Document Number(s)/Title(s): DOE/ORP-2008-01, Rev 0/RFI Report for SST WMAs

Item	Criteria (T=Tech, R=Reg, E=Edit)#	Page #, Sec #, Para #	Comment (s) (Provide technical, legal or regulatory citation for the comment)	Recommendation of the action required to correct/resolve the discrepancy/problem indicated.	Response
1.	R	General	DOE/ORP-2008-01 is to be an RCRA Facility Investigation (RFI) document, not a status report. The 1999 *Phase 1 RCRA Facility Investigation/Corrective Measures Study Work Plan for SST Waste Management Areas*, DOE/RL-99-36, Rev. 1, was the basis for the M-45-55 deliverable. The M-45-55 Milestone reads: "Submit a primary document: Phase 1 RFI Report integrating results of data gathering activities and evaluations for all SST WMAs, including a summary of impacts from the initial SST Performance Assessment, with conclusions and recommendations. Results from WMAs A-AX, C, and U will be included as appendices to the RFI rollup report addressing the SST WMAs under RCRA corrective action, so that a single document contains available information for the 200 Area SST WMAs and will support SST retrieval and closure." From DOE/ORP-2008-01, page 1-1 it states that: "This document is not a RCRA Facility Investigation Report in the usual sense of the *Resource Conservation and Recovery Act of 1976* (RCRA) or a Facility Investigation Report found in the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA). Rather, it is a state of knowledge as required by the *Hanford Federal Facility Agreement and Consent Order*." The *Phase 1 RCRA Facility Investigation/Corrective Measures Study Work Plan for SST Waste Management Areas*, DOE/RL-99-36, Rev. 1,stated that "Recognizing the potential need for future RCRA Corrective Action Program (RCAP) activities beyond those specified in this master work plan, DOE has designated the currently planned activities as "Phase 1." If a second phase of activities is needed for the WMAs addressed in Phase 1, or if releases are detected at other	The RFI report has significant omissions and misstatements when compared to the Work Plan and M-45-55... "Phase 1 RFI Report integrating results of data gathering activities and evaluations for all SST WMAs, including a summary of impacts from the initial SST Performance Assessment, with conclusions and recommendations." Please correct the deficiencies as noted in the examples below and other comments.	See individual comments below.

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			SST WMAs, this master work plan will be updated accordingly." This means that the Phase 1 activities and high-level logic for the Hanford Site SST RCAP is to "**Prepare a Phase 1 RFI report that integrates the results of the WMA-specific characterization activities and field investigation reports, and establishes the basis for a CMS.**" That report was to be the DOE/ORP-2008-01 that we are reviewing. **The scope of the 1999 work plan stated that:** … "The Phase 1 RFI is intended to collect environmental data to support decision making not only for RCRA corrective action, but also for the SST waste retrieval and SST closure projects. In addition, Phase 1 will seek to address the information needs of other Hanford Site activities, but only to the extent that these information needs are incidental to those associated with corrective action, retrieval, and closure. Characterization to support the design of tank waste treatment and related support facilities' is not within the scope of the RCAP, nor is characterization to support design of the immobilized low-activity waste (ILAW) disposal facility. Evaluations under the RCAP will not postulate any releases from these facilities (i.e., in the context of supporting cumulative risk analyses)." ... "The focus of Phase 1 is on understanding releases from elements of the TSD units that lie within the WMA boundaries. Notwithstanding this focus, the WMA-specific DQO process must identify all relevant sites associated with and adjacent to the tank farms (e.g., nearby waste sites being addressed under DOE'S ER Project). As judged appropriate by the Tri-Parties through the DQO process, the scope of Phase 1 RFI characterization may be expanded to consider releases from TSD elements outside the WMA boundaries and to consider releases from adjacent waste sites being addressed by the ER Project. Actual characterization of such sites may be performed by other programs, if appropriate, but would be coordinated with the SST RCAP." … *Reference:* DOE/RL 99-36, *Phase 1 RCRA Facility Investigation/Corrective*		

			Measures Study Work Plan for SST Waste Management Areas, DOE/RL-99-36, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.		
2.		General	Eight review questions were formulated and assessed to determine the adequacy of the document in meeting the intent and scope of the activity. The assessment found that five questions were not addressed adequately in the document, and two were only practically addressed. The questions and determinations, with some narrative, are given below.	Correct document deficiencies.	
			1. Does the report provide some basis for interim actions? Yes. Appendix K (Tier 2) gives a detailed summary of how this part of the RFI/CMS program has proceeded, including criteria for decision making and for implementation of chosen measures. There are some missing pieces identified in the following comments (e.g., basis for selecting T-106 for interim barrier—presumably a modeling study, but not specified; why monitoring the interim barrier is limited to 50 ft. depth). There are also some factual errors in the write-up that do not really affect the result, but should be corrected.		1. No response required. Specific items addressed in specific comments below.
			2. Does the report provide sufficient data and of a quantity and quality that would support a Corrective Measures Study? No. There are still major gaps in their understanding of the spatial distribution of contaminants in the vadose zone, especially the deep vadose zone and the very shallow (<20 ft.) areas. Without that knowledge, closure, corrective measures can not be adequately designed and implemented. Ancillary equipment has received little attention so that the extent of pipes and other ancillary equipment and any contained inventory is little understood. Progress has been made and more is known about past releases than at the start of this RFI/CMS program, but data to support any decision making are incomplete.	Provide the missing information or describe the path forward to address the missing information in the Phase 2 submission.	2. Concur – the *Hanford Federal Facility Agreement and Consent Order* (HFFACO) has been modified to include Phase 2 Activities (change request M-45-06-03, dated December 4, 2007, entitled "Modification of Tank Farm Corrective Measures and Interim Measures Milestones"). Refer to Figure I-1 of the HFFACO. This RFI report is an input to the third line of activities, starting with the WMA specific RFI/CMS Work Plan. Corrective Measures Studies (CMS) will be performed on each individual Waste Management Area. The additional data required to perform each CMS will be identified through the DQO process and collected through implementation of the WMA specific RFI/CMS work plan. The first WMA to which this process is being applied is WMA
			3. Does the report adequately characterize the waste within the source units and the waste released from the source units into	Provide the missing information or describe the path forward to address the missing	

			the soil? Partially. A number of boreholes and push holes have been constructed and provide good information for limited locations. What is needed is a more universal three-dimensional distribution of contaminants, both dangerous and radioactive waste constituents, that would allow effective planning for design of closure and corrective measures. SGE, while promising, still has limitations (especially in areas like tank farms with abundant infrastructure) to give an accurate and defensible three dimensional distribution that is needed (the vertical dimension is especially questionable). In places (e.g., PUREX cribs, SGE has not correlated with borehole data.	information in the Phase 2 submission.	C. The work plan for WMA C will be provided by December 31, 2008 (M-45-60). 3. The requested data will be provided through implementation of WMA specific DQOs and RFI/CMS work plans. See response to 2 above.
			4. Does the report adequately provide the three dimensional data needed for a CMS; i.e., does it adequately characterize the source and its waste, the media affected by releases to include the soil and groundwater? No. See comments above. CHG still maintains that uranium is fixed and largely immobile in the vadose zone in the BX and surrounding tank farms, yet a groundwater plume of uranium continues to grow and expand northwestward toward Gable Gap—a comment Ecology made 6 years ago in our comments on the B-BX-BY FIR that have as yet to be acknowledged and addressed. Furthermore, CHG maintains that no additional data is needed to understand contaminant fate and transport in B-BX-BY despite Ecology and stakeholders telling them that their investigations do not rule out hypotheses other than their chosen, favorite one. Groundwater plumes continue to grow and expand emanating from WMAs B-BX-BY, T, S-SX. The three dimensional distribution of groundwater contaminants is just starting to be investigated and has a long way to go before there is sufficient confidence in vertical contaminant distribution to proceed to corrective/remedial measures.	Provide the missing information or describe the path forward to address the missing information in the Phase 2 submission.	4. The requested data will be provided through implementation of WMA specific DQOs and RFI/CMS work plans. See response to 2 above.
			5. Does the report adequately and completely identify additional data that is needed? Partially, but not in one compact, complete section that specifies what needs to be known to be a complete RFI report that would support a complete CMS. And, of course, for the B-BX-BY area and its release of uranium, the answer is a resounding no.	Provide the missing information or describe the path forward to address the missing information in the Phase 2 submission.	5. The additional data required will be

					identified through the data quality objectives process, applied to each waste management area. These DQO reports will lead to development of WMA specific RFI/CMS work plans to collect the additional data, as shown in HFFACO Figure I-1. The first WMA to which this process is being applied is WMA C. The work plan for WMA C will be provided by December 31, 2008(M-45-60).
			6. Does the report clearly describe a path forward for further investigations to provide the scope and content for Phase II investigations? No. Appendix P is supposed to have contained the path forward, but was not included in the RFI submitted to Ecology. There are some recommendations for additional work in some areas (e.g., infiltration and barrier design, maintenance of corrective measures implemented in the period 1998 – 2002 that are beginning to degrade and not perform up to expectations)	Provide the missing Section.	6. Appendix P was referenced in error. The overall strategy for further Phase 2 investigations will be described in the Master Work Plan, to be provided by December 31, 2008 (M-45-58). The detailed plan for further investigation of each WMA will be provided in the WMA specific RFI/CMS work plan, as shown in HFFACO Figure I-1. The first WMA to which this process is being applied is WMA C. The work plan for WMA C will be provided by December 31, 2008 (M-45-60).
			7. Does the report clearly show how this work will lead to implementable corrective action and closure decisions that will satisfy: a) regulatory compliance? No, **b) closure performance standards?** No, **c) technical defensibility?** No. Regulatory compliance for the groundwater pathway can not be achieved (according to the SST PA) without addressing the past releases to the vadose zone. While Ecology conceptually agrees with this general conclusion of the SST PA, we disagree on the analyses that were performed to substantiate this conclusion (over 500 comments on the SST PA verify this dissatisfaction). No clear, defensible path to closure is identified, in part because of the failure to complete the tank waste EIS that is almost 4 years past due (original delivery scheduled for October 2004) and the reluctance to venture forward without the EIS. Without identifying a clear path to closure, it is not possible to evaluate whether closure performance standards of WAC 173-303-610 can be met. Furthermore, this analysis demonstrates that contaminants in the deep vadose zone remain an enigma, although we know they must be there and continuing to "bleed" into groundwater. While much of the work that has been done (particularly in the	Provide the missing information or describe the path forward to address the missing information in the Phase 2 submission.	7. The detailed corrective actions and closure decisions plan for further investigation of each WMA will be provided in the WMA specific RCRA CMS and closure plans, as shown in HFFACO Figure I-1. The first WMA to which this process is being applied is WMA C. The work plan for WMA C RFI/CMS will be provided by December 31, 2008 (M-45-60).

			science and technology parts of the program) is technically credible and defensible (analyses appearing in peer-reviewed journals being a criterion for success), much remains to be learned. There have been some significant discoveries, most notably the mobility of Cs-137 in the presence of very high Na waste streams such that the Na and Cs compete for the same soil sorption sites which allows infiltration of Cs to greater depth (S-SX FIR). However, to the contrary, the position continually put forth about the mobility of uranium in the vadose zone at WMA B-BX-BY is indefensible in light of the current data and knowledge of uranium mobility. Modeling that has been performed to date is not at a scale and level of detail that provides the confidence needed to reach decisions regarding closure. Simplifying assumptions in the modeling performed to date render these analyses indefensible. **8. Does the report update conclusions/findings in the FIRs for WMAs S-SX, B-BX-BY, T and TX-TY?** No. This report is identified as a "status" of work performed to date.	Provide the missing information or describe the path forward to address the missing information in the Phase 2 submission.	8. Appendix N provides some updates to the FIR conclusions and findings. They are indicated as square brackets. Page 1-16:-The future impacts from wastes currently in the vadose zone that resulted from past releases from the B, BX, and BY tank farms are not expected to exceed drinking water standards at or beyond the WMA boundary *[noted added: during the next 1,000 years]* as long as high-volume liquid discharges to the vadose zone are eliminated. These concentrations are most likely due to releases from the BX tank farm. *[note added: groundwater monitoring has continued. Uranium and technetium plumes are moving south, resulting in higher values near B and*

					BX Tank Farms.] Page 1-17: Estimations of technetium-99 distribution during Hanford Site reprocessing, storage, and disposal and the residue left in the vadose zone have been improved *[noted added, particularly from the work on understanding the bismuth phosphate separations process]* and past assumptions corrected. However, the amount of technetium-99 that was initially discharged to the vadose zone and that might have already reached groundwater is still uncertain. Page 1-18: The levels found in the boreholes near tanks BX-102 and B-110 were fairly similar to each other but less that the maxima reported in Hartman et al. (2002) (i.e., tritium: 2,410 pCi/L and 2,810 pCi/L; nitrate: 57,500 ug/L and 16,400 ug/L; technetium-99: 2410 pCi/L and 1640 pCi/L; and uranium: 10.8 ug/L and 2.9 ug/L near tanks BX-102 and B-110, respectively). . *[note added: groundwater monitoring has continued. Uranium and technetium plumes are moving south, resulting in higher values near B and BX Tank Farms.]* Page 1-28: However, the source(s) of these contaminants is not certain and is being investigated (Section 7.4 and Appendix C, Section C4.0). *[Note added: new groundwater wells have been added and the groundwater monitoring has continued These results are the subject of active investigations.]* Page 1-29: The interpretation of these measurements is just beginning and the source is uncertain. *[Note added: new groundwater wells have been added and the groundwater monitoring has continued These results are*

					the subject of active investigations.] Page 2-4: Berms and gutters are being constructed around the S, SX, T, TX, TY, and U tank farms to lessen potential water run-on [*work is completed*]. *[Note added: The above interim measures have been installed at WMA S-SX.]* Page 2-5: As proposed in HFFACO Change Package M-45-00-01A, waste from two tanks in the S farm (i.e., tanks S-102 and S-112) will be retrieved and sent to double-shell tanks in 2006 thus beginning the process of waste removal [*tank S-112 has been retrieved; tank S-102 is undergoing retrieval*]. *[Note added: This paragraph is based on the goal of groundwater protection. Achieving other goals may result in a different conclusion.]* Page 2-5: Water lines serving WMA S-SX are being cut and capped. *[Note added: This work has been completed.]* Page 2-6: Additional data do not appear to be necessary to support interim action decisions. [*Note added: Characterization to determine the western edge of the SX plumes is needed for design of an interim barrier*]. Page 2-6: Quantify gamma activity directly beneath the tanks through the use of the laterals located beneath SX farm tanks *[Note added: work completed.]* Page 2-7: These laterals should be re-used for spectral gamma, moisture, and temperature measurements. *[Note added: This has been done.]* Page 2-7: The matric potential and moisture

					content measurements for sediment samples in WMA S-SX are valuable in determining the tank farm soil moisture regime and potential for contaminant migration (see Section 3.1.2 and Appendix C). These measurements can and should be extended to other tank farms. *[Note added: this has been done where sufficient uncontaminated sediments were available.]* Page 2-7: The only new characterization performed in the S tank farm was that using a cone penetrometer to detect gamma radiation and the retrieval of a few soil samples. Given the presumed leak volume of 90,800 L (24,000 gal), additional soil sample gathering at depth is indicated with subsequent contaminant analysis to provide data to support future waste retrieval activities (see Section 3.3 and Appendix B, Section B.6.0). *[Note added: Surface geophysical exploration was used, and a plume to groundwater was detected.]* Page 2-9" According to HFFACO Milestone M-45-58 (Ecology et al. 1989), a corrective measures study could be conducted after the RFI report is written if a study is determined necessary by Ecology. The date for issuance of the corrective measures study is to be determined. *[Note added: retrieval schedules have been deferred.]* Page 2-10: Therefore, aboveground piping and similar best management practices should be used during waste retrieval activities to minimize potential releases to the environment during future waste retrieval activities. *[Note added: above ground transfer lines is now the standard practice.]*

