



**STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF REMEDIATION - DOE OVERSIGHT OFFICE
761 EMORY VALLEY ROAD
OAK RIDGE, TN 37830**

April 21, 2017

Mr. John Michael Japp
DOE FFA Project Manager
P.O. Box 2001
Oak Ridge, TN 37831-8540

Dear Mr. Japp

**TDEC Comment Letter
Remedial Investigation/Feasibility Study for Comprehensive Environmental Response,
Compensation, and Liability Act Oak Ridge Reservation Waste Disposal, Oak Ridge, TN
DOE/OR/01-2535&D5
February 2017**

The Tennessee Department of Environment and Conservation (TDEC), Division of Remediation has reviewed the above referenced document pursuant to the Federal Facility Agreement (FFA) for the Oak Ridge Reservation (ORR). During a meeting among FFA representatives on February 27, 2017, the Department of Energy (DOE) relayed to TDEC that the D5 Remedial Investigation/Feasibility Study (RI/FS) report incorporates tri-party agreements to date and DOE's preferred resolution for issues where disagreements remain. Because significant issues have yet to be resolved, as described in the enclosed comments, TDEC cannot approve this RI/FS report at this time, and TDEC does not find the D5 report resolves informal dispute.

The discussion between Dr. Shari Meghreblian and Mr. Jay Mullis on March 23, 2017 provides a framework to move forward. TDEC met with DOE and EPA on April 11, 2017 to develop a path forward that could allow DOE to proceed with the Proposed Plan while continuing to resolve TDEC comments on the D5 RI/FS. The FFA parties are discussing an agreement and schedule for resolving TDEC comments and ending the informal dispute. This letter is intended to communicate TDEC concerns that will be resolved through that process.

The D5 RI/FS report does not include the site-specific characterization, waste characterization, and modeling necessary to assess risks of the waste disposal alternatives evaluated. Such information would normally be evaluated during the FS as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

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Therefore, the D5 report does not address key TDEC comments on the D4 version, which are incorporated herein by reference. The enclosed TDEC comments on the D5 report are not strictly required by FFA Section XXI because the D5 report was submitted in the context of an informal dispute that commenced last May. TDEC offers the enclosed comments to document unresolved problems with the D4 report and new issues introduced in the D5 report. Ongoing discussion and negotiation relates in part to a process to address all comments by the time of the Record of Decision while allowing DOE to conduct activities in parallel and to submit a Proposed Plan. However, final approval of any such approach is subject to a signed agreement among the FFA parties that is enforceable under the FFA.

The FFA parties continue to support on-site disposal at ORR provided it is protective of human health and the environment and compliant with Applicable or Relevant and Appropriate Requirements (ARARs). Meanwhile, TDEC recommends that DOE continue recent waste minimization and segregation efforts to conserve capacity at the existing CERCLA disposal facility, the Environmental Management Waste Management Facility (EMWMF).

Questions or comments regarding the contents of this letter should be directed to Brad Stephenson at the above address or by phone at (865) 220-6587.

Sincerely



Randy Young
FFA Manager

Enclosure

xc Patricia Halsey, DOE
Dave Adler, DOE
Rich Campbell, EPA
Connie Jones, EPA
Steve Goins, TDEC
Chris Thompson, TDEC
Amy Fitzgerald, ORCCA
Pete Osborne, SSAB

Tennessee Department of Environment and Conservation Comments on: *Remedial Investigation/Feasibility Study for Comprehensive Environmental Response, Compensation, and Liability Act Oak Ridge Reservation Waste Disposal Oak Ridge, Tennessee (DOE/OR/01-2535&D5)*

Background

In September 2012, the DOE proposed a second on-site waste disposal facility for the disposal of CERCLA waste on the ORR by submitting the *Remedial Investigation/Feasibility Study [RI/FS] for Comprehensive Environmental Response, Compensation, and Liability Act Oak Ridge Reservation Waste Disposal, Oak Ridge, Tennessee* (DOE/OR/01-2535&D1). That document followed an informal draft (D0) of a Focused Feasibility Study (FFS) submitted in September 2011. As proposed, the Environmental Management Disposal Facility (EMDF) would be primarily a Low Level Radioactive Waste (LLRW) Disposal Facility, but it would also be authorized under CERCLA to dispose hazardous and chemical wastes regulated under the Resource Conservation and Recovery Act (RCRA) and the Toxic Substances Control Act (TSCA). The Tennessee Department of Environment and Conservation (TDEC) and the U.S. Environmental Protection Agency (EPA) submitted comments on the D1 RI/FS in early 2013 that were not resolved in the D2 revision (June 2013), and that document was elevated to informal dispute.

Disputed issues included the characteristics of the site proposed for the facility with respect to siting criteria in TDEC and EPA rules regulating LLRW, RCRA, and TSCA disposal facilities and the credibility of assumptions made in modeling the long-term performance of the facility and associated preliminary waste acceptance criteria (WAC). More specifically, the facility as proposed would have been located near the DOE property boundary (~ 650 yards) overlying steep slopes (>30%), a shallow water table, wetlands, seeps, springs, a stream, and the complex hydrogeology of the fractured shales of the Conasauga Group, which drain groundwater to nearby streams and the highly karstic Maynardville Limestone. To overcome limitations of the location, the RI/FS proposed various engineered barriers, but it failed to provide substantial technical justification of their equivalency over time. While modeling used to assess the performance of the facility and develop preliminary WAC assumed some man-made components degraded over time, key components were assumed to retain their initial functionality indefinitely without maintenance. In this regard, clay components in the cap were assumed to limit water infiltration to 1 centimeter per year for the duration of the modeled period (1 million years), despite evidence that amended clays can degrade relatively rapidly. Likewise, an extensive underdrain system proposed to lower the water table beneath the facility was assumed to function without clogging or otherwise malfunctioning for the same period.

To resolve the dispute, DOE agreed to submit a D3 RI/FS (to be treated as D1 document) to address associated issues. In the interim, DOE proceeded "at risk" to collect characterization data at the location of its preferred on-site disposal alternative (Site 5). Associated results indicate that the location fails to meet TDEC siting criteria and would face many of the water management problems that challenge the long-term protectiveness of the currently operating CERCLA waste disposal facility, the Environmental Management Waste Management Facility

(EMWMF), due to the proximity of surface water, high groundwater levels, and significant groundwater discharges within the site.

TDEC received the D3 RI/FS on April 2, 2015. The D3 revision retained Site 5 as the preferred site for the on-site disposal alternatives and made only minor changes to modeling. Proposed limits on acceptable concentrations of radioactive or hazardous constituents in the waste were generally less restrictive than those proposed in the previous drafts. Consequently, major issues identified in comments on the previous versions of the document and discussed in subsequent technical sessions were not addressed or remained unresolved. Contrary to the previous versions of the RI/FS, DOE took the position in the D3 RI/FS that state regulations governing the disposal of LLRW (TDEC 0400-20-11) were not relevant and appropriate to the disposal of DOE radioactive wastes and that, therefore, the state rules should not be considered Applicable or Relevant and Appropriate Requirements (ARARs) for the proposed facility. It was also DOE's position that DOE Orders regulating LLRW should not be cited as requirements or to-be-considered guidance (TBC) in the Record of Decision (ROD) and other CERCLA agreements. TDEC rules regulating LLRW were removed as ARARs from the D3 RI/FS, as were DOE Orders listed as TBC, although DOE subsequently agreed to include TDEC rules that were analogous to DOE Orders in the D4 revision of the document, with exceptions. **The D3 revision also proposed that TDEC and EPA waive provisions of 40 CFR 268 to allow treatment of mercury-contaminated demolition debris within the EMDF disposal cells. TDEC comments on the D3 RI/FS were submitted to DOE on August 6, 2015.**

The D4 revision of the document was received by TDEC on March 17, 2016, and TDEC submitted comments on the document to DOE on May 16, 2016, followed by an Environmental Program Council (EPC) meeting later that month. As with previous submittals of the draft report, a series of Project Team meetings followed in an effort to resolve the remaining regulatory comments. While progress was made in some areas, DOE, EPA, and TDEC did not reach consensus on the basic information that would be necessary to select a preferred alternative that meets CERCLA threshold criteria or on numerous other issues that had persisted over the course of the four revisions of the document. Absent concurrence of the Project Team on these issues, the dispute was introduced to the Supervisory and Management Team (SMT) to assist in resolution. The first SMT meeting was held August 26, 2016.

