May 3, 2010

Mary Beth Burandt, NEPA Document Manager
U.S. Department of Energy, Office of River Protection
P.O. Box 1178
Richland, W A 99352
TC&WMEIS@saic.com

Re: Draft Tank Closure and Waste Management Environmental Impact Statement Comments

Dear Ms. Burandt,

Hanford Challenge and the Natural Resources Defense Council (NRDC) hereby submit our joint comments regarding the Department's Tank Closure and Waste Management Draft Environmental Impact Statement.

Hanford Challenge is a membership-based, regional public interest organization based in Washington State. Our mission is to help create a future for Hanford that secures human health and safety, advances accountability, and promotes a sustainable environmental and economic legacy for Northwest communities.

NRDC is a national non-profit membership environmental organization with offices in Washington, D.C., New York City, San Francisco, Chicago, Los Angeles and Beijing. NRDC has a nationwide membership of over one million combined members and activists. NRDC's activities include maintaining and enhancing environmental quality and monitoring federal agency actions to ensure that federal statutes enacted to protect human health and the environment are fully and properly implemented. Since its inception in 1970, NRDC has sought to improve the environmental, health, and safety conditions at the nuclear facilities operated by DOE and the civil nuclear facilities licensed by the NRC and their predecessor agencies.

Our vision for the Hanford Site is that the environs around it are safe and accessible for all potential uses, without restriction. In particular, any environmental remediation project at Hanford should:

- Protect the Columbia River over the long term, which means effectively addressing groundwater and soil contamination
- Not rely on institutional barriers or take any credit for human control beyond 100 years after the completion of the cleanup
- Protect human health and the environment, including workers, future residents, consumers of agricultural products, recreational and commercial river users, and tribal peoples
- Honor tribal rights and treaties
- Retrieve, treat and secure any contamination that poses significant risks to the ecology and current and future generations.

These comments were prepared by Tom Carpenter, Executive Director of Hanford Challenge, Geoffrey Fettus, Senior Project Attorney at NRDC, and expert technical comments were provided by two reviewers:

1. Marco Kaltofen, PE, (Civil, Mass.)
   Boston Chemical Data Corp.
   Natick, MA (Attachment 1)

2. John Brodeur, PE, LEG
   Energy Sciences & Engineering
   Kennewick, WA (Attachment 2)

Executive Summary of Comments

Generally:

1) The DOE should revise and reissue the draft EIS and not move forward with a final EIS until such time as a complete site characterization is conducted and after valid risk assessment models are developed.

2) The Draft EIS must conform to existing federal law and it must conform to lawfully rendered agreements. Metrics which do not meet the lawfulness test or do not carry the force of regulations fail to meet NEPA

standards. One such example is the use of future areal extent of groundwater above standards, as opposed to a metric which does carry the force of law, such as future human health risk to individuals or populations. Metrics for the NEPA alternatives selection must meet all established and lawful standards such as cancer and non-cancer risks to individual resource users, environmental risks, species level risks, and adverse impacts to Native American Indian cultural resources.

3) The existing failures to meet completeness standards for significant portions of the draft proposed EIS nevertheless are likely to legally preclude final approval of a comprehensive EIS. The failure to address groundwater in the saturated zone is an obvious weakness of the draft proposed EIS. This level of omission has not survived scrutiny in other formerly used defense facilities which have completed their respective EIS processes. Likewise, the failure to identify or even screen for preferential underground pathways for groundwater transport is another glaring omission, which has a significant bearing on the risk numbers generated by this drafting process.

   These omissions are so significant that severability of the various milestones on the road to creating a complete, comprehensive, and lawful EIS is essential.

4) Rather than use single scalar averages to represent all portions of the entire site uniformly, the Draft EIS should use of ranges of values or at least statistically significant values matched to actual site conditions. The current Draft EIS assumes that no preferential pathways exist in the subsurface, and that the site is perfectly homogeneous and well-characterized. Such conditions barely exist in the simple laboratory simulations, and never exist in any real-world systems. There can be no confidence in risk estimates that are based upon average values that imply homogeneity throughout the site. The use of such values fails to meet the standard of engineering practice demanded by the regulations upon which the EIS process is based.