					Page 2-11: As noted in Section 2.2.4.1, the near-surface characterization activities (e.g., cone penetrometer pushes) defined in the work plan have not yet been completed. The field activities should be completed during fiscal year 2003 with laboratory measurements completed soon thereafter. *[Note added. Work is completed.]* Page 2-12: A work plan based on the CMS will be issued by September 30, 2007 (HFFACO Milestone M-45-60). *[Note added: schedules have been deferred.]* Page 2-12: The first wastes to be retrieved from the T tank farm are from the T-200 Series tanks, presently scheduled in the year 2010. *[Note added: retrieval schedules have been deferred.]* Page 2-13: [Note added: This paragraph is based on the goal of groundwater protection. Achieving other goals may result in a different conclusion.] Surface contamination at depths of less than 4.6 m (15 ft) bgs is present. Soil removal could not be conducted without considering removal of the ancillary piping systems throughout the tank farms that connect the tanks. Removal of these pipes would have to be conducted in unison with soil removal activities. Soil and ancillary equipment removal should be considered as part of the CMS. Page 2-13: A demonstration project involving placement of an interim barrier over the plume from the tank T-106 leak may be very beneficial for the following reasons: The leak from tank T-106 has the largest

					technetium-99 content of any tank leak An interim barrier is projected to have a significant impact T tank farm will not be the site of active waste retrievals in the near future. [Note added: an interim barrier over the T-106 plume has been installed.] Page 2-14: Crumpler (2002) required that near-surface direct push probes be deployed around tank T-101 and tanks in the TY tank farm. This has not yet been done. It will be performed after similar work is performed in the C and B tank farms, unless the SGE results address the concerns that the direct push probes were to address. *[Note added: The work has been completed and the laboratory results issued.]* Page 2-14 All such new data will be documented in the RFI to be issued by January 31, 2007. *[Note added: The date is now January 31, 2008.]* Detailed updates to these conclusions and findings will be provided in Phase 2 WMA specific process for each WMA, as shown in HFFACO Figure I-1.
3.		General	Address the comments submitted to the Department of Ecology from the Nez Perce Environmental Restoration & Waste Management. Reference: Letter, from Gabriel Bohnee NPERWM to Jane Hedges, Ecology, "RCRA Facility Investigation Report for the Hanford Single-Shell Tank Waste Management Areas (DOE/ORP-2008-01, Rev. 0), dated March 24, 2008	Address and resolve comments and concerns identified in the referenced letter.	As discussed with Ecology on August 20, 2008, the ORP and TFC commit to providing written responses to the Nez Perce comments. ORP and the TFC will work with the Department of Ecology to develop the specific responses.
4.		General	Appendix P is missing. This appendix must provide the path forward. Furthermore, a summary of expectations (planning path) needs to be formulated for Phase 2 with associated scope, schedule,	Provide missing Appendix P. Provide description of what is to be provided in the Phase 2 RFI report.	The plan to produce appendix P was changed during the development of the RFI, and a reference to that appendix was inadvertently

			and funding requirements.		left in the document. The overall strategy for further Phase 2 investigations will be described in the Master Work Plan, to be provided by December 31, 2008 (M-45-58). The detailed plan for further investigation of each WMA will be provided in the WMA specific RFI/CMS work plan, as shown in HFFACO Figure I-1. The first WMA to which this process is being applied is WMA C. The work plan for WMA C will be provided by December 31, 2008 (M-45-60).
5.	OSWER Directive 9902.3A, 1994, RCRA Corrective Action Plan	General	OSWER guidance (OSWER Directive 9902.3A, Section VI.D. and F., p. 6-8) indicates that a Phase 1 RFI can be a Release Assessment, though a Release Assessment is optional. It was not clear from this document if this was intended to be a Release Assessment or not. The Findings Report for a Release Assessment should have an overview that covers • Confirmation of adherence to the work plan • Identification and logging of all sample locations • Summary of findings. Whether or not this is actually a Release Assessment, this report should start with an overview covering these topics. These topics, if present, are distributed throughout the document in such a way that it appears that they are not covered.	Include an overview discussing whether or not this document is intended to be a Release Assessment. If it is not a release assessment, give the Corrective Action Model that is being followed for the WMAs (see OSWER Directive 9902.3A, Section VI. D. and F., p. 6-8). [Note that Figure 1-1 on p. 1-3 of this RFI report does not mention Phase II work.] Also include in the overview the bulleted items given in this comment.	This document is not intended to be a release assessment. As noted in the comment, a release assessment is optional, not required.
6.	JL Criteria D6, F3, G3, G4, G6, G8	General	The Phase 1 Work Plan (DOE-RL-99-36, Rev.1) (Section 6.1.2) stated "The focus of this report will be to address cumulative risks (i.e., WMAs and other potential sources to the anticipated receptor) and a more quantitative risk evaluation, as necessary, based on the initial evaluation in the WMA-specific field investigation reports." It also stated, that according to Appendix H, "The report will include descriptions of human and ecological receptors; …evaluation of risks associated with existing contamination of several hypothetical receptor exposure scenarios;…"; and "For direct exposure to soil contamination associated with the SSTs, only the MTCA Method C (industrial) scenario would be evaluated. For protection of surface	Provide, in this document, risk assessment results for direct contact, ecological, surface water and cumulative risks in addition to risks associated with groundwater. If these risks are to be covered in a performance assessment (which they have not been to this point) or Phase 2 Report, provide in this document a detailed path forward for evaluating these risks.	The Master Work Plan (M-45-58), section 3, will identify the documents where these specific items will be discussed.

			water (the Columbia River), the MTCA Method B scenario would be evaluated (Section 4.1.2)." This document does not cover cumulative risk, direct contact risk, ecological risks or surface water protection. The SST PA did not cover these risks either.		
7.		General	Information presented on recharge, geology, and hydrology is a catalog of what is known at various scales and levels of detail that, in almost all cases, fails to address the significant key properties/parameters at the scale of a unique WMA site. Physical and chemical properties of the various strata and the component grain size distribution of these units at a scale needed for representative fate and transport modeling are absent. Key information on water lines, their integrity and past/present releases as a potentially significant component of recharge/infiltration are ignored.	Provide the level of detail or path forward for Phase 2 described and the needed confidence in modeling and risk assessment.	Tier 2 and 3 documents provided with the RFI package provided additional detail representing the current level of knowledge. Recharge: Tier 2 (Appendix C) and Tier 3 (M.J. Fayer and J.M. Keller, *Recharge Data Package for Hanford Single-Shell Tank Waste Management Areas*, PNNL-16688,) Geology: Tier 2 (Appendix E) and Tier 3 (S.P. Reidel and M.A. Chamness, Geology Data Package for the Single-Shell Tank Waste Management Areas at the Hanford Site, PNNL-15955) Hydrology: Tier 2 (Appendix F) and Tier 3 (R. Khaleel, Far-Field Hydrology Data Package for the RCRA Facility Investigation (RFI) Report, RPP-RPT-35222, Rev. 1) Additional information will be provided on a WMA specific basis per Figure I-1 of the HFFACO. The first WMA to which this process is being applied is WMA C. The work plan for WMA C will be provided by December 31, 2008. (M-45-60)
8.	HFFACO, Chapter 9	General	The documents referenced or attached for Tier 3 were generally non-primary documents, over which Ecology has not had input or has submitted comments that remain unresolved. Ecology does not consider incorporation of these documents into this document, by attachment or reference, a means of converting them into primary documents. Ecology generally did not review them as part of the review process for this RFI report and does not provide our approval of these documents, regardless of our approval/disapproval of this RFI report.	This comment does not have an associated action but is intended to inform the parties that Ecology is not providing approval of the Tier 3 or referenced documents with our review of this RFI report.	Comment noted.
9.	M-45-55	p. 1-3,	This diagram does not include all farms. It specifically excludes C,	Include a diagram showing the C-farm	RFI Report Figure 1-1 was directly quoted

	"Submit to Ecology… Phase I RFI Report…fo r all WMAs…" and M-45-98-03, Attachment 2	Figure 1-1	A-AX, and U. Page 1-1 of this document lists the results from field investigations at A, AX, C and U as being given in this report. It also appears from this diagram that RFI reports are supposed to precede retrievals. This has not happened in C-farm or S-farm.	corrective actions, and proposed actions for WMAs A-AX and U. Also, revise this figure to be consistent with the sequence of actions and reporting currently in use.	from the HFFACO change packages. A footnote regarding the additional information will be added to the diagram: "Field investigations were also performed for WMAs A-AX, C, and U and their Field Investigation Reports are included in this document as Appendix L (WMA A-AX and C) and Appendix M (WMA U)"
10.	T	p 10-1, sec 10.2, para 2	Comparison of two vs. three dimensional modeling is a model comparison (rather than a "validation"), since both models yield predictions (vs. an independent evaluation of model predictions against observed data). Alternatively, if the three dimensional model had been previously validated (against observed data), then the two dimensional model could be validated by comparison to the three dimensional model.	Change text from "validation" to "comparison."	Concur. Last sentence in 10.2 will read: "Thus, the Program performs most of its vadose zone modeling in two dimensions (so as to perform many more simulations) and occasionally compares the results of those runs using three-dimensional simulations."
11.	Editorial	p. 10-2, Section 10.3, 2nd paragraph	Release volumes and compositions are only hypothetical and are currently being revised.	Please restate the 4th sentence of the paragraph to: The hypothesized volume and composition of the leaks are provided in Chapter 9 and Chapter 17 ~~fairly well known (see Chapter 9 and Chapter 17)~~.	Concur with change. Sentence will read: The hypothesized volume and composition of the leaks are provided in Chapter 9 and Chapter 17.
12.	HFFACO, Appendix I, Section 2.5: "These PAs will be approved by Ecology and DOE.."	p. 10-3, Section 10.4, 1st paragraph; and Section 12.4.3, p. 12-9, 4th bullet	Readers need to know that the State has not approved the SST PA.	Include Ecology comments on the SST PA as a reference and attachment, and include a link to them in this section (it can be included right next to the link to the SST PA).	HFFACO, Appendix I, Section 2.5: "A PA will be developed for each WMA and will incorporate the latest information available. These PAs will be approved by Ecology and DOE." This statement in the HFFACO refers to the future WMA specific PAs that will need to be provided to support the RCRA CMS and Closure Plans for each WMA. These PAs will be developed with Ecology and will be approved by them. These PAs will drive revision of the SST PA. It is noted that Ecology has comments on the SST PA. A note will be added following the first sentence in section 10.4 stating:

					"There are key open issues on DOE/ORP-2005-1, based on comments from the Washington State Department of Ecology, which have not yet been resolved (Reference: Letter 0700068, J. J. Lyon to R. J. Schepens, Initial Single Shell Tank System Performance Assessment (SSTPA) for the Hanford Site, DOE/ORP-2005-1, Rev. 0)." The process that will be used to develop each WMA specific PA will address any applicable comments. This process will be described in the Master Work Plan, to be provided by December 31, 2008 (M45-58).
13.	E, T	p 10-4, sec10.4, Fig 10-2	For clarity, terminology in the figure needs an explanation.	Please describe the "Base Case" for WMA C	The figure was quoted from an early draft of the SST PA, but was not included in the final version. Due to the lack of reference support for the figure, it will be deleted, along with the final sentence on page 10-3.
14.	OSWER Directive 9902.3A, 1994, RCRA Corrective Action Plan	Chapter 12, General	This chapter goes beyond discussing that Phase 2 is the next step. It provides various technologies and discusses some of the criteria that may apply to the Corrective Measures Study. However, it does not cover all of the criteria (such as implementability and cost).	Discuss how all of the screening criteria will be addressed in Phase.	All of the applicable criteria will be described in the RCRA CMS that is provided for each WMA.
15.	R	p 12-2, sec 12.2.1, para 2	Note that state Dangerous Waste Regulations use MTCA for corrective action (WAC 173-303-64630).	Specify the use of MTCA for corrective action.	Applicability of MTCA will be discussed in the Master Work Plan (M-45-58).
16.	R	p 12-3, sec 12.2.3, para 1	RCRA addresses radionuclides when mixed with nonrad hazardous waste (i.e., termed "mixed waste").	Clarify that RCRA addresses radionuclides in mixed waste.	RCRA does not address radionuclides in mixed waste. The hazardous component of mixed waste is regulated by RCRA while the radioactive component is regulated solely by DOE under its Atomic Energy Act authority.
17.	E, T	p 12-7, sec 12.4.1, Table 12-2	In the cell for "Functional Aspect" of "In Situ Gaseous Reduction," Cr +6 is reduced.	Change "immobilizes" to "reduces."	Concur that "immobilizes" is misleading. For readability by a general audience, the sentence will be: "Irreversibly changes hexavalent chromium to less toxic and less mobile

					trivalent chromium."
18.	OSWER Directive 9902.3A, 1994, RCRA Corrective Action Plan	p. 12-7, Table 12-2	This table appears to be covering remediation technologies beyond interim measures. Also, it is not consistent with Table 12-1 or p. 12-1 because it does not appear to cover many of the implementability and cost criteria.	Include a table or extra columns in this table that show an evaluation against each criterion listed on Table 12-1.	All of the applicable criteria, including implementability and cost, will be addressed in the RCRA CMS that is provided for each WMA.
19.	T	p 12-9, sec 12.4.2, Table 12-3	Since these "Elevated Regions" are based only on Cs-137, there may be other elevated regions, based on other rads or nonrads.	Correct in this document or describe how the Phase 2 Report will broaden the assessment of elevated regions by evaluating other rads or nonrads.	Phase 2 reports will include the rads and nonrads as identified in the WMA specific planning process. The first RFI/CMS report planned is for WMA C (M-45-61).
20.	OSWER Directive 9902.3A, 1994, RCRA Corrective Action Plan (see Source Characteriz a-tion)	p. 12-10, Section 12.4.3, bullets	A reference to the SST DQO is needed as a source for a list of contaminants of concern. The tank contaminants are the source contaminants.	Add a reference to the SST DQO document: RPP-23403 for the COCs.	RPP-23403 is a reference document under several of the reference documents listed. It is not necessary to list all documents used in development of the referenced documents.
21.	JL Criteria G1, and OSWER Directive 9902.3A, 1994, RCRA Corrective Action Plan (see Section V.B.)	Chapter 15, General	The performance objectives are not consistent with those being developed in the SST PA comment resolution process.	Adjust the performance objectives to reflect resolution to Ecology SST PA performance objectives and Ecology comments 50, 53, 355, 357, 402, 413, 414, 415, 425, 450, 456, 459, 479, 480 on the SST PA. Also, include the media cleanup standards.	The performance objectives being developed in the SST PA comment resolution process will be used in the development of future WMA specific PAs in support of WMA specific RCRA CMSs as shown in HFFACO Figure I-1. Those performance objectives will be documented in the future PAs and will supersede previously published numbers as appropriate.
22.	E, R	p 15-1, sec 15.1,	Describe the distinguishing characteristics between a USDOE risk	Compare and contrast these two types of	A discussion of these two types of assessments

