2, lines 8-10	Wording here, "potentially hazardous" is very different than paragraphs on page xvii, Results and Discussion. This paragraph on xix is very good - should use this for developing footnotes for ecological risk, Figure S.1.	
2	Executive Summary, p. xix, 3rd para.	Presumably you are picking the Ranger scenario because it has the least hazard, and Native American Subsistence because it has the most. But nothing has been said to explain that [it is said in the body of the report, but didn't get picked up with the cut and paste].	

11	Executive Summary, Results and Discussion, pp. xx-xxiv, Table S.1	It is extraordinarily misleading to give the risk numbers with this level of significant digits. This must be modified! How do the risk estimates presented in this table consider background risk in Segment 1? Please indicate that all risks subtract risks from contaminants reaching Hanford site after Segment 1. Ensure that these figures match info in Figure S1. If insufficient information was available for evaluation then please designate this on Table S.1, perhaps by using an NA for not available, etc. This table is incomplete and misleading without this distinction from no risk situation. See paragraph 3, pg. xxv for example of type of info that should be present in this table.	
11	Executive Summary, Results and Discussion, p. xxv, paragraph 3, lines 4,5	Please clarify what "general lack of toxicity benchmark" means. Is this the same as they were not toxic under the conditions evaluated?	
11	Executive Summary, Results and Discussion, p. xxv, paragraph 4, last 3 lines	The statement is given here that says that there were minimal differences between any of the Native American Scenarios and recreational/residential risk assessment scenarios. A line of explanation should be given or referenced. Was this lack of difference due to lack of sensitivity of the Native American scenarios to reflect critical exposures, do additional facts need to be considered or are these different exposures actually only qualitatively different with quantitative similarities?	
4	Executive Summary, p. xxv	Are the nitrate or phosphate concentrations enough to cause eutrophication? Only toxicity seems to be considered in this document.	
2	Executive Summary, p. xxv, 4th para, 3rd sentence	Here's the explanation that was needed earlier about the Ranger and Native American scenarios	
8	Executive Summary, p. xxvii, under Carbon-14	The statement "seep water was surrogated with groundwater" is confusing. As written it is not clear if seep water is substituting for ground water or if ground water is substituting for seep water. A more correct statement would be "seep water was surrogated for ground water". A more pleasing statement would be "contaminant concentrations in seep water were substituted for contaminant concentrations in ground water in the calculations".	
11	Executive Summary, p. xxvii	Copper: what does it mean that chromium is "one of the highest risk to biota and humans?" Explain context for this comparative statement.	

4	Executive Summary, xxvii Copper	--is there a reason Cu is enhanced upstream, that could be stated briefly?	
4	Executive Summary, p. xxviii, Tritium	Because of public concern with Tritium leaving the Hanford Reservation, more information would be helpful. Later the radiation Dose Conversion Factor will be set to zero for soil, sediment and boating and to E-11 for ingestion, inhalation, and sweat lodge (I-5.56). Does tritium disintegration have such low energy that it has no effect? If it can't penetrate skin, I could understand the 0 for external exposure. However, once in the body, a low energy source could potentially release a lot of energy in a limited area. If this is not the case for tritium, it needs to be explained.	
8	Executive Summary, p. xxix, under zinc	The statement "...the median relative ratio to the upstream value..." is extremely unclear. What are the authors trying to say?	
5	Executive Summary, p. xxix, 12th line from bottom	Replace "identify" with "indicate that"	
2	Executive Summary, pp. xx-xxiv, Table S1	Table S1 contains important information, but without a good deal more explanation, the non-technical reader will just go glassy-eyed. The first problem is that there's little discussion of what a hazard index is (there's some in para. 2 on page xix) but not enough for the lay reader to be able to read this table. Isn't there some way to make this more understandable. Even in the main body of the technical material you've taken time in one of the side bars to do a little more explaining. Complicating the whole thing is the use of scientific notation. Even if the reader thought he/she might understand it, to suddenly get hit with "8.46E-06" is a real jolt. Also, the fact that there is no legend until the last page is bothersome. Put a legend on each page.	

2	Executive Summary, p. xxix, last two paragraphs	Quite good. The big question people are left with when reading this is whether people or critters are in risk. This addresses that head on. The only question that seems to remain is the context for this risk. How does it stack up with other risks in life? It would be nice to provide some broader context. On the other hand, from a risk communication perspective, it's important not to appear to be minimizing the risk.	
11	Executive Summary, p. xxx, paragraph 1	This paragraph could be improved. Scientific uncertainty is composed of two types of uncertainty, lack of knowledge and variability. I believe you are referring to lack of knowledge about reparion ecosystems. Please be more specific to help reader.	
5	Executive Summary, p. xxx, 4th line down	This refers to locations of highest contamination. It would seem important, if possible, to indicate how extensive, relative to the entire Hanford reach, these locations of highest contamination are. This may be a subject for future work, but can anything, at least qualitative, be said for now?	
11	Executive Summary, p. xxx, paragraph 3, last line	The word "may" should be removed and the word "thus" should be inserted.	
2	Executive Summary, p. xxxii, Part II, 1st para.	This section also suffers greatly from just being a cut and paste from the longer section. Start the section by reminding people what the difference is between a screening assessment and a comprehensive assessment, so they realize we've really moved on to a whole new thing.	
2	Executive Summary, p. xxxii, Part II, 2nd para.	This was either written by lawyers, a committee, or maybe even a committee of lawyers. Are you saying; "Although DOE staff were participants in meetings where these recommendations were prepared, DOE management is still reviewing these recommendations and preparing a DOE plan. These recommendations are included here as a public service, so readers will know what is being discussed."	
5	Executive Summary, p. xxxii, 4th para.	I don't quite follow how this is a "composite" assessment, in the sense that the net impacts from all contaminants in combination would be required. I doubt that the scientific basis for all the combined effects is sufficient to do this.	

2	Executive Summary, p. xxxii, Part II, general	Perhaps, because it's being published on behalf of the CRCIA team, you can't touch this. Otherwise the comments above about Executive Summaries apply here as well. It needs a re-write to be a stand-alone document.	
5	Executive Summary, p. xxxiii, 2nd para.	Meaning of "assessment down-to-size" is not clear. On line 6 of this para., insert "that" after "requires"	
11	Executive Summary, p. xxxiii, para. 3	Great! Recognition that this is a "living document." Can you define how changes and updates would be incorporated?	
5	Executive Summary, p. xxxiv, 3rd para.	The meaning of "HOW GOOD" is not clear	
11	General Editorial Suggestions	Although definitions are provided in a very good glossary attached to the document, for reader ease please include major definitions as part of the text of the executive summary. In general, the section entitled "Technical Approach" site characterization was useful (pg. 1i-xc). See a few specific comments below.	
3	Glossary	Really, it seems to me that you can use a dictionary just as well as I can, and I don't understand why you didn't.	
11	Glossary	Glossary was very useful.	
5	Glossary, p. xxxvii	Should "anthropomorphic" be "anthropogenic"?	
3	Glossary, p. xxxvii	In the definition of "background level," delete the word "hazardous."	
9	Glossary, p. xxxvii	"Background level" is not the "measured level at which the concentration of a hazardous substance is consistently present in the environment that has not been influenced by LOCAL human activities." A persistent contaminant such as a PCB arochlor, or dioxin, can be found thousands of miles from local human activities, but still not be "background level." Most readers understand "background level" to mean the amounts that would be present naturally, if human activities had not taken place to produce or alter the distribution of a contaminant.	
3	Glossary, p. xxxviii	In the definition of "beta particle," delete the words "high energy."	
3	Glossary, p. xxxviii	"Concentration" usually refers to a substance dissolved in a solution. This type of definition is very well done in the *Chemical Dictionary*.	

3	Glossary, p. xxxix	When you are referring to radiation dose, call it that. The term "dose" does not automatically imply "ionizing radiation."	
3	Glossary, p. xli	Your definition of "extrapolation" is incorrect. You have actually partly defined "interpolation" (which doesn't appear in the glossaary). Extrapolation is the inference of values of a variable in an unobserved interval from values in an observed interval, or the projection of values from an observed region to an unobserved region. Interpolation is the estimation of values of a fundtion between known values. Both are mathematical terms and have nothing to do with media, location, etc. Please correct this.	
5	Glossary, p. xli	I don't buy the definition of the geometric standard deviation	
3	Glossary, p. xli	The definition of "gross beta" should read "total beta activity of beta-emitting..."	
3	Glossary, p. xliii	LOEL is the lowest observed effect level (not "effective"). Please correct this -- it is responsible for some errors further on in the manuscript.	
5	Glossary, p. xliii	I also don't buy the definition of : mean (geometric)	
3	Glossary, p. xliv	"Order of magnitude" is defined as a "multiplying factor" of 10, not an "order" of 10.	
8	Glossary, p. xlv, under predator fish	The description of first-order and second order predator fish is confusing. According to the definition (as written) first-order fish are also second-order fish since they "consume other fish". Is this statement correct?;	
3	Glossary, pp. xlv-xlvi	"Proton," "rad," "rem" are all defined too vaguely. A proton has a mass of 1 amu in addition to a +1 charge; one rad is an absorbed energy of one erg per gram of absorber; one rem is the amount of ionizing radiation that does biological damage equivalent to one rad of gammas. "Alpha," "gamma," and "neutron" are for some obscure reason not defined at all. You should in any case be using (and defining) the standard international (SI) units.	
9	Glossary, p. xlvi	Why was a more informative definition of rem not given, when it was specifically requested? A suggested definition (p. 39 of *Closing the Circle on the Splitting of the Atom*, Department of Enery) was even suggested.	
3	Glossary, p. xlvii	"Sensitivity" is the capacity of an organ or organism to respond to stimulation.	
3	Glossary, p. xlviii	"Source term" is the mathematical formulation of the quantity of hazardous and/or radiactive substance whose migration through the environment is being modeled. It is the source term of the model. In a repository, for instance, it is completely different from the amount released. This confusion could result in some very damaging misinformation.	

3	Glossary, p. xlviii	The word "surrogate" means "substitute."	
11	Site Char., p. 1i	Site characterization - In general, this section entitled Site Characterization was useful (pgs. 1i-1xc). See a few specific comments below.	
4	Site Char., p. lxiii, Fig. 3	Could arrows be added to indicate where the seeps and springs are? This map should make it obvious where the potential flows are from areas of high contamination to the Columbia River. Do the mountains block migration from the 200 areas north and south, but leave the east open as a potential direction of movement?	
11	Site Char., p. 1xiv, para. 1	Statement is made that the unconfined aquifer will approach pre-Hanford site conditions. What assumptions about future land use is this making? Is this true if increased agriculture activities occur?	
11	Site Char., p. 1xix, para. 4	Was ground water used in this fish rearing activity?	
11	Site Char., p. 1xxii, para. 1	It was informative to learn that 87 lbs. of chromium was removed, however, this figure needs context. Is this approximately 1/10th total, 1/2? Please add. Also add reference if known.	
11	Site Char., p. 1xxii, para. 4, last line	Why does this sentence say "... volume of only 790 million liters....?" This seems like a very large amount where only seems inadequate.	
11	Site Char., p. 1xxv, para. 4	Statement is made that environmental monitoring was used to compare model with the actual releases. No indication of results. Were levels detected the same as model results? Don't just say "all results are published...", provide some clues.	
4	Site Char., p. lxxxi, Fig. 5	The map is good, but retaining the shading for Rattlesnake Hills, Gable Mountain and Gable Butte in subsequent maps causes problems (details below).	
4	Site Char., p. lxxxiii, Fig. 6	The map is good, but the shading of the mountains (consistent with Fig. 5), makes the greatest visual impact. It would be more useful if the mountains were less obvious, and used different levels of shading for the areas within an isopleth. Then the 2,000,000 area in 200-West would be more easily distinguished from the areas of lesser contamination. The units (pCi/L) should be explained in the graphic, or in the legend because this Fig. is likely to be reproduced and published without text. Also, there appears to be a path of tritium to the Columbia River at area 300; this is probably an artifact of the isopleths forming a "funnel".	

4	Site Char., p. lxxxiv, Fig. 7	Same problem with mountains being the most obvious feature of the map. At these concentrations of Nitrate, I would expect eutrophication to be a problem. If dilution prevents that, it would be useful to state it. I would expect the seeps with nitrate or phosphate to be green with algae.	
4	Site Char., p. lix, Fig. 2 and pp. lxxviii -lxxxvi	Among the various maps in the executive summary are the seeps shown? Are the "Old Hanford Townsite Springs" and the 300 area springs, the locations where ground water is entering the Columbia River? Is Fig. 4 the best indicator of springs--where they exist they are sampled (triangles in map.)? Fig. 2 shows some other springs (100 B/C, 100K, 100-N, 100H). Since this report emphasizes the Columbia River, it would be useful to be clear on these.	
4	Site Char., pp. lxxii-lxxiii	Does "Liquid Effluent Retention Facility" = tanks, single and double walled? The leaking tanks that have been in the news are described as being in the 200 area, but I found the only a mention of "large underground storage tanks" in the first paragraph.	
4	Site Char., pp. lxxiii - lxxiv	The discussion reads as if, in spite of attempting to stop or slow the migration of materials to the Columbia River (pump and treat), this will be a long term problem. Is that impression correct?	
11	Site Char., p. lvii, para. 2	River Flow rate?	
4	Site Char., p. xviii, Fig S.1	It would be more effective if this were in color, or if one Fig. showed human, another ecological, and another the overlap. I didn't understand this graphic until I saw the colored graphics on p. 4.22	
2	Section 1.0, p. I-1.1, icon	I like the use of icons -- in fact, generally this report is much more visually interesting than previous reports -- but is this really the icon you want to use? You're reinforcing two of people's biggest fear factors, nuclear and chemical. If you could just work in genetic engineering as well, you could have the top three all at once.	

7	Section 1.0, p. I-1.1	Introduction: The over-arching objective of the screening assessment described in this report is to "support decisions on Interim Remedial Measures" (e.g. page xi and page I-1.1). It is not clear, based on the discussions included in the Draft Screening Assessment, what specific decisions these would be or specifically how the results of the screening assessment might be incorporated into these decisions. Additional discussions would be useful to identify the types of interim remedial measures that might be affected by the results of the screening assessment and to describe how these results would be included in the decision making process. Are there ongoing or anticipated remedial measures that will be impacted by the screening assessment? If nothing more, a couple of examples might be useful to illustrate typical decisions and the decision making process. This should be discussed in the Introduction.	
4	General, and p. I-1.1	The use of the word "Contaminant" doesn't make clear if materials "stored" in unlined trenches, etc. are included.	
6	Section 1.1, p. 1.1	From the Document: "The Hanford Reach of the Columbia River was evaluated in the screening assessment in a way that will be useful in the CERCLA process but not necessarily in strict accordance with CERCLA procedures (for example, risk assessment methodology and remedial decision making)." The CERCLA methodology is derived directly from the National Research Council Report, *Risk Assessment in the Federal Government: Managing the Process* (1). This report outlines the paradigm to which all US government sponsored risk evaluations should conform. The PNNL evaluation is flawed in that it does not follow the guidance of the National Academy of Sciences and DOE has abrogated its responsibility in this regard. The CRCIA lacks the reliability needed for decision-making.	

6	Section 1.2, p. I-1.2, para. 1	This paragraph correctly assesses the limitation of the input data. From the Document: "The limitations of the CRCIA screening assessment were that it was restricted to ...4) limited amount of monitoring data, 5) a limited number of species and 6) a limited number of scenarios." However, to list together limited input data and numbers of scenarios as limitations is somewhat of an oxymoron. It is evidence of a fundamental misconception that is woven into the fabric of the document. A high level of sophistication)the large number of scenarios and pathways considered) can only be achieved with very sophisticated input data. This is not the CRCIA context. The CRCIA fails to demonstrate an understanding that the more comprehensive the evaluation, i.e. the more media modeling, the more scenario considered, the more uncertain the evaluation becomes. When an assessor is forced to make a value judgment in the face of limited data, reliability is reduced. Thus, the trade-off for increased comprehension is decreased reliability of the risk evaluation. The effort to bound the uncertainty is flawed. The lack of **reliability** in this product limits its usefulness as a decision-making tool.	
6	Section 1.2, p. I-1.2, para. 3	Toxicity is relative to dose. This concept is misrepresented through out the document. It is a unsupported value judgment to list zinc, phosphates, copper, chromium, and nickel as toxic chemicals. (Look on the label of your daily multi-vitamin. Some of these are essential for (healthy) life!) This statement should be qualified to project the understanding that *dose* makes the difference between an life essential element and a toxin. As it is, it misleads the public.	
6	Section 1.2, p. I-1.4, para. 1 and Section 5.1	It is an unconscionable misleading of the public to suggest that the risk between these exposure scenarios can be distinguished. This reviewer sees this as a fundamental flaw in the screening assessment. Risk evaluation relies on the dose-response relationships. The dose-response data used to evaluate toxicities of many of the agents listed as contaminates are from rodent studies. The uncertainties in extrapolating between humans and rodents results in a risk evaluation that lacks the precision to distinguish such explicit differences of human exposure. The process of establishing the bounds of uncertainty appears to be flawed.	