5) The Draft EIS should conform to CERCLA and for Washington State's Model Toxic Control Act[1] requirements for protecting human health. Lifetime cancer risks, under those laws should not exceed 1 $x10^{-5}$, applicable under MTCA when multiple carcinogens are considered.

[1] Washington Administrative Code (WAC) 173-340-200)

Offsite Wastes

6) Alternatives in the Draft EIS which include off site waste acceptance should be severed from this EIS process in order to maintain consistency with existing federal regulations. The acceptance of offsite wastes is neither required to proceed with any of the remaining Alternatives described in the EIS, nor does it further any of the NEPA required actions at the Hanford Facility, such as limitation of adverse environmental affects, prevention of negative alterations of short or long term land-uses, or the prevention of adverse outcomes from the irretrievable commitments of cleanup resources.

   The DOE is poised to spend tens of billions of tax dollars on one of the most complex and challenging remediation campaigns ever undertaken. Importing and disposing of offsite waste that will in fact add new contamination to the groundwater and violate drinking water standards for thousands of years is indefensible, and defeats the purpose of the remediation effort.

High-Level Waste Tanks

7) Hanford Challenge and NRDC support Oregon's Proposed Alternative 7 identified in its preliminary comments to the Department of Energy in a letter dated January 5, 2010. However, we believe that all the tank waste should be removed from the tanks, adequate characterization be performed to determine whether certain tanks need to be removed, and leaked waste that has leaked from the tanks into surrounding soils be retrieved and treated.

8) Per the above comments, additional clarity is needed in the Draft EIS on the long term environmental and public health impacts of leaving at least 1 percent of the HLW in place in the heel of the tanks.

9) Also, we write to clarify some areas of altered statutory requirements. Specifically, DOE should be aware that neither *NRDC v. Abraham*, 271 F.Supp. 2d 1260 (D.Idaho 2003) nor *NRDC v. Abraham*, 388 F.3d 701 (9th Cir. 2004) collectively, the "HLW Decisions," bar DOE from removing high-level radioactive waste (HLW) from the tanks and

treating that waste for disposal. Nor do the HLW decisions bar DOE from separating some portion of that waste into a stream that meets low-level radioactive waste (LLW) standards and disposing of that waste outside of a geologic repository in a properly licensed disposal site. Section 3116 of the 2005 National Defense Authorization Act, DOE's response to the original Idaho Federal District Court HLW Decision was a significant change to the entire structure and purpose of the Nuclear Waste Policy Act (NWPA), not a "clarification." That law has application in South Carolina and Idaho. Section 3116 does not have application in Washington or Oregon. See, Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005, Pub. L. No. 108-375, § 3116, 118 Stat. 1811, 2162-64 (2004).

10) The "waste incidental to reprocessing" concept codified in Section 3116 does not set cleanup standards of "99 percent," "most of the radioactivity," or an "inch and half of waste at the bottom of the tank." In fact, it sets no cleanup standard whatsoever and leaves the matter of how much radioactive waste to leave behind entirely up to the DOE. DOE should ensure that this concept is left out of its consideration of final and preferred alternatives for the Hanford Draft EIS.

11) Under the current NWPA, the Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission (NRC) regulate the geologic disposal of HLW – and decide what is (and what is not) HLW. At the Hanford Reservation, DOE may not unilaterally decide that HLW has been transformed into "waste incidental to reprocessing." If the concepts embodied in Section 3116 are in any way adopted or used in the Hanford Draft EIS, then EPA, NRC and the states will not have meaningful oversight over the amount of radioactive waste DOE decides to leave in the tanks.

12) NRDC and literally dozens of environmental and public interest groups stood with Washington, Oregon, New York, and New Mexico and objected to the concepts embodied in Section 3116. Only the states of South Carolina and Idaho – who sided with the other states as recently as March 2004 in objecting to DOE's assertion of "waste incidental to reprocessing" authority –submitted to DOE's cleanup budget-threatening tactics and supported the legislative change. Via Section 3116, DOE obtained an exemption from the NWPA and the ability to reclassify HLW as "incidental waste" without any

congressional or state oversight. No such similar path forward exists at the Hanford site.

