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STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

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December 28, 1998

Mr. Robert W. Lober
U.S. Department of Energy
Richland Operations Office
P.O. Box 550, MSIN: A2-22
Richland WA 99352-0550

Dear Mr. Lober:

Re: Comments on the *Draft Retrieval Performance Evaluation Methodology for the AX Tank Farm* (DOE/RL-98-72) (RPE)

The Washington State Department of Ecology (Ecology) has reviewed the *Draft Retrieval Performance Evaluation Methodology for the AX Tank Farm* (DOE/RL-98-72) (RPE). Ecology's comments are enclosed.

Overall, Ecology was pleased that the U.S. Department of Energy, Richland Operations Office (USDOE), used a systems approach in evaluating retrieval and closure options for the AX Tank Farm. There is some variation in the tone of the comments, reflecting the lack of agreement, among Ecology staff, as to the value of pursuing the RPE process at this time. These comments are believed to be representative of those which can be expected from the stakeholders in general.

Ecology agrees that a number of large data gaps need to be filled before any decision can be made on retrieval or closure. However, it is important to document the areas needing further study so that the USDOE can fill the gaps and reduce the large risk uncertainty associated with various closure options. Ecology is concerned about the quality of some of the data used in the analysis. For example, the composite analysis is used as the source for the groundwater modeling input for risk analyses. Ecology has had a long-running issue about the use of the composite analysis modeling and has not approved the use of this data.

Ecology will be happy to discuss the enclosed comments with you or your staff. Ecology intends to continue reviewing the document over the next month and may have additional comments.

If there are any questions, please feel free to contact me at (509) 736-3011, or Suzanne Dahl-Crumpler at (509) 736-5705.

Sincerely,

Steven J. Skurla
Nuclear Waste Program

SJS:ld
Enclosure

cc w/encl.: Craig West, USDOE
Dave Becker, NHC
Administrative Record: Single Shell Tank

cc w/o encl.: Doug Sherwood, EPA
Mary Lou Blazek, OOE

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1. Name of Reviewer: Steve Skurla et. al.	2. Organization of Reviewer: Department of Ecology	3. Phone No: 736-3011		4. Date: 12/28/98

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1.	General	The consensus of most of the Ecology reviewers was this analysis effort and the resulting document provides a good first step in the resolution of important questions which must be resolved prior to full scale retrieval of Single-shell Tanks (SSTs). This effort needs to be followed by other similar efforts so the momentum is not lost.		
2.	General	Well written document that addresses many of the issues outlined in the MOU between Ecology and USDOE. The technical approach is systematic and provides a process, which can be used on a tank by tank basis to establish specific tank leak loss, waste residuals, and needed technologies. However, before being used for final decisions on specific tanks, this systematic approach needs to be paired with a cumulative assessment for all tank farms and 200 Area waste sites.		
3.	General	An explanation is needed in multiple locations to explain to the lay reader why the results will not exceed drinking water standards – but health standards are exceeded. Suggested explanation: drinking water standards only assume consumption, while health standards assume that water is used for bathing, washing food, irrigation, as well as drinking.		
4.	Summary Section	A better write up is needed that describes the relationship of this RPE effort to the subsequent dependant efforts of retrieving SST waste. Explain the details of this effort and the Initial SST Retrieval System (ISSTRS) and Leak Detection Monitoring and Mitigation (LDMM). The document should specifically identify what steps need to be undertaken for subsequent work in between this RPE effort and the first SST retrieval.		
5.	Soil grouting	What sort of certainty was given to the technology of soil grouting? How was the idea of complete or incomplete coverage accounted for in the soil grouting scenarios? What actual field references were used to establish the viability of		

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		soil grouting technologies? How was the uncertainty accounted for in the modeling?		
6.	P. 6-19, ln. 25	Table 6-18 references should be added to Table 6.1.9.		
7.	P. 6-14, ln 23-31	This comment applies to this location and several other places in the document. It is stated that all options including no action option (where the entire tank eventually leaks) don't exceed the drinking water standards for TC-99 (900 pCi/l). This intuitively makes no sense to me when compared to SX Tank Farm historical groundwater data that shows Tc-99 as high as 8,000 pCi/l. How can tank leaks from SX Tank Farm cause concentrations in groundwater this great and the entire tank inventory leak at AX not cause a similar high concentration? The actual field data tells us that the eventual reality of tank leaks is that the groundwater has and will be again impacted above drinking water standards. In light of this, the modeling should be checked. This reality needs to be included in the document - as a caveat – so the reader will be aware.		
8.	General	Groundwater and vadose zone modeling seems to be one of the most (probably the most) important aspects of this study whose assumptions, applicability and the results are connected in a variety of ways (directly and indirectly) in the determination and calculation of : • Fate transport of contaminants, risk, uncertainty analysis, and finally in making conclusions/determination of: • Setting limits on the extent of waste retrieval losses to the environment on a tank and tank by basis, which are also linked with: • The deployment waste retrieval technologies, tank closure and finally, attaining regulatory compliance.		

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		Therefore the aspect of the modeling study needs serious attention. Regulatory agencies and tribal nations and stakeholders have not agreed with the conceptual model used by USDOE. We have rejected the existing basic conceptual model. Ecology's involvement to solve this issue in carrying out the RPE is negligible or did not happen at all. The conceptual model issue has been addressed not only by the previous "SX-Tank" expert panel but also presently being recognized by the national labs (under S&T initiatives of the groundwater, vadose and Columbia River Integration project". Ecology has not accepted the conceptual model used in the Composite Analysis (CA). In fact the conceptual model used CA more or less dates back to 1994 or so. At present, Ecology and Tribal Nations are involved with the task of developing a commonly accepted groundwater conceptual mode (not vadose conceptual model) with USDOE and PNNL. The basic issues that needs to be dealt with the conceptual model and modeling exercises for the RPE are summarized in the following items: a. Geologic information involving the basic raw data and their interpretation pertaining to Scale of heterogeneity-stratigraphy, geologic structure-correlation length, porosity, permeability, fingering scale, etc. b. Hydrogeologic data: field vs. interpreted data, field scale hydrogeologic data vs. local scale, Kd values at different pH conditions (Lab Kds vs. field conditions), the inverse square modeling out put vs. original field data, etc. c. Chemical data: geochemistry and contaminant specific chemical data (including fate and transport, etc.), etc. c. Non incorporation of pre Hanford groundwater condition: e.g. flow through north, recharge from the West Lake, etc. d. Physics and dynamics of flow involving multi phase		

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		flow, non-isothermal flow, reactive chemical transport, effect of waste chemistry on flow (density driven flow, dissolution and precipitation effects on porosity), formation, stability, and transport of colloids and particulate, coupling flow with reactions, measurements of water and concentration flux, etc. e. Assumptions and results of 2D modeling vs. 3D modeling e. Spatial and temporal distribution of net infiltration (including climate variations for long term forecasts) f. Spatial and temporal variations in water table elevation g. Impacts of remediation activities and engineered modifications of environment h. Methods to deal with data uncertainties There should not be any more attempts to revise this document till we solve the above issues. Ecology needs to engage with USDOE to evaluate the whole concept and direction of HTI.		
9.	General	As mentioned in the text and several of your presentations, there is hardly any site (TSD) specific information on geology, hydrogeology, etc. The interpolation of the data from non-site specific data is one of the major factors in increasing the degree of uncertainty. As mentioned above, the basic input data (the input from the CA) itself has a lot uncertainty. It looks like the total uncertainty, which sometimes reaches up to seven order of magnitude, may actually go much higher. Efforts must be made to clearly define the data gaps and define the factors causing these uncertainties.		