During the fall of 2016, DOE proposed a "caveated approach" and asked TDEC and EPA to approve the RI/FS report, despite unresolved regulatory comments regarding inadequacies in the evaluations presented in the RI/FS report. DOE asked that TDEC and EPA approve the deficient RI/FS with the promise that DOE would provide site characterization for a newly proposed site (Site 7c) along with waste characterization and risk assessment information, prior to submitting a ROD. TDEC requested an additional public meeting to offer opportunities for the public to comment on all data collected to support selection of the preferred alternative, including site characterization, projected waste inventory, modeling results, and the final WAC. TDEC also recommended that DOE support (fund) more robust and defensible modeling/verification by an objective, independent party as a fundamental step to implement the DOE-proposed caveated approach. EPA requested that DOE submit an RI/FS addendum prior to the ROD to document any site characterization data and other information collected

after the RI/FS that is needed to support the ROD. TDEC and EPA sent DOE caveats for discussion on December 9, 2016 to address unresolved issues. The document proposed a path forward with two main caveats of waste acceptance criteria and site characterization of Site 7c. In addition, the document identified a list of TDEC and EPA expectations for the path forward. TDEC and EPA were unable to reach agreement with DOE on the approach.

On December 21, 2016, DOE proposed an informal dispute resolution agreement, indicating intent to invoke formal dispute in accordance with FFA protocols if TDEC and EPA did not approve DOE's proposed agreement by January 6, 2017. TDEC and EPA did not sign DOE's proposed agreement.

Discussion among the three parties on January 9, 2017 resulted in submission of the D5 RI/FS intended to address regulatory comments agreeable to DOE in an effort to narrow the list of issues remaining to be resolved. TDEC received the D5 report on March 1, 2017.

Significant issues remain to be resolved. The D5 RI/FS report does not include the site-specific characterization, waste characterization, and modeling necessary to assess risks of the waste disposal alternatives evaluated. Rather, as noted in numerous DOE responses to TDEC comments on the D4 RI/FS, such comments "*will be considered in moving forward...through the CERCLA process*". Therefore, the D5 report does not address key TDEC comments on the D4 version. The resolution of other D4 comments is unclear because DOE has changed the proposed preliminary WAC and ARARs once again. Further, as relayed to TDEC at the February 27, 2017 meeting, where there were disagreements as to resolution of comments, DOE included DOE's preferred resolution. Lack of comment herein does not necessarily indicate TDEC agreement with DOE's preferred resolution as stated in the RI/FS.

General Comments

General Comments 1 through 24 are updated versions of corresponding Tennessee Department of Environment and Conservation (TDEC) comments on the D4 Remedial Investigation/Feasibility Study (RI/FS) report. In most cases, report revisions in the D5 version do not adequately address previous comments. Beginning with General Comment 25 below, TDEC offers additional observations and/or recommendations based on review of the D5 report.

1. The D5 version of the RI/FS was modified significantly from the D4 version. Like previous revisions, the D5 report addresses some regulatory comments in a satisfactory manner. However, it also incorporates elements of a "caveated" approach proposed by the Department of Energy (DOE) that TDEC and the Environmental Protection Agency (EPA) did not approve and that are not consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) decision-making process.

Like previous drafts, the D5 RI/FS does not provide sufficient information to demonstrate that the alternatives evaluated, including DOE's preferred alternative, would meet CERCLA threshold criteria—protection of human health and the environment and compliance with Applicable or Relevant and Appropriate Requirements (ARARs)—or justify waivers of those requirements.

Site-specific characterization data, defensible risk assessment results, and a detailed evaluation of alternatives are needed to support approval of an additional disposal site for radioactive, hazardous, toxic, and solid wastes in Bear Creek Valley (BCV).

The establishment of WAC that would be protective of water resources at any on-site disposal facility has been a consistent and significant regulatory concern. Limitations on waste acceptance will be necessary to ensure protection of human health and the environment at a radioactive waste disposal facility of the proposed size and location. The D4 version of this document failed to provide a sufficiently thorough risk assessment and enough additional information on candidate waste streams to support an informed decision regarding the relative benefit of an additional on-site CERCLA waste disposal facility. The D5 version contains no risk assessment at all, and it presents only preliminary waste limits (Tables 6-4 and 6-5). The limits are "placeholders" that are not supported by appropriate, site-specific modeling, which in turn is not supported by site-specific characterization data. Instead of providing the information needed to inform the selection of a protective remedy, the D5 report indicates that inventory limits will be determined in the future.

CERCLA requires that all remedial alternatives evaluated in a RI/FS report must meet the threshold criteria of protection of human health, protection of the environment, and compliance with ARARs (or justify waivers of those requirements). The D5 RI/FS report for the proposed Environmental Management Disposal Facility (EMDF) states that all on-site and off-site waste disposal alternatives would protect human health. The D5 report justifies this position by stating that protectiveness would be ensured by engineering design features, land use controls, and limitations on waste acceptance. However, the document does not provide the information that TDEC needs to verify the statement. The D5 report does not present adequate information about the physical characteristics of each site under consideration, nor does it provide sufficient information about the radiological, chemical, and physical characteristics of the waste to be disposed. Therefore, the D5 report does not demonstrate that the alternatives being evaluated would comply with siting criteria (or justify waivers), nor does it establish WAC that are protective of human health and environment, particularly for long-lived radionuclides such as uranium. Both demonstrations are necessary to assure long-term protection of human health and the environment. The lack of information in the D5 report introduces an unacceptable amount of uncertainty and fails to demonstrate long-term protectiveness for the public (e.g., fishermen or intruders) and the environment (e.g., water resources). The RI/FS report also does not establish WAC that are appropriate for the likely, but poorly characterized, waste volume and characteristics (waste inventory).

2. TDEC General Comment 2 on the D4 RI/FS report states that there is little evidence to support the assertion that *"most future CERCLA waste to be generated after EMWMF [Environmental Management Waste Management Facility] reaches maximum capacity would be able to be disposed at the proposed EMDF."*

The National Contingency Plan (NCP) requires that an RI report include a baseline risk assessment. In previous versions of the EMDF RI/FS, DOE included modeling to develop WAC in lieu of performing a baseline risk assessment. Preliminary WAC concentrations presented in

versions D1, D2, and D3 of the RI/FS are based on that modeling. In the D4 report, some preliminary WAC concentrations are based on modeling, while some radionuclide preliminary WAC values are assigned preliminary administrative limits instead of concentrations that are consistent with CERCLA risk criteria. TDEC agrees with statements in the D5 report (Section 6.2.3) that WAC limits applied during acceptance of individual waste lots and total individual isotope inventory limits for the facility as a whole are important to protect human health and the environment in the event of future releases.

The D5 RI/FS presents "placeholders" in lieu of a risk assessment, WAC, and total inventory limits; there is no modeling of radionuclide fate and transport. Therefore, the D5 RI/FS does not include the information necessary to address numerous TDEC modeling comments on the D4 and previous versions of the report, nor does the D5 report evaluate the protectiveness of the waste disposal alternatives. This approach is particularly troubling in light of the wide ranges of preliminary WAC presented in various versions of the RI/FS report to date. Table 1 summarizes the ranges of preliminary WAC values for a few key radionuclides presented by DOE in various versions of the report. These radionuclides are anticipated to comprise substantial proportions of future Oak Ridge Reservation (ORR) CERCLA wastes, and some are likely to contribute significantly to potential future risks to human health and/or the environment.

Given the lack of total inventory limits for individual isotopes, it is not clear that the placeholder analytic WAC concentration ranges presented in the D5 report (Table 6-5) are protective of human health and the environment or compliant with ARARs. As indicated in Table 1 (attached), uranium is evaluated as a carcinogen and a noncarcinogen. DOE's noncarcinogenic uranium values in the table are based on a HI of 3, and EPA commented that an HI of 3 is not protective of human health toxicity. Uranium metal has noncarcinogenic kidney toxicity and a Maximum Contaminant Level (MCL) of 30 µg/L in groundwater. Therefore, uranium metal toxicity at a HI of 1 may be a limiting factor for waste disposal at EMDF.

Remedial Action Objectives (RAOs) are included in the RI/FS to help assure overall protection of human health and the environment. RAOs address radionuclides and other hazardous substances and are broader than determination of excess lifetime cancer risk (ELCR). RAOs incorporate other objectives, such as, systemic or noncarcinogenic effects on human health from hazardous substances (e.g., uranium) and protection of water resources. TDEC comments on the D4 report indicate that DOE's proposed preliminary WAC are inconsistent with CERCLA and the EMDF RAOs stated in that document. DOE responded by removing the model-based WAC from the D5 RI/FS, deferring them to a future effort *intended* to occur after regulatory approval of the RI/FS and Proposed Plan. DOE's response to TDEC comments on the modeling in the D4 RI/FS includes: *"The previous radionuclide fate and transport modeling (included in the D4 RI/FS) that was completed for the East Bear Creek Valley site will be removed from the revised document. Radionuclide Analytic WAC that meet Remedial Action Objectives will be determined if an On-site Disposal Alternative is presented in the Proposed Plan. Independent modeling/verification is being planned to occur in parallel."*

