



STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Division of Remediation - Oak Ridge
761 Emory Valley Road
Oak Ridge, Tennessee 37830

June 4, 2025

Mr. Roger Petrie
Oak Ridge Office of Environmental Management
U.S. Department of Energy
Post Office Box 2001
Oak Ridge, Tennessee 37831

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COUNTY MAYOR'S OFFICE

Dear Mr. Petrie

TDEC Letter for the Remedial Investigation Work Plan for Bear Creek Valley Burial Ground, Oak Ridge Reservation, Oak Ridge, Tennessee (DOE/OR/01-2999&D1)

The Tennessee Department of Environment and Conservation (TDEC), Division of Remediation-Oak Ridge Office, received the above referenced Remedial Investigation Work Plan (RIWP) for the Bear Creek Burial Ground (BCBG) on March 11, 2025. The document has been reviewed pursuant to the Federal Facility Agreement for the Oak Ridge Reservation. TDEC provides the following comments and requests the U.S. Department of Energy (DOE) schedule a meeting to discuss prior to submission of a draft D2:

General Comments

- 1) The Remedial Action Objectives (RAOs) for this project as defined throughout the work plan and Data Quality Objectives (DQO) include general statements describing the characterization of source material and the goal of achieving a "final ROD for the BCBG and associated source media." It is unclear from the RIWP language if DOE is expecting to reach a final decision on shallow groundwater as part of this effort.
 - a. According to the U.S. Environmental Protection Agency (EPA) guidance, Non-Aqueous Phase Liquid (NAPL) in fractured bedrock constitutes both a "source material" and a "principal threat waste". Considering the scope of this project excludes deep groundwater and sources of groundwater contamination likely below the top of bedrock, DOE will be unable to achieve a final Record of Decision (ROD) encompassing all source media.
 - b. Provided that vertical hydraulic gradients in the area are upward and that shallow and deep groundwater are inherently interconnected, shallow groundwater will be impacted by deep groundwater sources (e.g., evidence of NAPL in the bedrock south of A-South). Without including deep groundwater characterization, no final decisions will be able to be made regarding shallow

groundwater as vertical gradients will continue to transport contaminated groundwater upward.

If DOE plans to pursue a final decision on shallow groundwater as part of this project, please revise the scope of the characterization for this project to include characterization of deep groundwater to support a final decision and achieve the RAOs outlined in the DQO. If DOE doesn't plan to pursue a final decision on shallow groundwater as part of this effort, please revise the language in the work plan to clarify that shallow groundwater will be evaluated only to help characterize what may be leaching from source areas and that the final decision for all groundwater will be deferred to the future Bear Creek Valley groundwater ROD. TDEC recommends that DOE include an evaluation of groundwater in its entirety as part of this effort.

- 2) Considering that the intent of this ROD project specifically excludes some media (e.g., waste and deep groundwater), the "Final ROD" referenced throughout the document will not encompass all media. Please add clarifying language explaining what media this "Final ROD" will be intended to cover and where the "Final ROD" is referenced throughout the document, title that ROD appropriately to clarify what media will be addressed (e.g., Final ROD for Soils and Surface Water at BCBG).
- 3) The Conceptual Site Model for the BCBG (Section 4) should include information from the 2014 Groundwater Strategy (DOE/OR/01-2628/V12&D2) which identifies three groundwater plumes associated with the BCBG: BCV-4, BCV-5, and BCV-6. These groundwater plumes include both shallow and deep chemical and radiological contamination. Please revise the CSM to include a discussion of these three plumes and their data gaps and throughout the document, reference how characterization efforts will address these data gaps.
- 4) The work proposed in this RIWP needs to include the collection of all data necessary for a complete evaluation of remedial alternatives in the Feasibility Study (FS). Considering that multiple (5 out of 7) potential remedial alternatives identified in Section 5 include leachate collection trenches, interception trenches, and/or hydrologic isolation, this RI effort should include some proposed scope of work directed at evaluating the feasibility of implementing these actions (i.e., geotechnical efforts) and collection of hydraulic parameters to support any future groundwater modeling efforts. Is DOE confident that this RIWP collects the necessary data to evaluate remedial alternatives in the FS, or do they anticipate another phase of data collection?
- 5) Several non-intrusive methods exist that could help define vertical extents of buried wastes and soil disturbances or be used to verify depths estimated from a process knowledge review. Understanding the vertical extent of the waste trenches/pits is key to evaluating bathtubbing, sources to groundwater, and how much waste exists below the water table. Reducing the uncertainty in the depths of waste trenches should be a goal of this RI beyond a basic reassessment of process knowledge, please add language explaining how non-intrusive technologies were evaluated and/or ruled out for use around the BCBG.
- 6) Considering that the Environmental Management Disposal Facility (EMDF) Natural Resources Assessment conducted in 2017-2018 was not able to successfully document several species identified by subsequent, more intensive surveys by DOE (i.e., Four-toed

