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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

August 6, 2015

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
4SD

Mr. John Michael Japp
Federal Facility Agreement Manager
Department of Energy
Oak Ridge Office of Environmental Management
P.O. Box 2001
Oak Ridge, Tennessee 37831

SUBJ: D1 Remedial Investigation/Feasibility Study for
CERCLA Oak Ridge Reservation Waste Disposal
(DOE/OR/OR/01-2535&D3; April 2015)
DOE Oak Ridge Reservation
Oak Ridge, Tennessee

Dear Mr. Japp:

The Environmental Protection Agency (EPA) completed its review of the subject document and is enclosing our comments in accordance with Section XXI.G of the Federal Facility Agreement (FFA). Pursuant to Section XXI.G.5 of the FFA, the Department of Energy (DOE) should coordinate efforts to respond to comments and revise the D1 document. The EPA will participate in comment resolution meetings to support efforts to develop a D2 document that is the product of consensus to the maximum extent possible. A response to the enclosed comments and a revised D2 Primary Document is due within sixty (60) days of the receipt of the EPA and State comments.

If you have any questions regarding this matter, please call me at (404) 562-8546.

Sincerely,

Jeffrey L. Crane
FFA Project Manager
Restoration & DOE Coordination Section
Superfund Division

RECEIVED
SEP 11 2015
BY:

Enclosure

cc: Randy Young, TDEC
Brian Henry, DOE ORR
SSAB

RECEIVED AUG 20 2015

EPA Review of
DOE ORR's D1 EMDF RI/FS for
ORR CERCLA Waste Disposal
(DOE/OR/01-2535&D3; April 2015)

GENERAL COMMENTS:

1. The revised Remedial Investigation/Feasibility Study (RI/FS) eliminates all radioactive low level waste (LLW) relevant and appropriate requirements (RARs) under Nuclear Regulatory State Equivalent Standards and "to be considered" (TBC) requirements under DOE Order 435.1. Many of these substantive requirements were included in the Record of Decision (ROD) for the existing CERCLA landfill (i.e., EMWMF) and in early drafts of this RI/FS. A large portion of the planned waste to be placed in this landfill is LLW. The following statements from DOE's Order 435.1-1 Implementation Guide (DOE G 435.1-1, 7/9/99), pages I-60 through I-64 and I-113 through I-114, appear to be in direct conflict with DOE ORR's action to eliminate LLW requirements from this draft of the RI/FS:
    a. *"...radioactive waste disposal facilities under the CERCLA process are to meet the substantive requirements of DOE O 435.1."*
    b. *"The CERCLA process is to be used to comply with the requirements of DOE M 435.1-1 for environmental restoration actions"*
    c. *"The substantive requirements of DOE M 435.1-1 should be directly incorporated into the CERCLA process to the extent practical and consistent with site-specific technical and regulatory issues"*
    d. *"The Deputy Assistant Secretary may assign the LFRG the task of reviewing the information submitted by the Field Element Manager."*
    e. *"The disposal authorization statement does not impact the decision in the CERCLA Record of Decision on whether to build a facility because this decision is made through the CERCLA process. The disposal authorization statement specifies the limits and conditions on design, construction, operation, and closure of the radioactive waste disposal facility. The disposal authorization statement could be included as part of the Record of Decision."*
    f. *For environmental restoration activities, if the CERCLA Record of Decision is to serve as the disposal authorization statement, it must include the same information as stated above, or the disposal authorization statement can be issued separately."*
    g. *Regarding the distinction between substantive and administrative requirements, DOE follows the guidance provided in the rulemaking published for the National Contingency Plan (NCP)... ...substantive requirements are those that set environmental protection requirements, criteria, or limitations..."*
    h. *"...substantive requirements of DOE M 435.1-1 are included as information "to be considered" (TBC) rather than specific ARARs because DOE Orders are not promulgated under the Administrative Procedures Act."*

Describe how DOE ORR is implementing each of these specific internal DOE requirements in a. through h. above and how these matters are coordinated with CERCLA process to constrain the level of contamination placed in the landfill, including a specific discussion of the RI/FS Appendix H, the subsequent Record of Decision and a final waste acceptance criteria.

2. *"DOE Order 435.1-1 Implementation Guide, p. IV-187 includes a discussion of the "All-Pathways Performance Objective. This discussion states: "Depending on the particular source of concern, DOE EPA, and the NRC have typically established limits of 10 to 25 percent (10 mrem)... ... although higher or low fractions may be appropriate."*

   Although CERCLA is a risk-based, not dose-based, program, the Implementation Guide alludes to situations in which DOE's dose-based requirements can be adjusted to meet more stringent standards. This may include showing protectiveness consistent with the CERCLA risk ranges. This discussion on radiation protection appears to support use of the CERCLA risk range as a means to reach consensus on cleanup criteria among DOE, NRC and EPA standards. Explain why the 10% fraction (approximating the upper bound of the CERCLA risk range) described above in DOE's guidance, or lower fractions of 1% and 0.1% (equating approximately with the middle and lower bound of the risk range) would be inappropriate to develop and evaluate alternatives that would satisfy both CERCLA risk-based and DOE Order dose-based thresholds in the FS.

3. The Point of Compliance (POC) in "a" below and the Point of Exposure (POE) in "b" through "d" below should be established as follows:
   a. At the downgradient limits of the waste in the disposal facility for protection of the groundwater resource (i.e., SDWA ARAR MCLs for chemicals and radionuclides [See attached table "Derived Concentration (pCi/l) of Beta and Photon Emitters in Drinking Water"]);
   b. At the location where discharges to surface water require protection of the surface water resource (i.e., CWA AWQCs) and ecological receptors (i.e., Bear Creek and its tributaries);
   c. At the downgradient limits of the waste in the disposal facility for protection of the future reasonable maximum exposed individual at a risk of 10^{-4} and an HI of 1; and,
   d. At the downgradient location where the future reasonable maximum exposed individual is exposed to landfill releases and any other source releases at a risk of 10^{-6} and an HI of 1.

4. Appendix H, Sections 2.4 and 2.5 describe the location for which the risk range must be met. Describe how the risk range is used in the evaluation. CERCLA uses the lower bound of the risk range (10^{-6}) for establishing the preliminary remedial goals (PRGs) for cleanup as the point of departure for evaluating alternatives. Alternatives may also consider adjusting PRGs to higher levels up to the upper bound of the risk range (10^{-4}). Clarify how this CERCLA principle is used in the document.

   During scoping meetings for this document it was discussed that fate and transport models used to calculate limits on waste concentrations would use the risk range at varying distances from the landfill with the upper bound of the risk range (10^{-4}) being used at the closest distance of 100 meters based on DOE Order 435.1. This location that is consistent with DOE Order 435.1 may be a reasonable point of exposure for the 10^{-4} upper bound of the risk range, given the uncertainty in the fate and transport models in this complex hydrogeologic setting. However, as discussed in other comments, the location of the point of exposure adjacent to Bear Creek is a concern because it assumes greater mixing of contaminated groundwater with karst flow in the zone of Bear Creek. Also, at further distances, potential future releases from the EMWMF and other sources should be accounted for in establishing limits on waste concentrations, consistent with DOE Order 435.1 guidance for a composite analysis. For these reasons, as discussed during scoping meetings, setting the point of exposure the furthest distance from the landfill at Bear Creek may be a reasonable location for the most conservative approach to setting limits on waste concentrations that may appropriately account for greater uncertainty in fate and transport models due to the greater distance and use the lower bound of the CERCLA risk range (10^{-6}). A point of exposure in between these two locations that is not likely to be impacted by other potential source releases may be appropriate for establishing limits on waste concentrations based on the mid-point of the CERCLA risk range (10^{-5}). Model runs that consider these risk-based exposure scenarios at varying locations for the point of exposure may provide the best approach to managing the uncertainty in release scenarios for establishing limits on waste concentrations.

5. DOE Order 435.1 guidance requires an evaluation for the protection of water resources. CERCLA and RCRA require protection of water resources at a POC (See General Comment 3) that is established at the down-gradient limit of the waste. This location is not the same as the POE for the maximum exposed individual for purposes of the risk evaluation, as described in General Comment 4. In Appendix H, describe how the pre-WAC will ensure protection of the water resource at the CERCLA/RCRA POC that uses the 4mrem based MCL standards for protection of groundwater resources for radionuclide contamination, and the protection of surface water resources from releases into NT-3.

6. Appendix H, Section 3 establishes models for fate and transport and exposure. DOE should also consider building into the suite of models the PRG calculator models developed by Oak Ridge National Lab for EPA Headquarters.

7. The onsite disposal alternative screens out all locations considered except for Option 5. This single retained onsite location includes site conditions that would require a waiver and implementability challenges similar to the existing EMWMF Landfill that was built over NT-4 for which performance issues have arisen due to a shallow water table along the axis of NT-4. Additional alternatives should be retained for the detailed analysis that will address the following concerns:
    a. Retain an alternative(s) that will not require a TSCA Waiver of the requirement established in 40 CFR 761.75(b)(3) - *"There shall be no hydraulic connection between the site and standing or flowing surface water;"*
    b. If a TSCA Waiver related to the hydraulic connection between the site and standing or flowing surface water is needed at all other locations considered in Appendix D, an alternative for detailed analysis which minimizes this shallow water table connection (i.e., not located on an NT to Bear Creek) to the site and the scope of the variance required under 40 CFR 761.75(c)(4); and,
    c. The EMWMF Landfill encountered unexpected high water table locations due to its construction over NT-4. Unplanned actions were taken to mitigate high water table

conditions. Furthermore, since the action to construct the underdrain, high water table conditions remain a concern. Given the uncertainty of the effectiveness of this underdrain design over the long-term, an additional alternative(s) that would not require an underdrain should be included in the detailed analysis.

8. Appendices B (Waste Volume Reduction) and C (On-site Treatment and Disposal Options for Mercury-Contaminated Wastes) describe and evaluate potential options for managing CERCLA waste both on and off-site. Appendix B screens out all waste volume reduction treatment actions from the on-site alternative. Conversely, Appendix C screens out all options for treatment except in-cell treatment. The appendices should be used to identify the most viable treatment options and establish alternatives for the detailed analysis that evaluates use of treatment, consistent with the preference for treatment, and not using treatment in the different alternatives for the detailed analysis. This will enable a comparison, against the nine criteria for consideration of whether or not to deploy treatment, and in the Case of Appendix C, whether to deploy treatment at the point of generation or in the landfill.