6	Section 1.3, p. I-1.4, para. 5	Document: "..assurance that the preponderance of the risk addressed for humans was either acute toxicity or long-term carcinogenicity and for other species..." This is likely an incorrect or misleading statement. Acute toxicity is a measure of toxicity from short term exposure. EPA reference doses and reference concentrations, are based on life-time (chronic) exposures.	
8	Section 1.3, p. I-1.5, first para.	In this paragraph three categories of contaminants are defined. Carcinogenic chemicals are identified as chemicals with "cancer causing agents". Toxic chemicals are identified as those with a poisonous agent. Lastly, radionuclides are identified as "radioactive isotopes". In the interest of balance, you should identify radionuclides as "radioactive isotopes which have cancer inducing properties". After all, EPA has identified radionuclides as proven human carcinogens. And, if you don't identify radionuclides as cancer causing, then someone might accuse you of having a pro-nuclear bias in the way you are analyzing things.	
11	Section 1.3, p. I-1.5, para. 1, lines 2-3	What does the sentence "Toxic chemicals are those with a poisonous agent," refer to? This needs to be rewritten.	
6	Section 1.3, p. I-1.5, para. 1 and Section 2.0, p. I-2.1, para. 3	Document: "Carcinogenic chemicals are those with a cancer causing or promoting agent. Toxic chemicals are those with a poisonous agent." These paragraphs evidences a fundamental misunderstanding of the toxicological concept of dose-response and what is meant by agent.	
6	Section 1.3, p. I-1.5, para. 2	Document: "The estimates for radionuclides are reported as the risk of cancer fatality" This is a misstatement that misleads the public by overstatement. The estimate is of the probability for an *increased incidence* of cancer due to exposure. This is explained better elsewhere in the document but needs to be addressed here.	

3	Section 1.3, p. I-1.5, par. 2	Cancers associated with ionizing radiation exposure are no more nor less likely to be fatal than other cancers. In fact, most of what EPA calls "carcinogenic" chemicals are probable rather than known human carcinogens. We don't in fact know if any of them are human carcinogens, or in what doses (nor do we k now the dose/carcinogenic response for ionizing radiation either, for that matter). If you are making assumptions, state them and provide a reference from the published open literature. Furthermore, data for cancer incidence is very poor and incomplete, and I don't believe that's what was used anyway, nor was "fatality" used. Carcinogenicity is reported as risk of latent cancer fatalities (fatalities depend on treatment and other factors anyway) for all carcinogens, and I think that's what you probably used. I believe this paragraph is at best confuding and misleading and at worst, doesn't describe accurately the risk factors you really used. If you really used incidence, where did you get data?	
11	Section 1.3, p. I-1.5, para. 2, line 4	Insert word "exposure" before "dose has been estimated."	
6	Section 1.3, p. I-1.5, para. 3	The use of surrogating and extrapolation rules to approximate contamination levels. The use of surrogates is a poorly accepted practice. There are only a few situation were it should be considered. There is no explanation that allows the reviewer to determine the appropriateness of the surrogating and extrapolation rules. Again the uncertainty that these practices introduce is very large (and can not be quantified) further decreasing the reliability of the risk assessment.	
3	Section 1.3, p. I-1.5, par. 4	What "surrogation rules"? Where described? By what published authority? I read further where surrogates were used (meaning "substitutes") but not by what "rules." How were these different factors normalizeed? The described use of data departs so radically from ordinary accepted scientific procedure that it needs considerably better justification.	
6	Section 1.3, p. I-1.5, para. 6	Document: "Computational models were developed for all of the ecological species and human scenarios. A computational model is the tool used to produce quantitative results. It includes the algorithms and input data implemented on a computer to produce a solution. The computerized models and their parameters are described....The models were tested and verified prior to their use." Verification of the models can not be done to the extent that the models were used. This statement boarders on the outrageous.	

3	Section 1.3, p. I-1.6, box	Stochastic calculations like those you describe re usually done to incorporate incertainty in probabilistic analyses. If a stochastic analysis is done (as you describe), the sampled parameters must be demonstrably independent, or else parameters dependent on each other must be appropriately coupled. There is no evidence throughout the document that either circumstance was ensured. If this is not done appropriately, results of stochastic calculations can be unrealistic, absurd, and physically impossible.	
6	Section 1.3, p. I-1.6, para. 3	This paragraph suggests that the comments of the technical peer reviewers were considered in preparing the screening assessment. The paragraph suggest that the some resolution was achieved between the authors and the reviewers. With regard to this reviewer, this is not the case. No resolution was reached regarding the comments listed above.	
3	Section 1.3, p. I-1.7, box	If your readers need an explanation for 10^9, they are not going to understand the rest of the document either.	
2	Section 1.3, p. I-1.7, sidebar	This side bar is needed in the Executive Summary to explain how to read Table S1 -- although I'd still prefer you didn't use scientific notation in the Executive Summary.	
6	Section 2.0	The Exposure assumption are unreasonable. Particularly the suggestion that people might eat 9.7 ounces of fish each day of the year, that 100% of the deposited agent is translocated to edible portions of the plant, that 6 liters of water will be ingest per day.	
9	General, Section 2.0	A table is needed, in the text, showing which screening information (e.g., embryonic/juvenile fish toxicity; aquatic biota threshold toxicity) were missing for each of the 73 contaminants detected in the Columbia River and groundwater, and the 86 contaminants detected in soil and sediment (though many of these would be the same). This would help general readers understand the degree to which absence of information may have played a role in a contaminant not being included in the list of contaminants of concern.	
9	General, Section 2.0	Wouldn't bioccumulation be more relevant than bioconcentration for the purposes of screening, because it incorporates both bioconcentration and the accumulation of a substance through the food chain? Why was bioaccumulation not employed?	
3	Section 2.0, p. I-2.1, para. 1	This paragraph is hopelessly confusing, Which data sources were used, and for what?	

7	Section 2.0, p. I-2.1, para. 2	I stumbled a bit with the sentence related to "filtering" versus the "screening assessment." Some word other that filtering might be less confusing. The last sentence in this paragraph suggests there are locations or areas with groundwater contamination that have not been considered in the screening assessment because of the approach used to identify the contaminants for the screening assessment. If the same scope that was used to conduct the screening assessment had also been used to identify the contaminants, would the results have been substantively different? A statement about this would be useful. It is not discussed until the end of the chapter how the scores and rankings are actually used. I found myself reading the sections on how the scores are calculated without really knowing how these would ultimately be used. I recommend a paragraph on page I-2.1 that describes the general approach used to identify contaminants. The reasons for calculating scores and rankings should be described. This paragraph should also describe the idea of trying to develop lists of contaminants that are responsible for 99% of the relative risk for each medium so that the reader has some appreciation on how the scores and rankings will be used.	
11	Section 2.1.1-2.1.7, pp. I-2.3-2.14	Excellent list of references. Thanks for providing an annotated bibliography.	
3	Section 2.1.1, p. I-2.3, Dirkes reference	Tritium, as well as some other radionuclides, enter surface waters from atmospheric fallout, and this source has got to be differentiated from Hanford effluent sources. This reference is the first mention of tritium, and apparently does not differentiate. Without such differentiation, discussion of tritium contamination is meaningless.	
3	Section 2.1.1, p. I-2.7, Wells reference	What is "artificial radioactivity?" How is it distinct from any other kind? Moreover, there is plenty of real peer reviewed literature on health effects of ionizing radiation (e.g.*health effects of Low-Level Ionizing Radiation (BEIR V)*, issued by the National Research Council Committee on the Biological Effects of Ionizing Radiation). I doubt very much if WDOE reports are adequately peer reviewed and could withstand the critical scrutiny of real publications. Why didn't you use something like BEIR V?	
3	Section 2.1.7, p. I-2.12	My experience with USDOE environmental impact assessments and EIS documents indicates that they are not good data sources.	

11	Section 2.2.2, p. I-2.15, para. 2, lines 1-2	When non-detects occurred, please give detection level.	
10	Section 2.2.3, p. I-2.18, Table 2.2	The concentration for diesel must be an error or the sampling of diesel product in the soils of the 100N Area have avoided the analyzing the soils saturated with free diesel product. Page I-2.18 (Table 2.2) reports a maximum of 2,800,000 ug/Kg in soil. Soils with free product would typically exhibit 10 to 100 times this concentration, as reflected in the concentration of total petroleum hydrocarbons in soil. Page I-2.6 describes 45 cm of free product in the 100N monitoring wells.	
10	Section 2.2.3, pp. I-2.16, I-2.17, and I-2.19; Tables 2.1 and 2.3	Groundwater at the Hanford site contains several chlorinated solvents, notably, PCE, TCE and DCE in concentrations above MCLs. Vinyl chloride is not listed and is a very toxic degradation product of the others. I suspect one reason VC is not listed is because it is frequently analyzed at the Hanford site with detection limits well in excess of MCLs. I recommend that situations like inappropriate detection limits are scrutinized carefully when screening contaminants out of further consideration in the risk assessment. The lessons learned from the risk assessment should be translated back to the parties responsible for monitoring and analysis of groundwater.	
3	Section 2.3, p. I-2.16 to I-2.17, Table 2.1	Were detection methods for these substances the same? If not (and I suspect they weren't) how were the results normalized? Over what time periods was each datum collected? What is the point of listing maximum concentrations? What is the signifcance of such maxima?	
3	Section 2.3, p.I-2.19, Table 2.3	The data were taken over a period of 14 years. When did the maxima occur? Where? How did plume concentration shange with time? Which of the radionuclides listed are also found in atmospheric fallout? How did fallout concentrations change with time?	
7	Section 2.3, p. I-2.15 to I-2.42	Although not explicitly stated, it appears from the information provided in Table A.3 in Appendix I-A that the fraction of organic carbon was assumed to be equal to 0.013. To the best of my knowledge, no reference is given for this value.	

3	Section 2.3, p. I-2.20 to 2.43	1. Since the screening methodsand equations are analogous to each other, it would have been less confusing to present one set of equations and a table showing what the different variables were for the different screenings. 2. Why are neither radiological half-life nor physiological half-life considered? Radiological half life may not make a difference for uranium, but certainly does for tritium. 3. No specific references are given for the constants used (e.g., in the equation in Sec. 2.3.1.1). 4. Does "sum of all scores" mean for that type of contaminant or for all contaminants? 5. For a particular contaminant, either use TLM or LC_{50}. If both are used, you are double-counting.	
11	Section 2.3.1	Definition of slope factors should indicate that slope factor is derived from upper 95% confidence limit not maximum likelihood estimate (MLE). As this section is now written, it sounds like MLE. Please clarify.	
5	Section 2.3.1, p. I-2.20, 5th line from bottom	Briefly explain here the difference between "threshold toxicity" and "toxicity to fish"	
6	Section 2.3.1.1, p. I-2.22, para. 1	External Exposure : I have made issue of the significance of assumption underlying external exposure assessment. There must be included an explanation of the geometry of radiation source for external exposure and an estimate of the range of exposure when other geometries are assumed.	
3	Section 2.3.1.2, p. I-2.22-2.23	Do you seriously think that 0.6 lb of fish average per day is a realistic diet? This is typical of the repeated statements that excessive "conservatism" overestimates were used. Not only is this not realistic, it verges on the ridiculous. How is one to judge a result obtained from multiple excessive overestimates?	
11	Section 2.3.1.3, Pg. I-2.23	For clarity, shouldn't the value 12.6 and 4.02 be separately listed in equations, footnotes, so all can follow.	
1	Section 2.3.1.4	The Water Quality Criterion used is not specified. Was the freshwater chronic criterion used?	
1	Section 2.3.1.5	Define TLM clearly. TLM traditionally in aquatic tox. meant median lethal tolerance and was equivalent to an LC50.	
1	Section 2.3.1.7	What is meant by developmental effects? What test endpoints were used?	

9	Section 2.3.1.7, p. I-2.25	What does "Only a few positive connections between research on fish egg survival and contaminant concentrations were found," mean? Do you mean you found only a few examples of research EXAMINING fish egg survival and contaminant concentrations? Or that in research on fish egg survival and contaminant concentrations, only a few positive relationships were found? I suspect the former. Please state this more clearly.	
9	Section 2.3.1.7, p. I-2.25	Fish egg survival is not "developmental effects." It is a mortality effect, and should not be given the larger title of "developmental effects." Field studies are needed of the developmental condition of aquatic and riparian-dependent wildlife in the Hanford Reach. Likewise, laboratory studies of such wildlife immersed or exposed to Hanford Reach contaminated waters need to be undertaken.	
9	Section 2.3.2.4, p. I-2.29	What do you mean when you say, "While some effective dilution factor was required to find the actual risk..."? How do you know what the "actual" risk is, when this is only being estimated? What does it mean, "...some effective dilution factor was required..."? See also I-2.30; 2.3.2.5.	
9	Section 2.3.2.6, p. I-2.30	Is the "implicit assumption" that ranking for aquatic biota threshold toxicity and ranking for aquatic biota LC_{50} should be similar necessarily correct?	
5	Section 2.3.2.8, p. I-2.32, line 2	The assumptions or considerations used for EE would be good to know. This is potentially a very complex problem.	
1	Section 2.3.3.7	This does not make sense. If equation 23 was used, how was groundwater rising through gravel related to sediment concentrations?	
1	Section 2.3.3.8	Rad. exposure of fish is related only to internal dose. Why was external dose ignored?	
2	Section 2.4, p. I-2.43, sidebar	Love those sidebars. But in this case think just saying "the screens showed" assumes that the non-technical reader will remember what screens are. I think it might be clearer with "our screening process showed."	
9	Section 2.4, p. I-2.43	Conservatism of screening cannot be assumed. For instance, in Table 4.23 (p. I-4.47), regarding validation results for modeled exposures of non-human species, as many modeled transfer factors were underestimated as were overestimated.	

7	Section 2.4, p. I-2.43 to 2.47, Tables 2.4 through 2.11	Given that the objective of the risk assessment is to provide input into decisions related to remedial activities at the site, it may be useful to provide additional information in Tables 2.4 through 2.11 that give a sense of how much each constituent contributes to the overall relative risk. For example, in Table 2.4 there are apparently four constituents that contribute 99% of the relative risk (cesium, iodine, and two uranium isotopes). It may be useful to know if cesium is 98% of the relative risk, or 26% of the relative risk. In either case, the relative ranking could be the same.	
1	Section 2.4, pp. I-2.44 to I-2.47, Tables 2.5, 2.7, 2.7, 2.11	Why are toxicity thresholds higher than LC50s for several chemicals?	
9	Section 2.4.1, I-2.43	In the absence of data for some screening elements, you cannot know that you accounted for "over 99 percent of the relative risk." You are only estimating risk; you are not determining risk.	
5	Section 2.4.1, p. I-2.43, 3rd line from bottom	This sentence is not clear in its meaning. Needs further explanation here.	
9	Section 2.4.3, p. I-2.45	The fast-flowing nature of the river means that cotaminated sediment will spread farther downstream, more quickly, than if the river were slower. Would this indicate that sediment sampling should highlight areas in which the flow slows, downstream?	
1	Section 2.4.5, para. 1, p. I-2.47	How were "naturally-occurring background levels" defined? Surely not by concentrations immediately upstream of Hanford.	
11	Section 2.4.5, p. I-2.48, para. 2 to 4	Good discussion of possibly questionable results.	
3	Section 2.7.1, p. I-2.52	No rate of movement of plumes is given. What, for example, does "much more slowly" mean?	
11	Section 2.7.1, p. I-2.52, para. 4, lines 3-4	Is this statement still true given recent findings of contamination under tanks?	