**Table 1. Ranges of Preliminary Waste Acceptance Criteria (preWAC) for Key Radionuclides
Remedial Investigation/Feasibility Study (RI/FS) Report for the Environmental Management Disposal Facility (EMDF)**
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Facility (Report)	WAC Carcinogenic Pathway (pCi/g)	WAC Noncarcinogenic Pathway (pCi/g)	Comments
Technetium-99 (Tc-99)			
Half-life 213,000 years (D5 Table 6-5)			
EMWMF			
D5	172	36.7 ⁽²⁾	D5 Table 2-8, Radionuclide Data Set for Natural Phenomena and Transportation Risk Evaluation
EMDF			
D1	4,900	D1 Table F-10	
D2	4,900	D2 Table F-10	
D3	69,300	D3 Table H-8	
D4	45.6	D4 Table H-10	
D4	45.6 ⁽³⁾		See D4 TDEC General Comment 9; May 16, 2016, page 12-14
D5	40	D5 Table 6-5	Low Range (ORR Landfill)
D5	172	D5 Table 6-5	High Range (EMWMF WAC)
Uranium-238 (U-238)			
Half-life 4,470,000,000 years (D5 Table 6-5)			
EMWMF			
D5	1,200	1,500	160 ⁽²⁾ D5 Table 2-8, Radionuclide Data Set for Natural Phenomena and Transportation Risk Evaluation
EMDF			
D1	69,400	377,000	D1 Table F-10
D2	69,400	377,000	D2 Table F-10
D3	103,000	102,000 mg/kg 34,800 pCi/g	D3 Tables H-8/H-10/H-11
D4	3,170 ⁽¹⁾	52.2 mg/kg ⁽⁴⁾	D4 Tables H-10/H-13 See D4 TDEC General Comment 9; May 16, 2016, p. 12-14; Carcinogenic risk outside CERCLA risk range See EPA Comment D4.09: HI of 3 not protective of human health toxicity
D4	55.2 ⁽³⁾		See D4 TDEC General Comment 9; May 16, 2016, page 12-14
D5	35		Low Range (ORR Landfill)
D5	1,200		High Range (EMWMF WAC)
Plutonium-240 (Pu-240)			
Half-life 6,537 years (D5 Table 6-5)			
EMWMF			
D5	5,800	174 ⁽²⁾	D5 Table 2-8, Radionuclide Data Set for Natural Phenomena and Transportation Risk Evaluation
EMDF			
D1	951,100,000		D1 Table F-10
D2	951,100,000		D2 Table F-10
D3	83,300,000		D3 Table H-11
D4	4,870 ⁽¹⁾		D4 Table H-10 See D4 TDEC General Comment 9; May 16, 2016, p. 12-14; Carcinogenic risk outside CERCLA risk range
D4	222 ⁽³⁾		See D4 TDEC General Comment 9; May 16, 2016, page 12-14
D5	58		D5 Table 6-5 Low Range (2 order mag lower than high range)
D5	5,800		D5 Table 6-5 High Range (EMWMF WAC)

**Table 1. Ranges of Preliminary Waste Acceptance Criteria (preWAC) for Key Radionuclides
Remedial Investigation/Feasibility Study (RI/FS) Report for the Environmental Management Disposal Facility (EMDF)
(Page 2 of 2)**

Strontium-90 (Sr-90) Half-life 29.1 years (D5 Table 6-5)			
EMWMF			
D5	No limit	9,730 ⁽²⁾ 400,000 pCi/g ASA-derived WAC	D5 Table 2-8, Radionuclide Data Set for Natural Phenomena and Transportation Risk Evaluation
EMDF			
D1	No limit	D1 Table F-10	
D2	No limit	D2 Table F-10	
D3	No limit	D3 Table H-8	Little/no migration into surface water because COPC exhibits a high Kd (does not leach from soil) or the half-life is short (less than 50 years); Peak concentration in surface water > 15,000 years (Table H-6)
D4	No limit	D4 Table H-13	
D5	23,500	D5 Table 6-5	Low Range (NRC Class A Limit)
D5	4,100,000,000	D5 Table 6-5	High Range (NRC Class C Limit)
⁽¹⁾ DOE Assigned Preliminary Administrative Limit (D4, Page H-75) ⁽²⁾ Mass-weighted average based on waste disposed at EMWMF (pCi/g) ⁽³⁾ Calculated at 1×10^{-4} ELCR using EMDF D4 Appendix H methodology ⁽⁴⁾ Based on HI of 3			
ASA - Auditable Safety Analysis CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act COPC - Contaminant of Potential Concern D1 - Draft 1 of the EMDF RI/FS D2 - Draft 2 of the EMDF RI/FS D3 - Draft 3 of the EMDF RI/FS D4 - Draft 4 of the EMDF RI/FS D5 - Draft 5 of the EMDF RI/FS EMDF - Environmental Management Disposal Facility EMWMF - Environmental Management Waste Management Facility EPA - Environmental Protection Agency HI - Health Index Kd - soil-water partition coefficient mg/kg - milligrams per kilogram NRC - Nuclear Regulatory Commission ORR - Oak Ridge Reservation pCi/g - picoCuries per gram preWAC - Preliminary WAC RI/FS - Remedial Investigation/Feasibility Study TDEC - Tennessee Department of Environment & Conservation WAC - Waste Acceptance Criteria			

As discussed in TDEC General Comment 2 on the D4 report and acknowledged on page 6-2 of the D5 report, future EMDF CERCLA waste characteristics and waste acceptance limits may dictate the balance between waste volumes disposed on site and off site. However, in section 2.1.3 on page 2-5 the RI/FS states: *"Based on the evaluation of CERCLA disposal practices to date and assumptions about similarities in current and future CERCLA waste generation, a small percentage (volume) of future total CERCLA waste generated annually is assumed to require shipment off-site. Because it is not a differentiator between the On-site and Off-site Disposal Alternatives, this small percentage of waste is excluded from the RI/FS waste volume estimate information (for both alternatives) and is addressed qualitatively in the alternatives analysis (Chapter 7)."* The cost comparisons in Appendix I assume the total waste generated is disposed either on-site or off-site for these two alternatives. However, the off-site disposal costs are based on existing contracts for off-site disposal of small volumes of waste, and this approach biases the evaluation in favor of on-site disposal because those off-site disposal contracts do not have the benefit of economy of scale that is applied to the estimate for on-site disposal.

Among other apparent inconsistencies that introduce bias into the cost estimates is the assumption, stated on page 7-29 and in Appendix I, that *"Costs for continued care after 100 years following closure is the responsibility of the federal government for all radiological disposal facilities (including any commercial facilities such as might be used in the Off-site Disposal Alternative); therefore, those costs, which are expected to be similar for each alternative, are not included in any of the alternatives."* It is improbable that the off-site disposal alternatives, which utilize facilities on relatively flat terrain in arid environments far from centers of population, would require the same level of surveillance, maintenance, and monitoring to remain protective as the on-site alternatives in BCV. In contrast, Section 6.2.9 Post-Closure Care and Monitoring on page 6-107, states: *"S&M [surveillance and maintenance] and monitoring are assumed to be performed for a period of 1,000 years after facility closure"* for on-site disposal alternatives. TDEC General Comment 7 (below) identifies other potential uncertainties in the projected inventory of CERCLA waste that might be suitable for disposal in an on-site landfill.

3. CERCLA Section 121(d)(1) requires that *"Remedial actions selected under this section or otherwise required or agreed to by the President under this Act shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and control of further release at a minimum which assures protection of human health and the environment. Such remedial actions shall be relevant and appropriate under the circumstances presented by the release or threatened release of such substance, pollutant, or contaminant."*

TDEC commented on the D3 RI/FS regarding concerns with risk posed by an underdrain. TDEC's comment stated that the proposed East Bear Creek Valley (EBCV) site underdrains, like the underdrain at the EMWMF, would presumably supply several gallons of water per minute, even during drought conditions, and might be a usable water supply even when wells are dry.

Underdrains are engineered pathways for future release of hazardous substances, pollutants, and contaminants from the landfill. Over time, the underdrains would contain constituents released from the landfill directly overlying the underdrain, as well as from other areas of the landfill where constituents are released to groundwater and the contaminated groundwater

subsequently discharges to an underdrain. Underdrains provide a direct conduit to surface water with potentially minimal sorption or other attenuation of constituents.

Exposure pathways associated with a flowing underdrain should be evaluated to verify whether a site with a flowing underdrain meets the CERCLA Section 121(d)(1) threshold requirement for control of further release which at a minimum assures protection of human health and the environment. Further, these exposure pathways should be evaluated during the development of WAC to assure that future waste disposed does not pose an unacceptable risk due to a flowing underdrain.

The D4 RI/FS does not identify the underdrain as a potential exposure pathway. Further, potential risk posed by an underdrain is neither quantified in the D4 RI/FS nor used in preliminary WAC development. DOE's response to TDEC General Comment 3 on the D4 RI/FS states that Site 7c was added to the D5 RI/FS and is not expected to rely on the performance of post-closure underdrain systems to maintain a lowered groundwater table. The D5 RIFS redefines some potential future underdrains as "drainage features" and designates some of those as "temporary".