9. A primary basis for screening out site locations was due to the projected waste volume and the results in an area of the landfill footprint that would cross NTs. These assumptions are questioned due to the significant uncertainty in the waste volume forecast (i.e., + 25% contingency) and the lack of commitment to volume reduction. DOE should consider a smaller footprint with a recognition that the footprint may require expansion and alternatives where the expansion may not be a continuous footprint.

10. The implementability of the mercury in-cell treatment option requires further detail in describing how this activity can be conducted that adequately addresses:
    a. The risk of transportation spills of untreated mercury during shipment to the landfill;
    b. The risk of generating landfill leachate and contact water that contains excessive mercury concentrations that may be generated after placement but prior to subsequent LDR treatment;
    c. The benefits of small scale treatment batches to address concerns in b above; and,
    d. The ability to verify macroencapsulation performance objectives are being met in the vaults.

11. Include a more thorough discussion in Section 6, Section 7 and Appendix G on the TSCA *"Technical Requirements"* ARARs and provide factual information on how the landfill on-site locations meet, or waive, the siting ARARs in 40 CFR 761.75(b), including site soils (40 CFR 761.75(b)(1)); site hydraulic conditions (40 CFR 761.75(b)(3)); site proximity to the floodplain (40CFR 761.75(b)(4)); and, site topography (40 CFR 761.75(b)(5).

12. Include a more thorough discussion in Section 6, Section 7 and Appendix G on the TSCA "Technical Requirements" ARARs for leachate collection and handling (40 CFR 761.75(b)(7)) and landfill operations (40 CFR 761.75(b)(8)). The RI/FS needs to provide assurances that these action-specific ARARs are being met.

13. The third remedial action objective (RAO) presented in Section 4 lacks sufficient detail. For example, Section 4.1.2.1 (Development and Screening of Alternatives) of the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA/540/G-89/004), (OSWER Directive 9355.3-01), dated October 1988 (RI/FS Guidance) states that RAOs should specify the contaminants and media of interest, exposure pathways, and preliminary remediation goals that permit a range of treatment and containment alternatives to be developed. However, the third RAO presented in Section 4, which discusses ecological exposure, does not specify the contaminants of concern (COCs), media of interest, exposure pathways or preliminary remediation goals that permit a range of treatment and containment alternatives to be developed. Modify the RAO to specify the objective of meeting CWA AWQCs at the point of exposure (See General Comment 3) and where AWQCs are not available ecological or human health based levels of protection. Consider using the EPA Headquarters PRG calculator developed by ORNL for this effort. Revise the RI/FS to provide more clearly-defined RAO related to ecological risk that specifies the COCs, media of interest, and exposure pathways.

14. Table 5-1 identifies process options that are eliminated; however, the specific criteria (i.e., effectiveness, implementability or cost) are not identified which justify the elimination of these process options. For example, the Tumulus facility is eliminated; however, the reasoning for eliminating this process option is not clear. For clarity, revise Table 5-1 to clearly indicate the reasoning for eliminating process options.

15. Section 5.4.2 in Appendix B, Waste Volume Reduction, states, "Cost effectiveness is determined by comparing the cost of size-reduction processing (capital cost and operating cost) with the cost savings realized through the reduction in fill requirements and reduced landfill size for several waste material types and processing methods." However, by only evaluating cost savings, neither Appendix B, nor the RI/FS as a whole, takes into account additional benefits of Volume Reduction (VR). For example, by using VR, the siting location for the On-Site Alternative, could be effected due to a smaller footprint, which in turn could affect the overall protection of human health and the environment. As such, it appears more appropriate to consider VR in the context of being part of an On-Site Alternative that includes a smaller footprint, which would be evaluated against CERCLA's nine criteria. Revise the RI/FS to propose VR as part of a unique on-site alternative, or provide a basis for only evaluating VR in the narrow context presented in Appendix B.

16. Section 4, Treatment Options for Mercury Contaminated Y-12 Debris, in Appendix C states, "This section evaluates three general options for on-site macroencapsulation in terms of treatment effectiveness, technical and regulatory feasibility, and cost. This approach is similar to the technology screening process described in RI/FS Section 5.1.2, and encompasses the five balancing criteria used to analyze the general waste disposition alternatives in RI/FS Section 7." However, it is not clear why in-cell mercury macroencapsulation is not presented as a unique on-site alternative, with another separate alternative which would include generator/demolition site encapsulation; both of which would be evaluated against CERCLA's nine criteria. It is noted that Section 5.2.5, Treatment of Mercury-contaminated Debris, of the RI/FS indicates that Appendix C evaluates only the cost effectiveness and risk involved with performing the macroencapsulation operation at the

disposal facility versus at the demolition/project site. Revise the RI/FS to propose in-cell mercury encapsulation as a unique on-site alternative, or provide a basis for only evaluating mercury disposal as part of Appendix C.

17. Table 6-2, Summary of EMWMF Lessons Learned, states, "Underdrains can be successfully utilized in managing existing ground water at sites, but should be appropriately designed in advance of landfill operations. The materials of the various components of the underdrain system and backfill should be carefully selected to ensure drain longevity. Underdrains can provide a backup LDRS and should be part of the ground water monitoring plan for the facility." However, the performance issues with the underdrain at EMWMF are not discussed (e.g., intrusion of groundwater into the geobuffer, even with an underdrain in place) and the potential liability for long term protectiveness of human health and the environment of constructing a highly permeability unit that funnels directly to surface water resulting in potential very short time of travel of contaminant release, as the bottom most engineering feature of a landfill is not addressed. Further, the comparison of the underdrain to a backup LDRS, does not appear appropriate as the LDRS has an underlying geomembrane which greatly reduces permeability and has a storage system associated with it, both critical components. Revise the RI/FS to provide a more detailed analysis of the underdrain and its appropriateness as an engineered landfill feature, including references to other similar designs.

18. The RI/FS presents the On-Site Alternative in the Executive Summary (Page ES-8) as the preferred remedy for waste disposal; however, presentation and documentation of a recommended remedy is inappropriate at this time as this is performed during the Proposed Plan stage. As specified in the National Contingency Plan (NCP) and RI/FS Guidance, the FS documents the development and analysis of alternatives only. In addition, modifying criteria (i.e., State and community acceptance) have not yet been met. Revise the RI/FS to remove all language which discusses the On-Site Alternative as the recommended remedy

19. Appendix D, Section 2, Preliminary Screening, under the first bullet describing the siting criteria, indicates that a minimum landfill footprint area is 60-70 acres; however, this limitation appears to screen out a possible option of multiple, non-contiguous landfills which might otherwise be viable and potentially more suitable. For example, smaller landfills may require fewer ARAR waivers (i.e., Tennessee Department of Environment & Conservation [TDEC] requirements) and may also enhance implementability and long term protection uncertainty if not constructed over an NT surface water feature. Given the ARAR waiver concerns and the siting issues identified by TDEC at the location of Option 5, it appears that the RI/FS should evaluate the scenario of multiple, non-contiguous landfills as remedial alternative.

20. Appendix D, Table D-2, Preliminary Screening of Candidate Sites, eliminates several sites based on a lack of suitable area; however, this evaluation is based on projected waste volumes that are uncertain, overinflated, and without consideration of volume reduction (VR) treatment. Similarly, Table D-4, Secondary Screening of Candidates Sites, also eliminates sites based on disposal capacity. Revise Appendix B, Appendix D Section 6 and Section 7, consistent with General Comment 8, to support the addition of an alternative(s) with VR

treatment that consider more reasonable estimates of the waste generation forecasts (i.e., do not assume the 25% + uncertainty) and consider varying proportions of on and off-site disposal.

21. Appendix D, Section 3.1, Proximity to the Public, does not address the nearby Scarboro Community. Revise the RI/FS in appropriate locations (e.g., Section 7.1.9, 7.2.2.8, Appendix D, and Appendix E [1.2.2]) to address any potential Scarboro Community environmental justice concerns and efforts to implement community relations consistent with 40 CFR 300.430(c)(2), including consideration of environmental justice concerns (See http://www.epa.gov/oswer/ej/index.html). In this revision to the RI/FS and any update to the supporting Public Involvement Plan, describe DOE ORR's efforts to enhance community engagement for this evaluation of waste disposal alternatives to best engage interested members of the public (e.g., local officials, community residents, public interest groups, or other interested or affected parties), in addition to those opportunities for public engagement through the support of the Oak Ridge Site Specific Advisory Board (See EPA's letter of July 24, 2015 for further discussion on this matter).

22. Several locations within the RI/FS, including Appendix E, Section 2.3.3.2.1, Shallow Aquifer Zone, describe artesian conditions at the site at groundwater monitoring well GW-968/-969; however, the RI/FS does not discuss if these artesian conditions will affect the effectiveness or implementability of the proposed On-Site Alternative. For example, it is not clear if these conditions will affect: the conceptual site model, the surface water hydrology of the site; the ability of the underdrain to capture and prevent groundwater intrusion into the liner system; the effectiveness of the geologic buffer with this potential artesian condition; and, the effectiveness of a groundwater monitoring system. In addition, as groundwater intrusion into the geologic buffer has been an issue at EMWMF, potential artesian conditions at EMDF appear to be a critical issue. While it is noted that the RI/FS implies that the artesian conditions are the result of the well pad being excavated, it appears additional information on the potential issues associated with these artesian conditions should be evaluated. Revise the RI/FS to present additional information on the effects of potential artesian conditions at the site on the evaluation of the On-Site Alternative and address how shallow water table conditions affect the alternatives effectiveness and implementability.

23. Appendix B, Section 2.3.1.3 Cavities, states that the proposed EMDF site overlies lower Conasauga units that apparently are not susceptible to conduit development. According to Moore (1988), cavities in the Conasauga Group have been reported only in the Maryville Limestone, Nolichucky Shale, and Maynardville Limestone. While this assertion may have merit, the results of the tracer dye tests presented in Section 2.3.3.2, Results of tracer tests, of Appendix E, provide substantial insight into water movement as well as contaminant transport processes. First arrival velocities from as low as 6 ft/day to as high as 1,314 ft/day have been observed in tests conducted in the ground water zone of Conasauga Group units. As such, it is not clearly understood if the results of tracer dye test suggest other more dominant preferential flow paths may exists due to the presence of stratigraphic and structural controls (e.g., bedding planes, fractures, micro and meso-scale structures) that have more influence and dominance on valley head distribution and flow paths than the karst dissolution cavities and conduits. Revise the RI/FS to address this issue.