9	Section 2.8, p. I-2.56-57	Carbon tetrachloride, fluoride, chloroform, and plutonium should not be eliminated from the list of contaminants of concern, because they occur with technetium-99 and tritium in the 200 Areas. Cleanup for technetium-99 and tritium would likely help with cleanup of these other contaminants. The mixture of these could be problematic in ways you have not examined at all, because this is a single-chemical risk assessment. Maps need to be produced of plumes, showing the multiplicity of contaminants in each plume. That will help yield useful studies of how wildlife integrate these contaminants; which in turn will help yield clues to how humans are integrating these contaminants.	
9	Section 2.8, p. I-2.57; Plutonium	On p. I-2.57, it says that plutonium was "undetectable in surface or groundwater" near the Columbia River, but Table 2.1 (I-2.16) indicates that plutonium 238 was found at concentrations of .01 pCi/L in groundwater near the Columbia River and plutonium 239/240 at concentrations of .03 pCi/L. Am I misunderstanding something here? Is it present in any biota downstream of Hanford? Biota would be able to tell you if plutonium is truly "undetectable" in surface or groundwater near the Columbia River.	
9	Section 2.8, p. I-2.57; Plutonium	Reference is made to Table A.1 in Appendix I-A. I do not see a Table A.1 in Appendix I-A.	
9	Section 2.8, p. I-2.57; technetium-99	The text indicates that technetium-99 technically could be eliminated from the list of contaminants of concerns because "the groundwater concentrations are highest in the 200 Areas, as yet far from the Columbia River." However, on p. I-4.79, we learn that technetium-99 is one of seven substances driving the risk to some plants, herbivores, and/or omnivores consuming riverine organisms. On p. I-5.108 (Table 5.19), technetium is seen as one of the contaminants providing maximum risk in the the Native American Subsistence Scenario. How does the statement regarding near-elimination of technetium-99 as a contaminant of concern match up with the evidence that technetium-99 is one of a relatively short list of substances that are driving the risk to plants and animals?	

9	Section 2.8, p. I-2.57	The statement is made that technetium-99 could be eliminated from the list of contaminants of concerns, given that the "groundwater concentrations of [technetium-99 is] highest in the 200 Areas, as yet far from the Columbia River." However, technetium has been found at 2,270 pCi/L in groundwater near the Columbia River (Table 2.1; I-2.16), while "background" is 0.02 pCi/L. What is the reasoning here?	
9	Section 2.8, p. I-2.57; Trichlor-ethylene	The text is not clear why TCE, at 24.1 ug/l was not identified as a high priority pollutant. The sentence, "With the focus of the initial phase on contaminants of current potential risk and because the concentrations in the 200 Areas are essentially the same as those near the river, this contaminant was eliminated from evaluation in the screening risk assessment" does not seem to make sense. It is not self-evident to the reader. Please explain.	
10	Section 2.8, p. I-2.57	I am concerned that trichloroethylene did not make the list of high priority pollutants for two reasons: 1.) the groundwater concentration is several times the cleanup standard, and 2.) the degradation products of TCE are more toxic than TCE by a factors of 20 or more. With the decreased concern about TCE, I am very concerned that vinyl chloride and DCE will be ignored.	
11	Section 3.2.3, pp. I-3.5 to I-3.6, Figs. 3.2 and 3.3	It was difficult for this reviewer to distinguish the original river segment boundaries on these figures. Legend needs improvement.	
7	Section 3.2.3, page I-3.6, paragraph 1	It is not clear why a different size corridor is used for groundwater. The third sentence reads "For groundwater data it was necessary to use only a portion of these data that would be relevant to estimating the contaminant concentrations entering the Columbia River from the Hanford Site." Was this truly necessary or was it a reasonable way to control the amount of data that was considered? A line or two of explanation would be useful.	
11	Section 3.2.4, p. I.3.7	Distributional assumptions. This section highlights potential problems with the data and gives several good examples. However, this section is limited as it does not give the reviewer an indication of how the study dealt with these and other similar problems. Were these isolated problems or reflections of the types of problems encountered? If the latter, then how frequently were these encountered and is this information summarized?	
8	Section 3.2.4, p. I-3.7, first para.	Did you ever statistically test any of your data sets to see if in fact a log normal distribution fit the data?	

3	Section 3.3, pp. I-3.8-3.9, Figures 3.4 through 3.7	What were the detection limits for these data?	
8	Section 3.3, p. I-3.9, first para.	The last sentence in this paragraph notes that the absence of data from the effluent pipe data system is an "identified data need". Where else is this need identified? Making a statement to the effect that the needs are tallied and presented (such as in a final table) elsewhere might reassure the reader that identified needs won't simply be lost in the bulk of this document.	
7	Section 3.3, p. I-3.9, Figures 3.6 and 3.7	How can concentrations be negative?	
8	Section 3.3.2.4, p. I-3.12, second sentence	Insert a comma between 'wells' and 'not' to improve readability.	
8	Section 3.3.2.7, p. I-3.12, first sentence	The Oregon State Department of Energy goes by the acronym ODOE, not ORDOE.	
8	Section 3.3.2.11, p. I-3.13	This text reads as a not very subtle "put down" of the Columbia River Inter Tribal Fish Commission for their lack of cooperation. The paragraph states that the Commission was "contacted several times in August for input" and appropriate staff were unavailable. For all the reading public knows this contact may have been limited to several phone calls on the same day the office was closed. If the data were important, why was attempted contact limited to a single month? Perhaps the simplest solution is to revise the section to simply state that data were unavailable.	
3	Section 3.3.4.1, pp. I-3.16 to I-3.17	A reference to a QA plan or program is needed for this section. "Standard laboratory procedures" isn't specific enough.	
11	Section 3.3.4.1, p. I-3.16 -3.17	Data Quality. Minimal information on data quality is given.	
3	Section 3.4.2	1. Were filtered and unfiltered data mixed? 2. How in the world could "U" data be used in determining stochastic paraameters?	
11	Section 3.3.4.3, p. I-3.17	Raw Data files. The statement is made that estimated fields in the databases are not available in the raw data provided in Appendix A (Vol. II). Are these explained elsewhere? Need to show to improve transparency of process.	

11	Section 3.3.4.3, pp. I-3.18 to I-3.21, Table 3.3	Information on lack of data to analyze must get incorporated into earlier Table S.1 or Figure S.1, so non-detects are distinguished from not tested, no data.	
8	Section 3.4.2, p. I-3.29	Why aren't data evaluation conventions for radionuclides discussed at this point in the text?	
11	Section 3.4.2, p. I-3.29	It was unclear why rejected radiological analyses were retained when rejected, non-radiological data was not used.	
8	Section 3.4.2, p. I-3.29, second bullet	The practice of replacing "less than" values with half the reporting limit introduces a bias into the data, especially when you are combing multiple data sets which include the possibility of different detection limits for each data set. Has this bias been addressed in any way?	
8	Section 3.4.2, p. I-3.29, third bullet	Why were non-radiological data marked with "R" for rejected removed from the data set, but radiological analyses were retained even when marked with "R"? Is there a technical basis for this decision?	
8	Section 3.4.2, p. I-3.29, fourth bullet	Non radiological parameters with values of "U" for undetected were removed from the data set when choosing maximum values. How do undetected values differ from less than detection limit, or even "not detected" values? This data evaluation convention is confusing.	
3	Section 3.4.3, p. I-3.30, box	How can the use of a "maximum representative value" be justified? "Maximum representative" is something of an oxymoron anyway. Even an elementary statistical analysis indicates that the maximum value (90th %ile? 95th? 99th?) of a parameter is not representative. A stochastic analysis does not compensate for differences in data quality. It is a method for mathematically incorporating and expressing uncertainty.	
7	Section 3.4.3.1, . p. I-3.30	Neglecting concentrations in deeper groundwater wells is potentially non-conservative and raises suspicions. Are there data from deeper wells that give concentrations that are higher than the shallow wells? If so, where does this groundwater discharge? It would suggest off-site migration if it does not discharge into the Columbia. In my opinion, neglecting data from deeper wells is potentially an important mistake.	
8	Section 3.4.3.2, p. I-3.31, second paragraph	The Dixon test, as described in this paragraph, and illustrated in Figure 3.14 could allow the rejection of high data which are indicative of the start of an elevated release. Are there any checks /balances on the use of this approach to preclude discarding outliers which appear at the beginning or end of a sampling sequence (when the end or start of a contamination event might have occurred)?	

3	Section 3.4.3.2, p. I-3.32, par. 2	What are a "representative maximum" and a "representative median?" The median is the median.	
7	Section 3.4.3.2, pp. I-3.32 to I-3.33, Figure 3.14 and Table 3.6	This seems like a lot of outliers. Some of them seem a bit questionable. For example, why eliminate the July, 992 measurement in Segment 2, Cesium 137, Well 199-B3-47? The "outlier" in Segment 2, Sulfate, Well 199-B3-47 may be the result of a plume arriving at this location. It seems a bit questionable to ignore the latest observed value because it is high. This occurs at several other wells, including 199-K-30 (copper and ammonia), and 199-K-13. No mention is made if any "low" outliers were eliminated. Were there instances like this?	
9	Section 3.4.3.2, p. I-3.33-41; Table 3.6	Numerous outliers of particular contaminants were eliminated in any one river segment (e.g., four chromium outliers in River Segment 4; ten of cyanide in River Segment 4). It would seem prudent to re-sample the same sites in the river segment, and see if any of these eliminated amounts could be found.	
8	Section 3.4.3.2, p. I-3.42, first paragraph	The statement that "the stochastic process requires that attention be focused on best-estimate parameter values rather than conservative values" is incorrect. The whole idea behind the stochastic process is that you are able to sample across the entire probability distribution of several parameters to ultimately develop an output distribution as your product. The regulators can then pick whatever percentile they feel most comfortable with: 50%, 95%, 99% in setting their risk limiting criteria.	
7	Section 3.4.3.2, page I-3.42, para. 1	How many measurements were used to calculate medians for data that had a trend? The discussion indicates that the "most recent" measurements were used, but it doesn't say how many of these measurements were used.	
8	Section 3.4.3.2, p. I-3.42, fourth paragraph	Why, for non trending data, are you using the median well value to derive the parameter distribution. Why not simply use all the well data to derive the probability density function for wells?	
8	Section 3.4.3.2, p. I-3.43, first para.	Define the "inverse normal statistic" for readers unfamiliar with the term.	
8	Section 3.4.3.2, p. I-3.43, third paragraph	See comment for page I-3.29, fourth bullet. An explanation of what "undetected" versus "not detected" and "less than detection limit" might help unconfuse the reader.	

8	Section 3.4.3.2, p. I-3.43, third paragraph	The third paragraph gives an example of a fitting process used to "estimate" data previously reported as undetected. Is there a practical lower limit to the number of positive data points required to estimate values below the "undetected" threshold? For example if you had twenty samples, 18 as undetected, would you draw a line with the two "positive" results and make estimated values for the remaining 18? Some people might consider this as making up numbers to show an impact where none is considered to exist.	
8	Section 3.4.3.2, p. I-3.43, fourth para., second sentence).	This sentence is unclear. What are "data over space with high local concentrations"?	
8	Section 3.4.4, p. I-3.44, second para.	The statement that "external radiation media" within a segment cannot be easily pinpointed, is incorrect. The sampling location for a radiation dosimeter is an exact point in space and the locations are not often relocated. The dosimeter measures radiation emitted over a wide area, much like a well sample draws contaminants from some region around the well head when a sample is pumped out.	
2	Section 3.5, p. I-3.51, sidebar	Why was it OK to substitute data for missing seep and surface water data, but not OK to do the same for groundwater or sediment data? Without an explanation, it sounds arbitrary.	
11	Section 3.5, p. I-3.51, Sidebar	It would seem that the statistic that "of the possible 3024 data values, 1153 have no data even after the substitution," is important and should be carried into the executive summary.	
7	Chapters 4 and 5	These risk assessments are outside my area of expertise. However, I read through the chapters, and found the summary boxes generally useful. Some of these could be expanded (for example, in Sections 4.1.2.1, 4.1.2.2, 4.2.6).	
1	Section 4.x general	I still believe that there are errors in the trophic categorization of species and the results of the selection process do not make sense, but my prior comments were brushed off and the responses were acceptable to the regulators, so I will not raise those sorts of issues again.	

11	Section 4 General	Screening assessment of risk to the environment - This reviewer continues to have difficulty in accepting the extremely simplified assumptions that form the basis of this method to choose species to evaluate. For example, on page I-4.18, section 4.1.2.2.3 - an example is given for Chinook salmon versus Channel catfish. The rationale given for the scoring scheme is only the total length of time that the species remains in a potentially contaminated region versus consideration of sensitivity of that life stage. An argument could be made that the early life stages may be more sensitive therefore a species that only remains in the contaminated region at such a sensitive time would have a disproportionate risk of adverse effects from the contaminated sites that would not be reflected in a strict proportion of total life span statistic for the contaminated region. There are many other examples, some of which I highlighted in my first comments. If nothing else, at least these hidden assumptions should be delineated and impact assessed for total screening process. Also, the assumptions that are underlying the summary listed on page I-4.23-5, needs to be presented. What is the impact of these approaches?	
1	Section 4.1	This section is very repetitive of the site characterization.	
4	Section 4.1, p. I-4.1	It is useful to state, as is done here, that only direct effects are considered. It is unfortunate that the field is not developed to the point of being able to handle indirect effects.	
9	Section 4.1, p. I-4.1	Indicating that indirect effects will be addressed "if and where direct effects are found to be significant" is NOT adequate ecology. Sometimes the effects are indirect (and significant), even when direct effects are NOT necessarily recognized as significant. DDT would be an example, wherein direct effects of DDT to unwanted insects were not seen as asignificant, but the indirect effects on bald eagles were significant. This is why field data are so important, and why the lack of literature review of field data or generation of field data on the condition of the wildlife and vegetation of the Hanford reservation is a fundamental shortcoming of single-chemical, threshold/mortality risk assessment and this assessment so far. If the subsequent and more comprehensive risk assessment simply evaluates, as noted, "1) a larger segment of the Columbia River, 2) hazards posed by past, present, and future contaminant fluxes, and 3) a larger number of selected species," this shortcoming will not be addressed.	

4	Section 4.1.1, (General)	The ecological section is particularly well done. The boxes are very useful in explaining ecological terms to the lay reader.	
1	Section 4.1.2	If microbial populations were excluded, what were the fungi and algae that were included?	
11	Section 4.1.2.1, p. I-4.11, Table 4.2	In the future, this reviewer would suggest adding other individuals to the panel of regular biologists developing criteria for screening study area species. Why was there not a representative from the Nature Conservancy, Sierra Club, Audubon Club? Why are all scientists either from PNNL or from government? Should this group include some public university researchers?	
1	Section 4.1.2.2.1, para. 3	If the "scores do not represent real differences in exposure" what is the point?	
1	Section 4.1.2.2.11, p.I4.24, bottom	I find the disinterest in exposure duration remarkable. You may have ranked species on the basis of acute lethality, but that does not mean that chronic exposures do not matter to the assessment.	
4	Section 4.1.2.2.12, p. I-4.28, Table 4.17 (b) bullfrog	Might another reason for not selecting the bullfrog be that it may not be native to this area? In many cases bullfrogs are nuisance, introduced species that eliminate native amphibians and fishes.	
1	Section 4.2.1, p. I-4.30	The LOEL is not equivalent to the lowest concentration producing a clinically toxic response in any member of a population. Some LOELs correspond to more than 50% mortality. This phrase makes the endpoint sound far more protective than it is. Most screening assessments use NOELs or CVs.	

9	Section 4.2.1, p. I-4.30	At no point has this risk assessment listed the types of toxicological endpoints that are widely recognized by field wildlife biologists as having been significant in the 52 species or related species (e.g., reduced yield of vegetation, chick edema, endocrine disruption, alteration of parenting behavior). Such a chart (it could be done on one page) would help put perspective on the estimation of risk or non-risk based solely on LD_{50}s or a few laboratory LOELs. On I-5.24, acknowledgment is appropriately made of the ways that the strict toxicological endpoints considered in this risk assessment do not address stresses on eco-cultural systems or overall human-eco-cultural health. By the same token, acknowledgement needs to be made of both toxicological and ecological impacts of contaminants that have been found in field studies related to the wildlife species and vegetation species of the Hanford area.	
9	Section 4.2.1, p. I-4.31	The essentially exclusive use of laboratory, single-chemical, controlled dose experiment data to determine "risk" of the contaminants is not realistic. At no point has this risk assessment reported any field data indicating multiple contaminants in any of the final 52 species. This would put perspective on the estimation of risk or non-risk based solely on single chemical by single chemical analyses.	
11	Section 4.2.1, p. I-4.31	This page uses the term "benchmark" in two ways, only 1 of which is defined. "Toxicity Benchmarks" are defined in the first paragraph and used in paragraphs 2 and 6. In contrast, paragraph 6, last 2 lines, uses benchmark to refer to "benchmark species." Please define or rename. Pg. I-4.32 goes on to use "benchmarks" to refer to a variety of toxicity endpoints including 20% reduction in growth of plants whereas the following pages use both benchmark species and toxicity benchmarks. Some of the assumptions delineated in section 4.2.1 are very conservative. For example, on page I-4.34, 4th paragraph - the form of the metal will not be considered. For chromium this is especially important due to the carcinogenicity of Cr^{+6} form.	