TDEC observations suggest that it may be possible to configure a facility in that area that does not require a permanent underdrain, particularly under the proposed waste cells. However, there is no more site-specific characterization data than what DOE presented in the D4 report. DOE's response states that site-specific characterization would be conducted only after a preferred on-site disposal alternative (location) is presented in a Proposed Plan and that this comment *"will be considered in moving forward with characterization through the CERCLA process."*

As noted in the introduction above, DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the site-specific characterization information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

TDEC's position is that a permanent underdrain is an unacceptable design component if it would produce flowing water once the liner is fully constructed unless a defensible evaluation demonstrates that it would protect human health and environment over the long term. The RI/FS does not provide sufficient information to justify a waiver for the ARAR [TDEC 0400-20-11-.17(1)(h)], such as an assessment of the risk to human health associated with an underdrain. Any waiver of this ARAR would require evaluation for each stream associated with each on-site candidate location. However, the RI/FS does not contain the site-specific characterization information necessary to support such evaluations.

According to guidance (Nuclear Regulatory Commission Regulation [NUREG] 0902), the intent of this ARAR is primarily to ensure that there are no rapid hydrologic pathways for contaminants to migrate from the site. The RI/FS has not demonstrated that an engineered design feature, such as an underdrain to alleviate high groundwater levels, would be protective—particularly for hazards associated with long-lived radionuclides. The RI/FS must support claims of protection equivalent to siting criteria (ARARs), like those made in Appendix G.

The RI/FS does not provide sufficient information to support the claim that the proposed sites meet (or would meet) TDEC 0400-20-11-.17(1)(h), given that groundwater discharges to surface water within each of the proposed disposal sites. For example, the use of drainage features ("underdrains") to collect groundwater under the facility, as discussed in the RI/FS, does not eliminate the problematic groundwater discharge. Worse, they actually provide more rapid hydrologic pathways for contaminants to migrate from the site. Both of these factors are inconsistent with the intent of the ARAR.

TDEC notes that many discussions were held with DOE concerning the need for site-specific data to verify water levels, verify whether an underdrain would be needed, verify how an underdrain could be avoided, and determine what data may be needed to evaluate alternative landfill layout configurations. Those discussions included, but were not limited to, those held on June 30 and July 19, 2016. As stated throughout the process, TDEC does not support a site with an underdrain that would produce flowing water once the liner is fully constructed.

4. Compliance with siting criteria and development of WAC values are necessary for long-term protection of human health and the environment. TDEC Rule 0400-20-11-.17(10) specifies that *"The land owner or custodial agency shall carry out an institutional control program to physically control access to the disposal site following transfer of control of the disposal site from the disposal site operator.... The period of institutional controls will be determined by the Department, but institutional controls may not be relied upon for more than 100 years following transfer of control of the disposal site to the owner."* Thus, waste disposed should only take credit for decay of radionuclides during a maximum of two hundred (200) years after closure. WAC should be calculated such that there would not be a violation of RAOs if there were a release beyond 200 years after closure. To date, DOE, TDEC, and EPA have not established consensus on the appropriate period of institutional controls for the proposed facility.

The D5 RI/FS includes ranges of limits for several constituents, including cesium-137 (Cs-137) and strontium-90 (Sr-90), with lower values at Nuclear Regulatory Commission (NRC) Class A limits and higher values at NRC Class C limits. Given the lack of total inventory limits for individual isotopes, some of the concentration ranges seem unreasonably high for a radioactive waste landfill as large as the proposed EMDF (more than 2 million cubic yards of waste).

Disposal of fission products such as Cs-137 and Sr-90 at concentrations near NRC Class C limits, as proposed in the D5 report, would result in billions of curies of radioactivity in the Oak Ridge disposal facility, similar to the curie loading proposed for the deep geologic repository for high-level radioactive waste at Yucca Mountain, Nevada. For uranium isotopes, the facility inventory limit based on the upper range of concentrations provided in the table could be similar to that already disposed in the Bear Creek Burial Grounds (BCBG), for which DOE has provided no feasible long-term remediation approach.

In order for the FFA parties to be able to provide reasonable assurance that the WAC will protect human health and the environment, TDEC staff recommend that WAC concentrations be modified based on radionuclide decay and the duration of active institutional control (100

years) so that the radionuclides would have decayed to a point that RAOS are not violated, if released after active institutional controls are no longer effective. Based on statements made in the D5 report, some of which are quoted below, it is not clear that DOE is committed to long-term care more than 100 years after landfill closure.

Page 7-24, Section 7.2.2.4, Long-term Effectiveness and Permanence (On-site), Engineered and Institutional Controls states the leachate collection system and removal system above the primary liner and the leak detection and removal system below the primary liner would be effective for the period of active institutional controls. The period of active institutional controls is not known, but is assumed for design purposes to extend for at least 100 years. Subsequently, the final cover system, secondary liner, and geologic buffer would provide long-term control of leachate release since these engineered features would last minimally for 500 years.

Page 7-36 Section 7.2.2.8, Cost (On-site) discusses the need to include the cost of long-term S&M and groundwater monitoring needs for 100 years following closure of the landfill. The evaluation focuses on short-term costs (100 years) and does not adequately assess the long-term risks associated with on-site disposal or the costs of post-closure care, monitoring, and remedial action. This section states:

"Costs for continued care after 100 years following closure is the responsibility of the federal government for all radiological disposal facilities (including any commercial facilities such as might be used in the Off-site disposal Alternative); therefore, those costs, which are expected to be similar for each alternative, are not included in any of the alternatives."

Page 7-57, Section 7.3.3, Long-term Effectiveness and Permanence states "Off-site disposal of waste at EnergySolutions, WCS, and NNSS in the long-term may be more reliable at preventing exposure than on-site disposal on the ORR, as they are located in arid environments that reduce the likelihood of contaminant migration or exposure via groundwater or surface water pathways. Fewer receptors exist in the vicinity of EnergySolutions, WCS, and NNSS than on the ORR." Section 7.3.3 also states that while underdrain networks are necessary and effective in isolating wastes from the underlying saturated zone, they provide avenues for localized and relatively rapid transport of contaminants in groundwater that could be released below the footprint and discharge at underdrain outfall locations.

Page 7-58, Section 7.3.3, Long-term Effectiveness and Permanence, Engineered Containment Features states that "while the cover system remains in place, migration of contaminants into groundwater and surface water is the only credible pathway of exposure," implying uncertainty as to whether and how long the cover system will remain in place.

DOE's response to a similar TDEC General Comment 4 on the D4 RI/FS states, "No response required." The response then notes that the D5 report estimates the cost of long-term routine and nonroutine S&M of the on-site facility for a 100-year period. The

cost for long-term care after a 100-year period for an on-site facility is assumed to be similar to the cost (and borne by the same federal entity) for an off-site facility that has accepted the same waste. Therefore, costs to conduct S&M past 100 years are not included for either the on- or off-site facility.

In addition to noting that Section 7.2.3.2 of the D5 report states that future costs (for commercial facilities) will be "*a state¹ or federal responsibility (10 CFR 61),*" TDEC points out that S&M costs would likely be considerably higher for a mixed waste disposal facility located on steep slopes in the humid environment of east Tennessee than they would be for a facility located in the arid western United States (U.S.). Thus, the D5 RI/FS does not adequately account for the long-term cost differential to the federal (and/or state) government between disposal of long-lived radionuclides in the humid environment of Oak Ridge versus facilities already established for such waste in arid locations such as Nevada and Utah. TDEC does not accept DOE's argument that an established waste disposal facility in a desert region far from population centers would have the same long-term cost burden for maintenance, monitoring and institutional controls as a facility immediately adjacent to one or more streams along Pine Ridge.

As stated by the General Accounting Office (GAO, 2001):

"For several reasons, potential increases in stewardship costs to DOE at the [off-site] Envirocare [now EnergySolutions in Clive, Utah] facility are less likely than at the planned on-site disposal facilities, especially those in wetter climates. First, the Envirocare [EnergySolutions] facility is located in a dry climate, which would restrict movement of contaminants from the facility to the underlying groundwater. Second, the groundwater beneath the site is not suitable for human consumption or even for watering livestock because of its high mineral content. Finally, the facility is in a location that is remote from population centers.

...because cost is only one factor that is considered when making disposal decisions, off-site disposal costs do not necessarily need to drop below on-site disposal costs for off-site disposal to emerge as the better alternative. To determine the relative advantages of the two alternatives, officials must also assess their respective long-term risks, the stewardship activities that will address these risks, and the estimated costs of these activities. These long-term stewardship risks are highly uncertain. As the gap between on-site and off-site disposal costs narrows, this uncertainty becomes relatively more significant to the balancing among CERCLA criteria."

5. The risk assessment presented in Appendix H of the D4 RI/FS report does not provide reasonable assurance that the proposed facility would protect human health and the environment. That risk assessment is based on the same approach and software packages used for modeling risk at the EMWMF nearly two decades ago. Over the past several years,

¹ The State of Tennessee would not be responsible for future costs since the proposed EMDF is not a commercial facility.

TDEC made numerous comments expressing both lack of confidence in the risk assessment approach and concerns with the applicability of the models.