24. In Section 2.2.4, Seismicity, the text states although there are a number of inactive faults passing the Oak Ridge Reservation (ORR), although there are no known or suspected seismically capable faults. The text further states as defined in 10 CFR 100, Appendix A, a seismically capable fault is one that has had movement at or near the ground surface at least once within the past 35,000 years, or recurrent movement within the past 500,000 years. The citation 10 CFR 100, Appendix A refers to the Nuclear Regulatory Commission (NRC) regulation regarding Seismic and Geologic Siting Criteria for Nuclear Power Plants. However, the regulation NRC 10 CFR 100, Appendix A is not listed in Table G-3. Action-specific ARARS and TBC Guidance (Siting Requirements) for CERCLA Waste Disposal Alternative. Rather, Table G-3 lists 40 CFR 264.18(a)(1) as the applicable regulation regarding siting of a RCRA hazardous waste landfill. The applicable regulation 40 CFR 264.18(a)(1) requires a new facility where treatment, storage, or disposal of hazardous waste will be conducted must not be located within 200 feet of a fault which has had displacement in Holocene time. A fault is defined in 40 CFR 264.18(a)(2)(i) as a fracture along with rocks on one side have been displace with respect to those on the other side. Displacement is defined as the relative movement of any two sides of a fault, measured in any direction [40 CFR 264.18(a)(2)(ii)]. The Holocene period includes the past 11,000 years [40 CFR 264.18(a)(2)(iii)]. As stated, Oak Ridge lies within the East Tennessee Seismic Zone (ETSZ), a seismically active zone where the mechanism and frequency of occurrence of earthquakes in the ETSZ are not well understood. As such, based on the information presented in this section, it remains uncertain whether the EMDF has demonstrated compliance with the RCRA seismic standard. Revise the RI/FS to address this issue

25. The underlying assumption for the ground water modeling for the EMDF is that the subsurface can be treated as an equivalent porous medium (EPM); however, some experts have concluded that the EPM approach is not applicable for fractured rock. For example, Chapman and Parker (2011)[1] state that the EPM approach is inadequate for simulating contaminant transport in fractured porous rock (e.g., sandstone). Evaluation of modeling methods at several sites with fractured sedimentary rock indicates that contaminant fate and transport cannot be adequately assessed using an EPM approach; and, an approach based on a discrete fracture network (DFN) is necessary (Parker, Cherry, and Chapman, 2012)[2] with use of DFN software modules like Fractran, which can be run with MODFLOW. However, the groundwater model (MODFLOW/MODPATH) utilized to support Preliminary Waste Acceptance Criteria (PreWAC) development assumed an EPM and did not utilize a fracture-specific model. Since fractured sedimentary rock rarely has a sufficiently uniform fracture system, groundwater flow can be quite rapid along interconnected fractures or follow a

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[1] Chapman, Steven W. and Beth L. Parker. 2011. Use of Numerical Models to Examine Contaminant Mass Distribution and Attenuation in Fractured Sedimentary Rock, Proceedings GeoHydro2011, Quebec City, Canada, August 29-31, 2011.

[2] Parker, B.L., Cherry, J.A., and Chapman, S.W. (2012). Discrete fracture network approach for studying contamination in fractured rock. AQUAmundi: Journal of Water Science, 60, 101-116. DOI:10.4409/Am-052-12-0046. Please note that this paper indicates that based on more than 15 years of field research, an EPM should not be used to model contaminant transport in fractured bedrock, contrary to the statements from Groundwater (Freeze and Cherry, 1979); i.e., hyrdrogeology has moved beyond the information presented in this noteworthy and historic text.

lengthy tortuous path. As such, a detailed evaluation of the fracture network and use of a DFN software module is essential to accurately predict contaminant transport. The model should therefore be rerun using a DFN software module like FRACTRANS. If this is not done, the groundwater flow and transport model should not be used to predict contaminant arrival times after the EMDF is constructed. Regardless of the modeling employed, a sufficient monitoring well network should be installed so that contaminant release and migration can be monitored empirically.

26. Appendix H does not include sufficient information about model parameters and setup to facilitate an evaluation of the groundwater flow and transport model. If the MODFLOW/MODPATH/ MT3D modeling approach is pursued, Appendix H should be expanded to provide setup information for each of the model layers. For example, the recharge distribution is provided only for the upper layer and hydraulic conductivity is provided only for Layer 1. Revise Appendix H to present all of the model input parameters for each layer, including figures as necessary.

27. The discussion of flow model calibration is insufficient. For example, the following deficiencies were noted, but are not limited to:
    a. There is no discussion of calibration statistics;
    b. There are no figures depicting actual and simulated groundwater elevation contours for the various layers;
    c. There is no figure depicting residual head differences between actual and modeled groundwater elevations (e.g., where different colors are used to distinguish between positive and negative head differences and the residual head difference is posted);
    d. The details (e.g., parameters evaluated) and results of the sensitivity analysis are not presented;
    e. Total and effective porosity should be varied in the sensitivity analysis, but other parameters should be tested as well;
    f. The text should include a detailed discussion explaining the model calibration and sensitivity analysis and findings; and,
    g. Validation of the flow model is not discussed, so it is unclear if the model was validated.

Sufficient information, including the items listed above, is necessary to evaluate the validity of the statements made in Section 4.2.1.4 and how well the model approximates actual conditions. Specifically, it is necessary to ensure that the flow model approximates actual conditions before the output is utilized for further steps in the Pre-WAC calculations. Revise Appendix H to include all of the items discussed above.

28. The impact of using effective porosities that are a small fraction of the total porosity (i.e., see Appendix E, Section 2.3.1.1, where the effective porosity of soil and weathered bedrock is stated to be about 0.2%, compared to a matrix porosity of 30-50%) can result in underestimating the mass of contaminants in the transport model. If the total and effective porosity are similar, the error of using one or the other is not that great (compared to the wrong hydraulic gradient). But when the effective porosity is only a small fraction of the

total porosity, then the mass balance is incorrect. Leonard F. Konikow[3] (2011) stated:

"Although the assumption that porosity is spatially constant may be quite reasonable and induce very little error even when it varies spatially, it tends to mask another issue of concern about porosity that is generally overlooked or ignored. Specifically, the porosity term on the left side ... [of the classic advection dispersion equation] reflects the mass storage of solute within a volume of aquifer, and hence reflects the total (or bulk) porosity. The right side of ... [of the classic advection dispersion equation], however, reflects a porosity that is effective for the fluxes of water and solute-more a measure of mean cross-sectional area at the pore scale and interconnectedness of pores-and which will have a value less than that of the total porosity. If a single value representative of the effective porosity is used, then the solute storage capacity (and mass stored) would be underestimated; if a single value representative of the total porosity is used, then the average seepage velocity would be underestimated."

Revise Appendix H to consider this issue and include a mass balance for the transport model.

29. The approach for modeling contaminant transport needs to be evaluated. Specifically, the groundwater model does not account for rapid contaminant transport in fractured rock. Chapman and Parker state that "bulk average linear groundwater velocities in fractures [are] generally high (1 to >10 m/day [greater than meters/day])" (Chapman and Parker, 2011). Tracer tests in wells screened in fractured bedrock have resulted in estimated groundwater velocities ranging from 0.75 to 650 feet per day (i.e., Appendix E, Section 2.3.2.2). This tracer test data indicates that rapid flow in fractures is occurring. The implications for contaminant transport in fractures at these velocities are significant and may invalidate the predictions in Figure H-19 (MT3D Model-Predicted Groundwater Well concentrations (Relative to Leachate) with Time), as this figure indicates that contaminants will not reach the hypothetical receptor for more than 1000 years. However, at 650 feet per day, contaminants released from the landfill would reach the hypothetical receptor well (460 meters from the EMDF) in a little more than 2.32 days. Further, if flow rates like those observed during the tracer tests occur, there would not be sufficient time for chemical compounds to decay as assumed in Section 4.4.1 on page H-54. Revise the text to discuss this issue and the implications for the transport and PATHRAE models. In addition, run the PATHRAE model for chemical compounds

30. If the MT3D transport model is utilized, a sensitivity analysis is necessary. Conduct a sensitivity analysis for the transport model and revise the text to discuss in detail the parameters varied and the results of the sensitivity analysis

31. The Executive Summary states on page ES-4 that the analytic Waste Acceptance Criteria (WAC) of the proposed new disposal facility would ensure the risk to future receptors would not exceed and Excess Lifetime Cancer Risk (ELCR) of 10E-05 or a Hazard Index (HI) of 1 in the first 1,000 years. However, the RAOs included in Section 4.0, Remedial Action Objectives, for the EDMF state that risk will be maintained within the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) acceptable risk range

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[3] Leonard F. Konikow, 2011. The Secret to Successful Solute-Transport Modeling, Ground Water, Vol. 49, No. 2, March-April 2011, pp. 144-159.

of an ELCR of 10E-04 to 10E-6, and a HI of 1 to 3. Additionally, generally when a HI of 1 is maintained, the ELCR is 10E-06 is also maintained (as opposed to 10E-05). Revise the RI/FS to provide clarifying statements about how it was determined that an ELCR of 10E-05 or a HI of 1 for the EMDF will be achieved through the analytic preWAC, or revise the Executive Summary to be consistent with Section 4.0 of the RI/FS.

32. Section 4, Remedial Action Objectives, of the RI/FS states that the first objective for evaluating remedial alternatives is to prevent direct or indirect exposure of a human receptor to a future-generated CERCLA waste that exceeds an ELCR of 10E-04 – 10E-06 or HI of 1 to 3. Section 2.3, Hypothetical Receptor, of Appendix H states that the maximally exposed individual (MEI) was selected to be the hypothetical resident farmer. The text does not state whether a child of the resident farmer was considered. Provide a response about whether a child resident scenario was evaluated in this RI/FS.