13) Clean closure of the tanks is the preferred alternative. The Draft EIS should be revised to include alternatives for Double Shell Tank closure. The Draft EIS does not consider and evaluate a true clean closure scenario that includes cleanup of the groundwater, deep vadose zone contamination and groundwater contamination from past practice facilities. Instead, all of the Alternatives fail to meet regulatory compliance standards for groundwater contamination at some point. If alternatives are presented and analyzed in the Draft EIS that fail to meet regulatory standards, that should be identified, discussed and explained in the Draft EIS. All Alternatives should be compared to a true clean closure alternative. Alternative 6(b) is the closest acceptable alternative presented.

14) DOE should adopt an interim policy that the farms will be clean-closed. Tank farm closure decisions can be revisited and made final after completing a more comprehensive characterization of the groundwater and vadose zone in order to understand the basic characteristics of the contamination migration processes.

15) No action should be undertaken by DOE that would serve to preclude clean closure of the tanks, including grouting of tanks.

16) All tank waste should be immobilized through vitrification. None of this waste should be disposed of on the Hanford Site, however. Adequate provision for temporary storage should be made at Hanford until a deep geological repository becomes available for use. Hanford Challenge opposes bulk vitrification and stone-casting. We support Option 2B for two high-level waste and six low activity waste melters.

17) Safety and worker protection should be paramount considerations in the tank farm closure and vitrification processes.

<u>Groundwater and Vadose Zone</u>

18) The Draft EIS also does not include or consider decisions about groundwater remediation at the tank farms. Instead, all of the Alternatives create groundwater sacrifice zones by default because all

Alternatives fail to meet regulatory compliance standards for groundwater. Long-term groundwater impacts would result in extensive regions of contamination along the Columbia River shoreline making the area uninhabitable. Yet the Draft EIS states that groundwater decisions are not a part of this Draft EIS. The DOE cannot say that they are going to clean up the tank farms by sacrificing the groundwater, and then claim that decisions about groundwater cleanup are not part of the Draft EIS. Clearly the Draft EIS must include consideration of groundwater cleanup decisions.

19) There should be no grouting and "closure" of the tanks with amounts of HLW in place, as DOE would be unable to remove any additional waste from the tanks or further maintain the integrity of the tanks. While DOE can be expected to environmentally monitor the tank fields as long as DOE has custodial responsibility over the sites, it is not contemplated that the tanks would be monitored for any specified period of time beyond that and passive institutional controls will need to be in place. Currently, we are unaware of any requirement for markers to alert future generations to the hazards posed by the waste similar to the requirements for passive institutional controls at geologic disposal site(s) for high-level radioactive waste. Such a situation would be the equivalent of abandoning waste in place. The prevailing attitude of the scientific community also uses the term "abandon." The National Academies had this to say on the performance of grout in binding radioactive waste:

> Predicting performance in resisting water infiltration can be difficult because of uncertainties that include the degree to which the first layers of grout take up the residue, the water pathway effects of the cold joints between successive pours of grout, and the effects of preferential corrosion of the tank metal and penetrating structures (thereby offering a partial bypass path). Moreover, waste tank residue is likely to be highly radioactive and not taken up in the grout, so there is substantial uncertainty associated with the volumetric classification and average concentration of the waste

and prediction of the isolation performance of the system.[2]

20) A comprehensive workplan for achieving the legally mandated levels of groundwater restoration must be included among the alternatives in the draft final EIS. In effect, this draft EIS contains only a "No Action Alternative" for contaminated groundwater at Hanford.

21) The invalidity of the vadose zone model is demonstrated by the fact that there is a complete misunderstanding of the source of the contamination plume that was used in the attempt to calibrate the vadose zone model. Vadose zone modeling is not properly calibrated and is inappropriate for assessing risk from contaminant migration through the vadose zone.

22) There is inadequate characterization of the nature and extent of the vadose zone contamination. None of the larger vadose zone contamination plumes at the tank farms have been adequately characterized to the extent that they can be used to perform the type of model validation that is needed for the risk assessments.