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10.	General	Use of a particular modeling code should be discussed in detail with respect to why and how it relates to some of our previous studies. The results of this study do not match with several previous studies as far the direction of the migration and its concentration is concerned. There are tremendous discrepancies between the 2D vs. 3D studies in the integrated mass of simulated contaminant plumes and calculated moments 100 Ci source located at the AX tank farm. I think your present report would help us to refine and define our future modeling codes and finally to calculate risks and other related objectives.		
11.	Executive Summary, General	This document fails to consider the impacts of contamination already existing in the vadose zone and groundwater from past tank operation leaks as previously commented on in the TWRS EIS by the National Research Council (Sept. 1996) and the SX Independent Expert Panel (April 1997). One cannot determine impact on health risk without taking into account the waste that has already leaked from tank farm operations.		
12.	Executive Summary, General	This document appears to be a supplemental EIS disguised as something else. Is there an agreement between Ecology or even internal to USDOE that AX farm was not to be used to write a supplemental EIS?		
13.	Executive Summary, General	Based on the comments below, future revisions of this document should be stopped until the identified gaps (data needs) have been adequately filled.		
14.	Executive Summary, first paragraph	First paragraph of the Executive Summary gives the impression that enough data and information is known to make a decision for AX Farm. The methodology is driven far too much by the use of assumptions. With resources so limited to conduct the critically needed characterization putting money into a methodology that cannot be supported is wasteful and should be discontinued The efforts and resources should be reallocated to accomplishing the data		

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		needs identified on page ES-5 and 6. The value of this RPE is in recognizing what we are missing – characterization, health risks, and technology.		
15.	P. ES-2, ln 7	How does one verify that the best available data were used? Does the report use groundwater data such as the 12,000pCi/L Tc99 contamination under BX tank farm as a basis of what really is happening to the groundwater from tank leaks?		
16.	P. ES-2 ln 7-9	How do we verify that conservative assumptions were used? The SX Expert Panel identified a concern with bias in the modeling work performed on the TWRS EIS. The Expert Panel recommended that efforts to obtain independent modeling were needed. Same modeling company is performing this effort that performed work on the TWRS EIS.		
17.	P. ES-2, ln 21-22	The tank farms are to be closed under RCRA and Washington State regulations WAC 173-303 that does not allow for the "NO Action" concept. Why is money spent on continuing to pursue this option?		
18.	P. ES-3, ln 1-10	This section does not address the waste that has leaked into the environment from previous tank farm activities. Somewhere between an estimated one million to five million gallons of waste have leaked from single-shell tanks to the soil. The 8,000 gallon leak scenario should incorporate what has already leaked into the environment.		
19.	P. ES-3, ln 15-18	Uses the base of 8,000 gallons as a determination that "slight exceedance" would occur. This does not take into account the waste that may already exist in addition to what might leak during sluicing. Tc99 in the groundwater beneath BX farm has recently reached as high as 12,000 pCi/L which is 13 times the Drinking Water Standard of 900pCi/L. Where is this represented in the report?		
20.	P. ES-4, ln 1-10	Comments documented in COGEMA-98-881 dated September 30, 1998 express that costs and construction concepts are not well founded, especially those involving tank and soil removal. The concerns expressed in that document		

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		need to be addressed.		
21.	P. ES-4, ln 11-22	Such grossly high uncertainty levels directly conflict with sections of the report that attempt to quantify health risk and other limits, e.g. see regulatory compliance section on page ES-3.		
22.	P. ES-4, ln 26-30	This section states that retrieval leakage volume should be less than 8,000 gallons. The minimum detectable amount of leakage during retrieval is estimated to be 8,000 gallons. How can the leak volume be assured to be below that level?		
23.	P. ES-5, ln 1-7	This concept assumes minimal health risks from past and future tank leaks. How can one make this claim when such little real information is known?		
24.	P. ES-5, ln 8 through ES-6 line 26	This section (Data Needs) identifies significant and crucial needs that prohibit this document from achieving an acceptable level of uncertainty. The millions of dollars spent on the writing of this document should be reallocated . Work should now focus on how to resolve the critical needs such as – characterization data, health risks, and etc.		

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25.	General & Appendix A, General	I looked through some of the RPE. I mostly read Appendix A "Inventory and Source Terms", and just skimmed through the rest. I tried to compare the chemicals they looked at with data on the tank contents, but the chemicals chosen to base the risk on had nothing to do with the concentrations or volumes of the waste components. The hazard index and ability to move through the soil out weighted the volumes of waste components. They choose chemicals that represent 95% of the hazard, but very little of the volume of waste. The approach seems logical, but I will leave it to someone who knows more about soil transport to decide if the right stuff was looked at. Overall, I thought the approach looked good, but it came across as a house of cards with one assumption after another. They need more data (what's there and where will it go) to make the approach work or it is too easy to punch holes in.		
26.	Title	It is recommended that either the scope of the document be limited to "retrieval performance evaluation" or the title be changed to more accurately describe the scope of the evaluation. As closure and end states are being evaluated, the title is misleading in that it implies only retrieval is being evaluated.		
27.	General	Throughout the majority of the document there are references to closure alternatives and end states. As such, many comments have been generated which address the completeness of the evaluation and in particular, the omission of at least one important alternative. Although the majority of the text of the document appears to omit discussion and evaluation of the modified closure option (associated with soil), Section 6.3.6 discusses this option in detail. Not only does the regulatory discussion of included in Section 6 (Conclusions and Recommendations) accurately describe the		

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		applicable regulatory decisions and determinations to be made in relation to closure of the tanks and environmental media impacted by releases from the tanks, the section is very well written. Of particular interest, the regulatory discussion of Section 6.3.6 very clearly identifies necessary pause points in the closure process at which significant and potentially alternative-altering decisions must be made. To further explain, the following three descriptions of clean closure are provided in Section 6.3.6.3: 1) clean closure (of the tank) based on compliance with the TPA retrieval standard (assuming the use of a physical extraction technology), 2) clean closure (of the tank) using an immobilization technology after retrieval, and 3) clean closure (of the tank) using other removal or decontamination technologies and associated performance standards. Only evaluation of retrieval performance after retrieval has occurred will allow closure decisions to be made. For example, prior to or after retrieval has occurred, currently, it is necessary to evaluate if the physical extraction technology under the Hazardous Debris Rule has been met. This evaluation may involve or require an alternate performance standard for the physical extraction technology used during retrieval. The evaluation represents a pause point. Similarly, clean closure may be sought using an immobilization technology on the remaining residue after retrieval is complete. As such, depending on the form of immobilization, a demonstration that the immobilization has met the decontamination standard would likely be necessary. The demonstration represents a pause point. It should be noted that decisions should not be made prior to such "pause		