DOE's response to TDEC General Comment 5 on the D4 RI/FS report states:

"DOE disagrees. The modeling parameters and results presented in the D4 RI/FS were significantly changed from the D3 RI/FS; those changes were discussed at length in Project Team Meetings and are documented in responses provided to TDEC's D3 comments. DOE maintains that risk assessment presented in the D4 RI/FS, while acknowledging that it employs simplified representations of flow and contaminant transport, is in fact conservative. A demonstration of its conservativeness has been documented by Dr. Painter, a ground water modeling expert, in a recently completed report (ORNL-TM2016/235). Additionally, DOE points out that the results (WAC) presented in the D4 RI/FS are considered preliminary.

As noted in the D4 RIFS Project Team Meetings where comments were reviewed in depth and in informal dispute resolution meetings, modeling of radionuclide fate and transport will not be presented in the D5 RI/FS. Rather, a placeholder range (low to high) of analytic WAC limits for radionuclides will be presented, along with placeholder (total) inventory limits. The previous radionuclide fate and transport modeling (included in the D4 RI/FS) that was completed for the East Bear Creek Valley site will be removed from the revised document. Radionuclide Analytic WAC that meet Remedial Action Objectives will be determined if an On-site Disposal Alternative is presented in the Proposed Plan. Independent modeling/verification is being planned to occur in parallel. Discussion of specific elements of this path forward is included in the D5 RIFS Sections 3.2, 6.2.3, and 7.2.2.1.

This comment dealing with modeling and/or preliminary WAC will be considered in moving forward with modeling and WAC development through the CERCLA process."

TDEC disagrees with several points made in the response and the D5 report.

(1) The D4 version of the RI/FS addresses some TDEC comments on previous versions of the report. However, TDEC does not agree that the D4 risk assessment is conservative. Problems with the modeling have been discussed in TDEC comments on the D4 and earlier versions of the RI/FS. In the D4 RI/FS, DOE substitutes preliminary administrative WAC values based on 500 mrem/year for 28 radionuclides in lieu of limits based on RAOs. The D5 RI/FS report does not include the risk assessment necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives. As stated in TDEC comments on the D4 and throughout subsequent efforts to resolve those comments, TDEC has recommended that independent modeling/verification is necessary to determine the WAC and total inventory limits that will allow CERCLA waste to be disposed in a compliant and protective manner.

(2) DOE argues that TDEC's comment dealing with modeling *"will be considered in moving forward with modeling and WAC development through the CERCLA process"*. DOE advocates a parallel approach that is not consistent with the CERCLA decision-making process. TDEC needs the modeling/verification to make that determination. The performance assessment (PA) appears

to require at least some of the evaluations that TDEC has been requesting. The PA and Composite Analysis (CA) should be developed and approved by DOE's Low-Level Waste Disposal Facility Federal Review Group (LFRG). Cumulative dose/risk is evaluated in the CA to assure future remedial action will not be required at the disposal facility due to cumulative dose/risk from multiple source areas. TDEC understands that DOE will submit the PA to LFRG, using different modeling and additional exposure scenarios. DOE determines the schedule for submitting the PA to LFRG, and TDEC understands the LFRG review process takes about 6 months to complete. LFRG should also establish preliminary WAC for radionuclides for EMDF that the FFA parties could modify to be consistent with CERCLA and include in the RI/FS. TDEC has long argued that DOE can accelerate the schedule by completing and submitting the PA to LFRG earlier. TDEC also communicated to DOE during comment resolution meetings that if DOE intends for the PA, CA, and LFRG review/approval to resolve any of the modeling problems identified by TDEC, then those documents and reviews should be completed before DOE submits another RI/FS for TDEC review. In any case, DOE submitted a D5 RI/FS that does not resolve the problems.

(3) TDEC disagrees with DOE's response that changes to model parameters were "*discussed at length*" and "*reviewed in depth*" during Project Team and comment resolution meetings following regulatory review of the D3 and D4 versions of the RI/FS. During recent Project Team meetings, DOE terminated most TDEC efforts to clarify why/how certain values were applied/changed in the models, stating a preference for keeping discussions at "*a high level*".

(4) The groundwater flow velocities evaluated by Dr. Painter are on the low end of the range documented by tracer studies in settings on the ORR similar to those being evaluated in the RI/FS. Use of groundwater flow velocities more representative of flow through fractures may demonstrate that the modeling needs to be more conservative.

In summary, the D5 report removed the modeling and risk assessment sections that are necessary for a RI/FS, such that there is no assurance that the proposed facility would be protective. As stated in TDEC comments on the D4 and throughout subsequent efforts to resolve those comments, TDEC has recommended that independent modeling/verification is necessary to determine the WAC and total inventory limits that will allow CERCLA waste to be disposed in a compliant and protective manner.

6. As noted in General Comment 2 and summarized in Table 1, various versions of the RI/FS report present wide ranges of poorly supported preliminary WAC for key radionuclides. These radionuclides are anticipated to comprise substantial proportions of future ORR CERCLA wastes, and some may contribute significantly to potential future risks to human health and/or the environment.

An obvious example is the uranium-238 (U-238) preliminary WAC value presented in the D4 report. As TDEC stated in General Comment 6 on the D4 report, Table H-12 of that document includes a noncarcinogenic preliminary WAC for U-238 of 52.2 mg/kg, which is about 17.7 pCi/g, or about one-half of the 35 pCi/g allowed for disposal in the ORR Landfill. Based on available

waste inventory information, this value causes considerable confusion regarding the additional amount of future waste that could be disposed on site.

During comment resolution meetings, DOE presented a draft response stating that a calculation error was made that caused preliminary WAC values in the D4 to be a factor of two lower than the correct values. TDEC noted that DOE should back-calculate a preliminary WAC for uranium based on the MCL and assess future condition against RAOs at the appropriate exposure endpoints. At that time (fall 2016), DOE planned to provide corrected tables in the D5 report and address EPA's request that the risk assessment should not be based on an HI of 3.

TDEC also points out that RAOs are not limited to radionuclides and the analytic WAC should include both radionuclides and hazardous substances. Likewise, RAOs include both carcinogenic and noncarcinogenic effects and the analytic WAC should include carcinogenic and noncarcinogenic effects on human health under a range of potential future exposure scenarios. Also, the D5 limits WAC on hazardous chemicals to Land Disposal Restrictions (LDRs) without evaluation. The D5 does not include a process to determine whether hazardous constituents with no LDRs may pose or contribute to a threat or violation of RAOs. Land disposal restrictions are limited to hazardous waste. It is unclear whether hazardous substances other than hazardous waste with land disposal restrictions require WAC.

As noted in DOE's final response, the D5 RI/FS presents "placeholders" in lieu of WAC and total inventory limits. The D5 report does not model radionuclide fate and transport. Therefore, the D5 RI/FS report does not include the risk assessment necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives. The significant modeling error in the D4 report and DOE's decision to exclude modeling and risk assessment from the D5 report underscore the need for independent modeling/verification. It is TDEC's position that such independent modeling/verification is needed to produce WAC and total inventory limits that will allow CERCLA waste to be disposed in a compliant and protective manner.

7. TDEC General Comment 7 on the D4 report identifies potential uncertainties in the projected inventory of waste that might be suitable for disposal in a CERCLA landfill. Final WAC for the proposed CERCLA landfill may be almost as limiting as those at the permitted solid waste landfills for waste with constituents that pose long-term hazards, and a portion of this waste might be equally suitable for disposal as solid waste. For example, most of the waste generated by demolition of Building 1037 at the East Tennessee Technology Park (ETTP) is currently slated for disposal at the permitted solid waste landfills, but the waste inventory in Appendix A of the D5 RI/FS has not been updated to reflect this change. The waste characterization data and waste volume estimates in Appendix A appear to be based on information that is now several years old and, in some cases, outdated. The clean-fill-to-debris ratio used in volume calculations is also outdated and should be revised with more current information.

In the cost analysis, costs of waste characterization are borne by the project generating the waste in this analysis, but for certain waste streams, differences in characterization costs for

on-site disposal as solid waste or for off-site disposal are likely to be significantly different from characterization costs for disposal in a CERCLA landfill. Thus, the D5 RI/FS report fails to provide information to answer the questions raised by comments about the inventory of candidate waste and the total unit cost of disposal for on-site and off-site alternatives.

8. The D5 RI/FS report is not consistent with the CERCLA decision-making process.

8a. The 1,000-year compliance period cited throughout the D5 RI/FS is not consistent with the RAOs on page 4-1. Given the large quantities of long-lived radionuclides in the waste to be disposed, the RAOs on page 4-1 are applicable as long as CERCLA waste is managed, disposed or entombed at the landfill. The RAOs on page 4-1 include protection of water resources as long as CERCLA waste is in the landfill, a time period which presumably extends beyond 1,000 years. The compliance period evaluated in the RI/FS needs to be consistent with the stated RAOs.