33. The remedial action alternatives listed in Table 5-1, Technology Descriptions, Screening, Evaluations, and Selection of Representative Process Options of the RI/FS includes a list of the off-site facilities that were considered as possible options for disposal of the ORR waste streams. This list includes the Chem Nuclear commercial low-level waste (LLW) and mixed LLW disposal facility in Barnwell, South Carolina. However, Chem Nuclear is not listed in Section 5.1.3.1, Existing LLW and Mixed-Waste Facilities, and is not included in the evaluation of these potential off-site facilities provided in Section 5.2.3.2, Existing LLW and Mixed-Waste Facilities. Revise Table 5-1, and Sections 5.1.3.1 and 5.2.3.2 to provide consistent information about the off-site disposal facilities that were evaluated through the remedial action alternative selection process.

34. Appendix H, Section 4.4, Pathrae Modeling and Risk/Dose Analysis, states that the PreWAC for the proposed EMDF was developed based on the combined effects of contaminated ground water ingestion and contaminated surface water use for a hypothetical resident farmer. The source of surface water is assumed to come from Bear Creek; however, Appendix H does not discuss the possibility of ground water discharge to any other surface water location surrounding the EMDF. As such, it is unclear if other ponds, seeps or small streams may occur in the area surrounding the EMDF which would provide a more concentrated source of surface water contamination that would be accessed by livestock or the residents than the significantly attenuated/diluted Bear Creek source of contaminants. Revise the RI/FS to address whether there are other locations of surface water near the EMDF that may be impacted from contaminated groundwater which could present a more concentrated source of contamination other than Bear Creek.

35. The Appendix H, Section 4.4.1, Site-specific PATHRAE Model Development, states on page H-54 that the initial concentration of a single contaminant in the landfill was set at 1 Curie (Ci) per meter cubed (m^3) for radioactive species, and 1 kilogram (kg)/m^3) for hazardous species. However, the text does not describe how the assumed concentration for a single radionuclide was determined to be appropriate and conservative. For example, the text does not reference a document or present a discussion in the RI/FS that addresses the expected concentrations of contaminants in the waste and how this information was used to derive the 1 Ci/m^3 concentration used in the modeling. Revise Appendix H, Section 4.4.1 to state how

the 1 Ci/m^3 quantity was selected for modeling, and how this compares to the estimate of the most concentrated amount of any one radionuclide projected to be in the EDMF.

36. Appendix H, Section 4.4.2.5, Summary of PATHRAE Assumptions, states that one of the assumptions made for the PATHRAE code execution included assuming a near neutral pH condition exists in the waste zone based on the EMWMF data. However, in the scenario where waste is being released, an assumption of near neutral pH conditions in the surrounding soil, does not appear realistic or conservative. Revise the RI/FS to address this concern.

37. Appendix H, Section 5.3, Discussion of PreWAC Results, states in the second paragraph that the uncertainty/sensitivity analyses appropriately compel modeling of long-lived isotopes out to peak concentrations. The text further states, "[I]n this case, the model is run for much longer periods of time, with an increased time step." However, the text does not reference the document that contains the results of such modeling beyond the 1,000 year requirement. Revise the RI/FS to provide reference to, or incorporate the results of the uncertainty analyses for modeling radionuclides after the 1,000 year compliance period.

38. The second paragraph of Appendix H, Section 5.3, Discussion of PreWAC Results, appears to indicate that the sensitivity analyses conducted for radioisotopes included evaluating the effects of radioisotope decay and half-life, decay plus leaching versus decay only, and partition coefficients (as demonstrated in Figures H-21 – H-25) in determining peak concentrations for assessing dose and risk at the selected location of the resident farmer. However, Appendix H does not state whether sensitivity analysis included varying other model inputs such as geochemical effects (i.e. interaction of radioisotopes with soils or other constituents), hydrological (i.e., type of bedrock, groundwater transit rates) or environmental factors (i.e., rainfall totals) to determine whether these types of model inputs were more apt to affect the outcome of peak concentrations of radionuclides or chemical contaminants. Revise the RI/FS to state if sensitivity analyses for modeling peak concentrations of radionuclides and/or chemical constituents was conducted for any modeling inputs other than those discussed in Section 5.3, or if this type of detailed sensitivity analysis will be provided in future document submittals.

39. The RI/FS discusses several components, or potential components of the alternatives, but does not include costs for these items in Appendix I, Cost Estimates for On-Site and Off-Site Disposal Alternatives. For example:
    a. Section 3.2, Evaluation of Risk for the On-Site Alternative, indicates that additional risk evaluation will be completed in the design, implementation and closure stages of the project; however, these costs are not identified in Appendix I.
    b. The second bullet on page 6-7 of Section 6.2.2, EMDF Conceptual Design, includes a design element of the EDMF of "early actions;" however, early action costs are not itemized in Appendix I. It is noted that Section 3.2.2.1, Pre-construction Activities and Design (Elements 1 and 4 in Table I-3), of Appendix I, provides a description of activities included as early actions (e.g., groundwater monitoring); however, these cost are not itemized in Table I-3, Summary of EMDF Conceptual Design Cost Estimate.

c. Section 6.2.2.4.1, Clean-fill Dike, describes the dike to be constructed around the perimeter of the landfill; however, costs for this dike construction are not included in Appendix I.
d. The landfill gas collection and venting system is described in 6.2.2.4.7, Cover Systems. While it is understood that this system is not anticipated to be incorporated into the final cover, the RI/FS should note in Section 6.2.2.4.7 that costs are not included.
e. Section 6.2.2.6.3, Predicting Seasonal High Ground Water Elevations, indicates additional fill was required in the conceptual design of the landfill to raise the bottom of the landfill; however, it is not clear if these costs were incorporated into Appendix I.
f. Section 6.2.2.6.4, Data Gaps and Uncertainties, states, "Future mercury-contaminated debris that is planned to be treated in, and disposed of, at the EMDF [Environmental Management Disposal Facility] using the macroencapsulation method is not currently addressed by the conceptual design. Final design considerations will include an analysis of the stresses this treatment (e.g., construction of concrete forms to hold debris, and subsequent macroencapsulation activities) would place on the landfill floor, above the liner." However, Appendix I indicates that macroencapsulation is included in the costs and as such this discrepancy should be addressed

Revise Appendix I to include these costs or alternatively explain in the text of the RI/FS why these costs do not need to be included.

40. The RI/FS does not assess the environmental effects of the proposed remedial alternatives in accordance with Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites (EPA 542-R-08-002), dated April 2008 (EPA Green Remediation Guidance) or Methodology for Understanding and Reducing a Project's Environmental Footprint (EPA 542-R-12-002), dated February 2012 (EPA Environmental Footprint Guidance). For example, energy consumption, greenhouse gas emissions (carbon dioxide, methane, and nitrous oxides), pollutant emissions (carbon monoxide, oxides of sulfur, oxides of nitrogen, and particulate matter), water consumption, ecological impacts/change in resource use, resource consumption, and worker safety are not used to evaluate the environmental footprint of the remedial action alternatives. Revise the RI/FS to meet the level of detail specified in the EPA Green Remediation Guidance and EPA Environmental Footprint Guidance.

SPECIFIC COMMENTS:

1. <u>Section 2.2.1, As-generated Waste Volume Estimate, Background, Page 2-6</u> - The second bullet in this section states, "A correction to the waste volume estimate for Building 9201-4 (Alpha-4) demolition was used;" however, the correction is not described or quantified. For clarity, revise this section to provide additional information on this correction.

2. <u>Section 2.2.2, As-disposed Waste Volume Estimate, Background, Page 2-10</u> - This section indicates that the estimated capacity necessary for the EMDF is 2.2 M yd^3 (including uncertainty), but that the conceptual design in the RI/FS is based on 2.5 M yd^3. While it is

understood that this is conceptual design for the RI/FS stage of the project, it is not clear why the conceptual design criteria was not adjusted to 2.2 M yd^3, as this could impact siting requirements (e.g., a smaller footprint or the feasibility of using two smaller landfills in an improved setting). Also, it is not clear if a conceptually smaller landfill footprint would substantially affect the assumption in Appendix D, On-Site Disposal Alternative Site Screening, that a 60-70 acre site is required for the proposed EMDF. Revise the RI/FS to address these issues

3. Section 3.2, Evaluation of Risk for the On-Site Alternative, p. 3-6 - This section states, "For the On-site Disposal Alternative, long-term risk evaluation is a much more involved process. Residual risk can only be estimated in the early "feasibility" stage of this remedy, as the waste is not yet in place, and the types and amounts of contaminants are not yet fully known. As the remedy is further advanced through the design and eventually implementation and closure stages, a more quantitative approach to determining/verifying risk can be applied." However, it is not clear why conservative assumptions on the type and amounts of contaminants, and modeled receptor exposures cannot be used to account for the uncertainty and an appropriate residual risk determined. By postponing the risk evaluation to the design stage and beyond, it is not clear how evaluation of the On-Site Alternative in meeting the RAOs can be completed. Revise the RI/FS to provide additional information on the risk evaluation approach.

4. Section 5.3, Assembly of Alternatives and Ability to Meet Remedial Action Objectives, p. 5-18 - The description of how the On-Site Alternative meets the ecological RAO is not adequate. This section states, "Through compliance with ARARs and sound design, the onsite engineered disposal cell would effectively isolate the wastes from the environment, minimizing release of contaminants, and reducing overall environmental impact. Compliance with the facility WAC would also ensure minimal ecological exposure." However, the description as stated is vague and not quantified. As the ecological RAO (i.e., prevent ecological exposure to future-generated CERCLA waste) is also vague, it appears both the RAO and details on how On-Site Alternative meets this RAO require revision. Revise this section to provide details on how the ecological RAO will be met. In addition revise the RI/FS to include a more detailed ecological RAO.

5. Section 5.3, Assembly of Alternatives and Ability to Meet Remedial Action Objectives, p. 5-18 - The No Action Alternative is not included for each of the RAO bullets in this section and the accompanying description of how the alternatives meet RAOs. For completeness, include a discussion of the No Action Alternative as part of all of the RAO bullet points in this section.

6. Section 5.4, Figure 5-3 - The scenarios of various proportions for on and offsite waste should be retained for development of alternatives in Section 6 and detailed analysis in Section 7. The 80% in two landfills and 60% in one landfill onsite options are viable alternatives that would entail a smaller footprint that would be more implementable as related to site location issues, especially if waste generation forecasts are more realistic as mentioned in other comments.