23) When some of the massive past releases occurred, soils were at near-saturation conditions, causing downward flow along preferential drainage pathways to the groundwater. This type of contaminant migration is common at most of the Hanford tank farms as indicated by patterns of contamination distribution and as is found in the similar geologic conditions in the lower Columbia Basin. With these conditions, it is inappropriate to use the type of vadose zone contamination migration model that was used in the Draft EIS.

24) The first step to completing a valid risk assessment is to characterize the nature and extent of contamination in the soil around the tank farms. This means tracing the contamination from the source through the unsaturated zone soil and into groundwater at most of the contamination plumes. Currently active sources of groundwater contamination are not included in the risk models. Active sources of

[2] National Research Council, Commission on Geosciences, Environment, and Resources. Board on Radioactive Waste Management, Committee on the Remediation of Buried and Tank Wastes, Long-Term Institutional Management of U.S. Department of Energy Legacy Waste Sites. Washington, DC: National Academy Press. 2000, p. 40.

vadose zone contamination are also not included in the risk models. It is premature to make tank closure decisions and create groundwater sacrifice zones until the subsurface conditions are understood and vadose zone plumes are adequately characterized.

25) The Draft EIS should also evaluate a large scale soil excavation/removal strategy for deep contamination removal.

26) The DOE uses full clean closure costs but only partial clean closure benefits in its cost benefit analysis.

27) Technitium-99 contamination related to the BY Cribs (Figure N-5 in the Draft EIS) shows an increasing trend from about 500 pCi/L to 20,000 pCi/L and rising from about 1983 to the present. This trend indicates a dynamic groundwater contamination condition, not a steady state flow as modeled, and it indicates that an active vadose zone plume is just now entering the groundwater in the immediate vicinity of the well.

28) DOE should not plan to undertake any remediation that requires institutional controls beyond 10 years after closure. The Draft EIS appears to assume that the DOE, or another agency of the US government, will control the Hanford Site for 10,000 years (vol 2., p. Q-31). This is an extremely unlikely scenario, and defies common sense.

Detailed comments from Marco Kaltofen, PE, (Civil, Mass.), Boston Chemical Data Corporation, and John Brodeur, PE, LEG, are attached to this letter and should be incorporated in full as part of these comments.

In addition to the attached expert comments, we also offer the following detailed comments:

29) The Draft EIS alternatives should be amended to identify mitigation to protect the soil, groundwater, environment and future generations.

30) Please identify how Quality Assurance/Quality Control (QA/QC) procedures and protocols were used in the performance of the draft TC&WM EIS analysis.

31) p. 24, Vol. 1, 1.7.1: Retrieval should be governed by more than the 99 percent volumetric goal. After the 99 percent volumetric retrieval, if

specific radionuclides remain that pose unacceptable health or environmental hazards, then they should be targeted and more retrieval should be required until their health and environmental hazards are at or below acceptable level.

32) p. 24, Vol 1,: “Using currently available liquid-based waste retrieval and leak detection systems, waste would be retrieved” may be problematic. No retrieval method should unduly increase the amount of contaminants that leak into the surrounding soil. Sluicing tanks that are known to be leakers is not an acceptable option, unless it can be clearly demonstrated that future leaks will not occur. The leak detection systems must be accurate and the retrieval process must be highly regulated to ensure that the retrieval process will be stopped before any significant leaks can occur.

33) p. 24, Vol1: “For analysis purposes, it was assumed that the WTP would need to be replaced after 60 years” means that DOE must guarantee that the replacement will occur, else the analysis is meaningless.

34) p. 24, Vol1: “filled with grout to immobilize the residual waste” is inaccurate. The grout may serve to reduce the mobility of the residual waste contaminants, but it will not completely “immobilize” them.

35) p.27, Vol1: “closed as an RCRA hazardous waste landfill unit under WAC 173-303, “Dangerous Waste Regulations,” and DOE Order 435.1, as applicable,” Remove “as applicable” because both requirements do apply.