When determining the WAC, the FFA parties should determine how long they intend the U.S. Government and the DOE or DOE's successor to perform post-closure care, monitoring, and remedial action. The associated costs of post-closure care, monitoring, and remedial action should be incorporated in the RI/FS. As stated in General Comment 4, such long-term cost estimates for each alternative should account for the differentials between disposal of long-lived radionuclides in the humid environment of Oak Ridge versus facilities established for such waste in arid locations in the western U.S.

8b. In addition to the lack of a risk assessment consistent with RAOs and CERCLA, the D5 states on page 3-7 that *"...a Proposed Plan would be presented to the public prior to full completion of the WAC protocol and site characterization. Therefore, this RI/FS presents key assumptions concerning the WAC and site characterization, which the Proposed Plan will be predicated on."* This is a component of DOE's proposed "caveated approach" (described in the introductory text above) that TDEC did not accept. DOE's transmittal letter for the D5 RI/FS (dated February 28, 2017) also states: *"Current plans are to provide a revised draft Proposed Plan, based on the findings of the enclosed Feasibility Study, for your review and approval in the next 30-45 days."* Submittal of a Proposed Plan without regulatory approval of the D5 RI/FS report or agreement of the FFA parties would not be consistent with the CERCLA decision-making process. Under CERCLA, a Proposed Plan identifies a preferred alternative that is protective and compliant with ARARs and presents that alternative to the public after completion of the evaluations presented in the RI/FS, including regulatory approval (or agreement of the FFA parties).

9. The risk methodology applied in the D4 RI/FS was unacceptable because it did not demonstrate that risk is within the CERCLA 10^{-4} to 10^{-6} risk range for constituents that, according to the D4 RI/FS, peak after 2,000 years. The D5 RI/FS effectively contains no "long-term risk evaluation," as described on pages 3-6 and 3-7: *"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.... At this feasibility stage, radionuclide-specific WAC ranges are applied to the on-site alternatives, which are believed to encompass any final, site-specific WAC limits (to be applied in terms of waste lot acceptance) that have yet to be determined. Total inventory limits for each radionuclide will also be determined and applied if an On-site Disposal Alternative is*

selected, further ensuring protectiveness of the remedy and playing a key role in limiting residual risk. This document relies on a key assumption that final WAC and inventory limits developed for a proposed candidate site(s) provide protection of human health and the environment. That key assumption must be verified through subsequent development of final WAC and inventory limits."

Therefore, the D5 RI/FS report does not include the risk assessment necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives. TDEC has recommended that DOE support (fund) more robust and defensible modeling/verification by an objective, independent entity as a fundamental step to resolve deficiencies in the RI/FS report and determine the WAC and total inventory limits that will allow DOE to dispose CERCLA waste in a compliant and protective manner.

10. In response to a TDEC suggestion between the D3 RI/FS and D4 RI/FS, the D4 report evaluates the extent of underdrain(s) needed for each site and whether any site may require only "minimal underdrains"—i.e., underdrains that would dry up due to capping or cutting off the recharge area such that the landfill would not require a continually functioning underdrain once the facility is constructed. TDEC staff believe that a temporary underdrain that does not lie beneath the waste would pose significantly less threat than a permanent underdrain under the waste.

The D4 RI/FS (page 6-41) states that the conceptual underdrain proposed for Site 7a (Figure 6-15 in the D4) is similar to that for the West Bear Creek Valley (WBCV) site (Site 14), which is described earlier on page 6-41 as follows: *"For the WBCV Site, the proposed underdrain system follows the two main drainage channels located within the site footprint. The system also intercepts any documented seeps and springs located within the landfill footprint. The individual pieces of the system are similar to the EBCV option because the natural drainage ways extend across most of the WBCV site, but fewer areas of underdrain appear to be required."* The Site 7c footprint presented in the D5 report is similar to the 7a footprint described in the D4 report. The D5 version (page 6-25) states, *"The eastern areas of the footprint would cover some of the valley formed by D-10W and warrant a temporary drainage system to ensure proper drainage of shallow groundwater during construction."*

As noted in General Comment 3, TDEC does not support a site with an underdrain that would produce flowing water once the liner is fully constructed. DOE needs to present site-specific data demonstrating that any underdrain will be temporary and not flow upon liner completion. TDEC expects that the ROD will clearly specify that any flow from an underdrain after liner construction will trigger additional investigation and landfill reconfiguration to eliminate the underdrain.

TDEC staff believe that evaluation of the protectiveness of Site 7a/7c must be based on site-specific hydrogeologic characterization to determine the extent and permanence of any engineered drainage features. This information is necessary to determine whether waste disposal at that location would meet CERCLA threshold criteria, including demonstration of which siting regulations can be met and which could be waived without compromising

protectiveness. The D5 report does not present this vital site-specific characterization information.

11. As noted in TDEC comments on the D4 RI/FS, TDEC personnel visited Sites 7a, 7b, and 7c under various groundwater and surface water flow conditions. TDEC observations suggest that it may be possible to configure a facility in that area that does not require a permanent underdrain, particularly under the proposed waste cells. Following subsequent discussions, DOE proposed a reconfigured Site 7c in that area in an effort to maximize on-site waste disposal capacity while minimizing the potential need for an underdrain to manage the flow of water in surface streams. However, the D5 RI/FS does not demonstrate the suitability of Site 7c, which would need to be verified by a site-specific hydrogeologic assessment to determine whether one or more underdrains would be needed to manage groundwater levels.

We agree with the D5 RI/FS text on page E-171 that states:

"The lack of any site-specific data represents a significant technical data gap for Site 7a/7c, and results in much greater uncertainty regarding the proposed base elevations for the landfill cells presented in the conceptual design for 7a/7c (see Chapter 6 of the RI/FS Report). ...new site specific hydrogeological and geotechnical data will be required to establish key relationships between the base cell elevations and the underlying water table and bedrock configuration, as well as other data required for detailed design."

The D4 RI/FS also indicated that such data will be required for modeling, but that part of the sentence was removed from the D5 RI/FS. We do not agree with the text, omitted from the quotation above, stating that these data will be required *"If Site 7a/7c is selected for the EMDP"*. Rather, it is TDEC's position that CERCLA requires the RI/FS to evaluate such data to support recommendation of a preferred alternative in a Proposed Plan.

12. TDEC General Comment 12 on the D4 RI/FS report requests clarification/verification of calculations for the preliminary WAC values because of a lack of clarity in dilution factors and identified inconsistencies in the risk assessment. The D5 RI/FS report does not include the risk assessment necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives. TDEC has recommended that DOE support (fund) more robust and defensible modeling/verification by an objective, independent entity as a fundamental step to resolve deficiencies in the RI/FS report and determine the WAC and total inventory limits that will allow DOE to dispose CERCLA waste in a compliant and protective manner.

13. Several examples are provided below in which the D5 RI/FS cites the *Integrated Water Management Focused Feasibility Study* (UCOR 2017). That document has not been approved by TDEC or EPA and is in informal dispute. TDEC comments on the D2 (2016) version of that document are incorporated into these RI/FS comments by reference.

Page 4-1, Chapter 4 Remedial Action Objectives, last paragraph of the D5 RI/FS states: *"A third RAO is defined in the Integrated Water Management Focused Feasibility Study*

(UCOR 2017) to address landfill wastewater; all RAOs will be merged in the Proposed Plan and ROD".

Page 6-48, Section 6.2.2.4.6 Leachate Collection, Storage, and Transfer within Landfill Footprint states: *"Leachate generated from the landfill would be properly collected, characterized, and treated as necessary to meet discharge limits (given in the Integrated Water Management Focused Feasibility Study [Focused Feasibility Study] or IWM FFS [UCOR 2017]), or released if sample analysis indicated it meets discharge criteria (e.g., Managed Discharge, see Section 6.2.2.5.1 for more information)."*

Page 6-62, Section 6.2.2.5.1 Wastewater Management Systems, last paragraph states: *"For details regarding the water treatment alternatives and their operation (discharge limits and discharge locations), refer to the IWM FFS. ARARs associated with the IWM FFS are incorporated into the ARARs table of this document. It is intended that complete merging of conclusions reached in the IWM FFS and this RI/FS is addressed at the Proposed Plan stage. A single ROD will address the final integrated alternative, and include ARARs from both the RI/FS and the IWM FFS."*

Page G-16, Chapter 5 Chemical-specific ARARs/TBCs, first paragraph states: *"There are chemical-specific ARARs for the remediation and discharge of landfill wastewater under the four proposed action alternatives in the Integrated Water Management Focused Feasibility Study (FFS). Those chemical-specific ARARs are incorporated into this RI/FS..."*

The text on page 6-62 cited above indicates DOE's intention to merge the IWM FFS conclusions with those in the D5 RI/FS at the Proposed Plan stage. DOE's transmittal letter for the D5 RI/FS (dated February 28, 2017) states: *"Current plans are to provide a revised draft Proposed Plan, based on the findings of the enclosed Feasibility Study, for your review and approval in the next 30-45 days."* That timeframe (late-March to mid-April 2017) is not consistent with August 30, 2017 milestone for the EMWMF ROD modification to be based on regulatory approval of the D3 IWM FFS.