7. <u>Section 6.2.1.1, p. 6-5</u> - More details are needed in Section 6.2.1.1 or elsewhere, as appropriate, on the proposed rerouting of NT-3. Figure 6-8 shows the rerouted western branch of NT-3. The RI/FS does not provide any explanation for why the stream needs to be rerouted. Also, regarding Figure 6-8, BOTH the overprint pattern that encircles most of the landfill and the lighter blue line that bounds the northern part of the landfill and connects with rerouted NT-3 and an upstream tributary to NT-2 need to be identified in the legend.

8. <u>Section 6.2.2.2, p. 6-8</u> - The **Hydrogeological and Geotechnical Investigations** discussion in Section 6.2.2.2 of the RI/FS reads as if no hydrogeological or geotechnical investigations have been done for the area of the proposed landfill. This statement as written is incorrect, as indicated in the very next subsection of Section 6.2.2.2. However, the statement that no previous investigations have been performed is followed in the very next sentence by a statement that the investigations would evaluate areas selected for landfill support facilities, roadways, and on-site spoil/borrow areas. There needs to be some statement regarding the criticality of hydrogeological and geotechnical investigations of those areas to the overall viability of the EMDF. If such investigations are critical to selection of the EMDF they should be done, at least in a limited sense, before moving forward with the EMDF as the alternative for waste disposal.

9. <u>Section 6.2.2.4.2, Upgradient Diversion Ditch with Shallow French Drain, p. 6-11</u> - This section states, "A design requirement will be to evaluate the possibility of the upgradient ditches and drains failing. This evaluation would be conducted in order to demonstrate that the landfill will remain protective of the environment in the event these features fail." However, it is not clear why this evaluation would not be performed prior to the FS to assist in evaluating the protection of human health and the environment as part of the FS process. Revise this section to include this evaluation or provide a rationale for not including it as part of the RI/FS

10. <u>Figure 6-13, EMDF Cross-sections, Page 6-33</u> - This figure includes a dashed line described as "Model Predicted Post Construct Water Levels;" however, a reference to where this model data and output is available is not included. For clarity, provide a reference to these model calculations.

11. <u>Section 6.2.2.6.3, p. 6-37</u> - The first iteration of predicting the seasonal high water table, using data from other areas, seeps, springs et cetera did not indicate areas that could be below the water table that were documented by the Phase I characterization data from groundwater monitoring in the proposed landfill area. So, this being the case, how confident is the prediction of subsurface conditions that could be encountered in the EMDF landfill area based on subsurface data from other areas where there is more well/boring coverage? Section 6.2.2.6.4 indicates that the conceptual design for the EMDF is based on data from nearby areas. There needs to be a more comprehensive summarization here or elsewhere in the RI/FS regarding the specific data and locations that were considered.

    Are there any data suggesting Bear Creek baseflow downstream of the confluence of NT-3 with Bear Creek substantively differs from the value would be predicted by summing measured or inferred NT-3 baseflow in the downstream NT-3 reach and Bear Creek baseflow upstream of the NT-3 confluence. The concern is any possible discharge of underflow with a significant contribution from the NT-3 watershed into Bear Creek downstream of the confluence or notable loss of water from Bear Creek into the underlying aquifer at the point where NT-3 mixes with Bear Creek.

Since the EMDF disposal cells will be constructed in phases, the EMDF disposal option

should build into the conceptual design the idea that should monitoring indicate a problem with maintaining groundwater levels beneath the initial landfill cell(s) at a sufficient depth below the landfill, all future cells will be redesigned as needed to avoid this problem as later landfill cells are opened.

12. Section 6.2.4, p. 6-40 - The compacted clay liner needs to conform to the specifications of 40 CFR 264.301(c)(1)(i)(B). Appendix H Table H-1 indicates the clay would meet the minimum liner specifications required by this regulation. However considering the unfavorable aspects of the proposed EMDF location (overlying existing streams, springs and seeps, for example) it is recommended that the clay liner be designed to exceed the minimum specification with respect to at least the hydraulic conductivity.

13. Section 6.2.9, p. 6-44 - The basis for an assumed 100-year post closure period needs to be identified and some consideration of potential costs that would be associated with a longer life-cycle duration of post-closure monitoring should be included in the RI/FS for a fair cost comparison with the offsite proposal.

14. Section 7.2.2.3, Long-term Effectiveness and Permanence (On-Site), Page 7-9 - This section indicates that the geomembrane liner design life is at least 200 years; however, this section does not include a reference to data to support this assumption. Revise this section to provide a reference to information to support this 200 year design life.

15. Section 7.2.2.3, Long-term Effectiveness and Permanence (On-Site), Page 7-9 - This section states, "A more detailed and quantitative assessment of inadvertent intrusion scenarios and risks will be performed per DOE requirements to be completed prior to landfill construction;" however, it is not clear why this detailed risk assessment would need to be completed at a later stage of the project and could not be completed as part of the RI/FS. Revise this section to include this evaluation or provided a rationale for not including it as part of the RI/FS.

16. Appendix A - The appendix only presents waste characterization data for radionuclides. Explain why characterization data is not provided for chemicals.

17. Appendix A - Are there any soil properties criteria for soils that would be brought in to supplant contaminated soils used as landfill matrix material? Is there any benefit to using imported fill material that has defined chemical/textural properties as matrix to be landfilled with debris, versus maximizing the use of contaminated soil as fill? The contaminated soil might be less favorable as a matrix based on its intrinsic properties. Since there appears to be considerable understanding of radioactive materials present in areas that presumably will contribute to the EMDF waste stream (Appendix A, Table A-5), are there some of these

materials that are so highly contaminated that co-disposal with a soil of known texture and chemical properties would be a reasonable way to reduce the mobility or toxicity of that radioactive waste material?

18. Appendix B, Section 5.4.2.3, ROM Cost for Size Reduction Facility, p. B-29 - This section indicates that for a Rough Order of Magnitude (ROM) estimate type, a 35% contingency is added to capital costs to account for unanticipated cost items and resources; however, the basis for the 35% contingency is not provided and appears to be high. Revise this section to provide a basis for this contingency and, if necessary, revise the cost estimate using a more appropriate contingency.

19. Appendix B, Table B-10, Total Life-cycle Costs for Size Reduction Facility, p. B-29 - This table includes $21,131,000 in operating crew costs; however, it is not clear if this is a present value costs and how the present value was calculated (e.g., discount rate). Further, as the operating costs represent roughly 50% of the overall cost in Table B-10, it appears additional details are needed to support the basis for these costs to ensure they are appropriate. Revise this table, or appropriate sections of Appendix B to provide additional line item information on the operating costs of the Size Reduction Facility.

20. Appendix B, Table B-10, Total Life-cycle Costs for Size Reduction Facility, p. B-29 - This table includes 20% for project management costs; however, the basis for the 20% level is not provided and appears to be high. Revise this section to provide a basis for the project management costs and, if necessary, revise the cost estimate using a more appropriate percentage.

21. Appendix B and Section 5.2.4 - parts of Section 5.4.2.of Appendix B should include an evaluation of other possible benefits of size reduction such as lower potential risks associated with less number of trips to haul debris, reduced usage of fuel (a potential TBC with respect to Executive Order 13693), and other possible considerations in addition to reduced footprint size and implementability.

22. Appendix C, Table 5-1 - Regarding the treatment of mercury-contaminated debris (Table 5-1; Appendix C), the RI/FS should include consideration of a process option that results in encapsulation in the proximity of the disposal facility before actual land disposal. This option mostly avoids any implementability issue related to transportation of encapsulated wastes (see Table 5, Implementability column) while avoiding an ARAR issue with respect to the requirements of 40 CFR Part 268. This comment is relevant regardless of the location of an on-Site landfill.

23. Appendix E, Figure 1 - As EPA discussed in July 8 2015 meeting regarding Phase I characterization results, there are likely benefits to implementing a more robust, quantitative flow monitoring program at some or all of the locations where there is currently "observational monitoring" of flow (see Appendix E, Figure 1 for locations).

24. Appendix E, Table 2 - In a note at the bottom of the table, there is a statement about the open-hole deep wells not being developed because they were open-hole completions. Any

new well should be developed to, at the very least, remove any particulate matter than might have settled in the well after the well was drilled. If these wells are left as is, and used as long-term monitoring points, the wells need to be developed, or data should be provided showing why the wells do not need to be developed (documentation of well drilling technique without addition of drilling mud; no evidence of downward grout migration from the cased interval; evidence of sufficiently clear discharge water during routine well purging).

25. Appendix E, Section 2.3.3.2.1, Shallow Aquifer Zone, p. E-44 - This section indicates that well GW-977 was dry, but does not provide information on why the well was dry, of if this condition was expected. Revise this section to provide information on why well GW-977 was dry.

26. Appendix E, Section 2.4.2.2 - This section states that the lower reaches of NT-2 and NT-3 may either not be gaining streams during high baseflow conditions or may be losing streams. Some detail is needed regarding why these would be losing streams in these specific areas. Is it because of hydrologic conditions associated with high baseflow and unique to the lower reaches of the streams or is it because the streams are flowing over more permeable rocks.

27. Appendix E, Section 2.4.2.4 - The document discusses surface water contamination detected in NT-3 resulting from various sources to the east of NT-3. The proposed EMDF could conceivably be the source of contamination reaching NT-3 in the future. There should be some discussion in the RI/FS of how monitoring of NT-3 water quality will be able to distinguish potential releases from the EMDF and ongoing stream contamination from other identified potential sources.

28. Appendix E, Section 2.6.2.3 - Paragraph 2 states there has been no detailed assessment of stream quality in the footprint of the EMDF. There needs to be some assessment of NT3 upstream of the area affected by the BY/BY remedial actions, in the area more or less encompassing both of the lower reaches of the two principal NT3 tributaries (i.e. just upstream of the wetlands areas which are upstream of the culvert beneath the Haul Road (see Figure 1, Appendix E) as well as within the wetlands upstream of the tributaries. An assessment needs to be made of how construction and placement of the EMDF will affect these areas with respect to both the wetlands hydrologic function and biota in the wetlands and uncovered stream segments upstream of the haul road.