36) p.27, Vol1: “The BX and SX tank farms would be clean-closed by removing the tanks, ancillary equipment, and soils to a depth of 3 meters (10 feet) below the tank base.” The selection of 10 feet must be addressed here (based on contaminant concentrations and costs) and must be justified elsewhere. “Where necessary, deep soil excavation would also be conducted to remove contamination plumes within the soil column.” “Where necessary” needs to be replaced by specific requirements or at least a reference to a section where the specific requirements are located.

37) p.27, Vol1: “The MLLW would be disposed of on site.” The proposed location for future disposal must be identified and analyzed, else DOE may only be transferring a problem from one location to another.

38) p.27, Vol1: “Using currently available liquid-based retrieval and leak detection systems, waste would be retrieved to a volume corresponding to 90 percent retrieval, less than the TPA Milestone M-45-00 minimum goal of 99 percent.” DOE agreed to the TPA Milestones, thus there is no need to analyze or present an alternative that would violate DOE's legally-binding commitments.

39) p.29,Vol. 1: “The HLW debris from clean closure would be managed as HLW and stored on site.” Debris needs to be defined. Hanford Challenge supports the DOE’s proposal to characterize the melters as HLW, and disposed of according to the requirements in the Nuclear Waste Policy Act.

40) p.29,Vol. 1, Tank Closure Alternative 6C: While the soil cleanup is to a deeper level than for other alternatives, cleanup may be needed at even greater depths. Also, for this alternative and all others, plans for cleanup of soil that is not directly under tanks must be included.

41) Vol. 2, p541, D.1.1 (D-2): “All radionuclides are decayed to January 1, 2001 (DOE 2003a).” It is unclear whether ingrowth of progeny is properly considered, which can be of vital importance. If ingrowth was not considered, please do so and make the appropriate corrections.

42) Vol. 2, p542, D.1.1 (D-3): “For the groundwater release screening scenario, only drinking water consumption was considered.“ If screening is not performed for all groundwater pathways, key contaminants may be screened out that should not be. Either provide evidence that the limited screening is bounding or extend the screening to all groundwater pathways that are analyzed.

43) Vol. 2, p542: “Radionuclides contributing less than 1 percent of impacts” is unclear. Was the total contribution from the screened out contaminants less than 1 percent or was the contribution from each individual radionuclide less than 1 percent? If the latter case is true, then it is possible that slightly less than 36 percent of the impacts were ignored. Please clarify the statement and ensure that the former case is what was adopted. Please provide details on how the screening analyses

were performed, whether the same computer programs and models were used as in the final analysis or if surrogates were utilized.

- Also, it is unclear whether daughter ingrowth was considered in the screening analyses. Please state exactly what was analyzed. If progeny ingrowth was not considered, then the screening analyses must be corrected.

- Please state how uncertainty was included in the screening analysis. If uncertainty was ignored, then the screening could easily miss important contaminants. If uncertainty was not included, then the analysis needs to be corrected.

- Please provide a complete list of the expected inventories for all contaminants before the screening process was performed and what their impacts were.

- Inventories of all organics that could complex with contaminants and affect their mobility are required.

44) Vol. 2, p2231, Q.2.4.2 (Q-25): "Physical characteristics of soil were based on site-specific measurements, description of the soil as silty clay loam (Mann et al. 2001)" Please provide a complete set of soil physical properties, rather than relying on a single description. Hundreds of soil measurements have been performed over decades and clay has almost always only been detected in very minute quantities. Much better support is required before such an important analysis can rely on a single statement from an author that is not a geologist. Any covers have conceptually been considered to be impregnated silt overlying sand, gravel and basalt.

a. If impregnated silt is considered, then rock corrections are needed for porosities and other physical properties.

45) Table Q–7. No evidence of rock corrections is evident. Please make the appropriate corrections here and throughout all the physical property data and analyses.

46) Tables Q-7 to Q-8. Properties such as the hydraulic gradient, dry bulk density and vadose zone thickness will vary across the site. Also the use of a single strata would cause any bona fide geologist to go into

shock. Unless it can be demonstrated that the current analysis is bounding, individual analyses for each tank farm is needed.