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		points" because the decisions are appropriately based upon the specifics associated with the particular evaluation/determination/demonstration/petition/waiver/etc.. Section 6.3.6.3 continues on to accurately describe several other important pause points. Therefore, it is recommended that three decision logic diagrams be devised for retrieval, tank closure, and soil remediation/closure. The diagrams should include the potential decision points as described in Section 6.3.6.3. The logic diagrams should also clearly identify what decisions and/or actions must occur as the tanks progress from waste retrieval, to tank closure, and lastly, to soil remediation/closure.		
28.	P. ES-1, ln 5-6	Identify in the executive summary that the TWRS EIS excluded tank closure decision alternatives and that a "supplemental" EIS is required for consideration of tank closure decision alternatives.		
29.	ES and RPE	Identify if this document satisfies the requirement to perform a supplemental NEPA analysis. The TWRS EIS clearly describes the NEPA requirements as requiring "....Federal agencies to analyze the potential environmental impacts of their proposed actions to assist them in making informed decisions." The TWRS EIS goes on to explain that "A major emphasis....is to promote public awareness of these actions and provide opportunities for public involvement." Still more description of the NEPA process is offered by the TWRS EIS by "An EIS is prepared in a series of steps: compiling Federal and State agency, stakeholder, Tribal Nation, and public comments to define issues requiring analysis (a process known as scoping); preparing the Draft EIS; receiving and responding to public comments on the Draft EIS; and preparing the Final EIS. The final step in the NEPA process is issuing a Record of Decision on the proposed action, which		

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		documents the decisions made by the agency." Given the above descriptions and explanations, it is recommended that the RPE clearly identify how the RPE will be used "to support DOE decisions under the NEPA." In addition, a description of the process which will be followed which includes identification of the RPE, should be included to communicate how and at what times public and stakeholder input, if applicable, will be considered.		
30.	P. ES-1, ln 20	Identify in the executive summary that the TWRS EIS analysis assumed a 99 percent retrieval. Also, identify if the TWRS EIS analysis must be revisited by assuming a 90 percent retrieval in the RPE.		
31.	ES and RPE	A clear delineation between the scope of the TWRS EIS and this document should be described in either the executive summary or in the document. As the TWRS EIS evaluated retrieval activities in the various tank waste management alternatives (see TWRS EIS for descriptions of alternatives), it appears the RPE is duplicating this portion of the analysis. If the retrieval technology is questionable regarding retrieval percentages (i.e., 99% versus 90%), it is understandable why an analysis of the various percentages is justified. As the TWRS EIS analyzed this work scope or activity using different assumptions, it is recommended that an analysis of just retrieval be generated and be presented as an addendum or supplement to the TWRS EIS. After the retrieval analysis is completed, it would then be appropriate to collect data (as is recommended by the RPE) which would ultimately allow decision makers and stakeholders information upon which to base informed decisions. Therefore, it is recommended that the scope of the RPE be greatly reduced to that which analyzes the retrieval activities (the various percentages of retrieval as alternatives) and		

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		identifies what data must be collected to support a final decision. As a significant amount of data is not available for the RPE, the analysis is incomplete and subject to widely varying "bounding" scenarios.		
32.	P. ES-2, ln 2	It is recommended that an additional bullet be inserted which states: "Identify the key decisions."		
33.	P. ES-2, ln 2	Identify if the term "key decisions" is the same as that used by the DOE Orders and Systems approach or provide a definition of the term.		
34.	P. ES-2, ln 20	It is recommended that an additional bullet be inserted which states: "Retrieving waste followed by a modified closure approach by which no strategy is precluded."		
35.	P. ES-2, ln 29-38	The document identifies that there is a "cost penalty" for a tank removal associated with a retrieval leakage loss but it does not identify a similar "cost penalty" for performing corrective action (primarily groundwater) during a post-closure period (after closure-in-place has occurred). This approach biases the analysis. This process appears to be proposing that final, end-state decisions be made based on non-final end-state closure costs. The significance of this approach can be put into perspective by considering a similar TWRS EIS issue. The TWRS EIS no action alternative analyzed the associated costs of no action. Those costs included the replacement of double shell tanks. Without the replacement costs, the no action alternative could have been considered to be favorably biased as an alternative. Similarly, for the RPE to not analyze the costs of corrective action (i.e., vadose, groundwater, surface water, etc.) associated with the alternatives it may be considered to favorably bias the no action and the close-in-place alternatives. Therefore, the analysis is significantly incomplete and biased.		
36.	P. ES-4, ln 26-32	The scenario as described by the text justifies analysis of a		

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		modified closure approach.		
37.	P. ES-4, ln 17-21	This data need justifies analysis of a modified closure scenario. Such an alternative should have "built-in" hold places where data must be obtained prior to a closure-in-place, clean closure, modified closure or no further action alternative is selected.		
38.	P. ES-4, ln 33-34	As indicated by the data needs as described on pages ES-4 through ES-6, it is apparent that the data needs are numerous. A previous comment requests the insertion of the identification of "key decisions" as part of the systems approach. Similarly, it would be beneficial to this approach if the significance of the data needs were evaluated in relation to making a/the key decision. To further explain, important information for the decision maker would be to understand the "costs" or "risks" associated with proceeding without the identified data. For example, to proceed without understanding if 90% or 99% waste can be retrieved may render certain data needs moot. If only 90% retrieval occurred, a decision maker may be far more apt to decide on a closure-in-place alternative. If so, certain data needs may become more important (i.e., allowable source limits, post-closure corrective action, cumulative analyses, etc.). Therefore, an association of data needs is recommended whereby the decision-maker can understand the significance of the data needs in relation to the four alternative.		
39.	P. ES-5, ln 1-4	The statement implies that cost data are not needed for restricted land use options. Under a restricted land use option, there would be costs associated with post-closure care of the closed-in-place tanks. These costs should be taken into consideration and analyzed prior to making a closure decision which precludes other alternatives.		

