0058527

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
1315 W. 4th Avenue • Kennewick, Washington 99336-6018 • (509) 735-7581

December 16, 2002

Mr. James E. Rasmussen
Office of River Protection
United States Department of Energy
P.O. Box 450, MSIN: H6-60
Richland, Washington 99352

RECEIVED
JAN 16 2003
EDMC

Dear Mr. Rasmussen:

Re: Conditional Approval of the S-102 Functions and Requirements (F&R) Documents RPP-10901, Rev. 0, Deliverables of Hanford Federal Facility Agreement and Consent Order (HFFACO) Milestone M45-05-T116

58166

The Washington State Department of Ecology (Ecology) is fully supportive of the important risk reduction actions of single shell tank (SST) waste retrieval. The retrieval demonstrations are important because they will move a significant amount of high risk waste out of SSTs to double shell tanks (DSTs), and demonstrate new and improved retrieval and leak detection technologies. The United States Department of Energy (USDOE) Office of River Protection (ORP) has made substantial progress toward the retrieval of SST waste over the past few years and Ecology compliments ORP's commitment to SST waste retrieval. Due to this effort, the actual moving of waste from old failing storage tanks to safer tanks is just around the corner.

Ecology has completed its review of the S-102 F&R document and has decided to issue a conditional approval of the document. Ecology approves the technical approach for final retrieval design for tank S-102. ORP should consider this letter as approval to continue with final design. Recognizing the need for continued progress toward SST waste retrieval and, while acknowledging Ecology risk assessment concerns that are currently subject to risk workshops, Ecology will not require resolution of S-102 Retrieval Performance Evaluation (RPE) related comments prior to conditional approval of the S-102 F&R document. Non-RPE F&R comments must be resolved. In general, these include, but are not limited to, a lack of sufficient leak detection mitigation and monitoring (LDMM) including development and implementation of ex-tank leak detection, extent of retrieval is based on limits at best available technology, not risk driven, and LDMM implementation is technology driven, not risk driven. Removal of mixed waste from non-compliant single walled tanks is a key step towards a required final tank system closure. Ecology continues to support retrieval of as much tank waste as technically possible, as defined in HFFACO M-45 Milestones, and will not impede progress toward that goal. Therefore, Ecology approves the above referenced F&R documents subject to the following conditions:

1. Resolve all non-RPE specific comments and submit related corrections, missing information, etc. to Ecology's satisfaction no later than five weeks after the receipt of this letter.

2. Ecology requires all RPE related corrections, requested changes, and additional information, etc., as appropriate/applicable to other tanks/tank farms, be incorporated into all future RPE and SST closure documentation. To this end, Ecology and ORP are currently developing agreements concerning level of risk analysis needed for retrieval actions, level of risk analysis needed for individual tank closure/HFFACO appendix H determinations, and level of risk analysis needed for tank farm Waste Management Area closure.

3. Ecology understands that ORP is currently planning field testing of ex-tank LDMM technologies and plans to deploy an ex-tank technology at S-102 if the technologies prove to add value. Ecology requires that ORP maintain design flexibility to incorporate at least one viable ex-tank LDMM technology for each retrieval. Ecology expects that ORP will continue to seek out and invest in technology to improve the capability to detect and mitigate leaks during retrieval. Ecology is aware that the ex-tank technology test data is available and should be forwarded to Ecology within two weeks of the delivery of this letter.

4. Ecology shall be included in the process control program, including the development of process controls and review of documentation.

The use of a risk analysis to determine risk to human health and the environment for a range of retrieval leak volumes and waste residual volumes has some value; however, calculating a risk-based maximum leak loss used to determine leak detection limits of detection equipment and to calculate allowable residual waste or limiting retrieval equipment performance is not acceptable. The goal of leak detection shall be to detect the smallest leak volume practicably achievable in order to document the performance of the retrieval demonstrations, and to provide timely data from which USDOE and Ecology can make informed retrieval/closure decisions. Additionally, the retrieval design goal is driven by retrieving as much as technically possible, not to exceed a residual beyond 360 cubic feet.

If you have any questions please contact Suzanne Dahl at (509) 736-5705 or Dick Heggen at (509) 736-5716.

Sincerely

Jeffery Lyon
Tank Waste Storage Project Manager
Nuclear Waste Program

cc: Jim Thompson, ORP
Andy Stevens, ORP
Robert Lober, ORP
Roger Bauer, CHG
Keith Carpenter, CHG
Todd Martin, HAB
Rick Gay, CTUIR
Russell Jim, YN
Pat Sobotta, NPT
Ken Niles, OOE
Administrative Record: M45-SST Retrieval