salamander) and NEON (i.e., Southern Short-tailed shrew, Southern Red-backed salamander, Blue Ridge Two-lined salamander), it appears the level of effort allocated to the EMDF assessment was likely not sufficient to definitively state that T&E species are not present. TDEC encourages DOE to conduct surveys with sufficient survey effort to support the development of the Feasibility Study, based on species accumulation curves, species effort curves, or similar, and considering best methods based on species with a potential to be present (including threatened, endangered, in need of management, or other rare species).

Specific Comments

- 1) **Section 1.4, Pages 1-7 - 1-8** - Please define what BCBG source media is intended to be addressed. The language in this section needs to clearly define what media is included in this RIWP scope so that the intent to omit evaluating all groundwater as an objective of this project is clearly stated upfront. For example, if groundwater and buried waste is not intended to be addressed in this scope, state as such.
- 2) **Section 1.5.2, Page 1-9** - The language in this section indicates that the characterization scope is designed to avoid characterizing areas where groundwater is impacted by leachate. Characterizing areas where leachate has the potential to impact the surrounding media is critical for the evaluation of remedial alternatives in the Feasibility Study. Please revise the language here to clarify the characterization efforts in these areas will not be minimized.
- 3) **Section 1.6, Page 1-12, First Bullet** - The RIWP as written will not address all remaining data gaps because it does not include investigation of the nature and extent of buried waste or all groundwater. Please revise this bullet to clearly identify what data gaps this RIWP may fill and what data gaps will likely remain.
- 4) **Section 2.2.4** - Please add summary tables in this section showing historical leachate sample results from both the NT-7 and NT-8 leachate collection systems.
- 5) **Section 3.7.2, Third Paragraph** - This paragraph states that the hydraulic conditions limit the development of "extensive contaminant plumes at BCBG." Please revise this language to discuss the uncertainty respect to the extent of groundwater contamination.
- 6) **Section 3.7.3, Table 3.3**
 - a. This table appears to completely omit radionuclide results from the PFI sampling. Please revise to include the radionuclide results discussed in Section 3.7.3.2 and their associated MCL and/or PRGs.
 - b. EPA's generic RSL table has a screening level for lead in tap water as 10 ug/L, please correct the table to show the correct RSL for lead.
 - c. Please include a reference to the Tennessee groundwater quality criteria TDEC 0400-40-03 in the table footnotes.
- 7) **Section 3.7.3.3, Page 3-20** - The TN state general use groundwater quality criteria for lead is 0.005 mg/L. This numerical criterion is correctly documented in Table 3.3 but incorrectly stated in this section 0.015 mg/L. Please revise to be 0.005 mg/L and confirm that the summary statistic in Table 3.3 is correct.

8) **Section 3.8.2, Table 3.5**

- a. Chloride is shown to have a TN Fish CCC of $2.30\text{E}+05$ ug/L. The State of Tennessee does not have chloride values listed for Fish CCC in 0400-40-03. Please remove from the table.
- b. Please update the table footnotes to reflect MCL values derived from TDEC Rule 0400-40-.03 (i.e., nickel and lead).

9) **Section 3.8.2, Table 3.6**

- a. Please check the HH SSL for arsenic. The EPA generic tables list the risk-based SSL as 0.0015 mg/kg.
- b. Please check the MCL SSL for lead. The EPA generic tables list the MCL-based SSL as 9 mg/kg.