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		It should be noted that corrective action costs associated with closure-in-place may be significant enough to justify true consideration of another alternative which at first consideration may have seemed prohibitively expensive.		
40.	P. ES-5, ln 8-11	Recommended wording for the end of the sentence is: "....retrieval loss volume and concentration; residual waste volume and concentrations; and existing vadose and groundwater contaminant characterization concentrations."		
41.	P. ES-5, ln 13-16	Data on pre-existing vadose contamination as an additional contaminant transport parameter should also be included. It is currently theorized that contaminant transport through a contaminated zone occurs faster.		
42.	P. ES-5, ln 18-19	A determination of a "point of compliance" represents an excellent example of a determination whose time may not appropriately arrive for years. The optimal time to make this decision/determination may perhaps be after all the wastes have been retrieved from all tanks in a tank farm, a waste management area, or even in an entire area (200 East or 200 West Area).		
43.	P. ES-5, ln 18-19	Identify or define if the term "point of compliance" refers to a topographic land use feature, a waste management delineation, or a groundwater monitoring point.		
44.	P. ES-4 - ES-6	The identified data needs supports a pause between retrieval and decision making so that data can be collected and evaluated prior to making a closure decision which may preclude future closure options. It is noted that a modified closure scenario would represent a process or alternative which would allow such a "pause".		
45.	P. ES-4 - ES-6	It is noted that the data needs descriptions do not identify when which data would be most beneficial to obtain. To further explain, the composite analysis appears to represent data needed for the NRC to enable a determination of the material's eligibility to be disposed. The document does not indicate if such a determination would be made on a tank		

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		farm by tank farm basis or if the determination will be made in total (after waste is retrieved from all tanks). Again, due to the significant data needs, the approach would benefit from a "pause" for deliberation/evaluation of multiple analyses prior to final closure decisions being made.		
46.	P. ES-6, ln 3-6	The determination (to be made by the NRC) described by the text represents an excellent justification for a pause in this particular decision-making process. As indicated by the text, the determination must be made prior to any other action (i.e., if remaining source amounts are too great, further removal and/or decontamination will be required). Therefore, this requirement justifies the performance of all retrieval activities followed by some level of data collection (to support this particular NRC determination) followed by this particular NRC determination, followed by characterization data collection, followed by the making of interim and/or final closure decisions. Such a process represents a phased implementation of how final closure decisions will be made. This process also emphasizes the lack of information currently existing upon which to base final closure decisions. Therefore, it may be concluded that the RPE process scope is too large and should either be reduced to just retrieval (which was covered by the TWRS EIS) or should clearly identify mandatory pause points whereby data/information may be obtained to enable decision makers and stakeholders the ability to make informed decisions which do not prematurely preclude a viable and/or desirable alternative.		
47.	P. 1-1	It is recommended that an additional box similar to the TPA SST retrieval and closure requirement box which identifies what the Hanford Site RCRA Permit specifies for closure (i.e., clean-closure, closure-in-place, and modified closure).		

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48.	P. 1-1, ln 27	It is recommended that after the word "remediated" in the last sentence, the words "and/or managed" be inserted.		
49.	P. 1-1, Summary	It is recommended that a bullet which asks the following question be inserted: "Prior to deciding on 'clean closure', 'modified closure' and/or 'closure-in-place', what level of soil and/or groundwater characterization is required?"		
50.	P. 1-1, Summary	It is recommended that a bullet which asks the following question be inserted: "Prior to deciding on 'clean closure', 'modified closure' and/or 'closure-in-place', what level of soil and/or groundwater remediation is required?"		
51.	Page 1-1, Summary	It is recommended that a bullet which asks the following question be inserted: "How will existing SST WMA groundwater contamination be analyzed – on a tank by tank basis, farm by farm basis, WMA by WMA basis, etc.?"		
52.	P. 1-1, Summary	It is recommended that a bullet which asks the following question be inserted: "How will existing SST WMA groundwater and vadose zone contamination impact the final closure selection or decision-making process?"		
53.	P. 1-2, ln 9-14	The modified closure option for which the Hanford Site is permitted is not included in the closure definition/description. Include and describe the modified closure term and reference the Hanford Site RCRA Permit.		
54.	P. 1-2, ln 9-14	Throughout the document, the terms "restricted land use" and "unrestricted land use" are used. While this terminology may best describe the strategies in relation to land use planning, for regulatory purposes, they are synonymous to "closure-in-place" and "clean closure". It is recommended that this explanation be added to the closure RPE term definition.		
55.	P. 1-2, ln 11-14	Recommended re-wording for the sentence is: "Closure for the tank farms will be performed under the Hanford Site RCRA Permit, the TPA, and Washington State Dangerous Waste Regulations (WAC 173-303) for tank wastes and tank waste constituents. Closure will also be performed under all applicable Federal and State regulations. In addition, closure		

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		will be performed under DOE orders pertaining to radioactive wastes and waste constituents."		
56.	P. 1-3, ln 18-22	. The text identifies that the impact analyses do not extend beyond "the interface of groundwater and the Columbia River". The text further identifies that the RPE evaluates strategies and options that would result in releases to the river "at levels of potential concern." The last sentence on the page concludes "Prior to making final waste retrieval and closure decisions, cumulative impacts and impacts to the river would need to be addressed." The text implies that the RPE is incomplete and does not allow or adequately support "final waste retrieval and closure decisions" to be made. Furthermore, by not including a modified closure approach (by which final closure decision do not have to be made immediately after retrieval) or evaluating corrective action during post-closure (for the closure-in-place option), there is a positive bias towards selecting a closure-in-place (landfill) option. Therefore, the analysis approach associated with the RPE omits significant deliberative consideration and does not allow decision-makers an ability to make informed "final" decisions. This omission represents a serious deficiency.		
57.	P. 1-3, ln 20-22	The last sentence states "Prior to making final waste retrieval and closure decisions, cumulative impacts and impacts to the river would need to be addressed." Again, the process by which this document will "support DOE decisions under the NEPA" is unclear. A question arising from the statement could be: "Will any final closure decisions on any tank be made before the cumulative impacts and impacts to the river are evaluated and addressed?" Another question arising from the statement could be: "Can the RPE be used to support decisions which reduce the scope of tank waste cleanup?"		

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		How exactly the RPE will be used is very unclear.		
58.	P. 1-5, Fig 1.0.1	There is a typographical error in the title of the figure.		
59.	P. 1-6, ln 4-6	Recommended wording for purpose number 1 is: "evaluating the extent of SST waste retrieval as specified by TPA milestone M-45-00".		
60.	P. 1-6, ln 6-8	Recommended wording for purpose number 2 is: "establishing criteria for determining allowable leakage volumes". This wording is in agreement with M-45-08-T02.		
61.	P. 1-6	It is recommended that the additional purpose be inserted in the list: "establishing acceptable leak monitoring/detection and mitigation measures necessary to permit sluicing operations." This wording is also in agreement with M-45-08-T02.		
62.	P. 1-6, ln 9-12	It is recommended that purpose number 4 be deleted. The analysis is incomplete and cannot, at this time, adequately evaluate final closure options which would allow decision-makers and stakeholders to make an informed decision. It is noted that the item could be re-written as: "implementing SST retrieval based on meeting TPA waste volume retrieval requirements".		
63.	P. 1-6, ln 12-13	It is recommended that purpose number 5 be deleted. Until the analysis is complete, regulators are not able to determine what "compliance" will look like. To explain, depending upon the approach (tank-by-tank, farm-by-farm, WMA-by-WMA, etc.) to be taken for closure, compliance may take several forms (clean closure, modified-closure, and/or closure-in-place). In addition, compliance may require corrective action under certain scenarios and/or additional decontamination and/or removal under other scenarios. As such, other than the retrieval volumes required by TPA M-45-00, the regulators do not have the ability to determine what compliance will represent at this time.		