		para 1	assessment vs. performance assessment.	assessments.	will be included in the Master Work Plan.
23.	T	p 15-2, sec 15.3, para 1	The natural system consists of all abiotic media, including not only soil and groundwater, but also air, sediment, and surface water. The natural system also includes biota.	List all components of the natural system.	Concur – change bullet to: "The natural systems include soil, groundwater, air, sediment and surface water, as well as biota"
24.	T	p 15-2, sec 15.3, para 6	Ecology agrees that one conceptual model is insufficient. Several alternative conceptual models can facilitate the assessment of model uncertainty.	Add a discussion on how multiple conceptual models will be developed and analyzed in the Phase 2 Report to better evaluate model uncertainty.	The Master Work Plan will include a discussion of how multiple conceptual models will be developed and analyzed in the Phase 2 Reports.
25.	T, R	p 15-3, sec 15.4, Table 15-1	Provide rationale for inclusion of specific contaminants in groundwater, while excluding others (e.g., other metals, such as As, Pb, Cd)? In addition to groundwater and air resources, list performance objectives for soil, surface water, and sediment resources, as well as for humans (e.g., public, workers, intruders) and ecological receptors (e.g., terrestrial and aquatic biota).	List performance objectives for protection of all abiotic media, as well as human and ecological receptors.	The following Tier 3 (Section 2.9) document included the requested performance objective: "F.M. Mann, J.D. Crumpler, and A.J. Knepp, *Performance Objectives for Tank Farm Closure Performance Assessments*, RPP-14283, Rev. 2, CH2M HILL Hanford Group, Inc., Richland, Washington. As noted in the table heading for Table 15-1, only the key performance objectives are provided. The reference provides a systematic investigation.
26.	R	p 15-4, sec 15.5, para 1	Re the protection of groundwater, fate and transport models are described in WAC 173-340-747. MTCA allows for alternative fate and transport models, according to WAC 173-340-747(8).	Please provide the reference for the agreement to supersede M-029-02. Regardless of the criteria for models, they must meet WAC requirements. Provide justification of the use of an alternative fate and transport model showing compliance with MTCA requirements.	The use of an alternate fate and transport model will be justified in the Phase 2 documents supporting the WMA specific RFI/CMS.
27.	T	p 18-8, sec 18.6, para 1	Please qualify to what degree site specific characterization data are needed (as opposed to data derived from more generic models) to offset the enhanced complexity and variability of soil conditions observed at Hanford.	Describe how site specific data will be used with to reduce uncertainty.	The use of site-specific data to reduce uncertainty will be described in the WMA specific DQOs.
28.	T	p 19-9, sec 19.7, para 1	Re contaminant release, please explain how these "surprises" (conflict between prediction vs. observation) will ultimately contribute to analysis of uncertainty in risk estimates.	Describe how these new insights have informed the risk assessment and reduced uncertainty.	These variations between predicted contaminant behaviors as initially described in the conceptual model, and observations based on site characterization

					results will be reflected in future WMA-specific PAs and risk assessments (the latter which directly support RCRA corrective action) as sensitivity cases. The variability in estimated health risks associated with these differences in contaminant behavior will be discussed as uncertainties in the PAs and risk assessments. Discussion of these uncertainties will be used to better inform and characterize the estimated risks associated with contaminant releases to the vadose zone. The variations between predicted and observed contaminant behavior also may identify future characterization and science and technology activities to obtain a better understanding of contaminant release and transport.
29.	T	p 22-9, sec 22.6, para 1	Both basic science and site specific information are needed to develop conceptual models that incorporate key features, events, and processes. Multiple models may be needed to encompass a range of potential representations.	Describe how uncertainties will be addressed, including through the use of multiple models.	The Master Work Plan will discuss the general use of multiple conceptual models to address uncertainty, and WMA specific PAs will address the specific conceptual models under consideration for each WMA.
30.	T, E	p 22-9, sec 22.6, para 2	As used here, please define (via more detail) "conceptual models" vs. "risk assessment models." Is the distinction one of theory vs. application, respectively?	Define and contrast "conceptual model" vs. "risk assessment model."	As used here, a "conceptual model" is a qualitative description of features, events and processes. A "risk assessment model" is the numeric implementation of that qualitative description.
31.	E	p 22-10, sect 22.7, para 1	For Tier 1, a list of analytical instruments is not really needed for a nontechnical audience (see Front Matter, p. iii, Table 1), since the list does not enhance a conceptual understanding of geochemistry and contaminant distribution in the vadose zone.	Please move the listing of analytical instruments to the appropriate Tier and provide this document with a brief and more conceptual summary.	Concur that a listing of instruments is not required in this document Tier. However, it is not incorrect, so it is not deemed beneficial to remove it.
32.	T	p 22-12, sec 22.8, Table 22-2	Please describe rationale/criteria for listing these particular contaminants, while excluding others (e.g., H-3, CCl4, TCE, CN, F).	Provide text (e.g., table footnote) to describe rationale for included and excluded	Concur. The table heading will be changed to "Major Geochemical Features of Tank Waste

				contaminants.	Contaminants of Interest, Generalized to Typical Uncontaminated Hanford Site Groundwater". Also a footnote will be added stating "There are other contaminants in the groundwater underlying the Hanford Site (e.g., tritium, carbon tetrachloride, trichloroethylene) that are thought to result from other Hanford operations."
33.	WAC 173-340-720, Method B	p. 23-6, Table 23-1	The values given in the first column are only federal drinking water standards. For some of these contaminants the state drinking water standards are lower: carbon tetrachloride (0.337 µg/L); trichloroethene (0.11 µg/L) and chromium (species dependent; hexavalent chromium 48 µg/L). The State criteria do apply.	Revise the values for carbon tetrachloride, trichloroethene, and chromium to the state values.	Table 23-1 was directly quoted from Hartman et al., 2007, and therefore was not revised to show state requirements. A note will be added to the table to state: "The quoted table addresses only federal drinking water standards, state requirements will also have to be addressed in support of future corrective measure studies."
34.	T	p 24-1, sec 24.2, para 1	Although this is Tier 1, summary information on the new groundwater model would be helpful. For example, this might include a conceptual/qualitative discussion of model structure, spatial/temporal resolution, boundaries, validation, and sources of uncertainty.	Provide details on the new groundwater model or how it will impact the modeling for the Phase 2 report, including revisions to existing modeling results.	Phase 2 WMA specific risk assessment work supporting RFI/CMS reports will describe the ground water model(s) used.
35.	HFFACO, Appendix I, Section 2.5: "These PAs will be approved by Ecology and DOE...";	Chapter 25, General	This chapter repeats some of the information in the SST PA. Ecology has not accepted the SST PA or its conclusions at this time. The comments provided for this chapter parallel some of Ecology's concerns on the SST PA.	Modify this document based on Ecology's SST PA comments. Reference Ecology's SST PA comments in this chapter.	Comment noted – not specific enough to be actionable. It is noted that Ecology has comments on the SST PA and a process is underway to address those comments in the development of future WMA specific PAs.
36.	E	Chap 25, General	In an effort to simplify the language for Tier 1, some of the information does not appear entirely correct.	Do not sacrifice accuracy when simplifying text.	Comment noted – not specific enough to be actionable.
37.	T, R	Chap 25, General	In addition to human health risk, environmental impacts also include an assessment of ecological risk (which is lacking here). DD	Please add an assessment of ecological risks.	Ecological risks will be addressed as part of risk assessments conducted to support RCRA Corrective Action. The relationship between the risk assessments supporting corrective

					action, and the WMA-specific PAs supporting WMA closure, are discussed in the Master Work Plan. A revision to Chapter 25 will note the inclusion of ecological risks.
38.	T, R	Chap 25, General	Risks (or HQs) should be calculated for both rad and nonrad contaminants in all exposure scenarios.	In order to assess risk more completely, both rad and nonrad risks should be addressed.	Comment noted – not specific enough to be actionable. Both radiological and non-radiological risks will be considered in WMA specific risk assessments.
39.	E	p 25-1, sec 25.1, para 4	The second bullet is more conventionally described as "noncancer effects." In addition to cancer and noncancer effects, effects can also be described as chronic and acute.	Conventional risk terminology should be employed, where appropriate.	Comment accepted – a revision to Chapter 25 will be provided incorporating this change.
40.	E	p 25-1, sec 25.1, second grey box	The word "increase" might be replaced with "elicit" to clarify the sentence.	Use of the term, "elicit," is more suitable in this context.	Comment accepted – a revision to Chapter 25 will be provided incorporating this change.
41.	T	p 25-1, sec 25.1, para 5	Naturally occurring radiation may lead to a lifetime cancer risk closer to 1E-2 than 1E-3, based on the ICRP60 risk coefficient of 5E-2 risk/Sv (5E-4 risk/rem) for fatal cancer (e.g., [300 mrem/y]*[5E-7 risk/mrem]*[70 y]=1E-2 risk).	Please correct the derivation of cancer risk from natural background radiation.	Comment accepted – a revision to Chapter 25 will be provided incorporating this change.
42.	T	p 25-2, sec 25.1, para 1	Although a toxicant dose may be subthreshold for a particular effect, subthreshold doses from other toxicants may compromise the biological system. In some cases, adaptation may not occur, and the body becomes less resistant to subsequent stressors.	It should be acknowledged that contaminant doses may be subthreshold (individually) but may combine to produce and adverse effect (cumulatively).	Comment accepted – a revision to Chapter 25 will be provided incorporating this change.
43.	T	p 25-2, sec 25.2, para 1	Re the sunburn example, "time of year" relates to dose intensity (not "toxicity") and "time in the sun" relates to dose duration (not "dose"). Toxicity is the adverse effect (i.e., sunburn).	Re the sunburn example, correct use of the terms, "dose" and "toxicity."	Example may be misleading and will be deleted – a revision to Chapter 25 will be provided incorporating this change.
44.	WAC 173-340-700 through 760 require calculation of hazard index	p. 25-3, Section 25.2.2	This section needs a discussion of hazard indices.	Add discussion to this section about hazard indices (the sum of hazard quotients).	Comment accepted – a revision to Chapter 25 will be provided incorporating this change.
45.	T, E	p 25-3, sec 25.2.3, para 2	The sentence structure is not quite correct. That is, for rads, risk is not "radiation dose," and for chemicals, risk is not "the ratio of the	Correct the definitions for of "risk," "radiation dose," and "ratio of the person's daily dose to	Comment accepted – a revision to Chapter 25 will be provided incorporating this change.

			person's daily dose to the reference dose." Risk is cancer risk, whereas radiation dose and the ratio specified [daily dose/reference dose] are simply other metrics for exposure and hazard, respectively.	the reference dose," in relation to rads and nonrads.	
46.	T, E	p 25-3, sec 25.3, grey box	An exposure scenario may be better described as a "set of assumptions," rather than a "collection of events."	Please use this suggested terminology.	Comment accepted – a revision to Chapter 25 will be provided incorporating this change.
47.	T	p 25-4, sec 25.3.1, para 5	To estimate cumulative risk, groundwater contamination should not be examined separately from waste intrusion. "Separate engineering problems" is not a valid reason for segregating exposure pathways and associated risks. That is, the same receptor (e.g., onsite intruder) can be exposed to contaminants via exhumed soil and groundwater.	Include exposure to both contaminated soil and groundwater in the intruder scenario.	Selection of exposure pathways for the intruder scenario for future WMA-specific PAs will be consistent with guidance provided by DOE and NRC (NUREG-1854). If appropriate, doses may be estimated from pathways from contaminated soil and groundwater, for certain scenarios. However, use of the intruder scenario is limited as defined in DOE O 435.1 ("[f]or purposes of establishing limits on the concentration of radionuclides that may be disposed of near-surface. . ."), and is viewed as a highly hypothetical case as originally defined by the NRC (see the EIS supporting the licensing requirements for land disposal of radioactive waste, NUREG-0782). There is no defined regulatory basis within either state or federal RCRA for assessing the intruder scenario or using it in selection of corrective measures for corrective action or closure decision making.
48.	T	p 25-4, sec 25.3.1, para 6	In addition to groundwater exposure via drinking water and irrigation, include showering for the offsite receptor.	Showering with groundwater should be included as an exposure pathway for the offsite receptor. This would include dermal contact, as well as inhalation of volatiles (e.g., NH3, H-3, C-14, Rn-222) and aerosols (e.g., Cr+6).	The potential for showering with groundwater to provide an exposure pathway will be considered as part of the risk assessment supporting each WMA specific CMS.
49.	T, E	p 25-5, sec 25.3.1, para 2	Scenario risk factors (e.g., EDE, ILCR, HQ per unit groundwater concentration) should specify all embedded assumptions for transparency.	Please list assumptions underlying scenario risk factors.	The underlying assumptions are presented in detail in *Exposure Scenarios and Unit Dose Factors for the Hanford Tank Waste Performance Assessment,* HNF-SD-WM-TI-707, Rev. 5 (Rittman, 2007). That document is incorporated by reference into Chapter 25.

					The intent of the discussion in this paragraph is to concisely describe the risk calculation methodology of impact measure (EDE, cancer risk or HQ) per unit groundwater concentration. The necessary transparency underlying these values is presented in Rittman, 2007. This paragraph will be revised to provide a cross-reference to that document.
50.	T	p 25-5, sec 25.3.2.1, para 1	It is stated, "The majority of volatile chemicals are removed from the waste as part of remediation." This may not be true for certain nonrad volatiles (e.g., NH3). Please include nonrad volatile contaminants in this analysis on gaseous emissions.	Both volatile rads and nonrads should be included in the analysis of gaseous emissions.	The chemicals of potential concern will be identified as part of the risk assessment supporting each WMA specific CMS. A revision to Chapter 25 will be provided incorporating this change.
51.	OSWER Directive 9902.3A, 1994, RCRA Corrective Action Plan (see Air Contamina-tion); WAC 174-440-750 requires considerati on of vapor pathway for contaminat ed soil; JL Criteria F3	p. 25-5, Section 25.3.2.1, and p. 25-7, Section 25.3.3.1	This section on gaseous emissions omits chemical vapor emissions. Currently, chemical vapors associated with tank farms include, for example, N-nitrosodimethylamine, ammonia, N-nitrosomethylethylamine, nitrous oxide, mercury, N-nitrosomorpholine, ethylamine, formaldehyde, methylamine, acetonitrile, 1-butanol and many others (CH2M-32068-FP, Rev. 0). These contaminants would also be associated with tank waste and tank releases to soil.	Describe and include chemical vapors associated with the waste. Calculate and present in the risk assessment the risks and hazards associated with releases of these vapors. At a minimum they should be included in the risk uncertainty analysis.	The chemicals of potential concern will be identified as part of the risk assessment supporting each WMA specific CMS. A revision to Chapter 25 will be provided incorporating this change.
52.	WAC 173-34-700 through 760; JL	p. 25-5 – 25-8, Section 25.3.2, General	All intrusion scenarios should include chemical hazards and risks in addition to radionuclide risks. State regulations (for example WAC 173-340) require evaluation of direct contact risks and hazards associated with all hazardous substances at contaminated sites.	Include chemical risks and hazards for intruders.	See the response to Comment 47. The intruder scenario is intended for making decisions regarding radionuclides.