10) **Section 3.9, Table 3.7** – The table should be updated to reflect the most recent changes to the State-listed species, updated in December 2024. For example, while the Southeastern Shrew is no longer listed by the State, the Long-tailed Shrew and the Meadow Jumping Mouse are listed “in need of management” but are not included in this table. The Eastern Small-footed bat is now also listed “in need of management” by the State but is not listed in this table. There are also 3 additional bird species currently listed “in need of management” (Chimney Swift, Brown-headed Nuthatch, and Eastern Whip-poor-will), all 3 of which have been documented in or adjacent to Bear Creek Valley in recent years through avian point count surveys conducted by the independent NEON ecological organization. These are only a few examples of mismatches between the outdated list in Table 3.7 and the most recent updates to the State-listed species; please revise the table to address all missing species.11) **Section 3.9, Page 3-31, First Paragraph** – Previous investigations to identify threatened, endangered, or other sensitive species in the Bear Creek Watershed have documented more species than the presence of the Indiana bat, Gray bat, and Northern long-eared bat. Studies conducted by both TDEC and DOE/ORNL have also documented the Little Brown bat, Tricolored bat, and Eastern small-footed bat, all of which are State-listed as of the December 2024 update to the State-listed species. The Tricolored bat is also proposed to be listed endangered at the federal level. Please update the text accordingly for a complete assessment of sensitive species.12) **Section 3.9, Page 3-31, Second Paragraph** – The EMDF Natural Resource Assessment conducted in 2017-2018 did not originally document presence of the Four-toed salamander, which remains listed by the State as “in need of management.” However, additional site surveys to support the Early Site Prep work for EMDF did subsequently identify this species at the site. In fact, the RDR/RAWP for Early Site Preparation for EMDF documented some of the largest populations of this species on the ORR within Bear Creek Valley. Additional site surveys within BCV have more recently documented additional populations of the Four-toed salamander away from the EMDF site. Please update the text to reflect a complete accounting of listed/sensitive species in Bear Creek Valley.13) **Section 4.1.1, Page 4-1** – Please reference the range of depths buried waste is present in the subsurface. If this is unknown, then state that the depth of buried waste is not understood and is a data gap.

- 14) **Section 4.1.1, Page 4-1, Last Paragraph** – This paragraph includes a statement that *"groundwater near BG-B and WIP have exceeded 2,000 mg/L in historical samples, which is about 1% of the maximum PCE solubility."* The solubility of PCE ranges from about 150 – 206 mg/L, please verify the correct units are being used.
- 15) **Section 4.1.3, Page 4-2** – Please include a range for the thickness of the shallow groundwater flow system. For this purpose, please confirm that the shallow groundwater flow system is assumed to extend from first encountered water to the base of the weathered bedrock.
- 16) **Section 4.3, Page 4-5, First Bullet** – Please include the Tennessee General Use Groundwater Criteria.
- 17) **Section 4.5.3, Page 4-14** – Please delete the word "shallow" before groundwater in this section. Both shallow and deep contaminant plumes are present in the groundwater within the BCBG; and it is not appropriate to limit the groundwater secondary source to only shallow groundwater.
- 18) **Section 4.5.4, Figure 4.6** – This figure does not appear to include the vapor intrusion pathway for a future commercial or residential building. Please revise this figure to capture the vapor intrusion pathway due to contaminated groundwater and surface/subsurface soil.
- 19) **Section 4.5.6, Page 4-16** – Fish consumption has been included in risk assessments to develop discharge limits for both EMWMF and EMDF due to uncertainty about future stream conditions. Given that BCBG is located between these two landfills, fish consumption should also be evaluated as a risk pathway for a future resident to be consistent with other risk evaluations in this area of Bear Creek Valley. Please incorporate this risk exposure pathway into the Human Health CSM and update the text accordingly.
- 20) **Section 4.5.6, Page 4-16** – In addition to human health exposure pathways associated with plant uptake and exposure through consumption of garden vegetables, please explain whether the gardening scenario includes exposure pathways through consumption of livestock and livestock byproducts, like milk or eggs, as livestock are likely to be exposed to the same media that create risk through the vegetable gardening pathway. If not included, these exposure pathways need to be added to the human health CSM in Fig. 4.6, Table 4.3, and discussed in text accordingly.
- 21) **Section 4.5.6, Page 4-16, Table 4.3 and Figure 4.6** – It appears that the evaluation of exposure media and routes for human health is incomplete and does not include an inhalation pathway for groundwater via showering or other similar indoor water use for a future resident. Please add this exposure route to the Human Health CSM for completeness.
- 22) **Section 5** – The tables in this section include PRGs for metals, PCBS, SVOCs, pesticides, and VOCs while the table footnotes and text state that PRGs are for radiological contaminants. Please correct the column headers to accurately reflect what is a PRG and what is an RSL.
- 23) **Section 5.1.2.2 and Table F.1** – There are no references to state laws regarding wetlands. Please add references to State Rule 0400-40-07.03.