	F&R S102 Ecology Comments
	General Comments
	The document organization needs to be streamlined so as not to repeat the same information repeatedly in different sections. For example, LDMM is discussed several times in different sections. Discuss a subject completely once in one place, and refer the reader to that place at all other places where the subject arises. Future F&R should be streamlined.
	LDMM discussions are almost exclusively in-tank measurements. Ex-tank techniques mentioned are drywell and groundwater monitoring, in very short, incomplete descriptions. There is limited discussion of high-resolution resistivity (HRR) or electrical resistance tomography, both of which are currently being tested and refined. Please expand.
	This may be a primary document requiring Ecology approval, but DOE has provided insufficient detail and assurances to allow Ecology to grant approval for waste retrieval. Ecology expects to be provided detail in a follow-on design meetings, minimally at the 30% review.
	To what extent will the difficulties encountered in waste retrieval projects at other DOE sites be alleviated by appropriate rehearsal in the Cold Tank Test Facility? Please address.
	The Lessons Learned tables reveal, in many instances (especially regarding operations and maintenance of equipment, quality control, lack of system engineering design/oversight), that careful, critical thinking was not properly incorporated into the original design. What seem like fairly obvious steps/processes to consider in engineering design were omitted leading to a problem that required some corrective action that is subsequently written up as a Lesson Learned. Ecology expects that with computer simulation of processes and with the opportunity to practice operations and with equipment to be used in the Cold Tank Test Facility that these previous errors are not repeated. Please address.
	Missing from this F&R document is a section detailing the approach to developing "technical" retrieval requirements. Section 3.0 describes an approach to develop "risk-based" retrieval requirements. This is not acceptable. Risk estimates may be used to drive/determine retrieval sequencing, actions during retrieval, and final tank end states. However, M-45-00 requires "…retrieval of as much tank waste as technically possible…", not to some predetermined risk-based limit. WAC 173-303-640 requires that all waste be removed from a tank. It does not support deriving a predetermined risk-based leak loss volume that is used to limit the development of technical LDMM requirements. Provide the missing section detailing the approach to developing technical retrieval requirements.
Exec. Sum. Pg. v	Third Paragraph: Retrieval goals only focus on M-45-05A. Missing are the main goals listed in M-45-00 as follows: "…retrieval of as much waste as technically possible, with tank waste residues not to exceed 360 cubic feet …". Insert the missing text.
Exec. Sum. Pg. vi	Second Paragraph: Ecology has significant concerns over the general implication that grout or certain material will be added to the tank soon after retrieval, creating problems if additional future retrieval is needed. Any addition of material following retrieval must be on a case by case basis with sufficient detail to show the physical and regulatory rationale for adding material as well as the degree of difficulty in future removal of the material.
Exec. Sum. Pg. vi	Why is "minimum depth of grout required to reduce radiological constituent concentrations to levels that would not exceed Class C limits…" discussed here if 'not within the scope of this retrieval project"?
Exec.Sum. Pg. vi	Last Paragraph: Explain in detail the following two phrases: "Economically achievable and economically available. It seems that DOE is mixing the term "economical" into two other separate variables (achievable, and available). Economy or cost should be analyzed separately after other factors are taken into account. Describe the process used to analyze the achievable and economical aspects of any part of the retrieval process this process is applied to.

Page 1-1	Third Para: Ecology does not agree with the description of a "...risk based approach...". The actual approach must begin with retrieval of as much as technically possible as stated in M-45-00. Risk may be used to help determine retrieval sequencing, decisions that may come up during the actual retrieval, as well as end state of the tank. The third bullet in this paragraph needs to be corrected. LDMM requirements will be technology based. Using risk as the main/only consideration, DOE would be required to detect all leaks, no matter how small, in S-farm since risk impacts already exceed regulatory limits prior to retrieval. Ecology is familiar with DOE efforts to test and implement ex-tank leak detection and expects ex-tank leak detection to be implemented and demonstrated in a meaningful way during these early retrievals. Revise the text to emphasize the technology driven approach. Also include a statement similar to the language found in M-45-00 regarding retrieval of as much waste as technically possible.
Pg. 1-2, 1st paragraph	LDMM is a regulatory requirement, more than "[LDMM] are capabilities and actions that have been legally agreed to by DOE, Ecology, and EPA in the [HFFACO]".
Pg. 1-2, para 2.	Waste Retrieval is to be technology driven and is to be applied to tanks in a sequence beginning with high-risk tanks and proceeding to lower risk tanks. IT IS NOT RISK DRIVEN. Risk may affect the choice of waste retrieval technology and the potential for leaks that would add to the existing vadose zone contaminant load. Please correct
Pg. 1-3, para 2, sent. 3.	Please change sentence to read, "In the absence of these requirements, however, the results of the RPE are used to ***estimate*** risk posed by residual waste (i.e., past leaks, ***retrieval leaks***, and residual tank waste) in the S-Farm to establish performance requirements....."
Page 1-5	Describe/summarize how the soil from the large surface spill at S-farm was remediated. Include an estimate of how much contamination was removed and how much remains in the soil.
Pg. 1-5, sent. 3.	The sentence indicates that surface contamination has migrated to ~73 ft. The August 2000 Addendum to the S Tank Farm Report (GJO-97-31-TARA) shows Cs-137 to >10 E6 pCi/g at a depth of 26-27 ft., an abrupt increase from 10 E1 pCi/g at 20 ft in borehole 40-02-03. This is NOT the profile of a well illustrating downward migration of surface contamination. There is clearly a subsurface source here at the approximate depth and location of a cascade line. There are also historic gross gamma logs for this borehole. What do they show? What is the source of this contamination if not S-102? Please correct and clarify.
Pg. 1-6, table 1-1	The Waste Tank Summary Report for Month Ending July 31, 2002 gives different volumes than in Table 1-1. This summary report states S-102 sludge = 105,000 gal and salt cake = 384, 000 gal., for a total waste of 489,000 gal. The data in Table 1-1 gives different data, especially sludge = 16, 000 gal.
Pg. 1-8.	Gross-gamma and spectral-gamma logging detects only gamma-emitting contaminants with a radius of ~1 ft. from the borehole. Please clarify. Drywell monitoring before, during and after the waste retrieval should specify: the boreholes to be logged, to what depth, and how often; also, the type of tool(s) to be used, the limit(s) of detection and the logging procedure (especially the rate at which the tool is moved in the hole). Please clarify or indicate where this level of detail will be provided.
Pg. 2-1, 1st par.	What governs retrieval and LDMM technologies? State and federal requirements or HFFACO or both
Pg. 3-1, last bullet	What will be applied from retrieval and LDMM technologies deployed at other DOE sites?
Page 3-1 to 3-12	Section 3.0. The entire section (with the exception of Section 3.3) is unacceptable as written. (see general comment) DOE has incorrectly interpreted the direction provided in M-45-05-T16. The TPA milestones do not require DOE to design retrieval systems based on risk. Risk, in S-farm, already exceeds regulatory limits; therefore; attempts to design a retrieval system and LDMM based on risk are not