	Criteria F3				
53.	JL Criteria G1 and G3	p. 25-5 – 25-8, Section 25.3.2, General	On-site potential future receptors include Native Americans. Two scenarios are available for use. Native American scenarios are expected and evaluated for all Hanford sites in the 200 areas and river corridor.	Calculate Native American risks and hazards for the CTUIR scenario and the Yakama scenario. If others become available prior to the revision of this document include them also.	Native American scenarios that are consistent with the Tri-Party response to HAB Advice #132 will be evaluated as appropriate in future risk assessments and WMA-specific PAs.
54.	E	p 25-6, para 1	Please provide a reference for the USDOE limit on Rn emanation (20 pCi/m2-s).	Provide the specified reference.	Comment accepted – a revision to Chapter 25 will be provided incorporating this change.
55.	R, T	p 25-6, sec 25.3.2.2, para 1	MTCA requires a 15 ft soil depth for the point of compliance for both protection of human health (WAC 173-340-740[6][d]) and ecological receptors (WAC 173-340-7490[4][b]). In addition, receptors may be exposed (e.g., soil direct contact) to waste in the shallow vadose zone (<15 ft), as a result of past spills.	For human and ecological receptors, include exposure to shallow soils (<15 ft) in accordance with the WAC requirements.	Comment accepted – a revision to Chapter 25 will be provided incorporating this change.
56.	WAC 173-340-740(6)(d) and -7490(4)(b); JL Criteria G6	p. 25-6, Section 25.3.2.2,	The basement excavation scenario only considers a depth of 10 ft. State regulations use 15 ft for evaluating direct contact exposure: WAC 173-340-740(6)(d) "For soil cleanup levels based on human exposure via direct contact or other exposure pathways where contact with soil is required to complete the pathway, the point of compliance shall be established in the soils throughout the site from the ground surface to fifteen feet below the ground surface. This represents a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface as a result of site development activities." At depths of 15 ft using the tank farm configuration as it is present today, shallow releases such as air releases, pipe releases, equipment releases and various spills would be encountered in addition to pipes and other ancillary equipment, and possibly top portions of the tanks. Fifteen ft is also the standard point of compliance for ecological risk assessment according to WAC 173-340.	Address WA State requirements on the use of a depth of 15 feet and do not assume a barrier has been placed over the site – remedy decisions have not been made for the tank farms. Calculate the risk and hazards associated with excavating the releases and structures present at depths between today's ground surface and 15 ft below ground surface.	The language cited is intended to describe a basement excavation, not to specify regulatory requirements. The specific applicable exposure scenarios and regulatory requirements will be identified as part of the risk assessment supporting each WMA specific CMS.
57.	Ecology comment #368 on SST PA; JL Criteria G1, G3 and	p. 25-5 – 25-7, Section 25.3.2	An excavation scenario for intrusion is needed.	Include a construction intruder scenario involving road construction, utility trenching, mining excavation or other construction activity.	See the response to Comment 47. An excavation scenario may be appropriate for evaluating closure alternatives that do not include a barrier. As described previously, selection of exposure pathways for future

	F3				WMA-specific PAs will be consistent with guidance provided by DOE and NRC.
58.	T, R	p 25-6, sec 25.3.2.3, para 2	It is stated, "Lifetime cancer risks and HQs cannot be calculated for the well driller because of the short exposure period." However, on p. 25-3, it is acknowledged, "dose can be received in one day or could be spread out in small amounts through the year." Moreover, EPA (1989, RAGS, p. 6-23) specifies, "The approach for carcinogens is based on the assumption that a high dose received over a short period of time is equivalent to a corresponding low dose spread over a lifetime." Therefore, it is possible to calculate risk and HQ for a short exposure period (e.g., several days). Carcinogen intakes are prorated over a lifetime, whereas noncarcinogen intakes are averaged over the period of exposure. A limited number of toxicity factors have been developed for acute and intermediate durations, in addition to chronic exposures (e.g., see ATSDR MRLs, http://www.atsdr.cdc.gov/mrls/pdfs/mrllist_11_07.pdf).	The intruder scenario, risk (and HQ) should be calculated for both rad and nonrad contaminants.	The specific applicable risk metrics will be identified as part of the risk assessment supporting each WMA specific CMS.
59.	WAC 173-340-720; Ecology comment #374 on SST PA; JL Criteria G1, G3 and F3	p. 25-6, Section 25.3.2.4,	The well driller scenario assumes that a well is drilled to obtain drinking water. There is no reason to think that the well would not be used for that purpose.	Include consumption of groundwater by the post-intrusion residents. State unrestricted use scenarios as described in WAC 173-340 include groundwater consumption.	Pathways that are consistent with DOE O 435.1 and 10 CFR 61 definition of intruder scenarios will be included as part of the risk assessment supporting each WMA specific CMS.
60.	T	p 26-1 to 10	General Comment on Chapter 26, Computer Codes: A chapter on uncertainty should be included in the RFI which describes modeling uncertainty. Uncertainty in modeling stems from aspects of design, conceptual model components, and model parameters that affect key factors and variables. EPA guidance recommends that the risk assessor "fully specify the assumptions and uncertainties inherent in the risk assessment to place the risk estimates in proper perspective" (Exposure Assessment Methods	Include a chapter on computer code uncertainty which describes key variables and assumptions and how the uncertainty is dealt with in the RFI. Where data has been collected to validate the model incorporate this process into the text.	The uncertainty and limitations of computer codes employed for each WMA model will be addressed in the WMA specific RFI/CMS reports.

			Handbook [EPA/600]. It is important to identify key site-related variables and assumptions that contribute most to the uncertainty than precisely quantify the degree of uncertainty (EPA/540/1-89//002). Although the models have been verified and are adequate for the RFI a validation process should be incorporated (Vadose Zone Modeling at the Hanford Site: Regulatory Criteria and Compliance for Risk Assessment Applications DOE/RL-2007-34). The validation process should be able to confirm the accuracy and utility of the model with field data. Where the model is used site specific measurements should be collected and verified.		
61.	HFFACO, Appendix I, Section 2.5: "These PAs will be approved by Ecology and DOE..."; JL Criteria G4, G6, G7	Chapter 27, General	This chapter repeats information presented in the SST PA. Ecology had numerous comments about the SST PA that are currently unresolved. If any new data were obtained in the Phase 1 investigations since the SST PA was written, they are not reflected here. Ecology cannot currently accept the statements and conclusions about risk made in this chapter. The following are three examples of issues associated with Ecology's SST PA comments: • Performance objectives (p. 27-2) • Regulatory requirements missing WAC 173-303 and WAC 173-340, RCRA, state and federal drinking water criteria (Section 27.4.6, p. 27-9) • Intrusion by excavation missing basement excavation, considering chemical contaminants (Section 27.6, p. 27-9)	Modify this document to acknowledge that there are key open issues based on Ecology's SST PA comments. Reference Ecology's SST PA comments in this chapter. Also, use new investigation data to improve the risk assessment.	It is noted that Ecology has comments on the SST PA and a process is underway to address those comments in the development of future WMA specific PAs. A footnote will be added to the citation of the SSTPA on page 27-1 stating: "There are key open issues on DOE/ORP-2005-1, based on comments from the Washington State Department of Ecology, which have not yet been resolved (Reference: Letter 0700068, J. J. Lyon to R. J. Schepens, Initial Single Shell Tank System Performance Assessment (SSTPA) for the Hanford Site, DOE/ORP-2005-1, Rev. 0)." New investigation data will be acquired for each WMA and incorporated into the risk assessment support the WMA specific RFI/CMS reports.
62.	DOE/RL-99-36, JL Criteria D15, G1	Chapter 27, General	This section should cover coordination of risk assessment efforts with site-wide efforts. The Phase 1 RFI Work Plan (DOE/RL-99-36, Rev. 1) (Section 4.1.5 and Section 7.3) gave several integration needs associated with GW/VZ Integration project, Groundwater Management Project, 200 Areas remedial action assessment, other RPP projects, other related Hanford Site projects and other organizations. The Work Plan indicates that the purpose for integrating, for risk assessment, was to provide a "clearer	Include a section in this chapter covering integration and cumulative evaluations of the RFI Phase 1 activities with other Hanford activities, using the Phase 1 Work Plan as a basis for the discussion.	Cumulative impacts are addressed in Chapter 28. Integration with other Hanford site activities will be discussed in the Master Work Plan.

			understanding of cumulative human health and environmental risks and other impacts as achieved."		
63.	T	p 27-1, sec 27.1, para 3	Although sensitivity cases appear to assess parameter uncertainty, it is not clear if model uncertainty is evaluated. For example, model uncertainty could be assessed with model validation methods (i.e., comparison against data sets independent of the data used to develop the model) or with alternative model formulations (e.g., relevance of physical/chemical/biological processes, spatial/temporal assumptions).	Both parameter and model uncertainty should be evaluated.	The parameter and model uncertainty associated with the risk assessments supporting each WMA model will be addressed in the WMA specific RFI/CMS reports.
64.	T, E	p 27-2, sec 27.2, para 3	Because "impact" is defined here as groundwater concentration or is defined by exposure (rad dose) or exposure and toxicity combined (cancer risk or HI), it must be qualified. In addition, impact is not necessarily restricted to a groundwater pathway.	Clarify the use of "impact," since it can have multiple definitions, as used here.	Add parenthetical comment following the sentence in question: "("Impact" is used here to mean any of the parameters in the header rows of Table 27-1)"
65.	R, E	p 27-3, sec 27.2, Table 27-1	In addition to exposure scenarios listed, please add MTCA Method B (unrestricted land use) for nonrad noncancer HI (HI=1), MTCA Method B (unrestricted) and C (industrial) for nonrad cancer risk (1E-5 risk), Native American for rad and nonrad effects, intruder (acute and chronic) for rad and nonrad toxicity, and ecological (terrestrial and aquatic) for rad and nonrad effects (HI=1). Provide results for other contaminant MCLs (e.g., nitrate, nitrite, uranium, U-238, Pu-239/240, Co-60, Np-237, Sr-90, Cs-137). Re table footnotes, please provide rationale for evaluation time periods.	Please expand the table information, per the comment.	The purpose of Table 27-1 is to meet the requirement to summarize the results of the SST PA, as discussed in section 27-1. HFFACO Milestone M-45-55 required the following of the RFI deliverable: "Submit to Ecology for review and approval as an agreement primary document a Phase 1 RFI report integrating results of data gathering activities and evaluations for all SST WMAs, include a summary of impacts from the Initial SST Performance Assessment. " No further action is required.
66.	E	p 27-6, sec 27.4.3, para 1	The equation has a "font conversion" error.	Please correct the font conversion error.	The equation should read: $T = d\theta/r$
67.	Editorial	Figure 27-3, p. 27-6	No units are given for impact or time, yet numerical values are given.	Include units for Impact and Release Time/Travel Time or relabel the axes "Relative Impact" and "Relative Release Time/Travel Time."	Concur that the y axis should be relabeled "Relative Impact". The x axis represents the ratio of Release Time/Travel Time, which is unitless, and is correctly labeled.
68.	Editorial	Section 27.43, p. 27-6	The equation relating travel time, distance from source to groundwater and recharge has a confusing symbol (a check mark).	Consider rewriting the equation as: $T = d / r^{0.5}$	The equation should read: $T = d\theta/r$ Printed copies show the equation correctly. Possibly an electronic printout led to incorrect presentation of the equation to this reviewer.
69.	T	p 27-7, sec	Text states, "the impact from a contaminant is proportional to the	Please reconcile text and figure.	Because the graph is plotted in log scale on

		27.4.3, Figure 27-5	inverse of the square root of time it takes to go from the source to groundwater." However, the figure does not depict this relationship.		both axes, it correctly depicts the relationship between travel time from source to groundwater and relative impact. For clarity, the unitless y axis will be relabeled "Relative Impact".
70.	T	p 27-8, sec 27.4.4, para 1	Note that Kd is dependent on many soil properties (e.g., pH, TOC) with a large associated uncertainty.	Describe the uncertainty and dependencies underlying the use of K_d's.	The following Tier 2 and 3 documents should be referenced for details: Appendix G ("Geochemistry", Section G2 specifies the process while Section G3 describes the WMA specific data). The *Geochemistry Data Package* by K.J. Cantrell, J.M. Zachara, P.E. Dresel, K.M. Krupka, and R.J. Serne, PNNL-16663 (particularly Chapter 6) gives more detail.
71.	T	p 27-9, sec 27.4.6, para 1	A concentration of 1000 pCi/L would not be below the 4 mrem/y MCL for many radionuclides (e.g., Sr-90=8 pCi/L, I-129=1 pCi/L, Cs-137=200 pCi/L). Similarly, 1000 pCi/L is >1E-5 ILCR for some radionuclides (e.g., Tc-99 at 1000 pCi/L=1.4E-4 ILCR, assuming water ingestion of 2 L/d over 70 y).	Please correct statements in this paragraph, per the comment.	This paragraph will be clarified to show that the entire paragraph is only addressing impacts from Tc, and to add the applicable dose conversion reference: *Dosimetry Data Package* by P.D. Rittmann, HNF-SD-WM-TI-707, Rev. 5. The dose conversion coefficients are taken from EPA/600/P-95/002Fa, 1997, (*Exposure Factors Handbook*) and ICRP Publication 66, 1994.
72.	T	P 27-9 to 27-10, sec 27.5 to 27.7	These sections (i.e., air, intruder, ecological impacts) need more detail. Relative to the groundwater pathway, these resources/receptors/scenarios and others (e.g., soil direct contact in a residential/farmer scenario) are not evaluated adequately.	Please expand sections on air and intruder impacts, as well as ecological assessment (i.e., nonhuman biota). Include missing pathways as noted.	These sections are summarizing the SST PA, per the milestone M-45-55 requirements. We are reluctant to add more detail until Ecology's comments are resolved. The WMA specific risk assessments will provide details on the specific exposure scenarios and pathways evaluated.
73.	T	p 28-1, sec 28.1, para 2	Please provide more detail on "cumulative impacts," in terms of spatial and temporal scales. In addition, note that cumulative impacts involve all media and all pathways (not just groundwater).	Define in detail cumulative impacts.	Comment rejected – development of the cumulative impacts for the Hanford site is out of scope of the RFI. We anticipate that cumulative impacts will be addressed in the Tank Closure and Waste Management Environmental Impact Statement.