47) Table Q-12 contains the following contaminants:

Hydrogen-3 (tritium)
Carbon-14
Potassium-40
Strontium-90
Zirconium-93
Technetium-99
Iodine-129
Cesium-137
Gadolinium-152
Thorium-232
Uranium-238
Neptunium-237
Plutonium-239
Americium-241

Table D-2 contains the following radionuclide:

Hydrogen-3 (tritium)
Carbon-14
Strontium-90
Technetium-99
Iodine-129
Cesium-137
Uranium isotopes
Neptunium-237
Plutonium isotopes
Americium-241a

It is clear that there is a disconnect between these tables. Also, it appears that ingrowth of progeny has not been considered which invalidates the analyses.

48) E.1.2.2.5 Leak Detection and Monitoring – Acceptable leak volumes need to be defined. Those definitions need to be developed based on contaminant concentrations and distributions from past leaks and spills and residual concentrations. Modeling should be able to predict risks from potential future leaks and those risks must be within acceptable levels.

49) p. 710, Vol. 2, E.1.2.2.53 (E-29): "However, given the limited sensitivity of some SST leak detection systems, larger leak volumes could occur." Maximum allowable leak volumes must be defined and leak detection systems must be demonstrated that will ensure that leaks greater than the maximum allowable cannot occur.

50) p. 1734, Vol. 2, L.1.3 (L-3) - "The Technical Guidance Document specifies five key requirements for development of the TC & WM EIS groundwater flow field, as follows:

a. The flow field should be transient (i.e., change with time).
b. The factor driving the transient behavior should be operational recharge to the aquifer rather than time-changing boundary conditions.
c. The sitewide natural recharge rate should be 3.5 millimeters (0.14 inches) per year.
d. Both a Base Case and a Sensitivity (Alternate) Case should be investigated; the difference between the two cases should take into account the uncertainty in the top of basalt (TOB) elevation in the Gable Mountain–Gable Butte Gap (Gable Gap). The intent of the TC & WM EIS is to illustrate any potential differential effects this uncertainty might have on simulated alternative impacts. This approach was preferred (as opposed to presentation of results for all alternatives for each flow field) for brevity and clarity of presentation.
e. Flow field development should be consistent with the frameworks for vadose zone and contaminant transport modeling.

f. Even if DOE provides an edict on the natural recharge rate, scientific justification is still required to use that value, else the analysis is useless.

51) p. 1742, Vol. 2, L-11, L.4.2: "The only time-varying fluxes of water across the model boundary are anthropogenic are recharges." The above statement is known to misrepresent field conditions. A detailed discussion of the misrepresentations is needed including an analysis of their effects. Examples of misrepresentations are that the river elevations change over time, leakage occurs through the basalt, and areas modified by man do not receive the natural recharge (e.g., buildings, roads, etc.).

52) p.1745, Vol.2, L.4.2 (L-11): "tank farms receive 100 millimeters (4 inches) per year." Because all cell footprints are 200 m X 200 m, a discussion of boundary conditions over cells only partially containing tank farm or other unnatural entities is needed.

53) "p.1745, Vol.2, L.4.2.4 (L-14): Values for over 200 sources (or sinks) of water were taken from the Cumulative Impacts Inventory Database (SAIC 2006) and encoded into the model." Information on which sources were selected and any rejections is needed to help check the model. Also comments from the LUG and experts are needed with the accepted resolutions.

54) p.1757, Vol 2, L.5.1.1 (L-26): "To mitigate the rewetting problem in the Gable Gap area within the model, inactive cells that represented the TOB were made active and assigned hydraulic conductivity values that are more than 500 times smaller than that of Hanford and Ringold Muds (0.001 meters [0.00328 feet] per day). Making the inactive cell active and using a low hydraulic conductivity value allowed the active water table cells above the TOB to rewet from below but also maintained the TOB as an impermeable boundary."

a. The DOE's claim to have an impermeable boundary of active cells with a non-zero conductivity is not possible. Also, a computer program that does not allow rewetting from any adjacent cell cannot represent physical reality, thus any analyses using such a computer program for Hanford sediments cannot duplicate certain physical processes and its results are suspect. Results from representative test cases must be benchmarked against computer program that can duplicate those physical processes to estimate the amount of error that is introduced by applying the computer program with known errors.