	acceptable. These systems must be developed to the maximum extent technically possible. If cost is a factor, then provide details of cost to be considered showing effects on the specific project as well as the entire tank farm system budget. See previous comment about including an additional section detailing the approach to technical requirements. Also rewrite this entire section to be clear, concise and understandable. Fig. 3-2 is illogical. This discussion is ambiguous and confusing and provides little assurance or confidence to Ecology and the general public
Page 3-2	Bullet #4. Explain this bullet. What is specifically meant by "...establish LDMM requirements based on protection of human health and the environment..."? Provide a detailed explanation.
Page 3-2	Bullet #7. Correct the 7th bullet to indicate there are two air permit requirements for each tank retrieval/closure project: a radioactive air NOC regulated by DOH as well as a non-radioactive air NOC regulated by Ecology. Correct the text.
p. 3-3, para 1, bullet 2	Re waste retrieval strategy, in addition to human health risk, risk to the environment (i.e., ecological risk) should also be considered.
Page 3-3	Bullet #2. Strike this bullet. It incorrectly describes the approach to retrieval and LDMM systems/requirements.
Page 3-3	Figure 3-1. This figure indicates that "Retrievals for WFD" bypass the retrieval technical development stage. There seems to be some confusion here. Please provide additional text describing this portion of the figure.
Pg. 3-3, Fig 3-1.	As a Field Investigation Report is unlikely to precede waste retrieval for C-106, either revise this figure or revise the schedule. Please correct. Pg. 3-3, last para. This statement is inconsistent with DOE plans for accelerated waste retrieval. Please revise and correct.
p. 3-4, para 3, bullet 1	Please list Kds for NO_3 and Tc-99. Waste remaining in the tank for 500 years is a calculational assumption, NOT a certainty. Please correct. The scenarios include the Residential (NOT Residual) Farmer, ... Please correct. Waste retrieval is to be technologically driven, NOT risk driven. The RPE is NOT to be used to calculate the "allowable leakage" and "allowable residual". Please correct this statement and this approach. This is a lesson that should have been learned from Ecology comments on the C-104 and S-112 F&R documents.
p. 3-5, para 1, bullet 1	Please list Kds for Cs-137, Sr-90, Pu-238, Pu-239, Pu-240, and Pu-241.
p. 3-5, para 2	There is no WAC 173-340-640. Please clarify. Re the last sentence of this paragraph, please provide more detail on the use of "alternate risk scenarios."
p. 3-6, para 1	As described, the RPE will be revised with each tank waste retrieval effort, so that cumulative risks associated with the S tank farm (as well as risks from other 200 Area waste sites) can be updated in order to support decisions related to tank farm closure.

	Is this the correct interpretation?
Page 3-6 Point 1	Delete last sentence. Add some description >> The ramification of residual impacts and leak impact can be assed
p. 3-7, para 1	There is no WAC 173-340-640. Please clarify.
p. 3-7, para 1, bullet 2	Is groundwater quality assessed against MCLs?
Page 3-8	Paragraph #2. Explain how the COC's for AX farm and S-Farm are similar.
p. 3-8, para 2	The decision to not perform an uncertainty analysis for tank S-102 appears to hinge on the apparent similarity to the AX tank farm. At a minimum, it would be helpful if uncertainties for tank S-102 and S tank farm were tabulated, grouped by category (e.g., source term, exposure, transport models/scaling effects, toxicity, cumulative risk, etc.), and qualitatively described as conservative or nonconservative with respect to risk.
p. 3-8, para 3, bullet 1	A simple diagram of the conceptual model of tank S-102 and S tank farm may be helpful, illustrating source terms, exposure pathways, and receptors. Provide details on the modeling procedure used to predict contaminant groundwater concentrations and discuss associated "model uncertainty."
Page 3-9	Bullet #2. Indicates that impacts from the entire tank farm are not modeled at the tank farm boundary because the contaminant releases were modeled using two-dimensional cross-sectional models. Describe what is needed to estimate impact from the entire tank farm at the fence line. Provide estimates of these impacts.
p. 3-9, para 3	It may be helpful to refer to Table B.5.6.
p. 3-9, para 4	It may be helpful to refer to Table B.5.7.
Pg. 3-10, last par.	What is the "high end of the residual waste volume range…"?
p. 3-11, para 2	Reference to Figure B.6.2 would help here.
Pg. 3-11, 2nd to end par.	Explain "The peak past leak impacts would not occur during the time period when peak residual waste impacts would occur and would not be additive."
Page 3-11	Last Paragraph. Indicates significant impacts at the tank farm fence line. It also indicates that composite (cumulative) impacts calculated at the fence line are significant. Provide estimates of these impacts.
p. 3-11, para 4	Please provide a citation for the "Composite Analysis." It is stated that due to the magnitude of past leaks (as well as contaminant sources from other waste sites in the 200 West Area), traditional risk criteria (i.e., 1E-5 ILCR) cannot be met. Given this reality, risk-based criteria are established to limit further impacts. This message should be highlighted, since risk estimates are higher than is conventionally regarded as acceptable.