1	Section 4.2.1.1, p. I-4.31, para. 1	The data sets searched are inadequate. For example, PHYTOTOX does not contain data on toxicity of metals. The authors should have at least used the ORNL benchmarks data base that DOE funded for this use and the EPA OSWER threshold values. Why make the taxpayers pay for literature searches and data extraction at every site?	
9	Section 4.2.1.2, p. I-4.31	No listing of the LOEL endpoints that WERE used seems to be present in the text, and it is not present in Appendix I-D, "Measurement Endpoint Values Used in the Risk Assessment." The LOEL endpoints and surrogate species that were used for each species in the calculation of risk should be displayed in a table.	
11	Section 4.2.1.2, p. I-4.34, para. 6	The statement that when LOELs were unavailable "they were estimated using 1/15th the LC_{50}" value needs support besides just listing references. Add comment that says something like: "This approach has been used by three different groups to estimate LOELs and has been found to be in good agreement with known LOELs."	
1	Section 4.2.1.2, p. I-4.35	Why was data for the most commonly tested species used? Why not the most closely related or most sensitive species?	
8	Section 4.2.2, p. I-4.36, Figure 4.4	The reproduction of this Figure is poor quality and difficult to read.	
8	Section 4.2.2, p. I-4.37, Figure 4.5	The reproduction of this Figure is poor quality and difficult to read.	
2	Section 4.2.2, p.I-4.37, Figure 4.5	Some labels are unreadable	
1	Section 4 (general) and Section 4.2.2, p. I-4.37, Figure 4.8	This whole business of estimating all exposures as body burdens and then converting toxicity data to body burden basis does not make sense to me. For aquatic species in particular, you are needlessly compounding errors. Most aquatic exposures are almost entirely due to gill uptake or equivalent direct exposure. Even when dietary exposures are important to aquatic organisms, the effects may not be a function of total body burden (e.g., lead). Where is the science that indicates that you gain any predictive ability by resorting to models like that in Fig. 4.8?	

11	Section 4.2.4, p. I-4.40, para. 5	Finally the document initiates a discussion of uncertainty and begins the delineation of two types of uncertainty, i.e., variability versus lack of knowledge. However, these terms are not used and this very important discussion is buried. This discussion should reference an earlier discussion that clearly lays out these two types of uncertainty. There needs to be consistency across sections. Executive Summary should also clearly explain these concepts. See earlier comments on uncertainty. In the 7th paragraph, it was good to explain why the decision was made to use triangular distributions versus earlier decision to use lognormal. Add note contrasting this distributional assumption versus earlier decision.	
11	Section 4.2.5, p. I-4.42, para. 1	This reviewer was confused by this paragraph. How do these assumptions "All animals were assumed to spend their entire time at the Hanford Site within a single river study sediment," compare with assumptions in section 4.1.2.2.3 where designation of what life stages a specific origin has in contact with contaminated media. This needs explanation. If one assumption is used for screening then later changes in assumption needs to be discussed.	
3	Section 4.2.5, p. I-4.43, Table 4.21	It is not at all clear that appropriate distributions were used (would it have been so difficult to identify the parameter instead of just giving a symbol and forcing the reader to dig around in Appendix I-D?). Here are the appropriate uses (M. Tierney, *Constructing Probability Distributions* SAND90-2510, Sandia National LAbs, 1990): Normal or lognormal: whenever it is known that the parameter is the sum of independent, identicalkly distributed random variables, and enough measurements have been m,ade to estimate the mean and variance accurately. Uniform or lognormal: is knowmn about a parameter is its range. Triangular: when the range of a variable is known and the analyst believes his or her "best estimate" is the mode.	
4	Section 4.2.5, p. I-4.43, Table 4.21	Parameters should be explained here, at least the simple ones. I'm guessing that BW = Body Weight; a few minutes searching appendix I-D didn't make it obvious.	

9	Section 4.2.6, p. I-4.44;	The validation results section for exposure modeling is an excellent step to take, except that Figure 4.6 shows only mule deer and smallmouth bass. Field validation of, for instance, Figure 4.12 should be a high priority.	
9	Section 4.2.6, p. I-4.44	Have any corrections been made to the model for mercury, given that mercury was underestimated in fish?	
9	Section 4.2.6, p. I-4.44	What has been done in response to underestimation of concentrations of chromium and tritium in herbivorous mammals?	
3	Section 4.2.6, p. I-4.44	Although the overestimates of radionuclide exposures are discussed, the rationale given for them is convoluted. I reread the Tc-99 explanation several times, and I still cannot understand why exposure was overestimated by a factor of 170: TC-99 concentration in pore water was higher than in surface water, so the surface water transfer factor (geom. mean = 170) was used instead of the pore water transfer factor (geom. mean = 9)? Why? Just to get a higher number?	
4	Section 4.2.6, p. I-4.44	Validation results--the lay public will assume these estimates as being poor estimators of what was found. Underestimating by 150 times (lead) won't convince the public that these models are useful. This section was somewhat hard to understand.	
3	Section 4.2.6, p. I-4.45	As on the previous page, no rational explanation is given for overestimating U-238 concentrations. Are you consistently overestimating concentrations or exposures or each or both? **There is absolutely no excuse for overestimating "mercury...due to the lack of data above the detection limit for sediment..."**	
8	Section 4.2.6, p. I-4.45, Figure 4.6.	The reproduction of this Figure is poor quality and difficult to read. The significance of the arrows in the Figure are also unclear. Are the arrows used to indicate the literature value of the transfer factors? If so, state as such in the text and on the figure. Is the plotted line used to show the model calculations for the transfer factors? If so, state as such in the text and on the figure. Is there a technical basis for joining the data points of transfer factors for different contaminants? If not, the data should not be presented as a line graph.	
4	Section 4.2.6, p. I-4.45, Fig. 4.6	What is the meaning of the arrows?	

4	Section 4.2.6, p. I-4.47, Fig. 4.7	Again, what is the meaning of the arrows? Is strontium-90 not shown in Fig. 4.7? Is the figure stating that the sediment to mollusc transfer rates reported in the literature are 1000 for each of the metals (the bars)? For two of the metals, the molluscs seem to discriminate against the sediment (Chromium and Nickel).	
9	Section 4.2.6, p. I-4.47	The statement is made that the model met the operational criteria for favoring a conservative estimate of exposure. However, Table 4.23 indicates that there were as many underestimates of exposure as overestimates. How does this seem to indicate that conservatism was favored?	
4	Section 4.2.6, p. I-4.47, last paragraph	This text doesn't seem to agree with Table 4.23. In the table, there are 5 metals for which the model estimates were less than the references; the text states the model was adequate for all but one metal (90-Sr).	
1	Section 4.2.6, p. I-4.47, Table 4.23	I do not see that the model performed well except for Sr. According to Table 4.23, uptake of 25% of chemicals was significantly underestimated for two of the trophic groups.	
8	Section 4.2.6, p. I-4.47, Figure 4.7	The significance of the arrows in the Figure are unclear. Are the arrows used to indicate the literature value of the transfer factors? If so, state as such in the text and on the figure. Is the plotted line used to show the model calculations for the transfer factors? If so, state as such in the text and on the figure. Is there a technical basis for joining the data points of transfer factors for different contaminants? If not, the data should not be presented as a line graph.	
11	Section 4.2.7, p. I-4.50	This reviewer had problems with both of these assumptions. The first assumption needs to be referenced if any data exists to support this assumption. The argument that is made that this is a conservative assumption also needs to be documented. If my experiences with nutrients and metals and their relationship with normal development is true, then these assumptions may not be true and this approach needs to be rethought.	
8	Section 4.2.7, p. I-4.50, Figure 4.8	The reproduction of this Figure is poor quality and difficult to read. The significance of the delta in the Figure is unclear. An explanation as to why the EHQ (which from the way the Figure is presented seems to be set to 1) increases at low environmental concentrations would be beneficial to the reader.	
1	Section 4.2.7, p. I-4.51, middle	Why is it assumed that the two curves may diverge but not converge?	

11	Section 4.2.7, p. I-4.51, and Fig. 4.9	Does this graph really support assumption 2? It appears that the copper concentrations in the Northpoint area are significantly higher than segment 1 ranges.	
1	Section 4.2.8, p. I-4.54 (bottom)	How can you assume that estimating concentrations higher than seep-spring data disqualifies the method? Some measured pore water values are higher than those surrogates (p. I-4.71). Why not use site-specific Kd values rather than literature values.	
1	Section 4.2.8, p. I-4.56, Fig. 4.12	I find it hard to believe that buffleheads are being poisoned by dermal exposure to chromium. You must have a high uptake factor for those thick-skinned little feet.	
7	**Section 4.2.9, p. I-4.61, Fig. 4.13**	Figure 4.13 is very busy, especially the upper graph. Perhaps split this into two groups.	
11	Section 4.2.9, p. I-4.61, Fig. 4.13	Why did symbols for lead, mercury and strontium change from Figure a to b? Very confusing, please keep consistent with Fig. 4.14.	
1	Section 4.2.10.1, p. I-4.60, para. 1	The complexity of the model set is irrelevant. The model for exposure of any endpoint species is simple. The fact that you need 5,500 parameters for all those species should not inspire either confidence or the concern mentioned in the text.	
3	Section 4.2.9, p. I-4.61, Fig. 4.13	Terrestrial species are indicating as having exposure to 100% of the LOEL for Cs-137 and Co-60 for several river segments. LOEL is the Lowest Observed Effect Level; that is, the lowest level at which there is an observed effect. So what effect was observed? Why isn't one reported? Is the LOEL not the LOEL? Or is this the result of the consistent overestimation of exposure? As it stands, the figure contradicts reality.	
3	Section 4.2.9, p. I-4.62, Fig. 4.14	This figure shows exposure of aquatic species to Zn at 100% of the LOEL. LOEL is the Lowest Observed Effect Level; that is, the lowest level at which there is an observed effect. So what effect was observed? Why isn't one reported? Is the LOEL not the LOEL? Or is this the result of the consistent overestimation of exposure? As it stands, the figure contradicts reality.	
7	Section 4.2.10, pp. I-4.63 to I-4.68	More summary boxes would be useful to try and get the material in this section more understandable. The uncertainties are important, and I would guess that most readers would have some trouble following this section.	
11	Section 4.2.10.1, p. I-4.60, para. 2	Approximately 5,500 parameters were estimated. A note about the large number of parameters that were estimated might be informative in the executive summary.	

1	Section 4.2.10.1, p. I-4.63	Life-stage and exposure information are provided in the EPA data sets cited. The authors may not have down-loaded it.	
1	Section 4.2.10.1, p. I-4.63, 1st paragraph, last sentence	The uncertainty analysis described would not generate the "range of exposures." Rather it bounds your uncertainty concerning exposure. For example, interspecies extrapolations contribute to your uncertainty but not to the range of exposures.	
3	Section 4.4.10.1, p. I-4.63-4.64	The consistent overestimation of concentrations and exposures, while carefully explained, leads the reader to wonder what good these estimates are. They are clearly not going to be used by the public "for comparison purposes only" (comparison to what? and to what purpose?). If there is measured or observed data, and the measurements are good, it should always take precedence over estimated data. Why was that not done here?	
1	Section 4.2.10.1, p. I-4.64, Fig. 4.15	How can you say the models are conservative when 8/16 observed means were underestimated by the model means (Fig. 4.15)?	
11	Section 4.2.10.1, p. I-4.64, Fig. 4.15	This figure is very good and provides a strong basis for these estimated concentrations. In section 4 an assessment of ecological risk is undertaken. I feel very uncomfortable with the interpretation of this section. I think extreme caution should be exercised in reviewing these analyses. First of all, this assessment was modeled after the approaches used in human risk assessment where risk is evaluated for specific organisms and cross-species extrapolation is common. This may be sufficient for initial screening assessments however, this approach may lose a tremendous amount for assessing potential impacts of contamination. A key characteristic of the ecological landscape is its interrelatedness and dependency upon the maintenance of adequate resources of multiple layers of organisms. By conducting this assessment on isolated organisms and not evaluating the significance of impacts on these isolated organisms on the ecological web, we could be missing very significant impacts. This limitation must be specifically discussed in Part I and the executive summary. (Part II starts this discussion.)	
7	Section 4.2.10.1, p. I-4.65, Fig. 4.16	Figure 4.16 is not legible. The shading needs to be changed.	

11	Section 4.2.10.1, pp. I 4.65-66, para. 4	These are very important points about zinc. Unfortunately, these points were not carried forward to final summary document, executive summary.	
8	Section 4.2.10.1, p. I-4.65, Fig. 4.16	The reproduction of this Figure is poor quality and difficult to read. The significance of the blocks in the Figure is unclear. The sensitivity of exposure estimates to model input parameters is not obvious from this figure.	
11	Section 4.2.10.1, p. I-4.66, para. 2	This paragraph highlights the problems with not using the form of metals during this assessment. Refer to my earlier concerns when this approach is first proposed. Most chemical analysis conducted during the time period that you have designated would have done specification as part of the assessment. This assumption is especially problematic for chromium and mercury.	
3	Section 4.2.10.3	The proposition that "animals were assumed not to travel ..." contradicts approximately 20 years of study (the Arid Lands Ecology study) that traced the extent of the habitat of large mammals on the Hanford reservation. Moreover, the assumption that stochastic sampling, coupled with keeping an animal in a particular segment, yields about the same modeled result as accounting for the animal's movement is not good. The animal's exposure is clearly dependent on where it is (coupled parameters). Exposure calculated from the fraction of animals in a potentially high exposure area can be very different from exposure calculated from the fraction of time a particular animal spends in such an area.	
2	Section 4.2.10.4, p. I-4.69, sidebar	Love those sidebars. They go right to what people want to know!	
11	Section 4.2.10.4, p. I-4.69, para. 4	This paragraph talks about "endpoint benchmarks," introducing yet another use for "benchmarks." This is very confusing to the reader.	
11	p. I-4.69-70	This reviewer does not think that these questions have been answered by this assessment. There is no discussion on what the possible impacts of changes in these species (that have been identified as possibility being at risk) would have on the larger ecosystem.	
3	Section 4.2.11, p. I-4.70	Shouldn't the assessment properly screen out the effects due to upstream contamination?	
9	Section 4.2.11, p. I-4.72	Why would you assume that the comparisons for chromium of measured pore water maxima and surrogated pore water maxima and geometric mean surrogated pore water would hold for "other contaminants of interest"?	
11	Section 4.2.11, p. I-4.72, para. 1, line 1	This sentence should read "...exposures estimated using surrogated pond water were higher in 2/3 cases than they would have been had measured values been used."	

8	Section 4.2.11, p. I-4.74, Fig. 4.17	Plotting this data as a line graph suggests that relationships exist between adjacent species. Is there a technical basis for joining these data points? If not, the data should not be presented as a line graph.	
8	Section 4.2.11, p. I-4.75, Fig. 4.18)	Plotting this data as a line graph suggests that relationships exist between adjacent species. Is there a technical basis for joining these data points? If not, the data should not be presented as a line graph.	
8	Section 4.2.11, p. I-4.76, Fig. 4.19	This Figure is unclear. What does the $\geq 2\Sigma$ (RR) mean (last line of the figure)? What does "no porewater" mean? Does it mean no porewater data for ^{14}C was available?	
2	Section 4.2.11, p. I-4.76, Fig. 4.19	Color makes a huge difference. Can color be used for Figure S1?	
1	Section 4.2.11, p. I-4.76, Fig. 4.19 et al.	It is unclear from the text and captions whether these tables refer to concentrations relative to background or to toxic exposure levels or both.	
4	Section 4.2.11, p. I-4.76 to 82, Fig. 4.19 to 4.22 xviii	After all the detail and calculations, this graphic is a nice way to a lot of detail. In color, it is very effective. The display of this information in the Executive summary is not as effective (black and white, and complex shading).	
5	Section 4.2.11, p. I-4.77, first para.	I find it hard to believe that Cs-137 and Co-60 can be indicated as providing potentially significant doses to terrestrial organisms. What were the dose rates? What was the criterion in this case? Also, should this para. refer to Fig 4.13, not 4.14?	
1	Section 4.2.11, p. I-4.77, last para.	Table 4.29 does not address the summing of risk scores.	
9	Section 4.2.11, p. I-4.78; Figure 4.20; and p. I-4.80; Figure 4.21	There should be a validation section for toxicology, as there was for exposure. A review of field literature on any health endpoints for any of the species in Figures 4.20 and 4.21, for instance, would be interesting. For instance, what is the reproductive success of bald eagles in this area? It would have given perspective on the judgment of risk or non-risk to species. Field validation of the risk estimates in this risk assessment should be of high priority as a next step.	
1	Section 4.2.11, p. I-4.78-80, Figs. 4.20 & 21	The captions for these figures are inadequate. what do the numbers refer to?	