29. Appendix E, Section 4.1.7.2 - Paragraph 2 indicates that the open-hole bedrock wells could be tested further during Phase II characterization activities and redesigned. EPA recommends that all such wells be tested and that the final monitoring zone(s) for each well should be optimized to monitor the interval(s) where leakage from the landfill is most likely to be detected.

30. Appendix E, Section 7 - Discussion is needed regarding future predictive modeling of surface-water discharge under conditions of higher precipitation than that actually observed during any monitoring conducted prior to final EMDF design. There should be an ability to predict groundwater and surface-water flows across the EMDF area and surrounding

watersheds encompassing the EMDF for a minimum of a 24-hour, 25-year precipitation recurrence interval (this selected recurrence interval and time period for the determination is based on such regulatory language as is available and pertaining to RCRA (40 CFR 264.301(h)). An assessment of potential rainfall-runoff and rainfall-groundwater levels conditions should also be made for lower probability (less frequent probability of recurrence) 24-hour rainfall events, if technically possible.

31. Appendix E, Section 7 - An evaluation and discussion of the suitability of the existing precipitation monitoring station Y-12(W) for evaluation of the rainfall-runoff relationship in the NT3 subwatersheds is needed.

32. Appendix E, Section 7 - In further Phase 2 investigations, detailed evaluations are needed of the relationship between rainfall and hydrologic responses to precipitation (stream flow; groundwater levels) in the EMDF area. The evaluations need to be probabilistically assessed by confidence limits on water-level and stream flow response versus rainfall estimates, using a 90% confidence on the slope of any trend line. Consideration should be given to raw data transformation if there is a non-linear relationship between variables.

33. Appendix E, Section 7.1.2 - Appendix E Attachment A Section 7.1.2 includes some discussion either indicating or implying that some of the to-date observed rainfall-runoff relationships have measurement errors relating to design or placement of some of the NT-3 stream flow stations. Any issues with the design, maintenance or siting of the stream flow gaging stations need to be resolved so that a more accurate record of rainfall-runoff conditions is obtained.

34. Appendix E, Section 7.2.3.1 - Attachment A provides an assessment of the relationship between precipitation and water levels in existing wells in the proposed EMDF area. At both GW-968 (intermediate) and GW-969 (shallow) wells, water levels are above ground surface for at least part of the monitoring period. These wells are near the upgradient/upslope margins of the proposed landfill area. Based on Appendix E Attachment A Figure 27, the intermediate monitoring depth (bedrock) has a higher head than the shallow well. The tested upper part of the bedrock at GW-968 had a relatively high hydraulic conductivity (Plate 2). One must therefore be concerned about the potential for enhanced upward movement of groundwater from the bedrock resulting from landfill and drainage construction that disrupts the low hydraulic conductivity saprolite geologic materials near the top of rock (see Plate 1; slug test K of 7.65E-7 cm/s from GW-969). This possibility may need to be considered further in landfill design.

35. Appendix E, Attachment A, Figure 25, text on page E-26 - This and other portions of the RI/FS infer that bedrock structural features associated with the greatest degree of hydraulic conductivity may be present along and near the valley floors, rather than in hilltop or hill slope topographic settings. Phase I investigations in the EMDF area have focused all groundwater monitoring investigations at locations away from the valley floors. EPA is concerned that the existing Phase I data do not account for the most significant hydraulic conductivities applicable to the various bedrock units. This absence of data from any valley floor locations has some unknown effect on groundwater modeling and needs to be

accounted for in modeling, needs to be addressed in targeted data collection during Phase II investigations and needs to be factored into the landfill and drainage design.

36. Appendix G, p. G-6 - DOE ORR has requested two waivers listed under 1 and 2:
    a. EPA does not believe that the CERCLA waiver (listed as 1) of the TSCA requirement specified is necessary or appropriate (See Specific Comment 38.a below).
    b. The basis that DOE ORR provided for a CERCLA waiver (listed as 2) from the ARAR prohibiting placement of untreated waste in a land disposal unit is inappropriate (See Specific Comment 38.b below).

37. Appendix G, Section 3, ps. G-7 through G-9 - While DOE ORR's description in this section of DOE Orders vis a vis NRC regulations may be accurate in the sense of distinguishing between DOE operations and the operations of commercially licensed nuclear facilities, DOE ORR's analysis and assertion that these distinctions apply to CERCLA and remediation under CERCLA is inappropriate, and this section should be removed.

    In conflict with DOE ORR analysis, there is nothing in the EPA *CERCLA Compliance with Other Laws Manual* that would suggest that the state NRC rule as promulgated requirement could not be considered relevant and appropriate or that any non-promulgated Federal or State advisories or guidance, such as DOE Orders, would be exempt from consideration as a TBC. Please note that EPA does not agree with DOE ORR's interpretation of its rule and advises DOE ORR that nothing in the NCP preamble would preclude the TDEC rule from being considered a relevant and appropriate requirement. Whether the rules may be relevant and appropriate is determined by looking at the rule itself. To the degree that TDEC regulations assist in designing a safe radiological waste disposal unit, they can be identified as relevant and appropriate requirements.

    TBCs are used in determining the level of cleanup or how to achieve protectiveness for CERCLA response actions if no ARARs address a particular situation or if existing ARARs do not ensure protectiveness. So, where an NRC regulation is identified as both relevant and appropriate for determining the level of cleanup or how to achieve protectiveness, use of the DOE Order may not be useful or necessary. While not all parts of DOE Orders are necessarily TBCs, parts of guidance or advisories that help determine protectiveness of a remedy, those parts can be identified as a TBC. Please include portions of the DOE Orders (see the specific comment on the ARARs table) for those parts of DOE Order 435.1 and 458.1 that should be included as TBCs.

    Alternatively, clarify why DOE ORR has used DOE Orders (and NRC rules) in other RODs and why this position has changed.

38. Appendix G, p. G-9 - This section describes two requested ARAR waivers:
    a. EPA does not believe that the CERCLA waiver of the TSCA requirement specified is necessary or appropriate. TSCA itself provides the basis of a waiver at 40 CFR § 761.75(c)(4), which states that the EPA Administrator may waive one or more requirements in 40 CFR §761.75(b) when evidence is submitted to the Administrator that "operation of the landfill will not present an unreasonable risk of injury to health

or the environment from PCBs" when those requirements are not met. Since the text here attempts to demonstrate "equivalent protectiveness," please revise this to demonstrate that the landfill will not present an unreasonable risk of injury to health or the environment from release of TSCA substances (e.g., PCBs).

b. The basis that DOE ORR provided for a CERCLA waiver from the ARAR prohibiting placement of untreated waste in a land disposal unit is inappropriate. DOE ORR asserts that the "interim" nature of the action justifies the waiver. This remedial action is not an "interim" action as described in *A Guide to Preparing Superfund Proposed Plans, Records of Decision and Other Remedy Selection Decision Documents*, EPA OSWER 9200.1-23P, July 1999. As noted in 40 CFR 264.552(a)(4), placement of CAMU eligible waste into or within a CAMU does not constitute land disposal of hazardous wastes. EPA notes that the Paducah Gaseous Diffusion Plant is considering an option of designating a portion of the waste disposal unit as a corrective action management unit (CAMU) under regulations at 40 CFR §264.552 and recommends further discussion and development of this as part of an Alternative during resolution of EPA comments.

39. Appendix G, Section 7.4, p. G-15 - Remove "At the request of TDEC and EPA" from the second paragraph, first sentence. It was a consensus decision, and not clear who first requested this path forward.

40. Appendix G ARAR Tables - Remove the fifth column and utilize the format for ARARs tables as shown in EPA guidance, *CERCLA Compliance with Other Laws Manual.* To the degree there are notes that refine or clarify the requirements, those descriptions should be inserted beneath the specific requirement and preceded by the word *"Note:"*.

41. Appendix G, Table G-3, p. G-30 - EPA does not believe that the CERCLA waiver of the TSCA requirement specified is necessary (See comment 38.a above).

    In addition, revise this citation by dividing the "Requirements" into two rows, which will place in one row the requirements that will be met (i.e., "The site shall have monitoring wells and leachate collection."), and those (i.e., the remaining requirements noted in this row) for which a TSCA waiver under 40 CFR §761.75(c) is being requested.

42. Appendix G, Table G-6, p. G-43 - In the first row, the "Tailoring of Requirement" column indicates that a waiver is being requested (See comment 38.b above).

43. Appendix G, Table G-6, ps. G-42 and -43 - Clarify whether this reference in the "Tailoring of Requirement" column to IWM FFS is intended to be a "tailoring" of the requirement, or if it is merely a reference to the FFS.

44. Appendix G, Table G-7, p. G-44 - See comment 38.b regarding the third row - "Macroencapsulation Treatment Standard" Action Characteristic.

45. Appendix G, Table G-7, p. G-48 - In the second row, clarify the note "Combined" in the "Tailoring of Requirement" column.

46. Appendix G, Table G-7, p. G-48 - In the bottom row, please clarify whether the comment beginning with "Free liquid" in the "Tailoring of Requirement" column indicates tailoring of the requirement. It appears that this text is superfluous and could be deleted.

47. Appendix G, Table G-7, ps. G-49 and -50 - Clarify whether the reference in the "Tailoring of Requirement" column to IWM FFS is intended to be a "tailoring" of the requirement, or if it is merely a reference to the FFS.

48. Appendix G, Table G-7, ps. G-56 and -57 - Remove the row associated with citation 40 CFR 264.90(f)(2). The Administrator has not been requested and is not considering developing alternative requirements for groundwater monitoring. Further, this flexibility is available only when (f)(1)(and (f)(2) have been demonstrated. If the flexibility of (f)(1) is later demonstrated, it can be addressed at that time.

49. Appendix G, Table G-7, p. G-57 - In the last row, last column, revise this text by deleting "an alternative to" and replace with "a refinement of."

50. Appendix G, Table G-7, p. G-58 - In the first row, last column, add, "no less protective, and is intended to be" before "more."

51. Appendix G, Table G-7, p. G-59 - In the first row, please strike the second sentence in the "Tailoring of Requirements" column. While the location of the EMDF within the "brownfield region" of Bear Creek Valley may or may not be a relevant factor in re-evaluating the point of compliance, this rather hypothetical statement tends to indicate agreement where there is none that this location status may impact the point of compliance.