p. 3-12, para 1	Establishing an 8000 gal retrieval leakage threshold volume corresponding to 1E-3 ILCR for the farmer would represent 0.018 (1E-3/5.5E-2) of the past leak risk. Similarly, establishing a 25000 gal retrieval leakage threshold volume corresponding to 1E-4 ILCR for the worker would represent 0.071 (1E-4/1.4E-3) of the past leak risk. Thus, it is arguable that these additional risks from retrieval leakage are not significant in comparison to past leak risks. The comparison (i.e., 23000 gal retrieval leakage volume associated with 10 times the Tc-99 MCL [9000 pCi/L in Figure B.5.4] vs. 25000 gal retrieval leakage volume associated with 1E-4 ILCR for the industrial worker scenario) demonstrates that these retrieval leakage volumes for tank S-102 are similar, given these assumptions. However, the utility of this comparison is limited, since these two situations exceed either the Washington state criterion for ILCR (1E-5) or the federal MCL for Tc-99 (900 pCi/L). For S farm the substantial impacts occur with any leaks – due to the already contaminated nature of the vadose zone. So the threshold leaks should be by default set at 0 or the lower detection limit of the best technology. Ecology cannot agree with this entire paragraph. Using 10 times the drinking water standard and assuming no further leaks from any other tanks is unbelievable position
Pg. 3-12	What are the corrective and mitigating actions that would be need to be considered to handle impacts from a leak? Is this described in detail else where? Is 10 times DW standards not at risk? I am not sure that comparison to 200-UP-1 is appropriate.
Page 3-12	First Paragraph. There is no regulatory basis for establishing leakage threshold volumes. The concept will not be supported. It is acknowledged there is a possibility some leakage may occur in certain tanks; however, it is expected that leak detection will be implemented to the maximum extent practicable, and not be limited by some risk-based calculation. Revise the text to reflect this requirement.
Nancy Uziemblo Pg. 3-12, 2nd last par.	How and where is it to be described that "[t]he best available and deployable, tank farms, LDMM technology will be used for Tank S-102 retrieval"?
Dick Heggen Page 4-1	First Paragraph. Missing is the requirement stated under M-45-00 to retrieve tank waste to the maximum possible extent, with a maximum residual volume of 360 cu. ft. Add the missing text.
Page 4-2	Sections 4.6.1 and 4.6.2. The basis for the listed functions and requirements is stated to be Section 3.2. Considering the unacceptable rationale presented in Section 3.0 and the fact that an approach for technical requirements is missing, using Section 3.2 as a basis is not acceptable. The requirements listed in Sections 4.6.1 and 4.6.2 are without adequate basis and; therefore, unacceptable. Provide the missing basis and revise these sections. (see previous comments).
Pg. 4-2, Sect. 4.6.1	At the "downselect" workshop last January, the target leak volume for testing the viability of any leak from ex-tank technology was 1,000 gallons, with the hope that it could be lower. How/why has this now become 8,000 gals, and what is the uncertainty of this minimum leak? Please address.
Page 4-2	Section 4.6.3. Good Engineering Practice = Basis? Explain this and provide additional technical basis.
Pg. 4-3	It is not clear to me how "Measure and estimate residual waste in tank S-102" and "Mitigate leaks during tank S-102 waste retrieval process" will happen.

Page 4-3	Section 4.7. Add to this section the current efforts to develop a closure DQO for measuring and estimating the residual waste in C-106 that may form a foundation for additional SST residual waste measurement efforts.
Page 4-3	Section 4.8. This statement does not indicate/summarize how or why leaks will be mitigated. Provide the missing information.
Page 4-3	Section 4.9 Add the word "mixed" before the phrase "...radioactive waste...". Also a description/summary of measures to be implemented to protect workers, public, and the environment. Provide the missing information.
Page 4-4	Section 4.16. Include a full description of the "pre-retrieval LDMM assessment" process. Appendix H has no connection with LDMM; it is only to be used following retrieval in situations where DOE cannot meet the technical requirements stated in M-45-00. Delete the reference to appendix H.
Page 5-1	First Paragraph. The functions and requirements related to LDMM as defined in Section 4.0 are based on risk, not technological capability and are unacceptable.
Pg. 5-1, Sect. 5.1, bullet 2	Leak monitoring includes not only estimating volume of the liquid that escaped containment, but the rate and direction of movement through the soil. Please correct. And also on Pg. 5-3, Sect. 5.1.3.
Pages 5-2 to 5-3	Section 5.1.2.1. Missing is an estimate of the accuracy of dynamic leak detection methods specific to S-102. This information is necessary to determine the adequacy of this method relative to S-102. Provide the missing information.
Pg. 5-3, 5.1.2.2	What will be used for "tanks that do not have a free liquid surface" or when a tank reaches this state, and "require alternative measuring devices? How will small leaks, or any leaks, be detected for tanks without a liquid surface?
Page 5-3	Section 5.1.2.2. Missing is an estimate of the accuracy of static leak detection methods specific to S-102. This information is needed to determine the adequacy of this method relative to S-102. In addition describe how the most promising methods would be applied to S-102. Provide the missing information.
Pg. 5-4, 5.1.4, 1st paragraph.	Shouldn't the system be designed to remove as much as possible even if leak has not been detected?
Page 5-4	Section 5.1.4, First Paragraph. Provide additional detail on how the retrieval system will be capable of removing as much of the pumpable liquids as possible after a leak has been detected. Describe how this is different than simply continuing to routinely run the tank retrieval system.
Page 5-6	Section 5.2, First Paragraph. Stating a specified confidence level for a range of possibilities is confusing. Is the probability of detecting a leak the same at 2 gallons/hour vs. 25 gallons/hour? The probability should be different for different rates. For both static and dynamic methods revise the probabilities estimates.
Page 5-7	Section 5.3. The risk-based approach described in this section is not acceptable. Revise the text.
Pgs5-1 – 5-8.	. Please revise and include ex-tank technologies in an integrated in- ex-tank integrated LDMM plan.
Pg. 5-7	The discussion should not evaluate CoCs and retrieval vs. no retrieval. Retrieval is to be done, and as much as possible should be removed. The comparison to leaving the tanks un-retrieved is not an option.
Pg. 5-9, middle bullet	Would dry well not be checked before starting and how would waste migration from another tank or ancillary equipment happen?
Pg. 5-9, 5.3.2	The Strategies for Leak Mitigation all seem to lead to pump faster. Have there been no discussions on actual actions?
Pg.5-9, Sect.	Drywell logging and groundwater monitoring are not good means for leak detection, but they do provide a means of leak