14. TDEC General Comment 14 on the D4 RI/FS report notes that assumed peak concentrations in the stream are about one-half what they should be, resulting in underestimation of peak effective risk for the carcinogenic pathway and peak effective dose for the noncarcinogenic pathway. The D5 RI/FS report does not include the risk assessment necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives. TDEC has recommended that DOE support (fund) more robust and defensible modeling/verification by an objective, independent entity as a fundamental step to resolve deficiencies in the RI/FS report and determine the WAC and total inventory limits that will allow DOE to dispose CERCLA waste in a compliant and protective manner.

15. TDEC General Comment 15 on the D4 RI/FS report indicates that the RI/FS should evaluate loading/flux from the landfill and whether the landfill WAC would potentially impact downstream water resources, based on recreational use and consumption of fish from Bear Creek. The D5 RI/FS report does not include the risk assessment necessary to address the D4

comment or support an evaluation of the protectiveness of the waste disposal alternatives. TDEC has recommended that DOE support (fund) more robust and defensible modeling/verification by an objective, independent entity as a fundamental step to resolve deficiencies in the RI/FS report and determine the WAC and total inventory limits that will allow DOE to dispose CERCLA waste in a compliant and protective manner.

16. TDEC General Comment 16 on the D4 RI/FS report requests that the development of protective WAC should account more realistically for the effects of erosion and the resulting effects on infiltration, leachate volume, leachate concentrations, peak concentrations, and dilution rates. The D5 RI/FS report does not include the risk assessment necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives. TDEC has recommended that DOE support (fund) more robust and defensible modeling/verification by an objective, independent entity as a fundamental step to resolve deficiencies in the RI/FS report and determine the WAC and total inventory limits that will allow DOE to dispose CERCLA waste in a compliant and protective manner.

17. TDEC General Comment 17 on the D4 RI/FS report indicates the need for an assessment of the potential human health risk from the consumption of fish from Bear Creek, which is classified for recreational use, if the water were polluted by site constituents and decay products such as polonium-210 (Po-210). Po-210 is in the decay chain for U-238, is highly toxic, and bioaccumulates in fish. The D5 RI/FS report does not include the risk assessment necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives. TDEC has recommended that DOE support (fund) more robust and defensible modeling/verification by an objective, independent entity as a fundamental step to resolve deficiencies in the RI/FS report and determine the WAC and total inventory limits that will allow DOE to dispose CERCLA waste in a compliant and protective manner.

18. TDEC 0400-20-11-.17(1)(h) states, *"The hydrogeologic unit used for disposal shall not discharge groundwater to the surface within the disposal site."*

EMDF is proposed for disposal of long half-life radionuclides, such as, technetium-99 (Tc-99 with a half-life $2.13E+5$ years) and various uranium isotopes (uranium-234 [U-234] with a half-life of $2.45E+05$ years, uranium-235 [U-235] with a half-life of $7.04E+08$ years, uranium-236 [U-236] with a half-life of $2.34E+07$ years, and U-238 with a half-life of $4.47E+09$ years) that will remain in the disposal facility long after engineering components fail. As explained in more detail in TDEC General Comment 18 on the D4 RI/FS report, the purpose for this siting requirement is to provide a sufficient buffer zone to implement remedial measures, if needed, to control releases of such radionuclides before discharge to the ground surface or migration from the disposal site. Long flow paths are preferred to separate the disposal site from the nearest point of groundwater discharge to increase radionuclide decay, hydrodynamic dispersion, and retardation of radionuclides in the aquifer.

Permanent underdrains that discharge groundwater to the ground surface may provide concentrated pathways for conveyance of pollution from the disposal site to surface water. The effect of flowing underdrains conflicts with the purpose of this requirement. The D5 RI/FS does

not evaluate the effect of this requirement with anticipated flow along strike to natural tributaries.

18a. The D5 RI/FS report (page 7-20) states that *"The proposed sites meet this requirement prior to construction in some cases (e.g., Sites 6b, 7a, and 7c)."* TDEC disagrees. Later in the same paragraph, the D5 report states that *"Site 6b has seep/springs in the landfill footprint limits (berms), and employs temporary drainage features to dewater the area during construction."* The presence of seeps/springs in the proposed landfill footprint at Site 6b indicates that Site 6b does not meet the requirement of TDEC 0400-20-11-.17(1)(h).

As noted in General Comment 11, TDEC personnel visited Sites 7a and 7c under various groundwater and surface water flow conditions. On September 27, 2016, even after several months of drought, TDEC personnel observed groundwater discharge at a headwater spring on the stream designated as D-10W. Moreover, the D5 report (page 6-25) also states, *"The eastern areas of the footprint would cover some of the valley formed by D-10W and warrant a temporary drainage system to ensure proper drainage of shallow groundwater during construction."*

As noted in General Comment 10, TDEC staff believe that evaluation of the protectiveness of Site 7 (or any other site under evaluation) must be based on site-specific hydrogeologic characterization to determine the extent and permanence of any engineered drainage features. This information is necessary to determine whether waste disposal at that location would meet CERCLA threshold criteria, including demonstration of whether TDEC 0400-20-11-.17(1)(h) could be waived without compromising protectiveness. The D5 report does not present this vital site-specific characterization information.

18b. The D5 RI/FS report (page 7-20) states that *"All sites proposed will meet this requirement at construction completion and prior to waste being placed. Sites require, to varying degrees, drainage beneath or around the footprint to provide a path for shallow groundwater, presenting as seep/spring and/or intermittent streams within the proposed general site areas."* TDEC staff believe that siting criteria like TDEC 0400-20-11-.17(1)(h) are intended to limit waste disposal to sites with hydrogeologic conditions that are protective, independent of landfill design considerations, such as WAC and drainage features. Sites that meet this siting criterion would not require design features such as underdrains to alleviate problems caused by shallow groundwater.

18c. The D5 RI/FS report (page 7-20) states that *"Both the EBCV and WBCV Sites have intermittent streams identified wholly within the footprints, including the spring/seep of the headwaters."*

There is some question as to which Bear Creek tributaries associated with the proposed sites, including NT-10 and NT-11 at Site 7a/7c, are intermittent or perennial streams. Streams draining from Pine Ridge to Bear Creek may exhibit no flow along some reaches under dry conditions, but there appears to be concentrated flow either in surface channels or in adjacent shallow macropores in many locations, even during dry periods. In any case, a stream determination should be made based on a report from a Qualified Hydrologic Professional for

regulatory purposes. Such a determination was not included in the RI/FS, so TDEC assumes that these tributaries are streams, rather than wet weather conveyances because they have well defined channels and appear as blue lines on U.S. Geological Survey (USGS) topographic maps. Given no information to the contrary, TDEC assumes that tributary D-10W would also be classified as a stream for regulatory purposes because staff observed groundwater discharge following several months of drought.

18d. The D5 RI/FS report (page 7-20) states that *"Sites 7a and 7c have a portion of an intermittent stream in the footprint or beneath berms, which will be rerouted and/or drained through the use of temporary drainage features during construction, and Site 6b has seep/springs in the landfill footprint limits (berms), and employs temporary drainage features to dewater the area during construction."*

As noted in General Comment 18c, TDEC staff consider the tributaries at Sites 7a and 7c to be streams for regulatory purposes.

As noted in General Comment 10, site-specific characterization data are needed to verify the assertion that shallow groundwater at Sites 7a/7c can be drained effectively and protectively through the use of one or more temporary underdrains. The D5 report does not present this vital site-specific characterization information.

As noted in General Comment 18a, the presence of seeps/springs in the proposed landfill footprint at Site 6b indicates that Site 6b does not meet the requirement of TDEC 0400-20-11-.17(1)(h).

18e. The D5 RI/FS report (page 7-20) states that *"Engineered features providing the isolation of groundwater and surface water expression are predicted to be relied on for varying periods of time at the different sites. Sections 7.2.2.4 and 7.3.3 present and compare, respectively, the distinctions encountered at each site."*

As noted in General Comments 3 and 10, any waiver of siting criteria such as those in TDEC 0400-20-11-.17(1)(h), would require evaluation for each stream associated with each on-site candidate location. This information is necessary to determine whether waste disposal at that location would meet CERCLA threshold criteria, including demonstration of which siting regulations can be met and which could be waived without compromising protectiveness. The D5 report does not present this vital site-specific characterization information.

19. The D5 RI/FS (page 7-22) states that the facility design would also incorporate Toxic Substances Control Act (TSCA) requirements for a chemical landfill to accommodate waste containing polychlorinated biphenyls (PCBs) at concentrations >50 ppm. The discussion on page 7-22 also states that this accommodation will require the waiver of one TSCA technical requirement [40 CFR 761.75(b)(3)]: *"There shall be no hydraulic connection between the site and standing or flowing surface water...The bottom of the landfill liner system or natural in-place soil barrier shall be at least fifty feet from the historical high water table."* It states further that Appendix G Chapter 4 provides evidence and rationale to support obtaining this waiver.