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64.	P. 1-6, item 5	Recommended wording for purpose number 5 is: "establishing retrieval leakage losses data quality objectives to support TPA retrieval compliance determinations."		
65.	P. 1-6, ln 2-23	The stated purpose at the beginning of the paragraph (including the numbered items) compared with the last sentence of the paragraph, emphasizes the extensiveness of the scope of final closure. Clearly, the scope of the RPE would appropriately be limited to that of retrieval, leakage loss quantification, and data quality objective identification and implementation. The last sentence correctly identifies "ultimately the decisions also will require data and analysis from the remaining SST farms, the entire SST tank farm system, and other 200 Area waste sites." Apparently, actions beyond retrieving waste, quantifying retrieval losses, and characterizing remaining contamination are beyond the scope of the RPE due to the acknowledged ultimate requirement to obtain and analyze additional data. The paragraph needs to be re-written to clearly delineate the scope of the RPE.		
66.	P. 1-6, ln 9-12	The text of lines 28-33 on page 1-6 identifies a SST waste retrieval system design and operation that "must be based on decisions that are made early in the years ahead." The text also identifies that recent information indicates that waste processing will not begin until 2006-2007. Given the DST space constraints, the extremely large number of potential retrieval sequences, the continuing development of retrieval technology, the potentially necessary deployment of non-sluicing retrieval technology (to decrease leakage during sluicing), it is apparent that the purpose item number 4 is either too large in scope or incorrectly written. Recommended re-wording for item 4 is: "initiating SST retrieval based on TPA and/or Ecology-approved tank-by-tank retrieval requirements (i.e., volume of waste and retrieval leakage losses);".		

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67.	P. 1-6, ln 24-43, box	The TPA Milestone M-45-00 description accurately describes the consent order milestone. The description also identifies an ideal "pause point" after which closure decisions may be made. As this document appears to reconsider retrieval impacts (using different assumptions than were used in the TWRS EIS), and does not evaluate the entire impacts of final closure decisions (RCRA corrective action requirements associated with those tanks known to have leaked or spilled dangerous wastes {S-SX, B-BY-BY, and T and TX-TY WMAs}), the scope of the RPE should be limited to retrieval.		
68.	P. 1-7, ln 6-8	The text identifies data needs which will influence SST waste retrieval. Considering the significance of the data needs of the first 3 bullets (lines 9-19), the appropriate RPE scope would be limited to retrieval.		
69.	P. 1-7, ln 20-22	Tank farm end state requirements do not exist. Without performing an analysis which includes evaluation of corrective action requirements and all closure options (modified closure), the analysis is incomplete. Without a complete analysis, it is inappropriate for tank farm end state requirements to be decided upon at this time. In summary, the analysis may be interpreted to positively bias certain closure options by playing certain risks off against others (the most significant risk is likely associated with the omission of evaluation of RCRA corrective action requirements and/or impacts). Therefore, it is recommended that the bullet be deleted.		
70.	P. 1-7, ln 21-22	Tank farm end state requirements do not exist. Without performing an analysis which includes evaluation of corrective action requirements and all closure options (modified closure), the analysis is incomplete. Without a complete analysis, it is inappropriate for tank farm end state requirements to be decided upon at this time. The analysis may be interpreted to positively bias certain closure options		

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		by playing certain risks off against others (the most significant risk is likely associated with the omission of evaluation of RCRA corrective action requirements and/or impacts). In addition, as described below (lines 23-35), the scope of the RPE was agreed to be to "demonstrate the analysis necessary to make decision on a tank-by-tank basis regarding the Tri-Party Agreement interim retrieval (goal of at least 99 percent of the waste volume from SSTs." Clearly, the scope of this bullet goes beyond the described agreement. It is recommended that the bullet be deleted.		
71.	P. 1-8, ln 2-3	The text states: "providing the basis for future NEPA, safety, and regulatory actions affecting waste retrieval and tank farm closure." The RPE is an excellent document for identifying data quality needs associated with retrieval and data that will be needed prior to preceding with final closure decisions and RCRA corrective action. Although it analyzes various clean closure and closure-in-place scenarios, it does not achieve a complete analysis by omission of analysis of modified closure and RCRA corrective action requirements. Therefore, it is inaccurate to identify the RPE as providing the basis for tank farm closure considerations. It is recommended that either the words "and tank farm closure" be deleted or the sentence be re-written to identify the RPE as providing a basis for waste retrieval considerations but only an initial consideration associated with tank farm closure issues.		
72.	P. 1-8, ln 16	It is noted with interest that page 1-10 describes past sluicing of tank AX-104. Due to the identified volume of data needs and the technology uncertainties associated with tank waste retrieval, it is recommended that the words "further and/or" be inserted between the words "making" and "final".		
73.	P. 1-8, ln 19-21	As closure activities associated with the SSTs and DSTs will		

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		occur over the next few decades, identifying all data needs at this time "to support decisions on waste retrieval for eventual closure of the tank farm system" represents a scope that is not adequately supported by the analysis. Recommended wording for the bullet is: "Identify known data needs, analysis, and key decisions necessary to support the entire scope of tank waste retrieval."		
74.	P. 1-8, Additional Bullet	If the scope of the RPE is to address closure (by inclusion of analysis of modified closure and RCRA corrective action requirements), recommended wording for a closure work scope bullet is: "Identify known data needs, analysis, and key decisions necessary to support interim (modified closure) and final (clean closure or closure-in-place) closure decisions."		
75.	P. 1-9	Regarding stakeholder and Tribal Nation involvement and external review and input, it is requested that an identification of where the administrative record is located be inserted somewhere in the document. A logic place to insert such information would be on page 1-9.		
76.	P. 1-10, ln 6	The RPE is an excellent document for identifying data quality needs associated with retrieval and data that will be needed prior to proceeding with final closure decisions and RCRA corrective action. Although it analyzes various clean closure and closure-in-place scenarios, it does not achieve a complete analysis by omission of analysis of modified closure and RCRA corrective action requirements. Therefore, it is recommended that the words "and tank farm closure decisions" be deleted.		
77.	P. 1-10, ln 28	As stated in a previous comment, the RPE does not adequately support the development of closure criteria by omission of analysis of modified closure and RCRA corrective action requirements. Therefore, it is recommended that the words "and closure" between "retrieval" and "criteria" be deleted as the development of closure criteria appears to be beyond the scope of this document.		