5.3.1.	monitoring once waste has escaped a tank. Please revise.
Pages 5-10 to 5-11	Section 5.4.1. Considering that DOE is no longer planning to utilize the pulsed fluidic system, Ecology will not review this section. Provide an updated section describing the revised retrieval method.
Pg. 5-11	I thought the Fluidics system got de-funded and wasn't going to be used.
Pg. 5-11, Sect. 5.4.2, last sentence.	Neutron logging can also be employed in drywells to determine changes in the profile of moisture content. Please add
Pg. 5-13, 5-14.	Existing underground transfer lines, if single contained, can not be used for waste retrieval. Surface "hose in hose" constructed transfer lines can be monitored at each end point, but that does not determine where the leak occurred along the line. Please correct
Pg. 5-15	What will be used for in-tank detection and monitoring when there is a lack of free liquid surface?
Page 5-16	Section 5.2.2.1. If section 5.1.2.1 stated that dynamic methods provided no real-time leak detection, then why is it included as a leak detection method during retrieval? Provide an explanation and/or revised text for this section. Pg. 5-16, Sect. 5.2.2.1, para 1. Calculation of a new ILL after waste retrieval should be based on readings spaced at some intervals to allow all remaining drainable IL to reach the low point in the tank for measurement. Please correct
Pg. 5-19	Static leak testing can sometimes last to a year? What will be the acceptable 'wait' period?
Pg. 5-20	What will be considered "no significant impact to risk"? What are the "modifying operation conditions" for potential response actions?
Pg. 5-20, Sect. 5.5.2.3.	It is imperative that Ecology see all the details of an integrated LDMM plan, including the types of logging to be performed, the boreholes and depths where it will be performed, the logging rates, the frequency of logging, limits of detection. Other ex-tank technologies need to be included in an integrated plan. Please correct and submit this information.
Pg. 5-21	What exactly will be done "when the tank S-102 retrieval has been declared complete, an evaluation of the closure source term will be performed?"
Pg. 5-21, para 1	. Given that there is a minimum size leak that can be detected; the failure to detect a leak does not relieve DOE of the responsibility to conduct some surveillance of drywells (or other methods) following completion of waste retrieval. Please correct.
Pg. 5-21, Sect. 5.6	When will the ex-tank technologies be evaluated and added to this scope of activities? Please provide this information or indicate when it will be forthcoming

Appendix A

	General Comments
	How will the lessons learned for LDMM be applied at Hanford?
Page A-2-4, Section A.2.6	Last paragraph – Statement about C106 seems to be misleading.
Page A-3-2, Section A.3.1.3	I disagree with statement about overly conservative air permit.
Page A-3-14, Section A.3.1.37	Focused on C104, should be S102 (Typo?).
Pg. A-2-1, Section A.2.1 Paragraph 3	A lesson that should have been learned during the retrieval of the C-106 heat-producing sludge was that the cumulative error from multiple points of measure for mass balance calculation was so large, that it was impossible to measure any leak less than ~6,500 gallons—even if the actual leak loss was much less. While redundancy in measurements is generally good, it worked against a realistic measurement of leak loss during the C-106 waste retrieval. Please add.
Pg. A-2-2, Sect. A.2.2, paragraph 4	The term "drywells", as used at Hanford, refers to boreholes that terminate in the vadose zone and do not reach groundwater. If this is the same usage as at Oak Ridge, it would be impossible to measure conductivity in groundwater around the base of the tank using "drywells" that terminated above groundwater. Please correct.
Pg. A-2-2, Sect. A.2.2, paragraph 4	The technique of monitoring conductivity changes in groundwater works well for sites where the tank bottoms are in or very close to groundwater. That is not the case at Hanford SSTs where groundwater is more than 150 ft. below the tank bottoms and the travel time for leaked waste to reach groundwater would be days to weeks, an unrealistic approach for timely detection of leaks. Given this information, why is this LDMM approach even mentioned here? Please consider.
Pg. A-2-4, paragraph 2	Update the information provided here, as LDMM testing has continued in FY 2002 and will continue for at least one more year. Furthermore, the "downselect" workshop was held in January 2002, at which time High Resolution Resistivity and Electrical Resistance Tomography were selected for continued research and development. Please update.

Appendix B

	General Comments
Pg. B-3 (and elsewhere).	Pg. B-3 (and elsewhere). Retrieval and leak detection are to be TECHNOLOGY DRIVEN NOT RISK DRIVEN. Please correct here and throughout the RPE and this entire F&R document
	There is a large amount of repetition in Appendix B, making it difficult to determine if information is "new" or has already been presented. It would be helpful if results were not repeated in such detail (e.g., Analysis Results [Section B.5.0] vs. Conclusions [Section B.6.0]; Regulatory Compliance [Section B.5.1.5] vs. other subsections in Section B.5.0, etc.). Please refer to specific data tables and figures when discussing results, so that the reader can readily view supporting data. Otherwise, a large amount of time is wasted trying to locate the relevant data. In addition, please check all references to specific sections, tables, and figures. Numerous reference errors are noted, as indicated in these comments.
	The RPE evaluates short-term remediation (e.g., waste retrieval) risk to a worker and the general public, long-term post-remediation (e.g., post-closure) risk to a residential farmer and industrial worker, and intruder post-remediation risk. For long-term post-remediation risk, it may also be appropriate to include a Native American exposure scenario and an ecological assessment in order to more comprehensively demonstrate protection of human health and the environment, respectively. If the ecological risk assessment is based on contaminated groundwater (similar to long-term human risk), ecological risk could be evaluated in conjunction with a human irrigation scenario or at locations where groundwater intersects surface water (e.g., river seeps).
	Please note that a revised MCL for total U is 0.030 mg/L (Fed Reg. 12/7/00). This translates to 27 pCi/L, assuming a conversion factor of 0.9 pCi/microgram. This should be incorporated into the discussion of U-238 groundwater results, especially since over 99% (by weight) of naturally occurring U is U-238.
	Specific Comments
p. B-1, paragraph 2	The fundamental goal should not only be to meet "retrieval criteria" but also to minimize risk (consistent with the ALARA principle), considering all source terms (e.g., past leaks, retrieval losses, tank residuals).
Pg. B-4, Sect. 2.0, paragraph 2	Retrieval should be based on the most current BBI, NOT the August 2000 values. The BBI is being continually updated with new information. The August 2000 BBI may provide estimates of inventory that allow design to begin, but final design should be based on the most current BBI. Please address.
p. B-4, paragraph 2	HFFACO Milestone M-45-05-T16 mentions only human risk here, whereas on p.B-1 (para 1) both environmental and human risk are explicitly stated. Please include both human and environmental (i.e., ecological) risk in these discussions.