74.	T	p 28-1, sec 28.2, para 1 and 2	In addition to CCl4, TCE, and Tc-99, list other key contaminants that drive risk.	Please describe all contaminants that significantly contribute to risk.	Comment rejected – identification of all contaminants that contribute to the cumulative impacts for the Hanford site is out of scope of the RFI. We anticipate that cumulative impacts will be addressed in the Tank Closure and Waste Management Environmental Impact Statement.
75.	T	p 29-2, sec 29.2, para 4	Please acknowledge the uncertainty associated with identifying data needs, an inherently subjective process (since there are likely many more data needs than can actually be addressed).	Acknowledge the subjectivity and uncertainty in expert elicitation methods for identifying data needs.	Add the following statement directly prededing section 29.3: "There is subjectivity and uncertainty in expert elicitation methods for identifying data needs."
76.	E	p 29-3, sec 29.3, Table 29-1	These 1998 data needs have not all been resolved (e.g., Ecology comments on SST-PA have not been closed).	Acknowledge that resolution is incomplete, as a result of outstanding Ecology comments on the SST-PA.	Add sentence to section 29.3: "The Phase 1 activities made significant progress in addressing these data needs. Many of these activities are ongoing, and additional information will continue to be collected."
77.	T	p 29-5, sec 29.4, Table 29-2	In terms of modeling, data needs should include additional exposure pathways (i.e, other than groundwater, e.g., soil direct contact), a Native American exposure scenario (since it has been removed from Rittman, 2007, HNF-SD-WM-TI-707, Rev 5), and exposure modeling for terrestrial and aquatic ecological receptors.	Address the additional data needs, specified in the comment.	Specific data needs will be addressed in the development of the risk assessment for WMA specific RFI/CMS and closure documents.
78.	T	p 30-2, sec 30.3, para 1	Spatial and temporal scales of data collection and analysis should reflect the amount of uncertainty deemed to be acceptable. That is, spatial and temporal scales should expose and resolve key structural and functional characteristics and heterogeneities in abiotic media, so that complex features, events, and processes can be effectively understood and modeled.	Describe how spatial and temporal scales of data collection and analysis reduce uncertainty to an acceptable level.	Spatial and temporal scales will be addressed as part of step 4 of the DQO process applied to specific WMAs in phase 2.
79.	T	p 30-3, sec 30.4, para 2	A robust uncertainty analysis should accompany model evaluation to highlight model limitations.	In addition to testing models, evaluate parameter and model uncertainty.	Parameter and model uncertainty will be evaluated in the risk assessments for WMA specific RFI/CMS and closure documents.
80.	T	p 30-3, sec 30.5, para 1	"What if we are wrong" cases should assess both parameter and model uncertainties.	Both parameter and model uncertainties need to be evaluated.	Parameter and model uncertainty will be evaluated in the risk assessments for WMA specific RFI/CMS and closure documents.
81.	WAC 173-340-700 through-760	Appendix A, General	The conceptual model focuses exclusively on the groundwater pathway and excludes releases to the surface. Evaluation of the cumulative impact of multiple pathways of exposure is not evaluated.	Expand the conceptual model to consider near-surface releases and all of the associated pathways of exposure: direct contact, leaching to groundwater, and ecological exposure.	The conceptual models to be used for WMA specific risk assessments will be developed and documented in a collaborative process involving Ecology. Appropriate exposure

	requires evaluation of all direct contact, leaching and ecological pathways; JL Criteria G1, G2, G3, G4, G6			Determine the total site risk for humans by considering both direct contact and consumption of contaminated drinking water.	scenarios and pathways will be defined during that process.
82.	WAC 173-340-747 and JL Criteria G4	Appendix A, General	The WAC 173-340-747 default conceptual model for contaminant fate considers only partitioning and toxicity; contaminants that both partition favorably into water and have relatively higher toxicities require cleanup to lower concentrations than those that partition less favorably into water and have lower toxicity. The default conceptual model in WAC 173-340 does not include the assumption that certain contaminants in certain places are never a threat to groundwater, as would be the result in this evaluation if a contaminant was projected not to reach groundwater in 10,000 y. This document does not consider the alternate conceptual model given as a default model in WAC 173-340.	Discuss alternate contaminant fate models including the WAC 173-340 3-phase model. Indicate qualitatively, the difference between the cleanup requirements resulting from applying the 3-phase model and those that would result from the use of the conceptual model in this appendix.	The conceptual models to be used for WMA specific risk assessments will be developed and documented in a collaborative process involving Ecology. The use of alternate contaminant fate models will be addressed during that process.
83.	WAC 173-340 requires addressing the direct contact, ecological risk and leaching pathway for the contaminati on *from the surface to the groundwat*	Appendix A, p. i, Executive Summary, 4th bullet	The document makes reference to releases from the tank waste infrastructure to the subsurface but does not discuss air releases to the surface, or vault, pipeline and tank releases to the surface. This component of contamination is too often overlooked in tank risk assessments. In the SST PA comments, Ecology pointed out that many UPRs are shallow releases; for example: UPR-200-E-27 (C-farm release that started at 244-CR vault and spread by wind deposition), UPR-200-E-81 (C-farm puddle that formed on the surface due to a leaking underground transfer line), UPR-200-E-188 (airborne contamination release in C-farm from tank C-107), and others. The conceptual model needs to be revised in consideration of near-surface UPRs.	Revise the conceptual model and discuss various categories of releases, exposure pathways and contaminant leaching associated with releases from vaults, releases from near-surface pipelines, releases to air, wind-dispersed dust, and other surface releases.	Data needs to identify and evaluate near surface releases will be defined on a WMA specific basis in the DQO process. Near surface release information will be incorporated into WMA specific risk assessments as appropriate.

	er; JL Criteria G1 and G2				
84.	JL Criteria G2	Appendix A, p. ii, Executive Summary, 2nd bullet	The text states "Future migration rates are expected to diminish with the emplacement of engineered barriers that will reduce recharge rates to about 0.1 mm/y for some time…" This assumes a remedy which has not been selected or designed to function in this way. This assumption interferes with determining the need for interim measures and/or institutional controls.	Modify the text to state that migration rates of contaminants may decrease *if* an infiltration barrier is put over the tanks. Determine the need for interim measures and/or institutional controls in the absence of future barriers. Provide a discussion of the ranges of infiltration rates that may apply if there is no barrier.	The need for interim measures will continue to be evaluated on an ongoing basis. The need for future corrective measures including institutional controls will be addressed on a WMA specific basis in the risk assessments and RFI/CMS documents, as specified in HFFACO. Change the cited sentence to read: "To the extent that the site installs engineered barriers, future migration rates are expected to diminish and reduce recharge rates to as low as 0.1 mm/y for some time…"
85.	JL Criteria G2	Appendix A, p. iii, Figure ES-1	The figure suggests unrealistic contaminant migration in the subsurface. The first panel shows lateral migration of contamination. The bottom two panels show that the waste then gathers into a spherical body and moves through the subsurface as a sphere, in spite of the lateral migration that took place soon after the waste was released. The text in this appendix stresses lateral migration, and lateral migration is illustrated in Figure A2-16.	Modify the figure to reflect the conceptual model, which should include consideration of lateral migration.	Add the following footnote to the figure: "The plumes depicted in the figure are simplified to illustrate the time periods of contaminant migration. More complex conceptual models are discussed in the body of this document."
86.		Appendix A pg. i, bullet 4.	Not all release events can be stated as short term. Some releases from tanks might be considered short term, but other releases from pipelines and other infrastructure could also have been slow, chronic releases that were not detected for some time or perhaps never detected.	Address slow, chronic leaks of liquids from infrastructure.	A conceptual model of slow, chronic leaks from infrastructure will be presented in the Master Work Plan (M-45-58). In addition, slow chronic leaks of liquids from infrastructure will be addressed on a WMA specific basis in the evaluation of the WMA and the associated risk assessments, and documented in the RFI/CMS reports for each WMA as appropriate.
87.		Appendix A pg. ii, bullet 6.	This is an unsupportable statement, as deep vadose zone characterization is lacking and because groundwater has been impacted by tank and tank infrastructure releases. It's a reiteration of the DOE position that tank waste has not contributed to degradation of groundwater quality.	Substantiate or delete pg. ii, bullet 6 as addressed in the comment.	It is understood that "bullet 6" refers to the following statement on page i: "Waste fluids distributed rapidly over limited portions over the vadose zone until ambient moisture contents were essentially restored. Key characteristics and processes were unsaturated flow and significant lateral

					migration resulting from hydrogeologic controls. Consequently, waste contacted an expanded vadose zone volume compared to its initial volume. However, because of limited waste volumes, contacted vadose zone volumes were limited and at least 50 ft from the water table." The last sentence in this bullet will be deleted.
88.		Appendix A pg. ii, bullet 8.	Incomplete statement that ignores slow, chronic leaks of liquids from infrastructure, notably raw water distribution lines. Not all these releases from infrastructure were short-term, large releases.	Address slow, chronic leaks of liquids from infrastructure.	See response to comment 86.
89.		Appendix A pg. ii, bullet 9.	Infiltration rates from the ground surface will decline provided that any barriers are well designed and placed over the entire contaminated vadose zone. However, the effective depth of any barrier is not known, so deep drainage from the deep vadose zone may continue at some unspecified rate even after a barrier is constructed, if indeed that is a closure decision.	Address the aspects identified in this comment.	See response to comment 84.
90.		Appendix A pg. iii, Figure ES-1	Figure ES-1 is a poor illustration for a conceptual model that excludes sorption close to a source, lateral spreading, and tank waste reaching groundwater.	Correct this figure to better represent the desired conceptual model.	See response to comment 85.
91.	T	Appendix A pg. 1-1, para 1.	A single conceptual model continues to be stated regardless of what Ecology has stated about uncertainties in numerous variables that lead to multiple conceptual models which need further investigation.	Provide discussions as to the limitation in the use of a single conceptual model and discuss the use of multiple conceptual models	Discussion of the limitations of a conceptual model and the use of multiple conceptual models is included in the Master Work Plan (M-45-58).
92.	T	Appendix A pgs. 2-1 – 2.11, Structural Failure of SSTs.	The study by Haney was summarized; however, other studies indicate that a variety of factors contributed to failure of the carbon steel liners; e.g., the "beach line" effect resulting from corrosive liquids remaining at approximately the same surface elevation in the SSTs leading to pitting corrosion. Table A2-1 could be improved regarding leak volume estimates and available data; e.g., the minimum leak detectable by a drywell that is estimated anywhere from a few thousand gallons to tens of thousands of gallons provide some bracket. Also, in this table, there is no mention of the addition of cooling water in several tanks (e.g., A-105, C-105, C-106) over a period of time that was intended to keep tanks cool enough so as not to degrade the concrete. This added water could have dissolved	Improve Table A2-1 leak volume estimates and available data as described.	Historic leak loss estimates are being re-evaluated through a systematic process (Reference: RPP-32681, 2007, *Process to Assess Tank Farm Leaks in Support of Retrieval and Closure Planning*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, WA) and results being documented. The information used in development of WMA specific RFI/CMS documents will include the most recent leak loss evaluations.

			some waste making it mobile as well as providing a driving force to drive previously released contaminants deeper into the vadose zone. Not all this added cooling water can be accounted for by loss to evaporation and exit through the vent systems. Also in this section, many figures, especially the geophysical logging figures have illegible information such as the loss magnitude estimates at the base of drywell logging plots.		
93.	T	Appendix A Pg. 2-20, para 1	Laboratory values for moisture content can be "up-scaled" to field values to a point. The lab values can only be extrapolated for soils of similar grain size distributions, which, under natural conditions, vary over orders of magnitude. Thus, it is possible to project more confidence in model results using this practice of up-scaling than is warranted.	Modify the methodology used to predict soil moisture, describe the uncertainties and limitations,	Description of the uncertainties and limitations associated with the soil moisture modeling for each WMA model will be addressed in the WMA specific RFI/CMS reports.
94.	T	Appendix A Pg. A2-16 – A2-26	Vadose zone transport discussion focuses on physical and mechanical characteristics of fluid flow. While "reaction" with soil particles is indicated, the geochemical characteristics/properties of the soils are not discussed as a means of "filtering" contaminants with different K_d values which change with depth and distance from the leak as the composition of the migrating fluid changes. Also not mentioned are the effects of fluid temperature and viscosity as affecting fluid distribution and processes. While a reasonable discussion, it is incomplete.	Provide geochemical characteristics/properties of the soils discussion as a means of "filtering" contaminants with different K_d values which change with depth and distance from the leak as the composition of the migrating fluid changes. Also mention the effects of fluid temperature and viscosity as affecting fluid distribution and processes.	After the sentence on page A-22: "Intrinsically more reactive contaminants dropped out of solution during transit at various points in the progress of tank waste fluid, depending on the degree of reactivity, and tend to indicate only the early waste fluid distribution." Add the sentence: "This process can be thought of "filtering" the contaminants, depending on their reactivity." Request for fuller description on fluid movement: In order not to overly repeat information, the details of hydrology and geochemistry are more fully explained in Appendices F and G, respectively as well as in the Far-Field Hydrology Data Package (RPP-RPT-35222) and Geochemical Processes Data Package (PNNL-16663), which are part of Tier 3.
95.	Editorial	Appendix A Pg. A3-4, A3-5.	Editorial issues: there is no scale or direction arrow on Fig. A3-2; on the following page, paragraph 3 refers to "groundwater monitoring drywells" which is not possible, as drywells terminate in the vadose zone and do not reach groundwater.	Correct accordingly.	Figure A3-2 should have a North arrow added and should indicate that that tanks are 75 feet in diameter to show scale (pending approval of Security personnel). Paragraph 3 should be corrected to "groundwater monitoring wells…"

96.	T	Appendix A pg. A3-5	Inappropriately qualified statements (e.g., pg. A3-5) indicating that tanks might be the sources of groundwater contaminant plumes where the head of the known plume is adjacent to an SST (e.g., S-104, SX-115, BX-102). .	Rectify such statements.	Please clarify which specific statements are of concern and what changes are required.
97.	t	Appendix A pg. A3-6, 7	Incomplete discussion of leaking liquids (e.g., pg. A3-6, 7). Large, single releases from water lines etc. are discussed, with a few examples. Not discussed is the equally plausible hypothesis that small leaks not visible at ground surface could persist for years, potentially providing more driving force than a single large release. Also missing is any discussion of past tank farm flooding (e.g., Feb. 1979 in T Farm) from sudden melting of a significant snow and/or ice accumulation, along with uncapped drywells and poorly sealed boreholes/wells.	Provide a discussion of the equally plausible hypothesis that small leaks not visible at ground surface could persist for years, potentially providing more driving force than a single large release, and past tank farm flooding (e.g., Feb. 1979 in T Farm) from sudden melting of a significant snow and/or ice accumulation, along with uncapped drywells and poorly sealed boreholes/wells.	A conceptual model of slow, chronic leaks from infrastructure will be presented in the Master Work Plan (M-45-58). In addition, slow chronic leaks of liquids from infrastructure will be addressed on a WMA specific basis in the evaluation of the WMA and the associated risk assessments, and documented in the RFI/CMS reports for each WMA as appropriate.
98.	T	Appendix B Pg. 1-1.	Three pathways are mentioned. Each pathway leads to one or more receptor populations for which scenarios of possible exposure are developed. Receptors and scenarios are not mentioned, so this is an incomplete summary. Furthermore, statements are made that other pathways (e.g., biological transport, surface water) are dismissed without any discussion or reference to where an analysis might be found that concludes that these are relatively inconsequential compared with the direct exposure and groundwater pathways.	Expand summary to include receptors and scenarios. Discuss every pathway and clearly provide the basis for rejecting each that is not carried into detailed evaluations.	The conceptual models to be used for Phase 2 WMA specific risk assessments will be developed and documented in a collaborative process involving Ecology. Appropriate exposure scenarios and pathways will be defined during that process, and basis for selecting and rejecting pathways documented.
99.	T	Appendix B Pg. 1-1.	Incomplete information. Section B3 contains computer codes used to generate estimates of inventory by tracing materials from arrival on site, through reactors and processing plants, into SSTs and thence to cribs etc. The description is terse and provides no discussion as to the uncertainty of the input data to each model and the uncertainty of the output results. Some of the model outputs were then used as data in subsequent models introducing further uncertainty in inventory values. The uncertainty in these values is not discussed, but should be.	Expand summary to include uncertainty information for the data used to generate the inventory values and for the final values used.	Description of the uncertainties and limitations associated with the data used to generate the inventory values for each WMA model will be addressed in the WMA specific RFI/CMS reports.
100.	E	Appendix B Pg. 1-1.	Presentation could have been improved. For example, there is considerable discussion of the various processes used to recover uranium, plutonium, various isotopes and to finish the production product. Detailed discussion doesn't always lead to the identification of the wastes/constituents in the various waste streams associated with each process. The discussion is very verbose and could be condensed with the use of flow sheets/diagrams that show the processing and the constituents found in each waste stream. The	Modify summary as described.	Comment noted for editorial improvement of future documents.