52. Appendix G, Table G-7, p. G-64 - In the second row, last column, replace, "is replaced with" with "will be refined by." Change the reference in the note to §264.93.

53. Appendix G, Table G-7, p. G-65 - In the first row, last column, please delete the last sentence, and replace with "A ROD modification or other documentation consistent with EPA ROD Guidance and the FFA will be prepared."

54. Appendix G, Table G-7, p. G-66 - In the second row, last column, please change "substituted for" with "developed from."

55. Appendix G Tables - Include the following citations as TBCs, in appropriate sections of the tables. The table below is not presented in the same column order as in the RI/FS, so some re-arrangement will be necessary in order to include.

Location	Prerequisite	Summary of Requirements	Citation
Siting of LLW disposal facility	Construction of a LLW disposal facility—TBC.	Proposed locations for low-level waste facilities shall be evaluated considering environmental characteristics, geotechnical characteristics, and human activities including whether it is located in a floodplain, a tectonically active area, or in the zone of water table fluctuation.	DOE M 435.1 1(IV)(M)(3)(a)(2)
		Proposed locations with environmental characteristics, geotechnical characteristics, and human activities for which adequate protection cannot be provided through facility design shall be deemed unsuitable for the location of the facility.	DOE M 435.1-1(IV)(M)(3)(b)

Action	Prerequisite	Summary of Requirements	Citation
Characterization of LLW associated with landfill operations	Generation of LLW for disposal at a DOE facility—TBC.	Shall be characterized using direct or indirect methods and the characterization documented in sufficient detail to ensure safe management and compliance with the waste acceptance	DOE M 435.1-1 (IV)(I)

		criteria of the receiving facility.	
Characterization of LLW associated with landfill operations	Generation of LLW for disposal at a DOE facility—**TBC.**	Characterization data shall, at a minimum, include the following information relevant to the management of the waste: • physical and chemical characteristics; • volume, including the waste and any stabilization or absorbent media; • weight of the container and contents; • identities, activities, and concentration of major radionuclides; • characterization date; • generating source; and • any other information that may be needed to prepare and maintain the disposal facility performance assessment, or demonstrate compliance with the performance objectives contained in DOE O 435.1.	DOE M 435.1-1(IV)(I)(2)(a)-(g)
Staging of LLW	Staging of LLW at a DOE facility—**TBC.**	Shall be for the purpose of the accumulation of such quantities of wastes necessary to	DOE M 435.1-1 (IV)(N)(7)

		facilitate transportation, treatment, and disposal.	
Packaging of LLW	Storage of LLW in containers at a DOE facility—**TBC.**	Vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container.	DOE M 435.1-1 (IV)(L)(1)(b)
Treatment of LLW	Treatment of LLW for disposal at a DOE LLW disposal facility—**TBC.**	Treatment to provide more stable waste forms and to improve the long-term performance of a LLW disposal facility shall be implemented as necessary to meet the performance objectives of the disposal facility.	DOE M 435.1-1(IV)(O)
Treatment of uranium- and thorium-bearing LLW	Placement of potentially biodegradable contaminated waste in a long-term management facility—**TBC.**	Such wastes shall be properly conditioned so that the generation and escape of biogenic gases will not cause exceedance of RN-222 emission limits of DOE O 458.1(4)(h)(1)(d)(3) and will not result in premature structure failure of the facility.	DOE O 458.1(4)(h)(1)(d)(3)
Criteria for discharge of wastewater with radionuclides into surface water	Discharge of radioactive concentrations in sediments to surface water from a DOE facility—**TBC.**	Conduct activities to ensure that liquid discharges containing radionuclides from DOE activities do not exceed an annual average (at the point of discharge) of either of the following: (a) 5 pCi (0.2 Bq) per gram above background of settleable solids for alpha-emitting radionuclides. (b) 50 pCi (2 Bq) per gram above background of settleable solids for beta-emitting radionuclides.	DOE O 458.1(4)(g)(4)

LLW disposal operations	Operation of a LLW disposal facility at a DOE site—**TBC.**	Permanent identification marks for disposal excavations and monitoring wells shall be emplaced.	DOE M 435.1-1 (IV)(P)(6)(b)
		Waste placement into disposal units shall minimize voids between containers with the voids filled to the extent practicable. Uncontainerized bulk waste shall be placed to minimize voids and subsidence.	DOE M 435.1-1 (IV)(P)(6)(c)
		Operations shall be conducted so that disposal operations do not have adverse effects on other disposal units.	DOE M 435.1-1 (IV)(P)(6)(d)
		Void spaces within the waste and, if containers are used, between the waste and its container shall be reduced to the extent practical.	DOE M 435.1-1 (IV)(G)(1)(d)(1)
Monitoring of LLW disposal facility	Operation of a LLW disposal facility at a DOE site—**TBC.**	The environmental monitoring program shall be designed to include measuring and evaluating releases, migration of radionuclides, disposal unit subsidence, and changes in disposal facility and disposal site parameters which may affect long-term performance.	DOE M. 435.1-1 (IV)(R)(3)(b)
Closure			

Long-term management of uranium, thorium, and their decay products—**TBC**.	Control and stabilization features shall be designed to (1) provide to the extent reasonably achievable an effective life of 1,000 years with a minimum of at least 200 years; (2) limit Rn-222 emanation to the atmosphere from the wastes to less than an annual average release rate of 20 pCi/m2/s and prevent increase in the annual average Rn-222 concentration at or above any location outside the boundary of the contaminated area by more than 0.5 pCi/L.	DOE O 458.1(4)(h)(1)(d)(1)	
Release of property with residual radioactive material to an off-site commercial facility	Generation of DOE materials and equipment with residual radioactive material—**TBC**.	Residual Radioactive Material. Property potentially containing residual radioactive material must not be cleared from DOE control unless either (a) The property is demonstrated not to contain residual radioactive material based on process and historical knowledge, radiological monitoring or surveys, or a combination of these; or (b) The property is evaluated and appropriately monitored or surveyed to determine: 1. The types and quantities of residual radioactive material within the property; 2. The quantities of removable and total residual radioactive material on property surfaces (including residual radioactive material present on and under any coating);	DOE Order 458.1(4)(k)(3)

		3. That for property with potentially contaminated surfaces that are difficult to access for radiological monitoring or surveys, an evaluation of residual radioactive material on such surfaces is performed which is (a) Based on process and historical knowledge meeting the requirements of paragraph 4.k.(5) of this Order and monitoring and or surveys, to the extent feasible; (b) Sufficient to demonstrate that applicable specific or pre-approved DOE Authorized Limits will not be exceeded; and 4. That any residual radioactive material within or on the property is in compliance with applicable specific or pre-approved DOE Authorized Limits.	
Transportation of LLW	Preparation of shipments of LLW—TBC.	To the extent practicable, the volume of the waste and the number of the shipments shall be minimized.	DOE M 435.1-1(IV)(L)(2)
Transportation of hazardous materials on-site	Any person who, under contract with the DOE, transports a hazardous material on the DOE facility—TBC.	Shall comply with 49 *CFR* Parts 171-174, 177, and 178 or the site- or facility-specific Operations of Field Office approved Transportation Safety Document that describes	DOE O 460.1B(4)(b)

		the methodology and compliance process to meet equivalent safety for any deviation from the Hazardous material Regulations (i.e., *Transportation Safety Document for On-Site Transport within the Paducah Gaseous Diffusion Plant*, PAD-WD-0661).	
Transportation of hazardous materials off-site	Preparation of off-site transfers of LLW—TBC.	Off-site hazardous materials packaging and transfers shall comply with 49 *CFR* Parts 171-174, 177, and 178 and applicable tribal, State, and local regulations not otherwise preempted by DOT and special requirements for Radioactive Material Packaging.	DOE O 460.1B(4)(a)

56. Appendix H, Section 4.1.1, Site-specific HELP Model Development, ps. H-24 and H-25, Section 4.1.2, HELP Model Assumptions, p. H-25 and H-26 - The basis for the assumption that the underdrain system will function sufficiently well as designed to divert upwelling groundwater and the functional lifespan of this system are unclear. If this assumption is overly optimistic or the underdrain system fails to function after a period of time, groundwater infiltration will occur from beneath the liner system, which was not considered in the HELP model. To be conservative, failure of the underdrain system should be considered. Revise the HELP model to consider failure of the underdrain system.

57. Appendix H - There are numerous issues with the groundwater modeling documented in this appendix that include the following:
    a. As noted in Specific Comment 35, there is a lack of site-specific hydraulic data for areas of most probable facture concentration in the valley floor hydrogeologic settings that would be below or downgradient of the proposed EMDF landfill.
    b. There is an arbitrary, speculative design of the assumed water-supply well used by the

hypothetical receptor. A worst-case scenario should be applied for this receptor (well open hole or screened in shallower or deeper saturated materials (whichever is more conservative); accounting for a potentially smaller length of open hole or well screen (a potentially lower available drawdown from the well).

c. The selected exposure point for risk evaluation may be too far from the landfill margin (probably placing the well completion in the karstic Maynardville Limestone, with both the potential for substantive dilution of any plume from the landfill release and the potential for additional contribution to risk from other groundwater contaminant sources in Bear Creek Valley). Additive risk from other potential contamination in the bedrock is not addressed in the analysis, but if the receptor well is in areas where other contaminant sources may contribute to overall risk from groundwater exposure, it must be considered.
d. There is an absence of consideration of groundwater ARARs in the analysis, which would need to be met at the downgradient margin of the landfill, independent of any potential consideration of risk from exposure to landfill-contaminated groundwater or surface water.
e. There is a logical disconnect between DOE maintaining long-term control on potential exposure to groundwater in the Zone 3 designated industrial use area and DOE being unable to prevent the landfill cap from deteriorating over time. While failure of the underling multicomponent liner is possible and is less likely to be countered with corrective actions, if there is a presumptive maintenance of DOE authority (or some sort of authority) over land usage in the Zone 3 area over the course of the period evaluated in the modeling, then there is presumptively some ability of that authority to counteract landfill cover failure as well. If the landfill cover is projected to fail (even as an improbable, worst-case scenario), then an inability of any authority to maintain land-use controls should also be assumed. The fact that the hypothetical well is placed inside the Zone 3 area appears to be acknowledgement that maintenance of land-use controls in the area is not a given for the long term. Under this future scenario, there is no logical basis for not assuming the hypothetical well is located closer to the landfill than the modeling now assumes.
f. There is no documentation for the source(s) of the recharge values applied to the groundwater flow model.
g. Some of the hydraulic conductivity values presented in Table H-3 (model layers 1-3; Pumpkin Valley shale; Rogersville shale; Rutledge limestone) are inconsistent with field-reported hydraulic conductivity values from site-specific Phase I slug tests. Tabulated values are at least an order of magnitude higher than field-measured values.
h. Section 4.2.1.4 of Appendix H, paragraph 2 states that new groundwater monitoring wells installed during Phase I characterization have been used in UBCV model calibration and well head values were in generally agreement with the model-predicted values. There is no indication of what those values are (modeled heads versus observed heads), nor what observed water levels (water levels from a specific date; average water levels for a specific time period) were used in the calibration. The calibration needs to be fully documented in the RI/FS. Comment 29k provides further discussion regarding the model calibration.
i. There is no indication of the conductance values assigned to drain boundary cells.