1	Section 4.2.11, p. I-4.78, Fig, 4.20	These results are counter-intuitive. Why would largely herbivorous birds like the coot, Canada goose, and mallard have higher risks than piscivorous and insectivorous species? Are the bioconcentration and bioaccumulation factors <1 on average? Similarly, the harvest mouse is very high even though it is largely a granivore and seeds nearly always have low contaminant levels.	
8	Section 4.2.11, p. I-4.78, Figure 4.20	Plotting this data as a line graph suggests that relationships exist between adjacent species. Is there a technical basis for joining these data points? If not, the data should not be presented as a line graph.	
1	Section 4.2.11, p. I-4.79	More counter-intuitive results. If the media contributing the most to risks are sediment and pore water, how did weasels become one of the species most at risk? Also, given that the diets of weasels and harriers are nearly the same, how did risks to harriers get to be so low? Birds are not, in general less sensitive than mammals, so differences in toxicity would not seem to explain the difference in risk.	
11	Section 4.2.11, p. I-4.79, para. 3, last 3 lines	Authors suggest that risks estimated for copper and zinc were suspect pending analysis of filtered pore water samples.	
8	Section 4.2.11, p. I-4.80, Figure 4.21	Plotting this data as a line graph suggests that relationships exist between adjacent species. Is there a technical basis for joining these data points? There presence primarily makes the graphic more confusing. If there is no technical basis, the data should not be presented as a line graph.	

3	General Comment on Chapter 5 and a primary result of the screening assessment	Chapter 5 reaches the conclusion that tribal people potentially have much greater exposure to contaminants and are at much greater risk from those contaminants than any other segment of the population. This postulate of increased risk is based on exposure scenarios constructed around the fallacy that tribal peoplewill live an essentially hunter-gatherer existence while non-tribal people will continue to live in an ordinary late-20th-century way. This produces glaring inconsistencies (e.g., that industrial exposure is comparatively low because only exposure from the river counts). Worse, it biases the entire document toward an unsubstantiated and essentially false conclusion. Now, you can't have it both ways. If we give the Hanford worker the protection of an ALARA system, OSHA, and DOE orders, and we give the fish hatchery worker his or her 1990 job description, and the ranger administers the refuge in the 1990s manner out of the Othello office, then the tribal member is not going to "spend 365 days [per year] 24 hours/day on the site for a lifetime of 70 years" and is going to be buying most of his or her food (a major exposure route) at the supermarket in Toppenish or Yakima or someplace. He or she is in fact probably going to engage in some income-producing activity, if only to pay for the gas for the car or pickup truck. Tribal people today do not spend 24 hours every day of the year foraging for food on the banks of the Columbia River in the many places where they are free to do so. If we model the future life of non-tribal people like life today, the same must be done in modeling tribal life. Indeed, the EPA in 40 CFR Part 194 has ruled that life over the next 10,000 years should be modeled like current ordinary modern life. The tribal diet may contain more fish and more well water, but will in other respects be pretty much like anyone else's diet.	

3	General Comment on Chapter 5 and a primary result of the screening assessment	If, on the other hand, the tribal member is going to be either a subsistence resident, upland hunter, or river-focused hunter and fisher as described, then the local resident who is not a tribal member is going to live that kind of life also because there won't be any other options. In such a life, no mdern conveniences will be available to anyone, tribal or not, there will be no money, no electricity, no industry, and no machinery (no cars and no gasoline). Every resident of the area will be a "subsistence resident." or hunter-gatherer of some sort and will have that kind of exposure to river contaminants. Moreover, the average life span under those circumstances, both for tribal members and others, will be far less than 70 years (no modern medicine, high infant and prenatal mortality, no antibiotics...) and no one need worry about cancer because few will live long enough to contract this essentially old-age disease. A tribal resident who drinks nothing but river and seep water is very likely to become very ill with giardiasis before there is any effect from radiation.	

3	General Comment on Chapter 5 and a primary result of the screening assessment	Either everybody lives more or less as we do now, or nobody does. Either everybody is forced to wrest a living from the land and the river, or nobody is. In this context, even the "subsistence farmer" is a fiction, albeit a 19th-century fiction rather than a hunter-gatherer fiction. So no matter which scenario is used, everybody will have roughly the same exposure from the river: a person whose diet is mostly fish from the Hanford Reach might conceivably have somewhat higher exposure, but the document has already given the average 1990s resident a diet of about 2/3 lb of Columbia River fish a day. This type of scenario construction is fallacious in another way also. If all possible scenarios are being considered, then the sum of probabilities of occurrence of all scenarios is equal to one. That is, each scenario has a less than 100% probability of occurring, and the risk attendant on each scenario is the product of the probability of that scenario occurring and the consequence of that scenario. It is fallacious to attach a scenario to a particular population unless the probability associated with that scenario is related to the fraction of the subject population living that scenario. An alternative to the scenario postulate is the postulate of an individual receiving a maximum dose (the "maximum individual" of health physics) The tribal hunter-gatherer scenario carries this maximum individual to a ridiculous extreme; the subsistence farmer is a better approximation. However, the maximum individual does not belong to a particular group and has nothing to do with lifestyle beyond diet and inhalation, and the concept applies equally to all segments of the U. S. or Washington population. It would be an egregious travesty to use these ridiculous fallacious scenarios as a basis for funding any kind of remediation, or as a basis for anything else. To prevent such a waste, the scenarios should be removed from the text and a proper "maximum individual" scenario formulated.	

6	Section 5.1 and Section 1.2, p. I-1.4, para. 1 (a repeat comment)	It is an unconscionable misleading of the public to suggest that the risk between these exposure scenarios can be distinguished. This reviewer sees this as a fundamental flaw in the screening assessment. Risk evaluation relies on the dose-response relationships. The dose-response data used to evaluate toxicities of many of the agents listed as contaminates are from rodent studies. The uncertainties in extrapolating between humans and rodents results in a risk evaluation that lacks the precision to distinguish such explicit differences of human exposure. The process of establishing the bounds of uncertainty appears to be flawed.	
4	Section 5.1 (general), p. I-5.1-5.43	This is a lot of detail on different use patterns. I assume someone required this amount of detail; it will tire most readers, and possibly anger some.	
11	Section 5.1.1, p. I.5.1, last sentence	These last 2 sentences need to be modified. All of these calculations represent potential risk. Please replace phrase "actual risk." Suggested rewording as follows: The risks estimated are potential risks if people in the near future were to start performing the activity postulated in the scenarios.	
11	Section 5.1, pp. I-5.2 to 5.3, Table 5.1	This table was useful.	
6	Section 5.1 (and subsections), p. I-5.4 to I-5.40	If vegetation modeling must be done, then comparison with levels measured in on-site vegetation should be used. I content that the parameters currently used are grossly inappropriate.	
10	Section 5.1.2.1, p. I-5.8	HSRAM for air inhalation assumes 20 m^3/day. Personal communications with a professor of pulmonary medicine at the U of W indicates that normal resting inhalation rate is 6 L/minute or 8.6 m^3/day. However, an active person of 70 Kg can have a sustained rate of 60 L/min. with maximum rate of over 150 L/min. A person who is active on the site at a rate of 60 L/min for 8 hours, has an intake volume of over 28.6 m^3 or nearly triple the estimate of 10 m^3 for an 8 hour period. Therefore HSRAM and the EPA (1989) guidance are non-conservative in calculating inhalation exposure for active workers, rangers, Native Americans and others for an active 8-hour period.	
11	Section 5.1.2.1, p. I-5.8, para. 4	Please expand explanation on why MTCACR parameters were not used for workplace water consumption. (Add also as footnotes to Table 5.2 or 5.3.)	
11	Section 5.1.2.1, p. I-5.9, Table 5.2	Please add explanation in footnote for "Intake/Contact Rate Range," "Shielding parameter." Remember tables and figures should "stand alone."	

11	Section 5.1.2.2, p. I-5.10, para. 2, last 2 sentences	The estimate of drinking 1 liter/day of river water while at work seems high yet the average of 1 hour per day dermal exposure seems low. Were these values obtained from the State Hatchery Program?	
10	Section 5.1.4 General	This reviewer was impressed with the significant changes made in this section since the draft. Intake rates were increased to reflect realistic situations of the Native American lifestyle. Also, the addition of several paragraphs discussing the uniqueness of the Native American lifestyle and cultural harmony with the environment were welcome. As the synthesis section shows, the Native Americans in this area are at the highest risk of all the human scenarios for effects from exposure. The risks will likely be quantified at a significantly higher level when synergistic factors and developmental/immunologic/mutagenic effects are accounted for.	
11	Section 5.1.4.1, p. I-5.25, para. 5, lines 2-5	Horses are part of the human food chain but not commonly in the U.S. Sentence should be modified.	
11	Section 5.1.4.1, pp. I-5.25-5.29	This reviewer enjoyed reading the details given in the Subsistence Resident Scenario. For example, the caloric intake discussion was well thought out.	
10	Section 5.1.4.1, p. I-5.29	The eight topics identified for future work can have a significant impact on the assessment of risk to the Native American population and should be conducted. In addition, a calculation of the synergistic factors and developmental/immunologic/mutagenic effects will be critical. Although sublethal effects are not well understood, some attempt should be made to ascertain them based on continually updated literature review. Research is growing on exposure to lead and the other non-radioactive metals which indicates severe developmental delays in those children strongly affected.	
9	Section 5.1.4.1, p. I-5.29	The discussion of the critical data gap of mother's milk needs to be expanded. The reader needs to be presented with a stand-alone discussion of why mother's milk was not considered, and a discussion of why contamination of mother's milk matters.	
8	Section 5.1.4.2, p. I-5.33, first paragraph	Inconsistent use of notation. The notation s/he is used on the 9th line of this paragraph, but two lines before the gender-specific "he" is used.	
10	Section 5.1.4.5, p. I-5.40	Nasal retention of a discrete radioactive particle can be considerably lengthened beyond a 1-2 day period by phagocytosis within the anterior portion of the nose or throat. Such a particle undergoing phagocytosis could increase risk for cancer of the nose and throat or exacerbate a smoking-related condition.	

4	Section 5.2.1.3, p. I-5.52	The boxes are useful, but there is a need to explain briefly (maybe a box) that exposure X effect will be used to calculate risk. Otherwise, it isn't clear why the exposure is being calculated in such detail.	
11	Section 5.2.2.1, p. I-5.54, Table 5.14	I have not been able to review/verify each individual value used in the risk assessments, however, I have been doing some random checking and some of these parameters need some careful checking. For example, the deterministic bioaccumulation factor listed in Table 5.14 for mercury is 1000. The minimum and maximum is also listed as 1000. Given earlier comments that specific forms of compounds would not be considered, it seems strange that at least some consideration of the maximum should include recognition that-for methyl mercury-this parameter would range from 10,000 to 100,000. Why is there no variation from minimum versus maximum value? Have other parameters values been double checked? References: *Clarkson, T.W. (1995) Environmental contaminants in the food chain. Am. J. Clin. Nutri. 61(3 Supple.):682S-686S.* *Bigham, G.N. and Vandal, G.M. (1996) A drainage basin perspective of mercury transport and bioaccumulation: Onondaga Lake, New York. NeuroToxicology 17:279-290.* *Bodaly, R.A., St. Louis, V.L., Paterson, M.J., Fudge, R.J., Hall, B.D., Rosenberg, D.M. and Rudd, J.W. (1997) Bioaccumulation of mercury in the aquatic food chain in newly flooded areas. Met. Ions Biol. Syst. 34:259-287.* *Boudou, A., Delarche, A., Ribeyre, F., and Marty, R. (1979) Bioaccumulation and of mercury compounds in a second level consumer. Gamusia affinis-temperature effects. Bull. Environ. Contam. Toxicol. 22:813-818.*	

6	Section 5.2.2.2, p. I-5.55	I believe dose conversion factors for external radiation are based on an infinite exposure assumption. Thus, it appears to this reviewer that PNNL has incorporated the assumption that the radio isotope contaminant is found in an infinite slab geometry. This assumption weights heavily the risk associated with external exposure pathways relative to the other pathways. The result of this assumption is that contaminates associated with external exposure pathways are consistently assessed as contributing the largest risk. This is not because of the inherent toxicity (carcinogenicity) of these contaminates, rather it is because the conservatism incorporated into assessment of the external exposure pathway. The unacceptable consequence of this approach is that external exposure inappropriately becomes the focus of efforts aimed at reducing risk. In this regard, the infinite slab assumption is a hidden value judgment that expropriates the basic science. There must be included an explanation of the geometry of radiation source for external exposure and an estimate of the range of exposure when other geometries are assumed.	
4	Section 5.2.2.2, p. I-5.56, Table 5.15	The units and use of the numbers in the Radiation Dose Conversion Factors needs to be explained. A box would be useful; I found the text rather confusing. Because of the special interest the public has in Tritium, the use of 0 and very low numbers for ingestion, and inhalation need explanation.	
4	Section 5.2.2.3, p. I-5.57	The Chemical Exposure Risk Factors need to be explained more concisely. Most of the discussion relates to sources of information, but not to what the numbers mean. If a chemical has a small number, is it more toxic? Is it these numbers that are multiplied (divided?) into the exposure to estimate risk?	

6	Section 5.2.2.3, pp. I-5.57 to I-5.61	The approach to derivation of many of the reference doses are scientifically unsound. Perhaps most inappropriate are: Using toxicity factors that have been withdrawn by the EPA. In withdrawing them the EPA has indicated no consensus between toxicologist has been reached. These factors are not valid. Assignment of an uncertainty factor of 10 based on the width of the (benzene) dose/response curve overlooks the RAGS guidance for adding safety factor for extrapolating dose/response data and modification factors for soundness of study information. There is not consensus in this approach. Interchanging inhalation toxicity factors and ingestion toxicity factors. This approach is inconsistent with fundamental toxicological concepts. Generating RfDs for diesel fuel and kerosene from the animal LD_{50}s and "conversion factors". This approach is inconsistent with fundamental toxicological concepts. Using a generalization that RfD's have certainty of within a factor of 3 is not appropriate. The proof is within the very paragraphs of the section	
4	Section 5.2.2.3, p. I-5.59, Eq. (5.21)	Define reference dose--this seems to be converting the acute toxicity into a chronic toxicity. Is this a chronic dose of concern? As explained for TLV, the concentration not to be exceeded? (This is defined on p. I-5.62 in a box, and it may have been defined before, but it is needed here.	
11	Section 5.2.2.3, p. I-5.59, last para.	There are many hidden assumptions in using the adjusted TLV values to set public health standards. For example, the occupational limits are set for healthy working populations. Just scaling the values on a mg/kg body weight basis and extending occupational exposure scenarios to potential environmental exposures is inadequate to protect the diversity of individuals and children present in the public. This needs to be rethought or an extra safety factor is needed.	

4	Section 5.2.3, p. I-5.61 to 5.6.65	Before the Figures 5.1, 5.2, and 5.3 are shown, some additional explanation is necessary. The box on p. I-5.65 needs to be moved before the Figures are presented. The meaning of the numbers needs to be clearer--does 10^{-3} mean that 1/1000 persons would be expected to develop cancer (Fig. 5.1)? For the worst case (Native American Subsistence) the uncertainty approaches 1 = 100%. Is that what Fig. 5.1 is stating? Because this figure is likely to be reproduced without the box and text on the previous page, the explanation (that Segment 6 was selected because it is one of the areas with the highest Hanford related contamination) should be part of the Figure. However, in I-5.68-69, it is not consistently the greatest contributor of risk, except for Radionuclides. The pages I-5.68-69 should be cross referenced, so the reader knows that a comparison is being provided.	
11	Section 5.2.4.2, p. I-5.107, para. 4	Statement in this paragraph says "results illustrated in Figures 5.36 and 5.37 correspond well with results described in the preceding section." I think this is mainly true, however, I do question the xylene data for segment 13. I thought risk for Native American subsistence resident scenario was 1.8×10^{-4} versus below detection levels for xylene in segment 1. Please double check.	
11	Section 4.2.11, Analysis of Risk and Section 5.2.2.4, p. I-5.62, Table 5.17	This reviewer thanks the CRCIA team for providing this level of detail for the approaches used in the risk assessment; these were much more transparent. One point of the assessment that I feel needs to have a more in-depth evaluation is the sweat lodge exposure pathway. Recently, I was reviewing the new RBCA (risk based contaminant assessment) models from ASTM. They have developed risk assessment models for petroleum hydrocarbons many of which are very volatile. In these scenarios, the rate of vapor movement through soil was evaluated and of the exposure pathways they evaluated, the highest risks were calculated for vapor exposures within dwellings built over the plumes. In the sweat lodge scenario, this other pathway of exposure might be a significant addition to the vaporization of seepwater poured over rocks within the lodge. How was vaporization of volatile compounds handled in the residential scenario? The volatile compounds listed in Table 5.17 should be examined.	
4	Section 5.2.3.1, p. I-5.62	Cross reference back to map where Segment 6 is shown (Fig. 3.1, I-3.4).	