			level of detail in Section 4 contrast markedly with code descriptions in Section 3. As this report focuses on the groundwater pathway, the focus and level of detail seems inconsistent from one section to another, varying from oversimplified to overly complex, but not always focused on the most relevant information for vadose zone investigations and status. Section B3 is entitled "Inventory" and presumably would discuss inventory and its derivation. However, the author goes on at length about processes and waste streams by name, but focuses little on the specific constituents contained in each waste stream, the volume of waste associated with each stream, and the mass/activity of contaminants discharged to various facilities.		
101.	T	Appendix B Section B6.0	Section B6.0 should contain some information as to how it was determined that a tank had leaked to include: measured/observed data, uncertainty in the data and uncertainty in the final estimate of mass and volume released. Furthermore, the section continues to cite Field and Jones (2005) [e.g., Table B6-1, column 4 {revised leak estimates} which Ecology has noted is an unacceptable reference.	Section B6.0 should contain some information as to how it is determined that a tank has leaked.	Section B6.0 should be updated to include reference to RPP-32681, 2007, *Process to Assess Tank Farm Leaks in Support of Retrieval and Closure Planning*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, WA. This process is discussed in Section 6.5, and the process description has been provided to and approved by Ecology.
102.	T	Appendix B Section B6.0	The accuracy and precision of leak detection measurements (FIC, ENRAF, drywell logging) along with uncertainty of the measurements/data should be discussed. Furthermore, the inventory estimates focus on radionuclides and essentially overlook dangerous waste constituents.	Provide a discussion on the accuracy and precision of leak detection measurements.	Add: "The accuracy and precision of leak detection measurements is discussed in Welty (1988)."
103.	T	Appendix B Pg. B6-8,	Section B6.5 fails to note that these reports are just a status at the time a report is issued. The leak estimates for a particular farm or series of tanks will be periodically updated as additional data/information are obtained, to keep them as current as possible.	Correct text to reflect this information and updating process.	Add to section 6.5 the statement that; "These reports represent the state of understanding at the time the report is issued, and will be updated as new information becomes available."
104.		Appendix B Pg. B7-1, para 1.	Residual wastes are estimated using a video camera, but are not "measured" in any quantitative way, as this paragraph implies.	Correct this assumption.	Change sentence to: "After retrieval, waste residual volumes are estimated using video images, …"
105.		Appendix B Pg. B7-1, Sect. 7.2.1.	Section is incomplete in that it does not mention the process whereby Ecology has the right to review and approve a TWRWP prepared by the contractor in which the retrieval technology is proposed and justified.	TWRWP review and approval is a TPA process. Provide the needed information.	Change the sentence in section 7.2.1 from: "The technology chosen for each SST is based on guidance provided by Tank Farm Retrieval/Closure Projects." To say: "The technology chosen for each SST

					is specified in Tank Waste Retrieval Work Plans which are written and approved as described in HFFACO Appendix I, section 2.1.3."
106.		Appendix B Pg. 8-1, Sect. B8.0.	Discussion of leak detection during tank waste retrieval is incomplete. While HRR is discussed, no mention is made of the leak injection testing done at S-102. Drywell logging is not even mentioned.	Provide the needed information.	Change the second last sentence and add an additional sentence from: "Newer leak detection techniques (e.g., high resolution resisitivity) promise much lower detection thresholds." To read: "Newer leak detection techniques such as HRR which was demonstrated by leak injection testing near tank S-102 (RPP-30121) promise much lower detection thresholds. Leak detection during retrievals includes dry well logging and HRR and is performed in accordance with TWRWPs."
107.		Appendix B Pg B12-5 – B12 - 8, A-105 leak.	A-105 leak. a. The 1,000 gal total volume loss from this leak caused by structural deformation of both the steel liner and reinforced concrete shell has been shown to be incorrect. This is the value in RPP-23405 which Ecology does not accept, partly because of cases like A-105 where the estimated leak loss is too low. CHG calls this the largest leak in this farm, but sticks with the 1,000 gallon estimate. b. Detected count rates in gamma logging are mentioned, but no mention is made as to whether the probe used is the unshielded one or the shielded one (which requires a multiplier to get real values). Please add the type of probe used and the frequency; c. 241-A-105 in the monthly Hanlon reports indicates that this loss was between 10,000 and 250,000 gals which has been omitted. With all that happened at A-105, it is inconceivable that this volume estimate is 1,000 gals, while the A-103 leak volume estimate is ~2,000 gals based on far less evidence. AX-104, for which there is scanty evidence, is assigned an estimated leak volume of 8,000 gals. which is hard to fathom given the magnitude of other nearby tank losses.	Rectify this incomplete discussion to include the missing information and the updated estimates.	The following statement will be included for other tanks: "However, per Field and Jones (2006) this leak volume estimate and associated inventories are undergoing further review and are expected to be revised. Note: The A-105 leak inventory update is described in the A-AX leak evaluation report (RPP-37956) and will be updated in Hanlon and the WMA A-AX PA."
108.		Appendix B	AX-102 and AX-104 have leak detection pits at each tank, but these	Provide a discussion of these leak detection	Leak detection pits are identified on p. 1-7 of

		Pgs. 12-11, 12-12,	are not discussed and should be.	pits.	App. L. Add the following discussion here: "The four 241-AX SSTs were uniquely equipped among the SSTs with a network of drain slots in the concrete base beneath the steel tank liner. These drain slots were intended to channel liquid from beneath the steel tank liner to a 60-ft deep leak detection pit; one pit per tank. No radiation attributed to a tank leak was observed in AX-102 or 104 leak detection pits (Welty 1988)."
109.		Appendix B Pg. 12-17.	The following statement appears: been based. Therefore, attempts to resolve conceptual model uncertainties through further characterization are not needed. Given the uncertainty of events and release inventory and the fact that much of the discussion of BX-102 and BX-101 is based on a single borehole (299-E33-45) when additional boreholes, wells and drywell logs are available for analysis, the highlighted statement is incorrect. Many uncertainties remain and therefore many conceptual models are in need of characterization. No mention is made of the continually growing plume of uranium in groundwater that is moving northwestward toward Gable Gap. This statement is inconsistent with work being conducted for 200-BP-5. Furthermore, all the modeling performed was based on data from the single borehole E33-45 which is also inconceivable given the amount of other available data.	Rectify statement to reflect that there is a need for further characterization and provide the additional characterization needs.	Delete the entire paragraph in question: "Despite the uncertainties in the conceptual model provided by an apparently contradictory source and contaminant distribution information, the evaluation of the future risk and recommendations for remediation have not been jeopardized. The databases strongly indicate that the actual source term remaining in the vadose zone is less than that predicted from historical processing information. By assuming the higher source term inventory for risk assessment, a bounding high estimate of the future impact has been determined on which remediation recommendations have been based. Therefore, attempts to resolve conceptual model uncertainties through further characterization are not needed."
110.		Appendix B Pg. 12-18, Alternative Hypothesis.	Given the volume of data that was analyzed and interpreted, this is a pretty meek statement. However, the alternate hypothesis analysis is not given the equal weight that it deserves in describing and analyzing available data in this area. The statement highlighted above is made on the page before acknowledging that there is considerable uncertainty in the available data to allow a more definitive analysis. Furthermore, DOE has not resolved these two hypotheses as was requested by Ecology in its 2002 comments on the B-BX-BY FIR. Not only are the comments not resolved, but	Provide in the text an equal assessment of the stated alternative hypothesis.	Alternate conceptual model will be presented at a strategic level in the Master Work Plan (M-45-58). Detailed evaluation of specific alternate conceptual models applicable to each WMA will be addressed on a WMA specific basis in the evaluation of the WMA and the associated risk assessments, and documented in the RFI/CMS reports for each WMA as appropriate. Detailed evaluation of the

			DOE claims that no further work is needed for WMA B-BX-BY, as they have all the data needed for a credible performance assessment and for closure.		alternate hypothesis presented here will be included in the WMA B/BX/BY phase 2 reports.
111.		Appendix B Section B-12	The main document (Tier 1) describes the electrical resistivity work that has been conducted in this area. Interpretation of that data and what it indicates about the continuity of contaminant plumes in the vadose zone is very germane in Section B-12, but is completely ignored. DOE is actively supporting this technology and data to help resolve unknowns and uncertainties.	Provide a detailed discussion as to the electrical resistivity work that has been conducted in this area.	Some electrical resistivity discussion was included in this appendix; electrical resistivity work is ongoing in several WMAs. The Master Work Plan (M-45-58) will include a detailed discussion of electrical resistivity, and details of results will be provided on a WMA specific basis in the evaluation of the WMA, and documented in the RFI/CMS reports for each WMA as appropriate.
112.	T	Appendix B General comment regarding conceptual models	Preferential pathways (such as unsealed/uncapped boreholes, clastic dikes) seem to be ignored. When the conceptual model based on limited numbers of boreholes suggests that most released contaminants are held up in the vadose zone, then tank waste in groundwater needs some explanation as to how it infiltrated all the way to groundwater. Clastic dikes were "analyzed" in the SST PA, but the conceptual model of a clastic dike is incorrect. Therefore, any conclusions derived from this analysis are unacceptable.	Address preferential pathways in the report.	Preferential pathways and their role in conceptual models will be presented at a strategic level in the Master Work Plan (M-45-58). Detailed evaluation of the specific preferential pathways involved in the conceptual models applicable to each WMA will be addressed on a WMA specific basis in the evaluation of the WMA and the associated risk assessments, and documented in the RFI/CMS reports for each WMA as appropriate.
113.		Appendix B Pg. B12-31, bullet 5.	Maximum value given for Tc-99 in well 299-W23-19 is 81,000 pCi/L in 2001. However, Tc-99 reached 180,000 pCi/L in 2002-2003, so these data are old and must be updated.	Update information in the document.	Concur. Update this sentence: "The maximum technetium-99 concentrations occurred in borehole 299-W23-19 (81,500 pCi/L in March 2001) and are interpreted to be close to the point of contaminant entry into the vadose zone. The technetium-99/nitrate ratios (0.11 pCi/μg) at this borehole are present in boreholes 299-W22-46 and 299-W22-50." To read: "The maximum technetium concentrations occurred in borehole 299-W23-19 (about 180,000 pCi/L in early 2003) and are interpreted to be close to the point of contaminant entry into the vadose zone."
114.	Editorial	Appendix B	The correct prefix for drywells is 299-; the correct prefix for tanks is	Correct nomenclature.	Update the last sentence of paragraph to from :

		Pg. B-12-34, para 2.	241-. The 216- prefix is reserved for liquid discharge sites such as cribs and ponds.		"...and the prefixes for the drywells (50-) and tanks (216-) are not shown." To read: " and the prefixes for the drywells (299-) and tanks (241-) are not shown."
115.	Editorial	Appendix C, General	The subheadings are essentially the same in both Section C4.2 and Section C3.0.	Section C4.2, p. 4-4 through 4-9, should be consolidated with Section C3.0.	Chapter 3 deals with regional and central plateau issues, while Chapter 4 deals with specific tank farm issues, particularly at the WMA level. By breaking into 2 chapters, the chapter 3 discussion can be more easily used by others, making more likely consistent recharge reports for central plateau facilities. No further action required.
116.	JL Criteria B3	Appendix C, p. 5-1, Section C5.1	A publication giving Hanford lysimeter data has not been included in this section: Gee, G.W., J.M. Keller, and A.L. Ward, 2005, Measurement and prediction of deep drainage from bare sediments at a semiarid site. Vadose Zone Journal, v. 4, p. 32-40	For completeness, briefly discuss this publication in this section.	Concur – This reference is cited on page 5-3 and should also be included here.
117.	Editorial	Appendix D, p. 1-2, Figure D1-1,	The graph has no units for the x- or y-axes, though the y-axis has numerical values.	Include units for Impact on the y-axis.	y-axis should be relabeled: "Relative Impact on Pore Water and Groundwater Quality", which is unitless
118.u	OSWER Directive 9902.3A, 1994, RCRA Corrective Action Plan (see Source Characteriz a-tion); DOE/RL-99-36, Rev. 1 "The general purpose of the Phase 1 RFI will be	Appendix D, p. 3-3 – 3-5, Section D3.2	This section overlooks organic components of the waste entirely, and does not cover the redox reactions that affect the transformations and migration of nitrogen compounds. Processes influencing the fate of organic components of the waste include sorption, biodegradation, hydrolysis, oxidation, reduction, co-solvent effects and volatilization. Nitrogen transformations that should be discussed include denitrification, oxidation of nitrite, and nitrification of ammonia/ammonium.	(1) Delete the first paragraph of the section, since it omits organic contaminants. (2) Discuss the processes that influence organic components in the waste (3) Discuss the fate of nitrate and nitrite in the subsurface (4) Pursue collection of data for organic contaminants in the vadose zone in Phase II or the CMS.	1 - 3) Appendix D deals with tank waste residuals. The first paragraph identifies contaminants known to be present in tank residuals, known to have long half lives and known to be mobile if released from the tank residuals into the vadose zone. Sampling of tank residuals for all tanks will be performed prior to closure, including analysis of organic compounds. Should future sampling reveal the presence of organics in the residuals, this information will be integrated into Phase 2 reports. 4) The specific contaminants of interest in each WMA will be defined in Step 3 of the DQO process during Phase 2.