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78.	P. 1-11, ln 1-6	As stated in a previous comment, the RPE does not adequately support the development of closure criteria by omission of analysis of modified closure and RCRA corrective action requirements. Therefore, it is recommended that the words "and tank farm closure" between "retrieval" and "technologies" be deleted as the consideration of closure technologies appears to be beyond the scope of this document.		
79.	P. 1-11, ln 7-14	As recommended in a previous comment, delete the words "and tank farm closure" between "retrieval" and "strategies".		
80.	P. 1-11, ln 28-29	As recommended in a previous comment, delete the words "and tank farm closure" between "retrieval" and "strategies".		
81.	P. 1-11, ln 32	As recommended in a previous comment, delete the words "and tank farm closure" between "retrieval" and "strategies".		
82.	P. 1-11, ln 36	The types of decisions of item 8 is confusing by use of the terms "key decisions" and "final decisions". In addition, as previously stated, as the data needs associated with final closure decisions are tremendously large at this time, the scope of the RPE should only be that of retrieval with no closure strategies precluded. It is recommended that the words "final decision making" be replaced with "making key decisions".		
83.	P. 1-11, box	Modified closure as permitted by the RCRA Hanford Site permit should be included as a strategy in the box.		
84.	P. 1-13	As all of the closure strategies have not been evaluated/analyzed, the assumptions used in the RPE analysis may not "bound potential environmental and human health impacts" as stated. Either identify that all closure strategies were not evaluated/analyzed or reduce the scope of the RPE to only address retrieval.		
85.	P. 1-13	The assumptions do not appear to include "contaminant concentrations and volumes of past tank leaks and/or spills which have migrated to the groundwater based on process and operations history and groundwater sampling data." It is Ecology's determination that tank releases in the waste		

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		management areas S-SX and B-BX-BY have negatively impacted groundwater (i.e., the RCRA groundwater monitoring systems are performing interim status assessment monitoring). Either identify that all conservative assumptions were not evaluated/analyzed or reduce the scope of the RPE to only address retrieval.		
86.	P. 1-14, ln 7 - 8	As previously stated, the RPE scope should not include final closure decisions and/or end states at this time due to the tremendous lack of data upon which to analyze alternatives and base decisions. Therefore, it is recommended that the word "alternatives" be placed between the words "closure" and "to ensure decisions". Similarly, it is recommended that the words "by preclusion of strategies/alternatives" be placed after the last word in the sentence "decisions".		
87.	P. 1-15, ln 18	As previously stated, the RPE scope should not include final closure decisions and/or end states at this time due to the tremendous lack of data upon which to analyze alternatives and base decisions. Therefore, it is recommended that the words "to analyze" be placed between the words "retrieval and" and "tank farm closure". Similarly, it is recommended that the word "alternatives" be placed between the words "closure" and "are obtained".		
88.	P. 1-16, ln 8-38	The strategies do not include modified closure and therefore the RPE analysis is incomplete. Furthermore, it is inappropriate to analyze closure end states when they are not known or without meaningful and/or sufficient data. Lastly, it should be noted that the restricted land use strategy (closure-in-place) would very likely preclude all options associated with modified and unrestricted land use (clean closed) strategies and ultimately, alternatives. For these reasons, the scope of the RPE should be confined to that of retrieval.		
89.	P. 1-16 - 1-17, ln 40-43 and 1	The text explains that each of the restricted land use (closure-in-place) strategy options/alternatives analyzed impacts assuming that tanks, ancillary equipment, and contaminated		

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		soils would remain in place and be covered with a surface barrier. The text goes on to describe grouting assumptions. As stated above, the RPE does not include consideration of a modified closure approach and therefore the RPE analysis is incomplete.		
90.	P. 1-17, ln 5-6	The sentence explains that the strategies and options/alternatives were analyzed by comparing changing variable. The omission of the modified closure as a strategy and the numerous alternatives associated with that strategy stands out as an important deficiency which does not allow "the relative changes in environmental and human health impacts" to be considered and/or deliberated. Similarly, the omission of analysis of RCRA corrective action requirements associated with farms from which releases are known to have negatively impacted groundwater or which released wastes during retrieval negatively impacts groundwater stands out as an important deficiency which does not allow comparison of "the relative changes in environmental and human health impacts". The RPE should either include modified closure as a strategy and considerations of likely RCRA corrective action(s) or reduce the scope to that of retrieval.		
91.	P. 1-16, 1-17, and 1-18	Modified closure strategy would appropriately be considered a "restricted land use" strategy. Similarly, the consideration of RCRA corrective action(s) as a variable would appropriately be considered under the "restricted land use" strategy.		
92.	P. 1-16, 1-17, 1-18, and 1-19	On page 1-13, lines 4-8, it is indicated that conservative assumptions are used to support the RPE analysis. It also identifies a justification of usage of conservative assumptions to address "data limitations" associated with "contaminant concentrations and volumes of past tank leaks to the soils based on process and operations history and gamma and spectral gamma logging of boreholes".		

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		While this assumption is stated, it is unclear which assumptions were used to support analysis of the restricted and unrestricted land use strategies. For example, the restricted land use strategy appears to only describe "contaminant inventories" in relation to retrieval leakage losses. As another example, the unrestricted land use strategy repeatedly identifies a scenario by which "contamination from past leaks and retrieval losses" would be excavated to the extent practicable. Therefore, it is recommended that clarification be provided regarding whether or not existing contamination from past tank leaks and/or spills to the environment is included in the analysis.		
93.	P. 1-18, ln 13-22	Soil treatment may be considered a RCRA corrective action. As such, it appears there is an intent to evaluate soil corrective action(s) but not groundwater corrective action(s). This delineation is neither explained nor justified. Either include a comprehensive analysis of RCRA corrective action requirements (i.e., groundwater treatment systems and/or treatment train units) or reduce the scope of RPE to that of just retrieval.		
94.	P 1-19, ln 5, 8, and 24	The phrase "to the extent practicable" is used in association with the "unrestricted land use strategy" or clean closure scenario. The phrase does not support clean closure requirements. If the contamination cannot be removed and/or decontaminated to satisfy clean closure requirements (i.e., closure levels), clean closure is not an option/alternative. Perhaps more important in relation to this issue is the differentiation between retrieval leakage losses versus tank waste management releases. If the RPE is only evaluating remediation of retrieval leakage losses, it should only evaluate retrieval and not closure. Clearly, closure alternatives/options		

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		would consider remediation of contamination without consideration of its source. For example, for "end state" purposes, it does not matter how the contamination occurred, but how and to what extent it is being remediated. To further explain, during closure, it will not matter how releases from the tank occurred (i.e., leaks, spills, and/or retrieval losses). The degree to which contamination can be remediated will be the primary consideration during closure and/or corrective action. It should be noted that prior to selection of a closure option and/or corrective action measure, for characterization purposes, it is very important to understand how contamination occurred and is/was transported through the environment.		
95.	P. 1-20, ln 5	Due to the incomplete analysis of closure alternatives and impacts, it is recommended that the words "and tank farm closure" be deleted and the scope of the RPE be limited to retrieval.		
96.	P. 1-20, Box	The insert is incomplete in that post-closure considerations, characterization needs, and/or RCRA corrective action(s) are omitted. Either the scope of the RPE should be reduced to retrieval or the identification of these omissions should be clearly communicated in the document.		
97.	P. 1-20, ln 5-14	The sentences succinctly describe what a reviewer could interpret is the scope of this document. The document appears to be evaluating closure options rather than retrieval performance. Another name for the document could be "Closure Options Performance Evaluation" whose acronym could be "COPE".		