8	Section 5.2.3.1, p. I-5.63, Figures 5.1 and 5.2	The figures should contain an explanation of the range of values shown on the plot (ie, min, max, median...).	
4	Section 5.2.3.1, p. I-5.63, Fig. 5 2	The units (ratio) need to be appended to Fig. 5.2, possibly in the caption. A line at the 1.00 level might be placed with the explanation that this is the concentration determined by EPA to be safe (the reference dose).	
4	Section 5.2.3.1, p. I-5.64, Fig. 5.3	Again, the units should be appended to the Fig, either as a box, or in the caption. Why is cancer fatality used here and cancer incidence used in Fig. 5.1?	
8	Section 5.2.3.1, p. I-5.64, Figure 5.3	The figure should contain an explanation of the range of values shown on the plot (i.e., min, max, median).	
7	Section 5.2.3.1, pp. I-5.66, Fig. 5.4	Figure 5.4 was a bit difficult to follow. Perhaps some smaller symbols might help.	
8	Section 5.2.3.1, p. I-5.66, Fig. 5.4	This graphic is basically incomprehensible as presented. It should either be enlarged, shown in color, or simplified by showing only a limited number of parameters or scenarios.	
4	Section 5.2.3.1, pp. I-5.65-67, and Fig. 5.4	I found this section useful. After 43 pages describing different patterns of use, I was afraid that this much detail would be given again. This graphic may be subject to misunderstanding (that there is a !00% risk to NA Subs). As a discussion item, would it be technically correct to use the mean for NA Subs, and the others by ratio? The Y axis of the would show lower numbers, the relationships would remain the same. It would be easier to understand if the legend were reordered to represent the order used in the graphic, i.e., NA Subs were first in the legend, and Fish Hatch last. A few symbols switch, but one has to do a lot of searching as it is now.	
4	Section 5.2.3.2, pp. I-5.67-69	Again, put the units in the Fig.--cancer incidence, ratio of present/EPA safe concentration, incidence of cancer death. Reorder the legend so 95% level is the top, 5% the bottom. The x value is not defined in the middle and bottom graphics in Fig. 5.5, and why is a factor of 1.47 E-01 used in the middle of Fig. 5.6?	

4	Section 5.2.3.2, pp. I-5.67-69, Figs. 5.5-5.6	Examining these graphics seems to undermine the use of Segment 6 as the apparent worst case. A cross reference in the earlier material at the end of the paragraph 5.2.3.1 could state, Segment 6 is compared to others in 5.5.3.2.	
11	Section 5.2.3.2, p. I-5.67, para. 4	Lack of lead data should not "pull down" risk when there is just a missing data point. These points where there is lacking data, should be designated separately on the figures.	
2	Section 5.2.3.2, pp. I-5.68-69, Figs. 5.5-5.6	These contain important information. Any chance of a sidebar on how to read them, and what to look for?	
11	Section 5.2.3.3, p. I-5.71	This reviewer found the comparisons of the statistical and deterministic risk evaluations to be interesting. Thanks for providing these extra estimates so the range of possible values could be considered.	
11	Section 5.2.3.3, p. I-5.72, last para.	This paragraph suggests that the reference doses and potency factors are quite uncertain and that the risk factors used range in uncertainty from 10 to factors of 1000. This statement needs to be referenced. Our own research has shown that for trichloroethylene these potency ranges are over 4 orders of magnitude (Lee, et al., 1997). Other investigators have identified this area of uncertainty and it has been larger than any other uncertainty in risk assessment (Cullen, et al.). This magnitude of uncertainty needs to be acknowledged.	
9	Section 5.2.4, p. I-5.73	Body burdens of contaminants in humans' bodies at birth have not been mentioned. Likewise, the presence in any given North American of approximately 250 industrial contaminants provides perspective to the ability of risk assessors to determine "safe" levels of Hanford area contaminants.	
9	Section 5.2.4.1, p. I-5.74, Table 5.18	The title, "Maximum Human Health Risk..." is not accurate (see also, the title of Table 5.19). All that can be said about such risk estimates is "Maximum Estimated Human Health Risk For Individual Contaminants." For all the reasons stated in earlier comments (e.g., General Comment of Reviewer 007 on "Human Scenarios for the Screening Assessment"), risk assessors are not able to say whether their estimates are overestimates or underestimates. Endocrine disruption; immune system suppression; cumulative impacts; developmental effects; etc. all make the plain-language meaning of "maximum health effects" inaccurate.	
2	Section 5.2.4.1, pp. I-5.75-5.101	Again, it would be great to have a sidebar on how to read these graphs, and what to look for.	

8	Section 5.2.4.1, pp. I-5.75 to I-5.101, Figures 5.7 to 5.34	These graphics are largely illegible because of their reduced size and similarity of symbols when presented as such small type. There is adequate space on each page to substantively enlarge the graphics to make them legible.	
4	Section 5.2.4.1, p. I-5.76	The lead sentence is an "empty" sentence and the reader has several lines to go before finding out that benzene concentrations are high in the Col Riv before reaching Hanford. The seep water seems much higher, as indicated from the ratio of 1,000 times the concentration of area 1 (river).	
8	Section 5.2.4.2, p. I-5.102, Fig. 5.35	The graphic as drawn shows two truncated normal distributions. The middle of the figure identifies an area of increased risk as a result of Hanford operations. However, if a reader were to take the graphic at face value, it suggests that at risks less than 0.00001 (where the Hanford contribution doesn't exist - at least according to the figure) Hanford is still presumed to be a contributor. I suggest redrawing the graphic so that the tails of the distributions actually rest on the x-axis.	
8	Section 5.2.4.2, p. I-5.106, Fig. 5.38	The graphic as drawn shows two truncated normal distributions. The middle of the figure identifies an area of increased risk as a result of Hanford operations. I suggest redrawing the graphic so that the tails of the distributions actually rest on the x-axis, as they do in figure 5.39.	
11	Section 5.2.4.2, p. I-5.107, para. 4	Statement in this paragraph says "results illustrated in Figures 5.36 and 5.37 correspond well with results described in the preceding section." I think this is mainly true, however, I do question the xylene data for segment 13. I thought risk for Native American subsistence resident scenario was 1.8×10^{-4} versus below detection levels for xylene in segment 1. Please double check.	
2	Section 5.2.6.1, p.I-5.112, sidebar	I like the fact that you've given people a reference point so they can evaluate how significant the particles are. That's something that needs to be done overall with all the results.	
10	Sections 5.2.7.1-5.2.7.27, pp. I-5.116-126	Good, concise summary of risk by area. Areas that were described as having data gaps due to lack of information should be addressed in future monitoring efforts prior to the comprehensive risk assessment.	

7	Chapter 6	It would be useful to include some discussions related to how the information included in the screening assessment might ultimately be used. The introduction indicates that the results of the screening assessment would be used in making decisions related to Interim Remedial Measures. Now that we have the results, what do we do with them?	
10	Section 6.0: Synthesis of Results	The synthesis is well-presented and easy to understand. Table 6.1 is a useful representation of the contaminants by river segment. Limitations of the screening assessment are realistically reported.	
10	Section 6.2, p. I-6.9	Section 6.2 discusses data gaps and dismisses the presence of some of them due to lack of data to indicate a concern in the area. Based on my experience reviewing a number of reports on the upland characterization of the 100, 200, 300 and 400 Areas, significant data gaps are still present. Therefore, one can not assume that the upland has been well-characterized yet, and that the data gaps in the sediment, seep samples, and nearshore groundwater samples are accounted for.	
11	Section 6.3, p. I-6.10, para. 4, last sentence	Please modify last sentence to say "...locations for which estimated risk to both the environment and humans is evident"	
5	Section 6.3, p. I-6.11, 6th line from top	This "5 % greater" criterion is hard to understand. If I understand it correctly, if a section of river has a 5 % higher level of a contaminant that the upstream segment, then this will signal a potential problem. If this is correct, this seems overly conservative by a large margin. In any case, this concept needs to be more clearly communicated.	
9	Section 6.3, p. I-6.11	If swallows, mallards, American coots, harvest mice, Canada geese, and raccoons are the sub-set of terrestrial animals most likely to be affected, now go out and study these in the field: Reproduction; development; estrogen/testosterone levels; parental behavior; etc. Go study the Columbia pebblesnail, hyalella, daphnia magna, crayfish, Woodhouse's toad, suckers, clams, mussels, and salmon/trout larvae. In the field. They will integrate what you have not integrated in this risk assessment. They ingest, contain, concentrate, combine, and respond to mixtures of contaminants.	
9	Section 6.3.1, p. I-6.12;	If Hanford contaminants <u>contribute</u> to ecological and human impacts, then they are problematic, <u>even if</u> upstream sources are also contributing.	

10	Section 6.3.3	Many of the contaminants of highest concern are metals that are typically filtered using 0.45-u filter. Earlier sections indicate that the authors favor using filtered data over non-filtered because of the lack of biological uptake in the particulate fraction. However, it should be demonstrated much more clearly that biological uptake for all species under consideration does not occur in the colloidal fraction between 0.45-u and 1.0-u and the particulate >1.0-u if you are going to drop the unfiltered data. Bioassay work on the size range in question would be instructive, particularly studies that consider sublethal effects.	
8	Part II, General Comment, Part II	This section of the report is extremely vague, wordy, confusing, and in essence promises to evaluate every conceivable impact over all time to all individuals and ecosystems near the river. This section relies on the use of jargon and buzz-words to the extreme, and is not clear or concise in what it is attempting to do. The promises made in Part II appear over reaching in that they are committing the modelers to achieve results that have not been done before. Has this part of the document been read by those individuals who will be tasked to do the actual modeling?	
10	Part II General	A great deal of consensus building has apparently occurred to have developed this section to the extent it has been written. However, the reader has nothing but a vague concept of the discussions that have occurred because the section provides few details and many generalities.	

7	Part II — Requirements for the CRCIA General Comments	The activities and approaches described in Part II sound very logical and good, but I have some trouble taking any of it very seriously. I really question how much any of this means, given that the group who wrote the report has no authority to issue "requirements" for subsequent work. If there were recommendations from DOE, as I had expected, then I would be more inclined to give this serious consideration. If DOE does not "buy into" the "new paradigm for predecisional participation," then it won't be of much value. There is very little that is specific in the "requirements." They tend to be relatively generic. It is difficult to develop comments given the lack of detail and specificity that is available at this time. The ways in which the CRCIA is expected to be used should be described in more detail. Who are the "customers?" Page II-4 indicates that the CRCIA will be used to "provide results that are useful for decision making." What specific decisions will be impacted by the CRCIA? How will the CRCIA feed into these decisions? What information is needed for these decisions and what is the best format to get this data? Without considering these in more detail up front, there is a good chance that the final CRCIA will miss the mark and end not being very useful for anyone.	

11	Part II General Comments:	This reviewer had the opportunity to meet with members of the Part II phase of the CRCIA project and would like to thank these members for sharing their enthusiasm for the Part II project. It was obvious from that meeting, from individual contact with members and from reading this document, that this team really enjoyed working together on this project, that they had invested personal time on this project, and that they shared a tremendous respect for their team colleagues to approach the very complex Columbia River issues with fresh insight. I would compliment the members on their insistence on broadening the context for assessment of Columbia River impacts to include a more complete assessment of impacts for under-represented populations and to broaden the assessments to include cultural, economic and social impacts as well as human and ecological impacts. Also, their consideration of the interrelatedness of ecosystem impacts with cultural health is extremely important. This reviewer, however, feels that the team has a tremendous effort in front of them to put these ideas and concepts into a workable plan. This reviewer was very unclear about how the team was going to implement and accomplish these concepts. In places, the document was extremely detailed such as designation of "tolerance models" for dose response versus other areas of the document which were very unclear. Uncertainty is dealt with in many inconsistent ways throughout the document and this reviewer urges the team to see the specific comments listed below for detailed examples. In many places the document seemed incomplete, especially in the appendixes where details about approaches were to appear, but most sections had specifics missing that were referenced as examples to illustrate feasibility and labeling of Part II approaches.	

11	Part II General Comments:	Although admittedly biased, this reviewer felt that the public health and ecological impacts were neglected. Overemphasis of exposure assessment was evident compared to receptor impact assessment. To retain a comparable level of complexicity of modeling and assessment, the receptor component would need to be separated into an equivalent number of core tasks as was exposure assessment (i.e., approximately 5 tasks). This is especially true if the team is committed to looking at the tasks that are dominant and where value of information analysis would show the largest impact. (See specific comments on how receptor impacts have already been identified by many investigators as a dominant driver in assessments, yet is largely ignored.) The Part II document is ignored in Part I; was this intentional? It would appear that the Part I document would be used to develop interim guidance on how to apply the principles of domain and fidelity. Why not use this data to identify examples to illustrate feasibility and liability of Part II approaches? To move forward, the Part II team could convene several technical panels to address issues that remain unclarified in Part II. This would initiate activities on web design and model evaluation.	

11	Part II General Comments:	This reviewer has also listed numerous specific comments regarding what are the goals of this team. How will they impact the decision process? Many of these questions arise because the document is unclear on how the process will determine how recommendations and waste disposition goals will be met, how validation of waste disposition decisions and how advice will be sought and recommended to people down from Hanford. The implementation plans need to be delineated. In some sections, Part II made some very specific specifications; for example, the specification of tolerance models. In other cases, such as with fidelity and consideration of fineness of definition in determining timing and resolution, no methods were specified. The team needs to work on giving an evenness to this level of specification. This is especially true if the goals of the CRCIA team to integrate across assessment models is to be achieved (see Pg. II-2.2, Section 2.2). Each section of the appendix referred to additional materials that were in preparation, that were unavailable for review but that would be inserted into final document. This reviewer felt very uncomfortable with this approach as insertion of new, unreviewed material into an appendix would then mean that the document would not be reviewed as a completed plan. Are you planning to send out another revision? What is the timing for this?	

2	Part II, p. II-ii	The language in this disclaimer is better than para 2 of the Executive Summary of the paragraph under "Authority" on page. II-1.	
11	Part II, Summary, p. II-iv	Define what is "predecisional participation" for readers. This is a very important point. Don't let it get lost.	
11	Part II, Summary, p. II-iv, para. 1	This reviewer is very supportive of the use of sensitivity analysis to identify key factors that have the largest impacts on the overall assessment.	
1	Part II, p. II-5, para. 3, 4	As a tax payer as well as a believer in orderly and efficient processes, I find the section on avoiding duplication of other work disconcerting. Why are there multiple efforts going on that "appear to be similar to CRCIA." Even if they are lacking in some facets, it does not seem reasonable that there should be multiple efforts going on that would be similar enough to "appear similar" to a group that is as intimately involved in the site as this one. Could this be why the Hanford site has the most expensive ER program in the DOE system?	
11	Part II, Avoiding Duplication, p. II-5	Avoiding Duplication of Other Work is a very meritorious goal. Has the tie-in with other projects/decision making processes on site been implemented? Is there a clear plan for under intergration. Please see my later comments that suggest more tie-in in the Part I and interim plans are needed.	
9	Part II, Principles, p. II-7	While a primary consideration is that assessment results be able to distinguish among cleanup and disposal alternatives, it is important to note that different social, economic, cultural, spiritual, democratic, and watchdogging benefits accrue to different cleanup and disposal alternatives. These should matter as well as toxicological impacts. Lop-sided attention to "risks," at the expense of examining "benefits" of alternatives, indefensibly limits the level of discourse.	
11	Part II, p. II-7	Summarize - This reviewer agrees with the discussion of value on actual analysis rather than expect elicitation. This reviewer also feels "value of information" approaches are extremely useful.	
11	Part II, Uncertainty, p. II-7	Uncertainty - Has the team considered defining the two types of uncertainty that are usually used in assessments; i.e., lack of knowledge versus variability? This reviewer would suggest including this in this discussion as it fits with your identification of "value of information" approaches. Specific methods to address each of these types of uncertainty could be proposed.	
1	Part II, p. II-8, Figure 2	This metaphor raises extremely high expectations as to the ability of the CRCIA analysis to predict actual Hanford conditions!	

11	Part II, Development and use of Assumptions, p. II-8	Development and use of Assumptions- This reviewer strongly supports the need for all assumptions to be clearly delineated. In life there are tremendous number of assumptions made by all of us everyday from assumptions about the sun coming up and making plans for the week based on that assumption to very tentative assumptions that if wrong will negate our assumption. I would suggest that you apply your principle of dominance to this issue. Requiring approval of all assumptions of the board seems unwieldy.	
11	Part II, Research and Development of Analysis Methods, p. II-9	Research and Development of Analysis Methods - This reviewer would encourage the team to look at some of the analysis approaches that are used beyond the routine DOE risk assessment paradigm before reinventing new methods others have already struggled over. For example, on the topic of multigenerational mutagenic effects there are many interesting and relevant analyses that people have conducted in other disciplines but that have not been utilized in DOE risk assessments. Before developing new ones let's look at getting some ideas from researchers who have been wrestling with these concepts. In the area of cultural impacts there is also an equally rich literature that has largely been ignored in the DOE community.	
1	Part II, p. II-9, para. 3	What is meant by research on projecting mutagenic effects. If the authors expect that the exact results of future mutations will be predicted, no amount of research will give them that capability. If they mean predicting the general effects of an increase in mutation rate on human and nonhuman populations, the information is already available.	
11	Part II, CRCIA Phased Approach, p. II-9, last two paras.	This reviewer is somewhat unclear about the plan and first and second phases of Part II.	
11	Part II, General Requirements, p. II-10	Impact Comparison Baseline - This reviewer would caution the comparisons with upstream conditions as the only impact comparison. In the case of assessing impact from metals, mining activity in the Columbia River corridor North of the dams has caused considerable impacts in the region and the impacts of the DOE complex should not be judged acceptable solely because they are less than the other impacts. Some absolute criteria for impact based assessments is needed for reference that is independent of these geographical and historical comparisons. Some of the worst mining impacts were pre-Hanford times.	