55) p. 1758, Vol 2, L.5.4 (L-27): “Pre-Hanford head observation data are not available.” The TC & WM EIS groundwater flow model was assigned an initial arbitrarily high water table and run in transient mode for 500 years to simulate pre Hanford (1940–1943) conditions with only natural recharges applied per the Technical Guidance Document (DOE 2005). This initial 500-year model run approached long-term steady state conditions, which is assumed to represent pre-Hanford conditions.” Residents lived at the Hanford location, probably farming. Their effect on the environment must be included when establishing initial conditions.

56) p. 1758, Vol 2, L.6.1 (L-27): “Closer than 600 meters (1,969 feet) to the Columbia River, to remove the periodic fluctuations in the river stage from the head observation data” The periodic fluctuations in the river stage may be one of the most important factors affecting the transport of contaminants into the Columbia River, yet it is being rejected. At a minimum, separate analysis is needed to determine its importance and how to include that importance.

57) N.1.2; “Boundary conditions for the upper surface at each site are a specified recharge determined by technical guidance (DOE 2005)” For the saturated zone model, the recharge was altered annually based on human activities. The same rule applies to the vadose zone analysis, although the timing should be more refined.

58) N1.2; “More than 400 subarea models are required” for the vadose zone analyses. The edges of the subarea models were extended to the point where the side contaminant fluxes were set to zero. This approach requires that there is no interaction between the subarea models.

a. Please provide a single figure showing the footprints of all subarea models and state that there is no interaction between any subarea models.
b. Other: The tank T106 leak (and possibly others) was so great that it altered the vadose zone. A typical release to the vadose zone

model is not applicable and is not acceptable for such leaks. One example of the vadose zone alteration is that Cesium traveled so far, because so much Sodium (Na) flooded the vadose zone that it tended to occupy the sorption sites where the Cs typically would occupy.

59) p. 1933, Vol. 2, N.1.2 (N-3): "In summary, the process for the selection of hydraulic parameter values involved the matching of predicted to measured borehole moisture content profiles for all 16 soil types followed by the matching of randomly generated soil types to observed unconfined aquifer conditions for 3 primary soil types. It also provided for consistency with values of saturated hydraulic conductivity" Quantification of the random generation process is needed and numerical values for determining consistency are required, because as stated the values may not even be realistic, but could match what is stated.

   a. Other: Using 200 m X 200 m cells throughout the model domain will result in excessive smearing and likely numerical dispersion for contaminant transport analyses. What was done to address these concerns?

60) p.1937, Vol. 2, N.1.2 (N-7): "The early peak of the predicted technetium-99 profile occurs at the same time as the early peak of the measured total beta profile (see Figure N–5) but is lower because of the presence of radionuclides other than technetium-99 among beta emitters. The concentration level measured and predicted for technetium-99 for the current time period are in general agreement. Thus, the predicted concentration profile for technetium-99 shows qualitative agreement with the reported concentration of gross-beta activity."

   a. The above interpretation is highly suspect. First, information for Figures N-5 and N-6 are plotted separately making any interpretation difficult. Second, the time axes are entirely different, making any interpretation even more difficult. While the early peak Tc-99 concentration (~1E6) may be lower than the total beta peak concentration (~1E9), it is 3 orders of magnitude lower, while at later times, the measured values for Tc-99 actually exceed the measured value for total beta. Additionally, the latest measured values for both Tc-99 and total beta are trending upwards, while the predicted value are essentially constant. There is no general agreement here. Because the Tc-99 measurements are greater than the total beta measurements, some measurements are clearly in error. The measurement errors need to be addressed.