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98.	P. 1-21, ln 15-35	The text describes potential "points of compliance". An identification of the WAC definition of "point of compliance" should be inserted into the text. It should also be identified that if the tanks are closed in place with corrective action requirements imposed, the point of compliance could be the base of the tanks, the interface of tank fill with soil/rock, or any point in the vadose zone beneath the tanks.		
99.	P. 1-22, Table 1.3.1	The type of supporting modeling assumptions used for the "No Action" alternative are neither clearly communicated in the text nor by the table. The risk values for the "No Action" alternative are similar to those of the "Nominal Retrieval Losses" and would imply that a minimal amount of tank waste loss would be associated with the "No Action" alternative. It is recommended that an identification of certain assumptions associated with the "No Action" alternative be included either in the text or as notes to Table 1.3.1.		
100.	P. 1-23, ln 1-8	The two figures on page 1-5 communicate different risk estimates of radiological sources (total curies) and Tc-99. It is recommended that an explanation be included which explains the relative comparison of risks between radiological and non-radiological tank waste constituents. Although the text alludes at the differences between the two types of constituents and directs the reader to the section of the RPE where this information can be found, the explanation would add clarification to the document.		
101.	P. 1-26, Table 1.3.5	Include an identification that "End State Requirements" are those defined by the RPE. A note should also be added to the table which indicates the costs do not include contaminant transport characterization, post-closure groundwater monitoring, or corrective action associated with contaminant releases.		

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102.	P. 1-26, ln 4-17	An identification that the analyses did not include contaminant transport characterization, post-closure groundwater monitoring, or corrective action associated with contaminant releases should be included in the description of the comparisons. The additional costs for remediating and/or removing contaminated soils could bias the reader against selecting clean closure and/or modified closure alternatives.		
103.	P. 1-28, 1-8 and Table 1.3.6	The text and table appear to be communicating modeling results. In actuality, groundwater concentrations of Tc-99 associated with B-BX-BY, S-SX, and T-TX-TY WMAs have been measured well above the drinking water quality standard of 900 pCi/L. In fact, very high levels of Tc-99 have been measured in relation to B-BX-BY groundwater monitoring (approximately 12,000 pCi/L). Therefore, the groundwater and vadose zone monitoring data that have already been collected do not agree with the modeling results of page 1-28. This disagreement between modeling results and actual measurements should be identified in the text.		
104.	P. 1-28 and/or Table 1.3.6	The text or the table needs to identify where the model predicts the maximum concentration of Tc-99 in the groundwater. Specifically, the identification of contamination at the AX tank farm or at the shoreline of the Columbia River.		
105.	P. 2-8, ln 22	Insert the words "and/or waste constituents" between the words "equipment and waste" and "in the soils".		
106.	P 2-8, ln 24-34	The use of the RPE "as an example of how retrieval and closure decisions will be made" is identified in the text. It is requested that whatever else the RPE can be used for also be identified. For example, if this document satisfies the NEPA requirements in any fashion (i.e., if the RPE represent the supplemental TWRS EIS), this should be identified. As another example, if "closure" decisions could be made regarding AX tank farm because of this document, this should also be identified.		
107.	P. 3-5, ln 20-23	Identify that prior to selection of the AX tank farm (which		

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		includes AX-104), C-106 was considered and selected for this consideration. In other words, identify the criteria used for tank/farm selection.		
108.	P. 3-5, ln 24-28	Identify how many of the 149 SSTs have been sluiced and are believed to contain only hard residuals that could not be retrieved using past-practice sluicing. In other words, identify the criteria for tank/farm selection.		
109.	P. 3-5, ln 29-31	Identify how many of the 149 SSTs have associated documented leaks and/or spills. Similarly, identify how many of the 149 SSTs have available contaminant characterization vadose zone data. In other words, identify the criteria for tank/farm selection.		
110.	P. 3-8, ln 6-9	Identify the vadose zone waste characterization technologies to be used and explain how they will reduce uncertainties. If the explanation is simply that data will reduce the uncertainties and currently there is little, this explanation should be included.		
111.	P 3-8, ln 10-13	Identify how many of the 149 SSTs have "a relatively high amount of technetium and other long-lived highly mobile constituents". In other words, identify the criteria for tank/farm selection.		
112.	P. 3-35 - 3-38	The text on page 3-33, lines 23-34 describes the contaminant transport modeling effort. Currently, the Hanford Site is expending considerable resources to address this issue. As such, identify the various modeling efforts used to-date and include the justification for using the modeling approach selected for the RPE.		
113.	P. 3-83, ln 1-5	Figure 3.8.1 is included as a summary of "the path forward for closure of the hazardous waste constituents and major regulatory options under the baseline plan". Figure 3.8.1 appears to have omitted several decision points (i.e., the decision that physical extraction has or has not met the Hazardous Debris Rule, the decision that the remaining tank residuals satisfy decontamination standards, the decision that		

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		the tanks are clean closed and that clean closure for the soils is an option, etc.). Therefore, include a status of "acceptability" or "completeness" of the Single-Shell Tank Closure Work Plan in the text on page 3-38.		
114.	P. 5-1, Table 5.0.1	There are numerous decisions which must be made prior and during the retrieval and closure processes. It is recommended that the table include a column entitled "Decision needs."		
115.	P. ES-1, ln 15	Should include after the purpose, an explanation that no decisions are expected be made based on this RPE until data gaps have been filled and most major uncertainties have been reduced. The text sets up the expectation that this is the final draft of the document and has all the answers.		
116.	P. ES-4, ln 8	Prefer "an additional cost" to "cost penalty".		
117.	P. ES-5, ln 30-33	Don't see a contaminant transport "need" mentioned in this paragraph. There is a list of parameters.		
118.	P. 1-6, ln 30	Could you give the reader an estimate of the amount of over prediction of contaminant concentrations could be expected?		
119.	P. 1-21, ln 1-5	The cost estimates given in the report are probably fine considering our current state of knowledge. However, since they don't include treatment or disposal of ancillary equipment and soils we are leaving out a major hitter. My fear is that readers will have the impression that these costs are considerably lower than they will turn out to be. Please reinforce the cost unknowns in the conclusions and other places in the document, as appropriate. In regards to disposal at ERDF throughout the document, EPA has jealously guarded the ERDF for CERCLA only waste. It may be a hard sell to convince them that tank waste is worthy of disposal at ERDF.		
120.	P. 1-30, Table 1.3.6	Consider adding the size of the past leak to the table (perhaps as a footnote).		
121.	P. 1-30, ln 32	The leak detection piece of the document (and HTI) is very weak. Explain somewhere how HTI work relates to the TPA		