	to characterize the concentration of releases from SSTs"				
119.		Pg. E4-1 – E-4-26	Characterization information presented is by formations and sub-units of formations at a scale that is unsuited to detailed fate and transport modeling or to the design of remediation systems. Modeling, to be effective and representative of real fate and transport of fluids and contaminants, has to be done at a much finer scale to adequately represent thin units of limited lateral extent (e.g., few meters) and vertical extent (few mms to few cms) that can significantly affect the path taken by infiltrating/migrating fluids.	Phase II must address the limits of modeling (i.e., what is the smallest unit that can be modeled/simulated) and the means to acquire data of such a scale so as to be able to conduct true and representative fate and transport modeling. The devil is in the details which are not presented in this write-up. Please provide such details.	The conceptual models to be used for Phase 2 WMA specific risk assessments will be developed and documented in a collaborative process involving Ecology. The limitations of the modeling will be evaluated and documented as part of the Phase 2 reports.
120.		Pg. F4- 2-6	Effects of clastic dikes on fate and transport that are stated are the results of modeling. Without some confirmation that this is the path that might be chosen by an infiltrating fluid with density of 1 – 1.5 (i.e., wetting front instability), the modeling results are merely speculative and a function of assumptions of the input parameters, boundary conditions and the input parameter values. See work of Chris Murray (PNNL) near the Army Loop Road site. Modeling done in the S-SX FIR and the SST PA used an inappropriate conceptual model for a clastic dike, so the results have no credibility. What is meant by "far field" vadose zone?	Incorporate into the document and address missing definition.	Add a statement to paragraph 3 on page 2-6 acknowledging that modeling of clastic dikes has not been confirmed through measurement. The conceptual models to be used for Phase 2 WMA specific risk assessments will be developed and documented in a collaborative process involving Ecology. The appropriate modeling of clastic dikes will be evaluated and documented as part of the Phase 2 reports. The "far field" vadose zone is described in the introduction: "The "far-field," as opposed to "near-field," refers to vadose zone sediments which are relatively unimpacted by tank leaks. The far-field is away from the leak source (i. e., near-field) and at depths in excess of several meters below tank bottom. Once the contaminants from tank leaks have migrated deep within the far-field vadose zone, the deep drainage flux (i. e., recharge) is the primary driver for

					movement of contaminants to groundwater."
121.		Pg. F5-1 – F5 - 4	These parameters can be used to provide required modeling inputs. However, what is not clear is the scale and distribution of the strata to which they apply; i.e., the scale of heterogeneity in the lateral and vertical dimensions. Using these values over "composited" strata isn't necessarily the equivalent of the numerous thin and spatially distributed strata of sufficient unsaturated hydraulic conductivity contrast that can exert significant control over fate and transport of fluids.	Provide clarity as to the scale and distribution of the strata as applied.	The conceptual models to be used for Phase 2 WMA specific risk assessments will be developed and documented in a collaborative process involving Ecology. The scale and distribution of the strata requiring modeling will be evaluated and documented as part of the Phase 2 reports.
122.	Editorial	Appendix G, Section G2.0 – G2.8	These sections repeat concepts and text in previously given in Appendix D (Contaminant Release…).	Combine the two appendices into one.	Concur that there is significant overlap in these sections. Appendix G was designed to be self-contained. No revision will be made now, but if a future revision is deemed appropriate, restructuring the two appendices will be considered at that time.
123.	T	Appendix G	These statements below appear on pgs. G-2-5, 6 but are generally ignored in actual modeling where a constant Kd is used. For these reasons, the constant K_d model can provide adequate results when contaminant concentrations are low relative to the adsorption capacity and the variability in mineralogy and hydrochemistry is minimal along the groundwater flow path. The constant K_d model is not adequate for representing adsorption in situations where spacial variability in mineralogy and hydrochemistry is significant along the groundwater flow path. set of conditions for which the K_d value is to be applied was emphasized. It was also highly recommended that a knowledgeable geochemist with experience in the area of contaminant adsorption, speciation chemistry, and Hanford K_d values be consulted when selecting K_d values for conducting modeling efforts with critical outcomes such as performance assessments.	Provide a better description of the model deficiencies and how such inconsistencies can impact model results.	The conceptual models to be used for Phase 2 WMA specific risk assessments will be developed and documented in a collaborative process involving Ecology. The limitations of the use of constant Kd will be evaluated and documented as part of the Phase 2 reports a appropriate.
124.	OSWER Directive 9902.3A, 1994, RCRA Corrective Action Plan (see Source Characteriz a-tion,	Appendix G, p. 2-1 – 2-11, Section G2.1	This section does not consider modeling sorption as a nonlinear process, as a compromise between the K_d approach and surface complexation models. However, the text does acknowledge nonlinear sorption on p. 2-5 "Because there is a finite number of adsorption sites on the aquifer solid phases, adsorption will reach a practical upper limit as sorbate concentrations increase." The software package SESOIL uses a Freundlich approach rather than a linear K_d approach. This approach can be easily incorporated into a model.	Discuss, evaluate, and consider using conventional sorption equations (ex. Langmuir and Freundlich) for non-linear sorption.	The conceptual models to be used for Phase 2 WMA specific risk assessments will be developed and documented in a collaborative process involving Ecology. During this process, the tools for mathematical modeling will be selected.

	Migration and dispersal characteristics of the waste)				
125.	OSWER Directive 9902.3A, 1994, RCRA Corrective Action Plan (see Source Characteriz a-tion); DOE/RL-99-36, Rev. 1 "The general purpose of the Phase 1 RFI will be to characterize the concentration of releases from SSTs"	Appendix G, General	It appears that no data were collected for organic contaminants in any of the tank farms. They are not discussed or listed along with the parameters given for laboratory analyses. This class of contaminants includes carcinogens and noncarcinogenic toxic compounds that are regulated under RCRA and WAC 173-303. Their concentrations are needed for remediation efforts and risk assessments. Some of these compounds may exceed cleanup levels and may require remedial action.	Discuss in this appendix available organic contaminant data for the vadose zone. Pursue collection of data for organic contaminants in the vadose zone in Phase II or the CMS.	Phase 2 characterization will include compilation of existing data (including organic contaminant data) for each WMA to support development of DQOs. The DQOs will identify the additional data required on a WMA specific basis. Ecology is a participant in the DQO process in support of the Phase 2 RFI/CMS.
126.	JL Criteria B3	Appendix G, p. 3-35 – 3-36, Section G3.10	This appendix does not integrate sample results from WMA-U, which are given in the Field Investigation Report for WMA-U (Appendix M).	Discuss the geochemistry of WMA-U in Appendix G.	The lack of geochemical data in this appendix (Geochemistry) for WMA U was strictly a timing issue. Information is provided in Appendix M (WMA U FIR). When a rewrite of Appendix G is preformed, data collected since the preparation of this appendix will be

					added.
127.		APPENDIX H General	a) When reporting older data/documents, care should be exercised with the units of measure. Some units for 1940s and 1950s analyses are listed in units of pCi/L, when contemporary analytical techniques didn't allow for analyses to that level. Units were often reported as □Ci/L or □Ci/g. b) When discussing analyses for gross beta in groundwater, it would be beneficial to state what gross beta analyses report and what potential contaminants might be contributing to gross beta results. For example, little is known about early Tc-99 discharges, as Tc-99 was not analyzed as a specific isotope until the mid 1980s, but it may have been contributing some unknown amount to gross beta results. c) Care needs to be exercised in judging whether the volume of contaminated liquid was sufficient to infiltrate through the entire vadose zone to reach groundwater. Leaking raw water lines, spills, floods and other liquid releases, whether chronic (especially) or acute, could provide significant driving force to get contaminants to groundwater, and once in groundwater, significant vertical head to drive contaminants deep below the water table.	a) Please check units being reported. b) State what gross beta analyses report and what potential contaminants might be contributing to gross beta results. c) Evaluate the influences of other driving forces of contaminated liquid discharges that infiltrate through the entire vadose zone to reach groundwater.	a) The author of this Appendix, Duane Horton, is well aware of the difficulties of using historic Hanford documents, and has prepared the appendix accordingly. If specific results in Appendix H are suspected, we would appreciate that information. b), c) – The Phase 2 WMA specific RFI/CMS reports will include relevant information on the groundwater associated with each WMA. Those reports will include gross beta analysis information as available, and will also evaluate the influences of other driving forces of contaminated liquid discharges that infiltrate through the entire vadose zone to reach groundwater in each WMA.
128.		APPENDIX H Pg. 2-1, para 1.	There are places in the 200 East Area where the Ringold Lower Mud is present and confines/semi-confines groundwater beneath this unit in the Ringold A gravels.	Please correct.	Add this sentence at the end of paragraph 1: "There are places in the 200 East Area where the Ringold Lower Mud is present and confines/semi-confines groundwater beneath this unit in the Ringold A gravels."
129.		APPENDIX H Pg. 2-2, Table H-2.	Values listed for WMA B-BX-BY indicate that these is a groundwater divide. Where is this divide? Groundwater flow direction in the northern part of the WMA is shown as WSW; yet, a uranium plume continues to grow and expand northwestward from this WMA.	Please resolve and explain this conflict.	Insert the following after the first paragraph on page 2-5, discussing Table H-2: "There are two outlets of groundwater from underneath the 200 East Area. One to the north through Gable Gap and one to the southeast following the ancient course of the Columbia River. Hence, there exists a groundwater divide, that is, water north of this divide would go through Gable Gap. Because of Hanford operations, this divide has moved considerably over the years. In addition to moving with the water (advective), diffusion of contaminants can

					move by diffusion, sometimes resulting in concentration buildups contrary to a reversed flow direction."
130.		APPENDIX H Pg. 2-6, Fig. H2-3.	Given the large areas with very low gradients, it would be beneficial to have supplemental contours on the water table in less than meter increments.	Please address.	The Phase 2 WMA specific RFI/CMS reports will include relevant information on the groundwater associated with each WMA, and will provide more detailed contour maps as appropriate.
131.		APPENDIX H Pg. 2-10 – 2-13, text and figures.	These words and text need to be qualified to indicate that there isn't an instantaneous change in groundwater flow direction by many tens of degrees at the change of the calendar year. What are shown on the flow direction "roses" are the major flow directions over a period of years, but there is certainly a "transition" from one flow rose to the other that is not implied or stated with these figures. And there is still the discrepancy between the groundwater flow direction implied by the growth and expansion of the U plume to the northwest and the flow directions indicated on these flow direction "roses".	Please correct.	Add sentence to last paragraph on page 2-10: "Note that changes in ground water flow occur gradually, and dates of change are estimated."
132.		APPENDIX H Pg. 2-13, 2-14.	This discussion is oversimplified and in places incorrect. When the groundwater monitoring networks were installed in the early 1990s for WMAs B-BX-BY and C, flow direction was generally toward the west (B-BX-BY) to west northwest (WMA C). Flow direction at WMA A-AX was to the southwest.	Please correct this discussion.	Please clarify which specific statements are of concern and what changes are required.
133.		APPENDIX H Pg. 3-1, Sect. 3.1.	This discussion applies to background groundwater quality for the Hanford Site UNCONFINED AQUIFER. It does not apply to all the basalt aquifers.	Please correct.	Add sentence at the end of paragraph 1: "This discussion applies to the Hanford Site unconfined aquifer."
134.		APPENDIX H Pg. 3-6, Sect. H-3.2.	While mentioned briefly that groundwater flow direction has changed, more needs to be said about changing flow directions and their potential effect on "background" groundwater chemistry. With flow directions at some WMAs having changed by ~180 degrees, up- and down-gradient locations have reversed such that contamination arising from facilities formerly down-gradient may now be up-gradient and be contributing to what might be considered, "facility background.". This is especially true for areas like WMAs T, A-AX and B-BX-BY. There have also been complications in 200 West Area because of pump & treat operations for CCl4. Extraction and injection wells have produced cones of depression and mounds which have locally changed groundwater flow direction and caused	Please clarify	The Phase 2 WMA specific RFI/CMS reports will include relevant information on the groundwater associated with each WMA, and potential impacts of flow direction changes on the contaminant migration

			mixing of contaminant plumes arising from different facilities.		
135.		APPENDIX H Pg. 3-14.	It should probably be mentioned that many early cribs which received high volumes were monitored for groundwater to determine when contaminants "broke through" to groundwater so that discharges could be routed elsewhere. Thus, contaminated groundwater should come as no surprise around these WMA facilities.	Address such aspects in the report.	Concur. After the first sentence of Section H3.2 (Background Groundwater Contamination beneath SST WMAs) on Page H3-6, add the phrase "…, particularly discharges of hundreds of millions of gallons of tank waste to cribs and trenches near the WMAs."
136.		APPENDIX H Pg. 3-27, U.	A plume of uranium continues to grow and expand northwestward toward Gable Gap, yet groundwater flow is said to be to the south-southwest. This inconsistency has persisted in Ecology comments since Ecology reviewed the B-BX-BY FIR in 2002.	This inconsistency must be addressed and resolved in the report.	The best available information on the groundwater in this area has been presented – current information cannot resolve the conflict. The Phase 2 WMA B-BX-BY specific RFI/CMS reports will include updated information on the groundwater and will discuss this issue based on the state of knowledge at that time.
137.		APPENDIX H Pg. 3-30, WMA C sources	There may be multiple sources for contaminants seen in groundwater at WMA C, but the fact that CN occurs in a few wells (whose only known source is tanks in WMA C) and the NO_3 and ^{99}Tc plumes center beneath WMA C provides evidence that most of the contamination in groundwater arose from tanks and pipes in WMA C.	Address this aspect in the report.	Add sentence at end of page 3-30: "The presence of cyanide in wells suggests tank farm waste as at least one of the sources of the contamination."
138.		APPENDIX H Pg. 3-36, time series plots of WMA U wells.	The peak for older wells on the east side of WMA U in the early to mid-90s may reflect the clean out of U Plant that resulted in high volume discharges to the 216-U-14(?) ditch. These discharges affected not only groundwater contaminants, but also hydraulic head.	Please address, as this may be unrelated to depth distribution in the aquifer.	Concur. The lack of discussion of the impact of the ditches near WMA U in Appendix H is a timing issue. This was one of the first appendices to be written to establish the template for other appendices and data packages. The postulated impacts on the ditches on WMA U are discussed in Appendix M (U FIR). When a rewrite of Appendix G is preformed, data collected since the preparation of this appendix will be added.
139.		Appendix K GENERAL COMMENT:	Various interim measures have been implemented over the past decade, but this seems to have been a one-time activity with little or no maintenance or follow up to assure that these measures are functioning as intended. [See the adjoining quote on pg. K7-21]	Please address the inspection, evaluation and maintenance of interim measures performed in years past.	This comment is out of scope of the RFI document and should be addressed through separate means.