61) p.1938, Vol. 2, N.1.2 (N-8): "Estimates of isopleths of concentration of technetium-99 near the BY Cribs based on measurements reported for 2007 are presented in Figure N–7. These data were used to provide additional testing of the proposed set of values of vadose zone hydraulic parameters. The approach used TC & WM EIS source data for the BY Cribs, the STOMP vadose zone model, the MODFLOW-predicted transient flow field, and a particle tracking transport model to predict spatial distribution of technetium-99 in the unconfined aquifer for calendar year 2005. The results of this analysis are presented in Figure N–8." There is no reason why model results could not be presented for year 2007 to allow direct comparison with measured results.

a. The color scheme and inclusion of the mesh in Figure N-8 makes even trying to read the figure almost impossible. The two figures should be combined using simple contours, but different colors for measured vs. predicted values, with a zoom-in figure if needed.

b. Other: No mention of Courant numbers or Peclet numbers, common modeling metrics, could be found in Vol 2, calling into question the accuracy of any and all results.

62) p.1938, Vol. 2, N.1.2 (N-8): "The predicted concentrations show both qualitative and quantitative agreement with measured concentrations, with high levels near the sources and decreasing levels in the northwest direction. The predicted concentrations also show movement to the southeast due to transient flow in that direction under the influence of high aqueous discharges from past Hanford operations."

a. The "quantitative agreement" is questionable. Even 1D models would show higher levels near the sources. For quantitative agreement, a metric must first be established, such as an root-mean-square approach (as was used for the saturated zone well heads) where differences between predicted concentrations at well locations are compared to measured concentrations at the same wells. Next, an acceptable level for differences must be established. Differences must be calculated for all the times when measurements were recorded for each subarea model. In that manner quantitative measures can be established for each subarea and can be compared against a pre-specified standard.

b. Merely providing graphical results for a very small sample of subarea models is of limited value. It does not allow anybody to draw any meaningful conclusions, if for no other reason than the sample may not be representative. The preponderance of the evidence should demonstrate the accuracy and usefulness of the models.

c. Some more meaningful examples would be:
   i. compare model predictions with actual contaminant discharges to the Columbia River for a total system evaluation
   ii. compare model predictions with actual contaminant movement from the T-106 tank leak for a near-field release that has been well studied and documented
   iii. compare with pump-and-treat operations that combines the effects of large scale and long term contaminant migrations with the efficacy of human intervention with its implications on the various proposed alternatives

63) p.1941, Vol. 2, N.1.2 (N-11): "On the basis of this quantitative agreement of a factor of less than five quantitative agreements…" This makes no sense. Presentation of results over an extended period of time would be much more valuable and would provide much more information than a single snapshot in time

64) Figure N-9: please explain "Tritium picocuries per cubic liter"

65) Figure N-12: It appears that a considerable amount of numerical dispersion has infected the model, producing more widespread pollution than is real and lowering peak concentrations. A simple contour plot (without contour flooding) overlaying wells with zero or < 100 pCi/L of H-3 is needed to address this issue and help evaluate the accuracy of the modeling predictions.

66) Table N-1: "Plio-Pleistocene Cement" needs explanation. It does not appear that any rock (gravel) corrections have been included in this table. Please explain why not and provide justification.

67) Table N-1: No mention of horizontal hydraulic conductivity or anisotropy is provided. Please provide the missing information and its justification.

68) Table N-1: Please explain why the Hanford gravel has a hydraulic conductivity (0.0125 cm/s) that is less than that for Hanford sand (0.0202 cm/s). Those values do not agree with the basic material definitions and can lead to extremely erroneous model predictions.

69) Please identify how Quality Assurance/Quality Control (QA/QC) procedures and protocols were used in the performance of the draft TC&WM EIS analysis.

70) As noted by the Hanford Advisory Board's independent contractor's analysis, there are a number of unit conversion or data errors that raise serious doubts about the quality of the analysis.

Conclusion

We request that you withdraw this draft TC&WM EIS, and revise it to provide legally-compliant alternatives. We look forward to the DOE's response to our comments.

Sincerely yours,

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Tom Carpenter, Executive Director
Hanford Challenge
219 First Avenue S., Suite 120
Seattle, WA 98104
(206) 292-2850
tomc@hanfordchallenge.org

Geoffrey H. Fettus, Senior Project Attorney
Natural Resources Defense Council
1200 New York Avenue, NW
Suite 400
Washington, D.C. 20005
(202) 289-2371
gfettus@nrdc.org

cc: Shirley Olinger, Manager, Office of River Protection, ORP
David A. Brockman, Manager, Richland Operations Office