- 24) **Section 5.1.2.3** – This section only mentions state listed T&E species and what actions will be taken if state listed T&E species are impacted. Please revise the text to clarify actions that will be taken if federal T&E species are discovered including a statement that the Endangered Species Act and accompanying federal regulations would apply.
- 25) **Section 5.1.3.4, Page 5-10, Table 5.3** - Please confirm that MCLs are listed for radionuclides. For example, Tc-99 has an MCL of 900 pCi/L and alpha activity has an MCL of 15 pCi/L.
- 26) **Section 6.1.5, Figure 6.1:**
- Please explain why there are no proposed soil borings or wells between BG-C West and NT-8. This area does not appear to have been investigated historically and is a potential data gap considering shallow groundwater would likely flow from the BG-C West area towards NT-8 and residual contamination may be remaining in these soils. DOE should consider collecting additional soil samples from this area.
 - The legend in this figure suggests that soil borings will only extend to 15 ft bgs. This doesn't align with the language on Slide 87 of the DQO (Appendix G) that says soils borings will be advanced to the water table or bedrock refusal. Please revise the language to be consistent with prior agreements and ensure that impacts to subsurface soils are fully delineated.
- 27) **Section 6.2.4, Table 6.2** – TDEC recommends collecting both wet season and dry season samples from each of the leachate collection systems (NT-7 LCS and NT-8 LCS). Collecting from both seasons will allow for a more complete evaluation of contaminant flux from burial units.
- 28) **Section 6.2.6, Page 6-12** – This section should identify how data gaps noted for the area in the 2014 Groundwater Strategy document are being addressed with the proposed scope of work.
- 29) **Section 6.4.1.2, Table 6.5:**
- Please add a reference to footnote "d" to the source document that presents the site-specific values for recreation surface water/sediment exposure frequency.
 - Please verify the correct values and units throughout the table. For example, the referenced ingestion rates for surface water in the table are 0.11 and 0.12 **L/day** while the default surface water ingestion rates in the EPA calculator are 0.11 and 0.12 **L/hr**.
- 30) **Appendix A, Section 4.2.2** – Any discussion of step-out sampling in this section should be expanded to explain how the step-out procedure will evaluate both lateral and vertical extent of contaminated soil as a threat to groundwater.
- 31) **Appendix A, Section A.4.2.2.1, Last Paragraph** – Please provide the basis for determining a minimum step-out distance of 15ft.
- 32) **Appendix A, Section 4.2.2.7** – The waste inventory listed in Section 2.2.2 of this RIWP identifies waste oils, freon, chromium+6, and mercury. DOE should expand the list of analytes for the leachate samples to include SVOCs, mercury, hexavalent chromium, dioxins/furans, and PFAS. Considering that the waste will not be directly characterized within the scope of this project, these additional analytes for leachate would improve

indirect source term characterization and inform the future analysis of remedial alternatives.

- 33) **Appendix E, Section E.2.4** – Please clarify how the “*observational data from soil borings*” listed on Page E-3 will be recorded and how/where those observations will be shared with the regulators.
- 34) **Appendix F, Table F.1** – The State acknowledges that a more comprehensive list of ARARs will be developed for the Feasibility Study (FS) pertaining to a selected remedy. However, given that Bear Creek is an impaired stream, please include the requirements of The State’s Anti-Degradation Rule 0400-40-03-.06 as a potential chemical specific ARAR.

Review of this document meets the review cycle protocol of 90 days. Questions or comments concerning the contents of this letter should be directed to David Carlone at the above address or by phone at (865) 839-3362.

Sincerely



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