p. B-10, paragraph 1	How will inventory estimates of the ancillary equipment be acquired for closure, since there are currently "insufficient data" (p. B-9, para 2)?
p. B-12, paragraph 1, bullet 1	For long-term risk offsite, in addition to the residential farmer and industrial worker, a Native American exposure scenario should be included.
Pg. B-12, bullets 1 and 2	High-level waste is high level waste, regardless of whether it is the residual left in a tank after retrieval. A unilateral declaration by DOE of "waste incidental to reprocessing" for residual waste in a tank after retrieval and then managing the waste as TRU or LLW is unacceptable to Ecology and the State of Washington. This is at the heart of litigation by the Snake River Alliance and several tribes, to which the States of Washington and Oregon have signed on as *amicus curiae*. Delete this statement and others like it.
Pg. B-13, Sect. B.3.1.1, bullet 1	The RCRA TSD includes the tank(s), waste contained therein, waste leaked to the soil (i.e., the contaminated soil) AND the contaminated groundwater arising from tank leaks. Please correct.
p. B-15, paragraph 5	Please clarify that for long-term human health risk, pathways based on groundwater will include all those indicated in Figure B.3.2.
Pg. B-16, Fig. B.3.2	Although it may be appropriate to exclude an ecosystem risk analysis for an RPE, an ecosystem risk analysis for closure of a tank farm and an SST WMA will be required. Please address.
p. B-16, Figure B.3.2	Specify locations of the proposed exposure scenarios. For example, clarify that residential farmer and industrial worker scenarios for long-term risk are located outside the tank farm boundary. A Native American receptor should also be included under future long-term risk beyond the tank farm boundary. Explain why food ingestion is evaluated for short-term risk for the general public. Is this based on an air pathway?
p. B-18, Table B.3.1	I assume the two column headings labeled, "Remaining S Farm Tanks (gal)," refer to each remaining farm tank individually (not all remaining farm tanks together). Is this correct?
p. B-19, paragraph 2	To the extent possible, are mass balance considerations incorporated into source term estimates?
p. B-20, paragraph 3	Please give some indication of the uncertainty embedded in the BBI data (Hale, 2001).
p. B-21, paragraph 2	Please see comment for p. B-20, para 3.
p. B-21, paragraph 4, bullet 1	Please clarify the estimated magnitude of the ancillary equipment inventory, relative to the residual waste inventory.
p. B-25, paragraph 1, bullets 1-3	Which ERPGs (i.e., ERPG-1, ERPG-2, ERPG-3) will be compared with calculated exposure point concentrations of chemicals?
Pg. B-26, Sect. B.3.5	Groundwater impacts are assessed two dimensionally to a depth of 5m in the uppermost aquifer, apparently for both short- and long-term risk assessments. While possibly adequate for a pre-waste retrieval RPE, future impacts should use three-dimensional modeling to the bottom of the aquifer unless another approach is justified and valid. Please indicate when such

	an analysis will be forthcoming.
p. B-26, paragraph 5	Provide a basis for assuming that the COCs for S-102 are consistent with those in DOE/RL-98-72 (AX Tank Farm).
p. B-27, paragraph 2	Although the COCs listed apparently account for 95% of the groundwater pathway long-term risk, the COC list appears short. Please provide more detail on how the list was constructed.
p. B-27, paragraph 5	Explicitly state that past leaks were excluded from the STOMP model, as an additional source term in order to model groundwater impacts (if this is the case).
B-29, paragraph 1	Since the TWRS/EIS (DOE/EIS-0189) is being used to generate exposure scenarios, note that the TWRS/EIS also includes a Native American scenario which may be appropriate for long-term risk here.
p. B-29, paragraph 2	For the residential farmer, note that exposure is also via direct exposure (see Figure B.3.2). This would include external rad exposure to soil and sediments.
p. B-29, paragraph 3	If soil contact is included for the industrial worker, why is the soil ingestion pathway not checked in Figure B.3.2? Also, please include external rad exposure to soil for the industrial worker.
p. B-31, Table B.3.3	Because Cr is also a carcinogen via inhalation, a carcinogenic URF should be used for Cr (i.e., ILCR per g/mL), in addition to a noncarcinogenic URF (i.e., HQ per g/mL).
p. B-31, paragraph 2	Equation B.1 makes no distinction among noncarcinogens, nonradionuclide carcinogens, and radionuclides. All three types of COCs should be summed separately and presented separately due to differences in derivation methods (i.e., hazard index for noncarcinogens, ILCR for nonradionuclide carcinogens, ILCR for radionuclides).
p. B-32, paragraph 4	This risk allocation is useful for cancer risk but does not address noncancer hazards. It would appear you need a separate "hazard index budget" for noncarcinogens with an HI threshold of 1.0.
p. B-32, paragraph 5	As described here, the risk budget is based on waste volume, assuming all waste presents identical risk (i.e., waste composition is homogeneous among all tanks in S tank farm). Provide support for this assumption.
p. B-33, paragraph 3	Describe the uncertainty associated with considering only radionuclide COCs in the intruder scenario (i.e., excluding nonradionuclide COCs).
p. B-34, Table B.3.4	Provide rationale as to why the listed COCs in Table B.3.4 (exhumed waste) differ from those in Table B.3.3 (groundwater).
p. B-34, paragraph 4	Re USDOE vs. NRC methods for the intruder scenario, please compare assumptions, uncertainties, and relative degree of conservatism/nonconservatism.
p. B-48, paragraph 1, bullet 1	Leak detection requirements should be based on best available technology, rather than risk estimates.