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		leak detection milestones.		
122.	P. 3-58, ln 23	Don't know the source of the particle size information in Khaleel and Freeman, but if this is based of data gathered over a long historic interval, the results are suspect. As far as I know samples collected at wellsites until at least 1989 were quite likely not representative of the lithology of the sample interval. No response required.		
123.	P. 4-5, ln 22, 29, 34	Explain briefly how they estimated the amount of "pumpable liquid" remaining in the tanks.		
124.	P. 4-13, ln 13	This sentence is confusing. They are going to first remove saltcake, then sludge. Thought it would be the other way around. Please clarify.		
125.	P. 6-9, ln 18	Is it possible to reduce the uncertainty in contaminant concentration to less than 10-40 times?		
126.	P. 3-2, ln 30 P. 3-3, ln 10 P. 3-13, ln 29-40 P. 3-14, ln 16-20 P. 3-22, ln 31-37 P. 3-35, ln 17-22 P. 3-44, ln 14-26	The 10,000-year modeling period is questionable. Realizing that this number came from both tribal requests and federal regulations regarding radioisotopes, it may be useful to pick one or two alternative periods based on more near term human and ecological risk (i.e.,100, 500 or 1000 years). It would be worthwhile to determine what the modeling options become when the period of interest is drastically reduced. The accuracy of the model results may be orders of magnitude better. It does not make sense to model for 10,000 years when there is no way that accurate predictions on things such as population, weather conditions, geologic/hydro-geologic conditions (as well as many other parameters), can be made. More importantly assumptions on fate and transport of contaminants in both the vadose and groundwater become very unrealistic to accommodate such a long period of time. Recommendation: as part of the modeling analysis Jacobs should analyze for some much smaller time frames. If this has already been done then Ecology should be able to assess those results as part of setting closure standards for the tanks.		

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127.	P. 3-4, ln 9	Although it is imperative that every aspect of this document be open for discussion, some things such as tank selection may not need further consideration. The AX tank farm is clearly the least complicated of the TWRS system and still provides substantial technical challenges in terms of making accurate deterministic and probabilistic predictions of risk. Recommendation: for this modeling effort focus on the AX farm only. If success is achieved then move to a more complicated multi-tank system.		
128.	Page 3-23, Table 3.3.1	Was Ecology involved with the COC screening/selection process? If not then this table should be reviewed and commented on by Ecology staff. Recommendation: determine the status of this table.		
129.	P. 3-34 P. 3-47	It doesn't appear that WAC-173-340 was considered in presenting the appropriate risk calculations. WAC-340-740, gives specific formulas for estimating the upper-bound incremental cancer risk due to site related chemical releases. Recommendation: A comparison of the MTCA formulas to what is presented in t his section should occur. Since MTCA cleanup standards are being proposed as closure performance standards, it makes sense to utilize (to whatever extent practical) the risk equations that are provided in MTCA as well.		
130.	P. 3-36	This flow chart does not provide enough information in terms of how the different transport and statistical models relate. Recommendation: insert an additional flow chart that defines in adequate detail the two modeling paths (i.e., the deterministic vs. probabilistic) for predicting risk.		
131.	P. 3-37, ln 28-34	It is clearly stated that realistically anisotropic hydro-geologic		

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		conditions exist, however most if not all of the risk modeling pre-supposes isotropic conditions. Recommendations: further consideration should be given to the current modeling assumptions, so that a reasonable amount of accuracy is achieved.		
132.	P. 3-44, ln 21-26	The discussion on the different limitations posed by either 2-D or 3-D modeling should be more detailed. For example what substantiates the claim that over-prediction of contaminant concentration is a problem with the 2-D model? Recommendation: currently if there is not a better discussion on this topic within the RPE then one should be created.		
133.	P. 3-48, ln 1-3	There is a brief mention of selected times for calculating risk over the 10,000 year period of interest. What are these selected times and what are they based on. Recommendation: additional discussion on topic should be provided in the RPE, for review and comment by all end users.		
134.	P. 3-53 ln 1-8 P. 3-56, P. 4-8	Different parts of the RPE discuss that PORFLOW could be utilized as a probabilistic model with better results because it is able to more accurately model existing geologic conditions. It is possible that using PORFLOW instead of MEPAS should still be considered. Recommendation: further consideration of application of PORFLOW should occur		
135.	P. 3-53 ln 14-20	Numerical model uncertainty input parameter uncertainty and conceptual model uncertainty all must be considered to make accurate risk predictions. This is currently not the methodology being pursued. Why? Recommendation: add this additional data quality objective		

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		into the modeling effort.		
136.	P. 3-59, ln 15-22	The Bayesian statistical approach, (i.e., use of Bayes estimator) needs better clarification. Some authors of books on statistics warn that the Bayes estimator must be used carefully, especially with regard to using a prior density of the parameter of interest in place of data that is missing and should be collected for accurate modeling to occur. Recommendation: further clarification is needed on this topic. Application of the Bayesian approach with respect the data that is presented in appendix C is not clear.		
137.	P. 3-60, ln 11-25	Is the PDF discussed in this text the same as a probability density function (pdf) or is it more related to a cumulative distribution function (CDF). The statistical approach lacks the detail necessary to assess its validity. Assumptions made for modeling are not provided. Things like whether discrete or continuous functions are being applied; what data distribution is being assumed (i.e., normal, lognormal or non-parametric), whether a joint distribution is being applied in the Latin hypercube probabilistic model and what defines the data set (is it constrained and how). Recommendation: full documentation to support the statistical approach should be submitted. A document such as "the FORTRAN 77 Program and Users Guide for the generation of Latin Hypercube and Random Samples for Use with Computer Models" was very good information. Apparently this document doesn't represent what is being proposed in the RPE A specific document should be submitted as part of the RPE evaluation. A separate guide for the deterministic approach should also be submitted		
138.	P. 3-61	Same concern as preceding comment. For example item #3 discusses doing a total of 250 MEPAS runs, which is actually based on application of the LHS. Ecology must understand		

1. Name of Reviewer:	2. Organization of Reviewer:	3. Phone No:	4. Date:
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		first the validity of the LHS in order to agree that 250 iterations is sufficent. It may be better to take a monte carlo approach if greater accuracy can be achieved. The concept of vectors of variables and more generally multivariate statistics is arcane and somewhat complex, further explanation of this is imperative. Second example: line 31 begins discussion on sampling in k dimensions which is governed by a specified PDF. Is this PDF based on a discrete or continuous function? Does this imply that the $P[X \leq x] = 1$ is being assessed or is some other type of probability being modeled. Recommendation: a report/guide on the various aspects to the overall statistical approach is necessary.		
139.				