			The responsibility for all upgradient surfacewater runoff control measures constructed in FY 2001-FY 2002 was transferred to tank farm operations in FY 2003. Some of the control measures were damaged by a catastrophic rainstorm in April 2003, requiring subsequent maintenance activities. More recently, insufficient periodic maintenance has reduced the effectiveness of the control measures, and a new maintenance evaluation should be undertaken.		
140.		Appendix K GENERAL COMMENT:	In its evaluation of the preliminary performance assessment for WMA C, an Expert Panel recommended the installation of an interim barrier to delay the arrival of contaminants in groundwater resulting from infiltration through the vadose zone. Please add.	Please add the Expert Panel recommendation.	The Expert Panel (Merit Panel Review of the C Tank Farm Closure Performance Assessment, 2004) provided recommendations on the preliminary performance assessment for WMA C, in order to improve future performance assessments. These recommendations will be considered in the development of Phase 2 reports. One of the recommendations was to install a temporary barrier over WMA C for the 45 years until closure is completed. By the time the report was completed, retrieval of WMA C tank waste had been significantly accelerated, and it was determined that installation of a temporary barrier would interfere with ongoing retrieval and closure activities.
141.		Appendix K GENERAL COMMENT:	In discussing Chinook-induced floods, several statements are made that the first occurred in 1979. That is likely only the first documentation of such an event. Checking meterological data would likely reveal that such events occurred periodically during tank farm operations since the inception of Hanford Operations. Please check and correct.	Please check meterological records and correct these statements as needed.	The 1979 Chinook-induced flood is discussed only as an example of the types of events that cause large surface water run-off events. The fact that previous unrecorded Chinook events may have occurred does not affect this discussion. No further action required.
142.		Appendix K K3-3	Incorrect information on the application of WAC 173-160 to Hanford Wells. WAC 173-160 became a regulatory requirement following passage of RCW 18.104. It was not applied to the Hanford Site until 1986 when the first Federal Facility Consent and Compliance Order was issued.	Please correct this information.	Change the sentence in 3.1.2 from: "The construction of almost all the wells at the SST farms is not in compliance with the Washington Administrative Code (WAC 713-160), "Minimum Standards for Construction and Maintenance of Wells", which came into existence in 1973." To read: "The construction of almost all the wells at the SST farms is not in compliance with the Washington Administrative Code (WAC 713-

					160), "Minimum Standards for Construction and Maintenance of Wells". WAC 173-160 became a regulatory requirement following passage of RCW 18.104. It was not applied to the Hanford Site until 1986 when the first Federal Facility Consent and Compliance Order was issued."
143.		K3-4	Need to distinguish between "abandoned" which has a definition in WAC 173-160-111 and "decommissioned" which is addressed in 173-160-460.	Please correct.	Replace "abandoned" with "decommissioned" in this paragraph: "Most important the Washington State Attorney General's office has advised Ecology that construction standards for wells (WAC 173-160 et seq.) can only be relaxed if such action does not result in a threat to human health and/or the environment. These criteria must be met for each well at the Hanford Site regardless of the DQO for the well, irrespective of whether it is being used to directly support the RCRA program. Any well causing such a threat will have to be abandoned or remediated to the extent necessary to alleviate the threat."
144.		K4-1, 2	Caps on drywells were replaced nearly a decade ago and now some of them are either cracked or missing. Maintenance of such improvements MUST be continued.	Please correct this programmatic problem.	This comment is out of scope of the RFI document and should be addressed through separate means.
145.		K3-17	Modeling is stated to have demonstrated that an interim surface barrier at WMA B-BX-BY would not have much beneficial effect because of the depth of existing contamination in the vadose zone. This analysis suggests that there is some limiting depth beyond which an interim (or final?) barrier will have little, if any, impact. This is a key issue for barriers for any site relative to final closure/remediation.	Please provide additional discussion and basis for these statements as well as summarizing the modeling effort used to reach this conclusion (or at least provide a reference for same). Provide the Expert Panel views on this as well.	The text provides the reference to the basis for this conclusion: WMAB-BX-BY, A.J. Knepp, *Field investigation Report for Waste Management Area B-BX-BY,* RPP-10098, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington. The modeling is described in Appendix E of the reference.
146.		K5-1	Table K5-1. Per agreement with Ecology in 1993, clean sand is usually used within the saturated zone of the unconfined aquifer during decommissioning so as not to influence water quality. The casing is perforated, but pressure grouting usually begins a few feet above the extant water table.	Please state whether this procedure was followed, or give the reasons if it wasn't.	Modify the sentence: "Decommissioning of the wells was completed in July 2000." To read: "Decommissioning of the wells was completed

					in July 2000, in compliance with Washington State requirements."
147.		K7-21	Following the unusual 500 yr. storm and resulting erosion/deposition, the corrective measures consisted of regarding and returning to the pre-storm conditions. What corrective action has been taken to improve/upgrade this diversion system such that this doesn't occur again?	Please provide corrective measures, if any, initiated following the return of this diversionary system to pre-storm conditions.	The significant soil erosion and deposition that occurred at WMA B-BX-BY as a result of this storm was repaired by adding gravel to rebuild the berm and fill in eroded areas. The only new controls were put in place by Fluor. Coarse rock was placed in the eroded ditch between BX Farm and the 200-BP-5 soil barrier to mitigate future erosion at the base of the barrier.
148.		K7-26	The unusual storm occurred in April 2003. As of 2008, some 5 years later, no corrective measures have been taken at WMA A-AX and the situation remains unchanged.	DOE/ORP must submit a corrective plan to rectify this problem as well as that given above for WMA B-BX-BY by December 31, 2008 for Ecology approval. A maintenance plan that includes inspection and procedures for any needed repairs shall be submitted by DOE/ORP for Ecology approval by March 1, 2009.	This comment is out of scope of the RFI document and should be addressed through separate means.
149.		K8-11	The interim barrier at T-106 was not completed in FY 2007. Please correct here and throughout the report..	Correct the schedule for completion of the T-106 interim barrier.	Change reference to completion in FY 2007 to FY 2008 on pages 8-11, and change title of section 8.4 to note (FY 2007-2008)
150.		K8-16	What analysis/criteria were used to select a monitoring depth of only 15 meters, given that the effective depth of a barrier is a key question for this and all barriers?	Please elaborate on the decision to limit monitoring to a depth of 15 m.	The monitoring depth of 15 m for monitoring nests was selected because this depth extends into the undisturbed layer below the tanks. Changes in soil moisture are expected to be more significant above the undisturbed layer. As noted in the monitoring plan (PNNL-16538), "some of the existing dry wells located in T-Farm may be neutron logged provided the wells have a favorable completion design."
151.		K8-20, 21	The basis for the reduction of contaminants getting to groundwater with barrier emplacement is presumably some modeling effort. Please specify or reference how this analysis was performed, as modeling is very subjective and highly dependent on modeling assumptions, boundary conditions and input parameters and values.	Please specify the basis for the analysis that demonstrates the most reduction in contaminants reaching groundwater by constructing an interim barrier.	The opening paragraph of K8.4.7 states: "The FY 2002 interim surface barrier site-selection evaluation was updated in FY 2006 using data and modeling techniques derived from the SST performance assessment for the Hanford Site (DOE/ORP 2005)."

152.		K9-7	The text describes what has been done, but doesn't update what the effects of this approach have been other than the very small number of Ci removed by additional pumping at the end of sampling. What are the trends of concentration/activity of NO3, Cr and Tc-99 in this well over the past few years? What about the conductivity probe data and what it reveals?	Please update with recent results of groundwater concentration/activity data and conductivity data and the significance of these data.	Refer to Table K9-2 for the trends of Tc-99 concentration in this well over the past few years. It is anticipated that NO3 and Cr concentrations follow a similar pattern.
153.		K10-1	Please correct this figure. Wells 299-E24-19 and 299-E25-46 were constructed as RCRA monitoring wells in the 1990s, but are shown on this map as non-RCRA wells.	Please correct this figure as directed.	Figure K10-1 shows 299-E24-19 and 299-E25-46 as "Corroded Casing – Well has been decommissioned." This designation is correct.
154.	JL Criteria F9	Appendix N, p. 1-5, Section 5.1	The text states "A second phase of field investigation is not deemed necessary except for the purpose of reducing inventory and migration uncertainty at specific locations identified in Section 6.0." Ecology considers there to be significant uncertainty remaining in S-SX. In comments on the S-SX Risk Assessment, Ecology raised questions about the state of knowledge in S-SX and requested further evaluation of uncertainty. For instance, the following comments were submitted: • "Given the general lack of characterization within the tank farm, restricting calculations to characterized leaks results in a large underestimation of the quantity of waste present in the vadose zone. This should be discussed." • "Why are past leak scenarios restricted to cased where waste is still above the Plio-Pliestocene unit? For tanks S-104 and SX-105 it would appear that waste is not only below the Plio-Pliestocene, but is impacting groundwater. Add new run or justify why it is lacking." • "Peak concentrations for Tc-99 at the S Tank Farm fenceline is indicated to be 774 pCi/L. Tc-99 in downgradient well 299-W22-48 has already reached 4700pCi/L, apparently as a result of leaks at S-104, and concentrations are probably considerably higher at the fenceline. How do you reconcile this with your modeling results?" • "Estimate the inventories and provide them for UPRs 200-W-80, 200-W-81, 200-W-82, 200-W-109, 200-W-114, 200-W-127, 200-W-165, and the evaporator spill. Include the	Please delete the quoted text on p. 1-6 and re-evaluate a second phase of field investigation for S-SX considering Ecology comments.	The quoted text is a direct quote from the *Field Investigation Report for Waste Management Area S-SX* (Knepp 2002a), and is cited as such. It is currently recognized that additional field investigation is warranted in S-SX, and will occur as part of Phase 2.

			estimated inventories in Section 3.6 and use them in the evaluation of uncertainty in the risk assessment."		
155.	E	App N, p 1-1 and 2-1, sec N1.1 and N2.1, para 1	By repeating (verbatim) conclusions of six previous reports (i.e., SST PA and 5 FIRs for WMAs S-SX, B-BX-BY, T and TX-TY, C and A-AX, U), this RFI report has lost an opportunity to integrate and synthesize information from previous reports. This approach offers no new insights and conflicts with an iterative strategy (i.e., which is defined by refinement rather than repetition) embraced by the SST PA.	Conclusions from past reports should be integrated and exploited to refine previous conclusions and make new conclusions (and recommendations) in an iterative fashion.	The RFI Report is structured around functional areas, rather than WMAs. Therefore the synthesis desired by the commenter is in the chapters of Tier 1, the appendices of Tier 2, and the data packages of Tier 3, rather than in Appendix N. Appendix N simply attempts to place all the conclusions and recommendations of the SST PA and the FIRs in one place to satisfy the requirements of HFFACO milestone M-45-55: "Submit to Ecology for review and approval as an agreement primary document a Phase 1 RFI Report integrating results of data gathering activities and evaluations for all SST WMAs, <u>including a summary of impacts from the Initial SST Performance Assessment, with conclusions and recommendations</u>." (emphasis added)
156.	T, E	App N, p 1-2, sec N1.2, para 3	The SST PA did not really evaluate impacts of "alternative conceptual models." Instead, "sensitivity analyses" evaluated changes in parameter estimates (e.g., change barrier recharge rate), and "what if" cases evaluated changes in assumptions regarding future events (e.g., change time of barrier placement). Neither of these really alters the underlying conceptual model in a substantial manner (e.g., alternate contaminant transport mechanisms, additional exposure pathways).	Evaluate alternative conceptual models.	The strategic approach to conceptual models, including alternative conceptual models, will be discussed in the Master Work Plan. The conceptual models to be used for Phase 2 WMA specific risk assessments will be developed and documented in a collaborative process involving Ecology. The use of alternative models, as well as sensitivity analysis, will be evaluated and documented as part of the Phase 2 reports a appropriate.
157.	T, E	App N, p 1-2, sec N1.2, para 4	In addition to groundwater, intruder, and air pathways, other pathways/scenarios/exposures should be evaluated (i.e., soil direct contact, Native American, ecological receptors).	Additional pathways, scenarios, and exposures should be evaluated, per the comment.	The specific applicable exposure scenarios and pathways will be identified as part of the risk assessment supporting each Phase 2 WMA specific CMS.
158.	T	App N, p 2-3, sec 7.7.4, para 1	Provide more detail on how risks from surrounding facilities will be integrated with tank farm sources to estimate cumulative risks at the Hanford site.	Describe cumulative risks (from surrounding facilities and tank farms) more completely.	As noted in Chapter 28 (Cumulative Impacts from the Hanford Site), the cumulative assessment is being updated by others. Relevant conclusions from this and future cumulative assessments should be included, as

					appropriate, in Phase 2 documents to provide context and integration discussion.
159.	JL Criteria G4	Appendix 0, p. i, Table App-1	For Risk Assessment requirements, no state of knowledge is provided in Tier 2. Instead, there is deference to several non-primary documents.	Include risk assessment requirements in this document. See comment on Chapter 15.	The risk assessment requirements to be used for Phase 2 WMA specific risk assessments will be developed and documented in a collaborative process involving Ecology.
160.	JL Criteria D8, F3	Appendix N, General	Risk assessments performed as part of Field Investigation Reports (FIRs) are not approved by Ecology.	This comment has no specific action. It is to inform the parties that Ecology may not use risk assessment results from FIRs since they were not intended to comply with state regulatory requirements.	Comment noted.
161.	JL Criteria F3, F9	Appendix N, Section N1.5, General	Ecology provided numerous comments on the T-TX-TY FIR. None of the comments were dispositioned. The comments were not considered in preparation of the RFI document, as the summary chapter from the T-TX-TY FIR is repeated in the RFI. The comments pointed out many areas in T-TX-TY where the concentrations of contaminants in the soil exceeded regulatory limits. Ecology's comments specifically asked that the contaminated locations be targeted for Phase II of the RFI/CMS.	Include a section in this summary that discusses Ecology's comments on the T-TX-TY FIR and make reference to a Phase II that will address comments made by Ecology.	Phase 2 characterization will include development of DQOs for each WMA. The DQOs will identify the additional data required on a WMA specific basis. Ecology is a participant in the DQO process in support of the Phase 2 RFI/CMS.
162.	Cannot evaluate JL Criteria D14 for WMAs A-AX, C and U at this time; have not evaluated JL Criteria F12 yet	Appendix N, Sections N1.6, N1.7, N2.6 and N2.7	These sections extract summary information from FIRs that are attached to this document. Ecology is reviewing the attached FIRs on a separate schedule. Ecology does not currently accept the summary and conclusions from the FIRs for WMAs C, A-AX and U.	This comment has no specific action. It is to establish that Ecology will defer its review of the summaries of the WMA C and A-AX and WMA U FIRs until the FIRs have been reviewed.	Comment noted.
163.	HFFACO, Appendix I, Section 2.5: "These PAs will be approved	Appendix N, Section N.2.2, General	This section extracts directly from the SST PA. This section repeats information presented in the SST PA. Ecology had numerous comments about the SST PA that are currently unresolved. Ecology cannot currently accept the statements and conclusions about risk made in this section.	Modify this document based on Ecology's SST PA comments. Reference Ecology's SST PA comments in this appendix.	See comment 35.

	by Ecology and DOE..”;				
164.	JL Criteria B3	Appendix N, p. 2-5, Section N2.3, FIR section 6.2	This section is taken directly from the S-SX FIR and states “Numerical simulation results summarized in Section 4.2 suggest that compared to the no action alternative, placement of an interim surface barrier provides very little reduction in peak concentrations for mobile contaminants.” However, there are currently plans to design and possibly apply an interim barrier in WMA SX.	Integrate the new knowledge regarding interim barriers in SX and adjust the recommendations for S-SX to reflect the current plans, rather than the old plans given in the S-SX FIR.	New information with regard to the potential benefits of interim measures is being evaluated on an ongoing basis. If a interim barrier in S-SX is identified as a recommended action, a proposal will be provided to Ecology per Section 7.2.4 of the HFFACO.