The information needs to be included in the RI/FS.

j. Drainage features (underdrains) will be added as a part of the EMDF design are included in the modeling. There is a potential for substantive modifications to the design of these features depending on the results of Phase 2 investigations of the EMDF area. The modeling needs to incorporate a sensitivity analysis to account for potential modifications to the underdrain design, long-term degradation or clogging of the underdrain, and finally no underdrain.

k. For groundwater calibration, there should be acceptable calibration statistics demonstrating reasonable agreement between observed and model-predicted heads and no obvious consistent bias in model results (consistent over or under-prediction of observed water levels). The predicted versus observed water levels specific to the Phase 1 wells need to be graphically presented. Calibration statistics need to be presented in the RI/FS.

l. It is unclear from Section 4.2.1.4 paragraph 3 what the water balance represents. The text refers to the "model predicted ground water discharge above the Bear Creek/NT-3 junction." Whatever this value represents, it is being compared to the "...average flow rate at the junction location..." which is identified in Section 2.4.3.1 of Appendix E as the average daily flow at Bear Creek Kilometer 11.54, just downstream of the confluence of NT-3 with Bear Creek." The complete water balance needs to be included in the RI/FS, fully documenting each element of inflow and outflow.

m. The third paragraph of Section 4.2.1.4 refers to sensitivity analyses. The sensitivity analyses need to be fully documented in the document.

58. Appendix H, Section 4.2.1.1, UBCV Model Domain and Discretization, p. H-31 - The text does not discuss whether model layers 4 through 11 correspond to specific lithologic units in the EMDF. Further, it is unclear if there are sufficient monitoring wells screened in each layer to validate the model. Revise the text to discuss how model layers correspond to lithologic units, and specify the number of monitoring wells screened in each layer. If there are insufficient wells in each layer to validate the model, explain why model validation is unnecessary.

59. Appendix H, Table H-3, UBCV Groundwater Model Parameter Summary (Future Conditions), p. H-39 and H-40 - Since the hydraulic conductivity values are the same for each unit in Layers 4-8, it is unclear why separate layers are necessary as it appears that the same result would be obtained if a single layer was used. Revise the text to explain why separate layers are necessary for Layers 4-8, including whether there are any parameters that vary between these layers.

60. Appendix H, On-Site Disposal Facility Preliminary Waste Acceptance Criteria, Section 4.2.1.4, Model Calibration, Page H-41 - The text states that the "water balance shows that essentially all water has been mathematically accounted for," but a table with the water balance details for each model layer is not included. Revise Appendix H to include a table that provides the water balance details for each model layer.

61. Appendix H, Section 4.3.2, p. H-48 - The receptor well pumping rate of 240 gallons per day

is an arbitrary value, although reasonable, given the presumed number of groundwater users. Somewhat higher and lower pumping rates should be considered, to determine if there is any reasonable usage scenario where a larger relative contaminant concentration could be observed at a receptor.

62. Appendix H, Section 4.3.3, p. H-48 - Referring to the groundwater contaminant transport modeling, the last sentence in the first paragraph states most of the shallow plume discharges into surface water features. Has this mass been quantified for steady state conditions, assigned contaminant-specific concentrations for critical surface water locations, and the concentrations compared to any AWQC criteria that would be applicable to Bear Creek or NT3? Reviewing Table H-5 and Section 4.4.3, it appears that all of the presumptively contaminated water leaking out of the landfill is mixed with the assumed surface water flow at the hypothetical surface water receptor location to reach an assumed surface water concentration. If this is the case, the simplified process ignores several actual or potential factors in the leachate to surface water contamination mass transport process, including: (a) mixing of leachate with groundwater; (b) partial discharge of leachate contaminated groundwater into the surface water at the presumed receptor location and partial discharge of the contaminated groundwater into other surface water locations downstream of the presumed receptor location (underflow contaminant transport), and (c) potential presence of additional upstream sources of groundwater contamination that contribute contaminant mass to the surface water at the presumed receptor location.

63. Appendix H, Figure H-19 - The figure shows that the highest relative contaminant concentration is anticipated to be observed in model layer 6, followed by model layer 7. Model layers 5 through 8 are identified as the layers intercepted by the hypothetical receptor well. Is the higher relative concentration in model layers 6 and 7 related solely to the presumed well construction? If so, well design should be factored into a sensitivity analysis, specifically determining if a shorter production interval has any effect on observed relative concentration.

64. Appendix H, Table H-5, Parameters for Use in PATHRAE Modeling and PreWAC Calculations, p. H-59 - The text should discuss the basis for each assumed value and provide references for all other values. Revise the text and Table H-5 to provide the basis for each assumed value and to provide references for the other values.

65. Appendix H, Section 4.4.3, PATHRAE Model Results, p. H-60 and Section 4.4.3.2, PATHRAE-HAZ Results, p. H-62 - A fracture-based flow system should be considered for calculation of the groundwater well dilution factor (DF_{well}). At a minimum, a range of values that include referential transport in fractures that facilitate transport of contaminants to the creek and residential well should be provided. Revise Appendix H to include one or more DF_{well} values that accounts for facilitated contaminant transport in fractures in the PATHRAE and PATHRAE-HAZ model runs.

66. Appendix I, Table I-3, Summary of EMDF Conceptual Design Cost Estimate, p. I-16 -The Perpetual Care Fee element in this table includes a notation; however a footnote is not provided with the table. Revise Table I-3 to include this footnote.

Derived Concentrations (pCi/l) of Beta and Photon Emitters in Drinking Water

Yielding a Dose of 4 mrem/yr to the Total Body or to any Critical Organ as defined in NBS Handbook 69

Nuclide	pCi/l	Nuclide	pCi/l	Nuclide	pCi/l	Nuclide	pCi/l	Nuclide	pCi/l	Nuclide	pCi/l
H-3	20,000	Ni-65	300	Nb-95	300	Sb-124	60	Nd-147	200	Os-191	600
Be-7	6,000	Cu-64	900	Nb-97	3,000	Sb-125	300	Nd-149	900	Os-191m	9,000
C-14	2,000	Zn-65	300	Mo-99	600	Te-125m	600	Pm-147	600	Os-193	200
F-18	2,000	Zn-69	6,000	Tc-96	300	Te-127	900	Pm-149	100	Ir-190	600
Na-22	400	Zn-69m	200	Tc-96m	30,000	Te-127m	200	Sm-151	1,000	Ir-192	100
Na-24	600	Ga-72	100	Tc-97	6,000	Te-129	2,000	Sm-153	200	Ir-194	90
Si-31	3,000	Ge-71	6,000	Tc-97m	1,000	Te-129m	90	Eu-152	200	Pt-191	300
P-32	30	As-73	1,000	Tc-99	900	Te-131m	200	Eu-154	60	Pt-193	3,000
S-35 inorg	500	As-74	100	Tc-99m	20,000	Te-132	90	Eu-155	600	Pt-193m	3,000
Cl-36	700	As-76	60	Ru-97	1,000	I-126	3	Gd-153	600	Pt-197	300
Cl-38	1,000	As-77	200	Ru-103	200	I-129	1	Gd-159	200	Pt-197m	3,000
K-42	900	Se-75	900	Ru-105	200	I-131	3	Tb-160	100	Au-196	600
Ca-45	10	Br-82	100	Ru-106	30	I-132	90	Dy-165	1,000	Au-198	100
Ca-47	80	Rb-86	600	Rh-103m	30,000	I-133	10	Dy-166	100	Au-199	600
Sc-46	100	Rb-87	300	Rh-105	300	I-134	100	Ho-166	90	Hg-197	900
Sc-47	300	Sr-85 m	20,000	Pd-103	900	I-135	30	Er-169	300	Hg-197m	600
Sc-48	80	Sr-85	900	Pd-109	300	Cs-131	20,000	Er-171	300	Hg-203	60
V-48	90	Sr-89	20	Ag-105	300	Cs-134	80	Tm-170	100	Tl-200	1,000
Cr-51	6,000	Sr-90	8	Ag-110m	90	Cs-134m	20,000	Tm-171	1,000	Tl-201	900
Mn-52	90	Sr-91	200	Ag-111	100	Cs-135	900	Yb-175	300	Tl-202	300
Mn-54	300	Sr-92	200	Cd-109	600	Cs-136	800	Lu-177	300	Tl-204	300
Mn-56	300	Y-90	60	Cd-115	90	Cs-137	200	Hf-181	200	Pb-203	1,000
Fe-55	2,000	Y-91	90	Cd-115m	90	Ba-131	600	Ta-182	100	Bi-206	100
Fe-59	200	Y-91m	9,000	In-113m	3,000	Ba-140	90	W-181	1,000	Bi-207	200
Co-57	1,000	Y-92	200	In-114m	60	La-140	60	W-185	300	Pa-230	600
Co-58	300	Y-93	90	In-115	300	Ce-141	300	W-187	200	Pa-233	300
Co-58m	9000	Zr-93	2,000	In-115m	1,000	Ce-143	100	Re-186	300	Np-239	300
Co-60	100	Zr-95	200	Sn-113	300	Ce-144	30	Re-187	9,000	Pu-241	300
Ni-59	300	Zr-97	60	Sn-125	60	Pr-142	90	Re-188	200	Bk-249	2,000
Ni-63	50	Nb-93m	1,000	Sb-122	90	Pr-143	100	Os-185	200		