11	Part II, General Requirements, p. II-10	CRCIA Standards - This reviewer is a "Teratologist" -- one who studies teratogenic effects and I was somewhat surprised to read this section that said that the current regulations are written without consideration of teratogenic nor mutagenic effects. If this Part II assessment is going to use the IRIS data bases from EPA then the reviewers should be aware that teratogenic effects are included as part of those assessments. One can argue that those assessments are still inadequate (for example, limited multigenerational mutation studies), but this section should be rewritten to acknowledge these facts and to be specific enough so the readers of this document can understand what the team is interested in accomplishing. This reviewer would agree that minimal to nonexistent consideration of cultural effects has been done and that failure of the toxicological community to adequately assess impacts of mixtures is embarrassing. This section is very "all encompassing" and this reviewer would encourage some discussion here or later on how to stage this assessment. This reviewer was encouraged but confused by Figure 3 and approaches delineated in the remainder of the document to address this approach. It appears that approximately equivalent weight is given to this impact assessment in task 9 as to the 8 other factors listed in Figure C-1 (Pg. II-C.3). As noted in this reviewer's comments in Part I, the uncertainty present in impact assessment has been shown to be dominant in overall risk assessments and easily contributing over four orders of magnitude of uncertainty to the final evaluation. If your intent is truly to identify dominant factors in the impact assessment, then this team needs to look at the Structure of C-1, and allocation of efforts.	
1	Part II, p. II-10	Given that past effects are a constant in all remedial scenarios, what is the point of taking them into account? It just increases the total uncertainty in the estimates.	
2	Part II, p. II-10, 1st bullet	As a totally non-qualified, non-technical person, I would assume that except for certain radioactive materials that would leave a clear fingerprint, and except for a catastrophic failure, the impact of Hanford -- at least at the levels described in the screening analysis -- are going to get lost rather quickly in the "noise" from other sources downstream. Defining this all the way to Astoria strikes me as a wonderful way to ensure that this study will never get funded at a satisfactory level.	

2	Part II, p. II-10, 2nd bullet	The time of potential impact is an important consideration, since you know stuff is headed toward the river but just hasn't reached it yet. It might be useful to define what you've done in the screening analysis as a baseline of present conditions. Then, for useful discussion of remedial actions, talk about a "Future Without Remedial Action" and a "Future With Remedial Action." The difference between those two scenarios is the essential consideration in evaluating the value of any remedial action.	
8	Part II, General Requirements, p. II-10, fifth bullet	The statement that "few if any, current regulations were written with the spectrum of effects in mind that are of interest...such as mutagenic, teratogenetic, and cultural" is untrue and somewhat inflammatory. The radiation protection guidelines that have been in place since the 1950s were developed with the express purpose of limiting genetic effects as well as what we know call stochastic and non stochastic effects. In addition, in later years knowledge of radiation effects on the embryo and fetus resulted in the creation of standards to limit doses to pregnant workers. "Cultural effects" were factored into the regulations through the development of exposure scenarios, and the "maximally exposed individual" concept. For example, the accident and subsequent releases Windscale in the 1950s made scientists aware of the cultural use of seaweed in certain types of breads used by the inhabitants of the coastal areas.	
2	Part II, p. II-10, last bullet, last several sentences	Doesn't this leave the CRCIA team setting a bunch of standards? Will these be set with all the professional reviews and check and balances that international standards receive, or simply be based on the balance of power in the CRCIA Team?	
11	Part II, Section 1.0	What the assessment must include - This reviewer was surprised by Figure 3. Given the initial statement about the committee's commitment to assessment of impacts, this figure seems very contrary to that emphasis. The majority 7/9 of the tasks are focused only on identification of the problem and only 1 or 2 of the tasks are focused on characterizing what the impact is. This seems to be slanted to environmental monitoring without an equivalent emphasis on assessing impacts. Task 9 should separated into at least an equivalent number of tasks if the content of the Part II CRCIA team is to assess health (human and ecological) and cultural impacts.	

9	Part II, Section 1.0, p. II-1.1 and Appendix II-A, p. II-A.1	I would suggest that the Comprhensive Assessment should emphasize gathering field data on the condition of the aquatic and riparian-dependent wildlife and on the health status of workers and other human users of the nuclear reservation. It is the wildlife and humans who (a) integrate their exposure to multiple contaminants; and (b) provide a reality check on the estimation of risk in the paper risk assessment. I would suggest that to the degree that the "comprehensive" risk assessment is primarily a bigger, more complicated, single-contaminant-at-a-time paper exercise, then we will still be missing information on the reality of exposure and consequences of multiple contaminants in the area. I would suggest that the comprehensive assessment extensively examine how the wildlife and humans are doing, in the Hanford area.	
1	Part II, Section 1.0, p. II-1.1, Fig. 3	I hope that you are not serious about humans consuming bald eagles as one of your exposure pathways (module 7).	
8	Part II, Section 1.0, p. II-1.2, Figure 4	This graphic is of poor quality and is illegible.	
11	Part II, Section 1.1, p. II-1.3	This reviewer applauds the commitment of the team to look at the overall future impacts of current and planned wastes scheduled to arrive at the Hanford site. Also the commitment to look at the overall lifetime of the contaminants' impacts at the site is essential.	
1	Part II, Section 1.4, p. II-1.5	River bottom surveys for areas of upwelling would not be needed if there is no significant risks to salmon populations exposed to undiluted groundwater.	
9	Part II, Section 1.5, p. II-1.6	While recommendations call for evaluation of combinations of chemicals, it is field studies and manipulated exposure studies that will allow this. Single-chemical risk assessment cannot.	
9	Part II, Section 1.6, p. II-1.7	It is important, as stated, to be able to add species of interest as they are discovered to either be in trouble, or in harm's way in any of the contaminated areas.	
11	Section 1.6, p. II-1.7, para. 4	Chrome versus chromium. Please use chromium.	

11	Part II, Section 1.6, p. II-1.7, para. 3	It is unclear to this reviewer how the key species chosen by Part II process will differ from Part I. Could some specific examples be given? This reviewer is concerned that the same species-by-species approach will be taken in Part II as we taken in Part I. When assessing ecological health, the whole landscape should be looked at in total as impacts on a single species can result in magnification of effects across species related because of the interrelated nature of the ecological landscape. How will the species specific assessments discussed in this section be integrated with your concepts of ecological web assessment? Give an example if possible.	
9	Part II, Section 1.7, II-1.8	In the first full paragraph on this page, I believe you mean to say "It is also important to include as receptors [rather than 'species'] those which by virtue of different cultural life styles..."	
9	Part II, Section 1.9, p. II-1.9	The statement is made that "Tolerance assessment is one of the key objectives of the CRCIA....", and tolerance assessment is defined in this section as "some impact threshold below which effects can be tolerated with no unacceptable or irreversible effect." Tolerance assessment is not a scientific process, because science is not able to know the assimilative capacity, or "tolerance," of particular species for particular contaminants. We can learn of impacts that particular contaminants cause, but we can rarely know what amount of specific contaminants will <u>not</u> cause damage, because we don't know all the potential endpoints of damage that might be caused; the contaminants act in the presence of different contaminants; certain individuals will have susceptibilities we have not anticipated; etc. We can know some of the damage that specific contaminants can cause; but we cannot know "safe" amounts of contaminants, because they may be, in the context of an organism contaminated by multiple contaminants, the proverbial "straw that broke the camel's back." I would suggest that it is a more useful exercise to determine the greatest amount of benefits that may accrue to different clean-up alternatives, than to try to determine the greatest amount of a contaminant a species or organism can "tolerate."	

11	Part II, Section 1.9, p. II-1.9	Receptor Impact and Tolerance Assessment - Text needs to clarify whether individual or just population tolerance models have been accepted. This reviewer was surprised to read this proposal for tolerance models without specifications of endpoint, contaminant or population. How will tolerance models handle background effects? Will additivity be specified? This reviewer would need to see much more convincing support for this concept before the full scale acceptance of this specific approach for all assessments. This reviewer suggests caution in this "across-the-board" recommendation. Many assessors feel that biologically based models should be used rather than general tolerance models as is suggested. The CRCIA group should review these approaches as well before making such a specific recommendation.	
2	Part II, p. II-1.9, last paragraph	In my checkered past I was part of a team trying to project socio-economic impacts of a high-level repository for 10,000 years. From experience I can tell you that once you get beyond 25-50 years in the future you become so awash in uncertainties -- particularly if you are going to make the pretense of doing anything quantitative -- that it becomes virtually hopeless. It does occur to me that the Comprehensive Assessment probably does have to deal with a catastrophic failure scenario in some way. Beyond that, though, trying to second guess everything nature can throw at you is almost hopeless -- "What if an alien spacecraft crashed an Hanford and ..." More important, if you assume major climatic shifts, the magnitude of the other impacts caused by those shifts is likely to make Hanford impacts look like a third-rate player in the impacts game. Again, I doubt you'll be able to find the Hanford impacts in the noise -- except for the catastrophic scenario.	
11	Section 1.11, p. II-1.10	Hanford Site Disposition Baseline - This reviewer had several questions after reading this section. Does this section imply that the CRCIA team would never be envisioned to propose an alternative endpoint to evaluate if their analyses is suggestive that an alternative approach might be useful? From the reading in this section, it sounds as if no other considerations would be evaluated except for vadose zone characteristics. If this is not the case, then this section should be reworded to give the reader an understanding of what criteria would lead the CRCIA team to look at some other estimates (i.e., what criteria drives the need for CRCIA specific vadose zone characteristics).	

11	Part II, Section 2.1, p. II-2.1, para. 2, lines 1-2	Fidelity of Detecting Harmful Effects, What does "...requires the use of what one regards as important..." mean? Does this mean "....requires the identification of what is important..."?	
11	Part II, Section 2.1, p. II-2.1, para. 3	There are statistical methods to determine both fineness of definition and geographic resolution that is required for a given level of fidelity. Has the CRCIA team reviewed these? What specifications have they made?	
11	Part II, Section 2.1, p. II-2.1, last 2 lines	Please define "trade study methods."	
9	Part II, Section 2.3, p. II-2.2	This list is essentially more single-chemical risk assessment. Lip-service is given to "chemical dose calculation for multiple contaminants," without stating how that would be done. What is integrating multiple contaminants is the wildlife (and humans) in the area. Look at these organisms and humans to observe the consequences of multiple contaminants.	
11	Part II, Section 2.3, p. II-2.2, para. 1	How does selecting "dominant effects" reconcile with statements made on pg. II-2.1, paragraph 2, where requirements are discussed to have "sufficient assessment sensitivity to check any potential adverse effects/impacts?" This reviewer is still unclear how the CRCIA team will manage or compare dominant factors. One of the issues that that has plagued traditional risk assessments is comparing methods where prioritization of diverse impacts has proven illusive. Examples include assessment of cancer versus noncancer impacts, chemical versus radiological impacts, human versus ecological risk and "health" versus cultural impacts. To conduct the sensitivity and decision analytic methods specific in this approach, major work needs to be done on these topics. As this research is being done, does the CRCIA team have continuing plans? There is also an unevenness about what decisions the CRCIA team will make versus what approaches and methods the "analysts" will complete. For example, the CRCIA will specify vadose zone characterization but for data quality the team will "leave it" to the analysts to complete the definitions of the assessments' data quality. Should the team play a more consistent/active role? Would this necessitate adding additional team members to cover these areas of expertise? Would this be preferable?	

9	Part II, Section 3.5, p. II-3.2	The text says, "It has been stressed many times in this document tht the CRCIA Team believes conventional risk assessments to be inadequate, especially with respect to cultural considerations..." Although I do not question that conventional risk assessment does not adequately consider cultural cosequences, I believe that conventional risk assessment likewise does not adequately consider biological and health consequences, primarily because (1) we do not know know or examine all the potential biological consequences, and (2) it cannot integrate cumulative impacts, including synergistic impacts. I don't believe it is accurate to imply that conventional risk assessments are adequate for assessing risk and non-risk to health.	
11	Part II, Section 3.6, p. II-3.3,	Verification - What is "medical research of toxicity correlations?" *{Note: I am a medical researcher and toxicologist and I have no idea what is meant by this phrase.}*	
9	Part II, Section 4.0, p. II-4.1	The proposed management of the assessment is important for its involvement of those who will be affected by Hanford's cleanup and disposal decisions. Some of these must necessarily represent the vegetation and wildlife, that will be affected, as well. Particular attention needs to be paid to the range of useful questions that could be asked, and studies that could be done.	
11	Part II, Section 4.0, p. II-4.1, para. 3	Describe here the methods that will be used to determine CRCIA representation.	
11	Part II, Section 4.0, p. II-4.2	Please provide more details on what would happen during the interim period. What would be the goals/specifications of this period? How long would this last or would this involve a gradual replacement of faulted assessment practices over time?	
8	Part II, General Comment, Appendix II-A	A majority of the subsections are incomplete and contain a statement noting that additional requirements not appearing in the draft will be available by the draft's publication date. Why weren't these sent to the Technical reviewers for examination? From my review, it would appear that a substantial portion of the text has been left out.	

10	Part II, Appendix II-A	I could list the issues I believe need to be addressed; however, the many vague references to additional pages of explicit comments would likely include most of those. I would be very interested to see a detailed workplan developed for the comprehensive assessment that eliminates the vague generalizations and provides details for the upcoming study.	
11	Appendix II-A, Section 1.0, p. II-A.2, para. 1	This reviewer suggests at a minimum the addition of two additional points for characterization: 1) Total amounts of potential contaminants and source size, and 2) stability of contaminants under anticipated conditions. The extra 3-1/2 pages of detailed requirements were referenced but were not available for this reviewer to review. These should be put into a table at a minimum. {Note: the three missing pages of detailed requirements would have been good to review. The reviewer is not clear about how these contaminants will be ranked for significance of potential impact. Please add more details.	
8	Part II, General Comment, Appendix II-A, Section 2.0, p.II-A-2	The discussion of containment failure and contaminant release is extremely weak.	
11	Appendix II-A, Section 2.0, p. II-A.2,	The points detailed in this section on containment failure and release seemed appropriate, however, this section also had additional requirements that were not available for review.	
8	Part II, General Comment, Appendix II-A, Section 3.0, p. II-A-3	The discussion of transport mechanisms is extremely weak.	
8	Part II, General Comments, Appendix II-A, Section 4.0, p. II-A-4	The discussion of contaminant entry into the Columbia River is extremely weak.	
11	Appendix II-A, Section 5.0, p. II-A.6, P+A5.0-4	The document needs to define "...significantly contribute..." in the context of significance to habitat or drinking water contamination.	
11	Appendix II-A, Section 6.0, p. II-A.6	It is unclear to this reviewer how critical habitats will be identified. This section lists some criteria but it does not seem to be complete. Hopefully, the missing pages will provide the necessary information.	

11	Appendix II-A, Section 7.0, p. II-A.7, (A7.0-1)	Does this set of receptors also include residential populations? If so, please list.	
11	Appendix II-A, Section 8.0, p. II-A-8	Dose Assessment - It was difficult for this reviewer to understand the differences in dose assessment used in Section 8 in Part II from dose calculations from Part I. This Part II section makes reference to past exposures and states that these can be obtained from sampling and receptor measurements. It states that future doses must be estimated from models. This reviewer notes that for some contaminants, sampling cannot determine past exposures and models may also be necessary for this application as well. This section does not provide enough details for this reviewer to determine how "... a portion of the receptors of concern..." will be prioritized if fiscal constraints arise. This section also needs to give some hints on how background doses will be combined with new environmental doses.	
11	Appendix II-A, Section 9.0, p. II-A.9	Receptor Impact and Tolerance Assessment - This is a huge category with many very large impacts together. Insufficient details are given to determine what the assessment must include. How is the team going to handle noncancer versus cancer effects? How is the team going to handle susceptible sub-populations such as children or the elderly? Many more details are needed to understand how the team would like to evaluate cumulative effects from multiple exposures. Will this be done by using additivity assumptions?	
8	Part II, Appendix II-A, Section 9.0, p. II-A.9, bullet A9.0-4	How does the assessment team propose to translate dose assessment (or risk assessment) projections into an assessment of housing impacts?	
8	Part II, Appendix II-A, Section 10.0, p. II-A.10	If the assessment team wishes to take the impact evaluation to its illogical conclusion then they will be assessing impacts until the end of time since the non radiological constituents, such as lead, do not undergo radioactive decay. In addition, they will have to consider unlikely (but possible) scenarios whereby mile thick ice sheets cover the site or severe episodic flooding scours out portions of Washington and deposits massive boulders in the region. Is this their intent?	
11	Appendix II-A, Section 10.0, p. II-A.10,	This reviewer is confused by the reference to "normal" conditions. How is this different from the "current" conditions? Please clarify.	