p. B-50, paragraph 3	Describe provisions of the RCRA Subtitle C surface barrier for biointrusion and human intrusion control. How would these provisions influence a post-remediation intruder exposure scenario (see Figure B.3.2)?
p. B-53, paragraph 1	Case 5 in Table B.3.1 shows a residual volume of 27000 gal for tank S-102, not 6000 gal (as stated here).
p. B-55, Table B.5.1	The footnote at the bottom of this table (regarding intruder dose limits) does not appear relevant to the table data. Please clarify.
p. B-56, Table B.5.2	If the risk to population receptors is the number of LCFs, rather than the probability of an LCF as in the case of the MEI (according to p. B-55, para 3), please clarify the LCF column heading via a footnote. Also, please specify the size of the populations assumed for involved workers, noninvolved workers, and the general public and describe rationale for these estimates.
p. B-56 to B-57, Tables B.5.2 and B.5.3	Why do routine radiological risk analyses present MEI and population risks (Table B.5.2), while routine chemical risk analyses present only MEI risks (Table B.5.3)?
p. B-59, paragraph 3	Provide rationale for the selection of Tc-99, NO_3, and U-238 for groundwater modeling.
p. B-63, Figure B.5.4	I believe that this figure title should specify "retrieval loss volume," not simply "retrieval volume" (a large difference in meaning).
p. B-72, paragraph 1	The last sentence appears only true for Tc-99 (according to Table B.5.5), since U-238 and NO_3 peak with the largest residual volume (not the largest retrieval leak volume). Please clarify.
p. B-73, paragraph 1	The last sentence refers to Section B.5.3.3, although there does not appear to be a section with that number.
p. B-74, paragraph 1	Provide a citation for the conversion factor, 6E-4 cancer incidences/rem.
p. B-79, Table B.5.10	Please discuss the large number of exceedences (ILCR>1E-5 or HI>1) for many of the waste retrieval cases.
p. B-80, Table B.5.11	Note that even Case 1 (with the lowest impact) shows regulatory exceedences (ILCR>1E-5 or HI>1).
p. B-81, Table B.5.12	Same comment as for p. B-79, Table B.5.10.
p. B-84, paragraph 2	Clarify again here that retrieval leak loss was not evaluated for short-term human health risk (see p. B-22).
p. B-84, paragraph 3	Note that although worker and public doses may not exceed 500 mrem/y and 100 mrem/y, respectively, these doses translate to ILCRs of approximately 4E-3 (assuming 20 y exposure duration) and 3.5E-3 (assuming 70 y exposure duration), respectively. However, it is acknowledged that these lifetime risks are largely hypothetical, since these doses are to be incurred only over the short-term (i.e., waste retrieval duration=168 days, p. B-20).
p. B-84, paragraph 6	Please cite the sources for the distribution coefficients (i.e., Kd values) given for Tc-99 and U-238.

p. B-85, paragraph 3	Please cite the source for MCLs. Note that a revised MCL for total U is 0.030 mg/L (Fed Reg. 12/7/00). This translates to 27 pCi/L, assuming a conversion factor of 0.9 pCi/microgram. The MCL for NO_3 is also often expressed as 10 mg/L NO_3-N.
p. B-85, paragraph 5	The reference to "Table B.5.4" should be to "Table B.5.5" for Tank S-102 composite results.
p. B-85, paragraph 7	Provide rationale for selection of the 9 radiological COCs and 4 chemical COCs for evaluating long-term human health risk.
p. B-86, paragraph 3	The reference to "Table B.5.5" should be to "Table B.5.6" for retrieval leak results.
p. B-86, paragraph 4	The reference to "Table B.5.6" should be to "Table B.5.7" for residual waste results.
p. B-86, paragraph 5	The reference to "Table B.5.9" should be to "Table B.5.10" for composite results.
p. B-86, paragraph 6	The reference to "Table B.5.10" should be to "Table B.5.11" for cross section results.
p. B-86, paragraph 7	The reference to "Table B.5.14." should be to "Table B.5.13" for intruder dose results. The reference to "Section B.5.2.4.2" should be to "Section B.5.1.4.2" for NRC limits.
p. B-87, paragraph 2	If tank S-102 contains 487 Ci, according to the August 2000 BBI, should not something slightly less than 487 Ci be retrieved when a 2700 gal residual waste volume remains?
p. B-87, paragraph 3	If tank S-102 contains 275 Ci, according to Hale (2001), should not something slightly less than 275 Ci be retrieved when a 2700 gal residual waste volume remains? Perhaps the more obvious observation is the large uncertainty in S-102 inventory estimates and the need to maximize waste retrieval.
p. B-87, parag 5	Please explain why short-term human health and intruder risks were excluded from S tank farm assessments?
p. B-89, Figure B.5.17	Please mention that residual volume appears to drive the groundwater Tc-99 concentration for cross-section S-104 (as illustrated by composite release results) with composite groundwater Tc-99 concentration far exceeding the groundwater MCL (900 pCi/L) at various peak time points.
p. B-100, paragraph 1	The reference to "Table B.5.2" should presumably be to "Table B.5.16."
p. B-101, paragraph 1	Again, the reference to "Table B.5.2" should presumably be to "Table B.5.16."
p. B-103, paragraph 1	The reference to "Section B.5.3.2" should presumably be to "Section B.5.2.1." Although removing the past leak source component more clearly illustrates the effects of variation of retrieval leak and residual waste components, the ILCR and HI results are proportionately decreased. Please provide ILCR and HI results with representative values for all three sources combined (i.e., past leaks, retrieval leaks, residual waste).
p. B-104, Table	Several exceedences in ILCR (>1E-5) and HI (>1) are noted, even without considering past leaks.