1	Part II, p. II-B.1 (B0.0-2)	The hypothetical goal: "results must be able to show that, with 95% certainty, 99% of all impact has been identified" is a fantasy that seems to indicate a misunderstanding of uncertainty analysis and of the situation being addressed. We do not know what will happen in the future, so we do not know what all impacts will be. (Even in the future we will not know all impacts because we can not measure everything.) We can only select scenarios, develop models of those scenarios, estimate effects on selected endpoints using the models and available data, and estimate our uncertainty concerning those effects.	
11	Part II, Appendix II-B , Section 1.0, p. II-B.2	Fidelity - It was difficult for this reviewer to determine what data assurance and data quality would be required by the team. How would these criteria differ from those used in Part I. This section needs more details. How will the team evaluate what is an adequate model (B2.04)?	
8	Part II, Appendix II-B, Section 1.0, p. II-B.2, first sentence	The statement is made that the assessment calculations will represent actual conditions. This is incorrect if you intend to extend the assessment to future hypothetical scenarios.	
8	Part II, Appendix II-B, Section 2.0, p. II-B.3, B2.0-1	The statement that "consistency shall be maintained between boundary conditions of partitioned....." is not clear.	
8	Part II, Appendix II-B, p. II-B.2, item B1.03	The meaning of this sentence is extremely unclear.	
8	Part II, Appendix II-B, Section 2.0, p. II-B.3, B2.0-3	The statement is made that "integration of model equations for all exposure process and harmful effects steps shall be validated before committing resources to their use". Validation is a term used to describe if a model accurately depicts the system it is trying to mimic. You can only validate a model if you accurately understand how the system works. In trying to integrate multiple exposure processes to come to a total prediction of risk requires knowledge of systems we do not currently possess. Are you saying that the models will never be used because our current knowledge is too limited?	
11	Part II, Appendix II-B, Section 3.0, p. II-B.3	This section does not provide enough details to determine how dominant threats are assessed and prioritized. How will dominant effects be identified and once identified, compared and prioritized for evaluation?	

8	Part II, Appendix II-B, Sections 3.0-3.7, p. II.B.3-II.B-7	Substantial material was omitted from these sections, and makes evaluating them of limited value.	
11	Part II, Appendix II-B, Section 3.1, p. II-B.4	Hanford - This reviewer liked the reference to an iterative process to refine models.	
11	Part II, Appendix II-B, Section 3.2, p. II-B..4	This reviewer did not understand why this document states that "containment performance information should come from only one source, the US Department of Energy's...plans." Why was this specified? It would seem most technically defensible to use all available information and if it suggested that the DOE's containment calculations were off by 20 years then this information would be critical for accurate risk evaluations.	
11	Part II, Appendix II-B, Section 3.5, p. II-B.6, line 1	First sentence does not make sense - maybe missing text?	
11	Part II, Appendix II-B, Section 3.6, p. II-B.6	Insufficient details are provided for this reviewer to understand how good the assessment results must be.	
11	Part II, Appendix II-B, Section 3.8, p. II-B.7	Dose Assessment - This section needs to be reworked. Statements are included in this section that are not adequate. Two examples can illustrate these inadequacies. In the case of teratogenic effects, both dose and time of exposure define response. In fact, the same dose of teratogen 1 day later can cause no effect, whereas the day before, the embryo can have major malformations. Another example is immunological responses where strict dose response relationships are not clear. A DOE relevant example of such an immunotoxicant is beryllium.	
8	Part II, Appendix II-B, Section 3.8, p. II-B.7	The last sentence of this section on dose assessment makes the statement that "The tails of the distributions on the side of high dose are of particular importance to values, such as equity". What does this mean???	
11	Part II, Appendix II-B, Section 3.9, p. II-B.7	This reviewer is unclear how adverse effects will be "...assessed with sufficient fidelity to reveal actual conditions..."	
11	Part II, Appendix II-B, Section 5.0, p. II-B.8	This reviewer could not determine what the quality assurance plan would look like for this Part II evaluation.	

8	Part II, General, Appendix II-C, Section 1.0	This section is vague, confusing, and poorly written. What exactly is the author(s) trying to say?	
11	Part II, Appendix II-C, Section 1.0	The second paragraph in this section provided a good description of in "iterative search for dominant process features" and described the potential impact of interrelated factors on evaluations. This reviewer did not necessarily believe the sentence in the first paragraph that stated "By focusing on dominant features, simplified approximations can be used in models without compromising their validity." This reviewer would suggest adding a qualifier to this statement that suggests "in the majority of cases" or "frequently."	
8	Part II, Appendix II-C, p. II-C.1, C0.0-3	The statement is made that models of the exposure process and consequent impact shall be validated. Some of the exposure processes will be hypothetical occurrences taking place at a distant time in the future due to catastrophic events. How are these processes going to be validated?	
8	Part II, Appendix II-C, p. II-C.1, C0.0-5	What does "manage uncertainty to achieve balanced uncertainty reduction as well as integration with management of dominant factors" mean?	
11	Part II, Appendix II-C, Section 2.0, p. II-C.4	This reviewer would not obtain enough details from the section to understand the management of uncertainty. How do these three types of uncertainty relate to lack of knowledge uncertainty versus variability uncertainty?	
11	Part II, Appendix II-C, Section 3.0, p. II- C.5	This reviewer felt these points a-d were important but felt that this document did not provide such an architecture.	
11	Part II, Appendix II-C, Sections 3.1, 3.2, 4.0, 5, 6, & 7	These sections were incomplete and this reviewer could not assess.	

2	Part II, p. II-D.2, general	As useful as the CRCIA Team has been, and as supportive as I am of public participation, I think this proposal will violate several federal laws and some basic principles of accountability. The general rule in a democracy is that if someone has actual decision making authority over the expenditure of federal funds, they must either be an elected federal official, or report to an elected federal official, e.g. through the Executive Branch to the President. Again, as part of my checkered past I did an analysis of alternative decision making institutions for operations of the Columbia River (See System Operation Review EIS Technical Appendix on the Columbia River Forum). The closest things to what's being recommended are the Northwest Power Planning Council, and the Cal-Fed Bay Delta Program in California. The Power Planning Council sets energy policy for the region, thereby directly or indirectly providing guidance to the Bonneville Power Administration, among others. It also gets its funding through BPA. But the Council has enabling legislation (the Northwest Regional Power Act) and its members are appointed by the Governors of the 4 states. There are even questions about the Council's constitutionality, but for lots of reasons, the decision was made to act as if it were constitutional, without testing it. Another model is the Cal-Fed Bay-Delta program currently doing studies needed for implementation of the Central Valley Project Improvement Act (San Francisco Bay - Sacramento River Delta). In that case, the state and federal agencies are co-managing the studies, under some kind of cooperative agreement. But again, it is the official entities that are the decision makers, although there are extensive opportunities for public part	

2	Part II, p. II-D.2, general, continued	studies, so it is the official federal and state water and wildlife agencies that are the decision makers, even though there are extensive opportunities for public involvement. You might want to contact Lester Snow, the program manager of the Cal-Fed team, U.S. Fish & Wildlife Service, Sacramento, CA. I suspect they've researched these issues exhaustively. I understand the desire to guarantee that CRCIA team decisions have real impact. But I suspect that any effort to do more than sign a cooperative agreement about how the entities will relate is likely to run afoul of federal law. Including non-governmental representatives, particularly if not elected or appointed by a federal official, will get you even further afield. The Federal Advisory Committee Act specifically excludes granting decision making authority to committees with non-governmental members. I suspect the best you're going to be able to do is act "as if" the CRCIA Board is a decision making entity, without giving it full legal standing. Maybe by using the Cal-Fed model you can include the federal agencies, state agencies, and the tribes (which have standing as governmental entities), but I doubt that citizens appointed to represent constituencies can be an official part of a decision making body.	
10	Appendix II-D	The DOE is making an admirable effort to include the tribes and other stakeholders in the management and review process. I hope this effort continues to grow and a true partnership develops from this project. I applaud CRCIA for having brought diverse groups together and given them a strong voice to communicate concerns. I also think that this "big picture" perspective of the site that has developed out of the regional focus on the river is exactly what DOE contractors have needed to step back from their typically focused approach to individual operable units.	
11	Part II, Appendix II-D, Section 1.0, p. II-D.2, (D1.0-1)	Has the CRCIA team considered adding environmental advocates to the membership board? Is local business representation represented in "b) persons who use the Columbia River for sustenance, commerce or recreation?" Will Hanford workers be represented ? What about research communities? Several times in the document, reference is made to affected communities such as migrant workers - yet no specific position has been identified for this group. Has the team thought about adding this under represented group?	
11	Part II, Appendix II-D, Section 1.0, p.II-D.3, (D1.0-7)	This reviewer would urge that the openness of the meetings would include regular, scheduled time for public comment during the process not just at the time of final draft product release.	

11	Part II, Appendix II-D, Section 3, p. II-D.4, (D3.0-3)	The statement "The performing contractor is responsible to ensure that the Board acts in all matters with a grasp of the relevant technical considerations" is a very large mandate. The Board may want to confirm this with the outside technical expertise that is described earlier.	
11	Part II, Appendix II-D, Section 5.0	This reviewer was very interested to read points a, b, and c. The document does not provide details on how these points will be accomplished. If point a is true- i.e., that the Part II assessment would help determine the manner in which remediation and waste disposition should be done then shouldn't the plans for Part II include consideration of alternatives or outside sources as an assessment? This reviewer recalls specific statements being made that state "....containment performance information should come from only one source..." (Pg. 11-B4, Section 3.2.) Is this statement consistent with this large mandate. Similar inconsistencies in scope of alternative decisions could be raised for Part 6. How are revisions in planned criteria going to be accomplished?	
2	Part II, p. II-D.6, 7.0	The idea is good. One of the big problems with any advisory group is that over time they become unrepresentative. Requiring members to develop plans to stay in touch with their constituencies is essential. However, I don't think this will satisfy legal requirements for accountability, if this is actually a decision making entity.	
11	Part II, Appendix II-D, Section 6.0, p. II-D.6 (D6.0-4)	Did this reviewer miss earlier discussion on "gates?" How are these designed? Need more details on how these will be defined.	

2	General from *Data for the Screening Assessment Vol I* (Miley, T.B., T.K. O'Neil, et al, 1996); *Human Scenarios for th Screening Assessment* (Napier, B.A., B.L. Harper, 1996)	Many of my earlier comment remain unresolved Below is a list of those most obvious: **Unresolved Comments from the Data Volume I Review:** 1.2, Table 1.2: "2/20/96; The set of representative data in each segment for each medium will be assumed to be log-normally distributed." The reasons the management team arrived at this should be included. Definition of the probability density function is a very important issue. Is the probability density function that is actually used determined by the data? The basis for the log-normal distribution assumption should be provided. 1.3, par 1: The GIS cell size, relative to the area of the 27 segments, and relative to the area over which samples were collected should be provided. This information allows the reviewer to evaluate the appropriateness of assigning concentrations to defined areas. If the cells are defined by the grids on the maps in appendix B, it should be so stated.	

2	General from *Data for the Screening Assessment Vol I* (Miley, T.B., T.K. O'Neil, et al, 1996); *Human Scenarios for th Screening Assessment* (Napier, B.A., B.L. Harper, 1996)	**Unresolved Comments from the Human Scenarios Review:** The uncertainties inherent in risk assessment requires the assessor to make value judgments in the face of scientific unknowns. In making these judgments it is imperative that the assessor estimated the range over which each parameter may vary. If a range is inappropriately narrow, risk may be underestimated. If a range is inappropriately wide, the risk may be overestimated. High levels of uncertainty reduce reliability. Even the most appropriate estimates of scientific uncertainty may result in an inability to make distinctions between competing risks (2). It is the opinion of this reviewer the *Human Scenarios for the Screening Assessment* is misleading. The document defines exposure scenarios that can not be distinguished from one another. The uncertainties associated with the underlying parameters blurs their distinction. Include estimates of the variability for each: 1) the concentration of the contaminate These are referred to in 1.3 but not incorporated into this document or, to my knowledge, are estimates of range of uncertainty incorporated into, *Identification of Contaminants of Concern.* 2) the intake factor a) exposure frequency A range should be established rather than a single rate determined. b) exposure duration A range should be established rather than a single duration time. c) dermal surface area A range should be established. d) air mass loading A range should be established. e) intake/contact rate Ranges of estimate established for the contact rates are included in the exposure factor tables. It is reasonable that for any given day, soil is not ingested or inhaled, that no contaminate is absorbed through the skin, or that exposure to external radiation is experienced. **Therefore the lower limit of these intake rates should be 0 for each of the media.**	

2	General from *Identification of Contaminants of Concern* (Napier, B.A., N.C. Batishko, et al, 1995)	**Unresolved Comments from the Contaminates document:** 4.1, 2: Tables C.1, C.2, and C.3: Given the understanding that value judgments are a necessary part of any risk assessment, it is important to avoid any perception that values held by the risk assessor are unilaterally incorporated into risk evaluations. While MEPAS may be a very appropriate methodology for screening, this can not be ascertained from the documentation presented. The importance of a more in-depth review is highlighted, from a toxicological view point, by the inconsistencies between the toxicity factors used in *Identification of Contaminates of Concern* and *Toxicology Profiles of Chemical and Radiological Contaminants at Hanford.* So many of the contaminates are listed in the tables as screened by MEPAS that this may become a critical issue. An outstanding question this reviewer has concerns the appropriateness of the selected/derived toxicity factors.	
2	General from *Identification of Contaminants of Concern* (Napier, B.A., N.C. Batishko, et al, 1995)	4.1, 7: The assessment of external exposure seems to make a very significant assumption. It appears to this reviewer that it is assumed that the radio isotope contaminant is found in an infinite slab geometry. This assumption weights heavily the risk associated with external exposure pathways relative to the other pathways. The result of this assumption may be that contaminates associated with external exposure pathways are consistently assessed as contributing the largest risk. This is not because of the inherent toxicity of these contaminates, rather it is because the conservatism incorporated into assessment of the external exposure pathway. The potential consequence might be that, in risk-based decision-making, external exposure may inappropriately become the focus of efforts aimed at reducing risk. In this regard, the infinite slab assumption may be a hidden value judgment that expropriates the basic science. I suggest that the infinite slab assumption be reviewed by the CRCIA management team in the context of the many risk assessment that have incorporated it. If necessary, the geometry assumption should be formally replaced by one or more probability statements to provide a more realist assessment.	

	General from *Identification of Contaminants of Concern* (Napier, B.A., N.C. Batishko, et al, 1995)	4.1, 7: It appears to this reviewer that the 100,000 water/sediment ratio may have a very large potential to impact the risk assessment out-come. For sediment considerations, the ratio is used to estimate the concentration of the radionuclide in an infinite slab geometry. The potential to over-estimate risk is magnified by this layering of conservative assumptions. There are several outstanding question concerning the derivation of this ratio. Why is one ratio used to represent several of the contaminates? Why hasn't actual analytical data been used?	
2	General from *Identification of Contaminants of Concern* (Napier, B.A., N.C. Batishko, et al, 1995)	The ingestion and external slope factors used to screen the water sources, soil and sediment are not consistent with the parameters cited in *Toxicological Profiles of Chemical and Radiological Contaminates at Hanford* by B.L. Harper, D.L. Strenge, R.D. Stenner , A.D. Maughan and M.K. Jarvis. The document number is PNL-10601. For example the discrepancy for Radium 226 external exposure slope factor: 1.20 E-08 compared to 6.74 E-06. It is suggest that these parameters be reviewed and if the difference between parameters is greater than a factor of 5, then re-screening is recommended. What is the source of the oral slope factors for Benzo(b) and Benzo(k) Fluoranthene? (The use of surrogates in this context is meaningless and thus, and unacceptable approach.)	

1. NRC Risk Assessment in the Federal Government: Managing the Process: National Academy Press, 1983.
2. NRC Building Consensus Through Risk assessment and Management of the Department of Energy's Environmental Remediation Program. . Washington, DC: National Research Council, 1994.

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