B.5.17	
p. B-104, paragraph 3	Please see comment for p. B-87, para 5.
p. B-105, paragraph 1	Please see comment for p. B-84, para 6.
p. B-105, paragraph 2	Please see comment for p. B-85, para 3.
p. B-105, paragraph 3	Please see comment for p. B-85, para 7.
p. B-105, paragraph 4	Note that ILCR and HI results in Table B.5.17 exclude the past leak source component. Please see second part of comment for p. B-103, para 1.
p. B-106, paragraph 5	Although long-term human health risk may "drive" retrieval strategy, various groundwater MCLs are also exceeded (see p. B-85, para 3-6). Reference to Tables B.5.6 and B.5.7 would be helpful here in the summary of long-term human health risks.
p. B-107, paragraph 3	Reference to Figure B.5.13 would be helpful here.
p. B-107, paragraph 4	Where are the data showing that <34000 gal residual waste volume with no retrieval leakage are needed in order to meet the 100 mrem/y dose for the DOE intruder scenario?
p. B-107, paragraph 5	Reference to Table B.5.17 would be helpful here. Note that the discussion of risk levels in this paragraph assumes no past leak component of the source term.
p. B-107, paragraph 6	Reference to Table B.5.17 would be helpful here.
p. B-111, paragraph 1, bullet 2	Re the U-238 discussion, reference to Figure B.5.12 may be helpful.
p. B-111, paragraph 3	Re retrieval leakage and residual waste, please refer to Tables B.5.6 and B.5.7, respectively.
p. B-112, Figure B.6.1	I believe the figure title should indicate a 1E-5 ILCR (not 1E-4 ILCR). Although the curve for the year 3500 shows the smallest retrieval loss volume among the four years modeled, what assurance is there that year 3500 is the most restrictive year among all possible years?
p. B-114, paragraph 2	The last sentence (which refers to the farmer scenario at a 1E-5 risk) specifies no waste retrieval leak would be allowed. Figure B.6.2 indicates about 200 gal would be allowed for this scenario and risk. Is this just rounding?
p. B-114, paragraph 3	According to p. B-32 (para 5), the risk budget for tank S-102 is 9.6% of the S tank farm budget. Thus, given a tank farm risk of 1E-4, tank S-102 would be allowed about 1E-5 risk (not 7E-6 risk). Is this just rounding or is there another issue here?
p. B-114, paragraph 4	Figure B.6.2 indicates that some nonzero amount under 1000 gal (not zero gal, as stated) could leak during retrieval for tank

	S-102 for both the 6.2E-7 worker risk and 3.9E-6 farmer risk scenarios in order to meet the overall specified tank farm risks.
p. B-114, paragraph 6	The reference to Section B.5.2.4" should presumably be to "Section B.5.1.4."
p. B-115, paragraph 1	The DOE intruder scenario is not as restrictive as the long-term human health risk industrial worker scenario for defining risk-based residual waste volumes (p. B-107, para 4). Thus, why is it stated that this scenario is a significant driver for establishing tank S-102 waste retrieval criteria?
p. B-115, paragraph 1, bullets 1 and 2	Please reference Table B.5.13.
p. B-115, Figure B.6.3	Please provide a brief description on how this figure was prepared.
p. B-116, paragraph 1	Please see comments for p. B-87, para 2 and 3.
p. B-116, paragraph 3	Refer to Table B.5.2 for the general public MEI dose.
p. B-116, paragraph 4	Note that MCLs and DWSs are the same.
p. B-116, paragraph 5	Refer to Table B.5.5 for Tc-99, U-238, and NO_3 groundwater concentrations. Please see comment for p. B-85, para 3.
p. B-117, paragraph 1	Please refer to Tables B.5.10 and B.5.11.
p. B-117, paragraph 2	Please refer to Tables B.5.13 and B.5.14.
p. B-118, paragraph 3	This is an important finding that long-term human health risk (residential farmer scenario) fails the risk criteria, even for Case 1 with no retrieval leakage (see Table B.5.10).
p. B-118, paragraph 6	Reference to "Table B.5.14" should be to "Table B.5.15."
p. B-119, paragraph 1	Clarify that Tc-99 would exceed the DWS by almost 10 times at the 200 West Area fence line and be within a factor of 2 for the 200 Area exclusion zone (Figure B.5.19).
p. B-119, paragraph 2	Please see comment for p. B-118, para 6. Also, refer to Figures B.5.25 through B.5.30 for Tc-99 and U-238 results, excluding past leaks.
p. B-119, paragraph 3	Please refer to Table B.5.17 for S tank farm long-term human health risk results.
p. B-120, paragraph 2	Reference to "Table B.5.12" should be to "Table B.5.11." Reference to "Table B.5.19" should be to "Table B.5.17."
p. B-120, paragraph 3	Reference to "Section B.5.3" should be to "Section B.5.2."

p. B-120, paragraph 4	Please refer to Figures B.5.19 through B.5.24. Please see comment for p. B-85, para 3. Are ILCR and HI results shown for S tank farm at the two far field compliance points (i.e., 200 West Area fence and 200 Area Exclusion Zone boundary) with past leaks included in the source term?
p. B-121, paragraph 2	Please refer to Figures B.5.25 through B.5.30, as well as Table B.5.17. Please see comment for p. B-85, para 3. Please show relevant NO_3 groundwater data. In addition to Case 1, the HI criterion is also exceeded for Case 2 for the residential farmer at the 200 West Area fence line (Table B.5.17).
p. B-121, paragraph 3	Add another bullet for past leaks from tank S-104 (e.g., see Section 6.3.3.1).
p. B-122, paragraph 3	The text states that for AX tank farm (DOE/RL-98-72) it was concluded that additional data collection would not appreciably reduce "overall uncertainty." However, if the AX tank farm uncertainty analysis demonstrated 2.5 orders of magnitude variation in overall uncertainty (as a result of variation and uncertainty in exposure parameters), it would appear that collecting more site-specific data on exposure parameters at S tank farm would be warranted. The same would apply (albeit to a lesser extent) to source term and transport parameters.
p. B-122, paragraph 4	Excluding a quantitative uncertainty analysis, it would be helpful if uncertainties were tabulated, grouped by category (e.g., source term, exposure, transport models/scaling effects, toxicity, cumulative risk, etc.), and qualitatively described as conservative or nonconservative with respect to risk. For example, the source term may be nonconservative, as a result of excluding ancillary equipment.
p. B-122, paragraph 5	It should be acknowledged that "model uncertainty" may be large, relative to "parameter uncertainty." For example, the fate and transport model used to predict contaminant groundwater concentrations may comprise an even larger source of uncertainty than the uncertainty associated with various parameters in the model.