Appendix G requests an "equivalent protectiveness" waiver of the TSCA hydrologic conditions requirement, in accordance with 40 CFR 300.430 (f)(1)(ii)(C)(4), on the basis that implementation of (a) 10 ft of low-permeability vadose zone geologic buffer material below the landfill liner per TDEC solid waste requirement 0400-11-01-.04(4)(a)(2) and (b) the more stringent leachate detection and collection requirements under the Resource Conservation and Recovery Act (RCRA) would "*attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, criteria, or limitation through the use of another method or approach*". Thus, the D5 report argues that the facility design would meet or exceed groundwater protection provided by TSCA.

This argument is improved from the D4 version. Implementation of more stringent RCRA performance leachate detection and collection standards is a compelling basis for requesting a waiver based on equivalent protectiveness. However, the D5 RI/FS does not present the proposed design within the context of site-specific hydrogeologic characterization data to demonstrate whether 10 ft of low-permeability geologic material would exist in the vadose zone below the planned liner. Rather, the D5 report presents a conceptual design in the context of no site-specific data. The D5 report does not demonstrate which sites would meet the TSCA siting requirement or the extent to which design features would substitute for the requirement at each site. Rather, it relies on one or more assumed underdrains to lower the natural water table at most of the sites.

As noted in other comments, underdrains are engineered pathways that increase the potential for future releases of radioactive, hazardous, and toxic substances from the landfill. Underdrains may discharge eroded sediment and contamination to the ground surface and surface water with little sorption or other attenuation of constituents. Reliance on underdrains conflicts with the TSCA requirement that "*There shall be no hydraulic connection between the site and standing or flowing surface water.*"

20. The D4 RI/FS states that a second TSCA waiver [40 CFR 761.75(b)(5)] would be requested for the EBCV site (Site 5) only, noting that there is some question regarding whether the slopes of the EBCV site meet the requirement: "*The landfill site shall be located in an area of low to moderate relief to minimize erosion and to help prevent landslides or slumping.*" The D4 report requests a waiver on the basis that a landfill at the EBCV site could be engineered to be protective, minimize erosion, and help prevent landslides/slumping. The D4 version states that a waiver would be requested for the EBCV site only, and this statement was removed from the D5. However, it is TDEC's position that 40 CFR 761.75(b)(5)—and Tennessee Rule 0400-20-11-.17(1)(j)—might require a waiver justification at other sites, such as Site 6b.

21. As noted in General Comment 21 on the D4 RI/FS, consensus has not been reached on model input parameters. These parameters control the calculated amount of leachate, the calculated leaching rate, and time to peak concentration in surface water. The D5 RI/FS report does not include the modeling information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

22. Like the D4 RI/FS, the D5 report (page 4-1) defines two RAOs:
- a. Prevent exposure of humans receptors to CERCLA waste (or contaminants released from the waste into the environment) that exceeds a human health risk of 10^{-4} to 10^{-6} Excess Lifetime Cancer Risk (ELCR) or Hazard Index of (HI) 1.
 - b. Prevent adverse impacts to water resources or unacceptable exposure to ecological receptors from CERCLA waste contaminants through meeting chemical-, location-, and action specific ARARs including RCRA waste disposal and management requirements; Clean Water Act (CWA) ambient water quality criteria (AWQC) for surface water in Bear Creek; and Safe Drinking Water Act (SDWA) MCLs in waters that are a current or potential source of drinking water.

CERCLA and the RAOs reference SDWA MCLs. SDWA MCLs are identified in the RAOs for waters that are a current or potential source of drinking water. The future farmer scenario evaluated in the D4 RI/FS assumes drinking from a residential water well in the exposure risk scenario and development of the preliminary WAC. As a follow-up to the May 3, 2016 meeting discussing changes from the D3 to D4 RI/FS, DOE's contractor sent TDEC and EPA the following:

"For the EMDF D4 RIFS, PreWAC [preliminary WAC] for radionuclides predicted to peak after 2,000 years were based on a risk-informed, 500 mrem/yr radiological dose criterion. The flow and transport model predictions and receptor exposure assumptions utilized were the same as for the risk-based PreWAC, but rather than estimating ELCR with a carcinogenic slope factor (for comparison to a specific target risk level), the peak annual radiological dose was calculated using water ingestion dose conversion factors for each radionuclide. This predicted peak dose corresponding to the assumed unit waste concentration (1 Ci/m³) was then used to estimate the waste concentration limit (PreWAC) corresponding to the 500 mrem/yr criterion. The assumptions underlying this calculation are exactly the same as those made for calculating risk-based PreWAC."

In the D4 RI/FS, this methodology developed preliminary WAC limits for 28 radionuclides with ELCR in the range from about 2.6E-02 (2.6 per hundred) to 9.8E-4 (9.8 per ten thousand) based on the limited resident farmer scenario. Much of this risk results from drinking from the residential water well. The ELCR may be higher if additional pathways of exposure are considered. Moreover, potential use of groundwater for a drinking water supply does not end after 2,000 years and may increase farther out in the future.

TDEC General Comment on the D4 RI/FS indicates the need to demonstrate that preliminary WAC limits will result in groundwater concentrations at the residential water well that are less than or equal to the appropriate MCLs regardless of how far in the future modeling predicts peak concentrations. The D5 RI/FS report does not include the modeling information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

23. TDEC General Comment 23 on the D4 RI/FS report notes that geologic units vary among the evaluated sites, despite the valley-scale information presented. DOE's response states that site-specific characterization would be conducted only after a preferred on-site disposal alternative (location) is presented in a Proposed Plan and that this comment *"will be considered in moving forward with characterization through the CERCLA process."*

As noted in the introduction above, DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the site-specific characterization information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

24. TDEC General Comment 24 on the D4 RI/FS report indicates that groundwater conditions in BCV need to be described in a clearer way, noting that the D4 document quotes references out of context. The D5 report distinguishes between carbonate and noncarbonate rocks—e.g., the former could produce enhanced permeability such as karst features and the latter silicate settings would not. This is not appropriate because most bedrock settings show convergent, relatively rapid flow (Worthington et al., 2016). This should be referenced, and a short discussion should be added regarding discussions of groundwater movement in silicate settings as compared to carbonates.

25. TDEC agrees with statements in the D5 RI/FS that ARAR development is an iterative process and that ARARs will be documented in the ROD. Substantive requirements of TDEC's Division of Radiological Health (DRH) rules need to be included in Appendix G. TDEC is evaluating those rules and may provide additional ARARs to be included in the ROD.

For example, the D5 report (Appendix G, Section 4.4 Technical ARARs with Additional Notes, page G-16) presents several notes that were previously included as footnotes on the ARAR table in the D4 report. One such note says, *"Table G-4, TDEC 0400-20-11-.16(1); TDEC 0400-20-11-.17(1)(c, d, g, i, j, k); and 0400-20-11-.17(2)(b, c), [Note: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), and (5).]"* This note omits the requirements of paragraph (3) and (4) of TDEC 0400-20-11-.16. TDEC agreed that paragraph (4) can be omitted from the ARAR table, since it refers to exposure during operations and DOE has requirements for this. While paragraph 4 may be relevant, it may not be appropriate since it is redundant. However, the FFA parties have not agreed whether to include paragraph (3), which reads as follows:

"(3) Protection of individuals from inadvertent intrusion.

Design, operation and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed."

DOE contends that they will require protection of individuals from inadvertent intrusion under their own authority, but DOE has not provided an argument for why the TDEC ARAR is not appropriate.

Other ARARs that should be added include most parts of TDEC Rule 0400-02-11-.08 paragraph (3) subparagraphs (a)&(b), portions of paragraph (1) of TDEC Rule 0400-20-11-.09, TDEC Rule 0400-20-04-.08, and any other rules that might facilitate verification that performance objectives will be met.

DOE removed TDEC 0400-11-01-.04(3)(a)&(b) from the D5 version of the RI/FS report. The specific requirement of interest is that:

"Disposal Facilities must be located, designed, constructed, operated, and maintained such that the fill areas are, at a minimum: 200 feet from the normal boundaries of springs, streams, lakes, (except that this standard shall not apply to any wet weather conveyance nor to bodies of water constructed and designed to be a part of the facility)...."

Appendix G, Section 4.3 states that a waiver of TDEC 0400-20-11-.17(1)(h) is not needed. This statement confuses siting requirements with design requirements. In Section 4.2 of Appendix G, DOE applies similar reasoning, stating that no waiver of 40 CFR 761.75(b)(5) is needed for any site evaluated in the RI/FS, despite the steep slopes at EBCV (site 5). Similar reasoning is also applied to the rationale for requesting a waiver of TSCA 40 CFR 761.75(b)(3) in section 4.1 of Appendix G. However, there is no mention that a waiver would presumably be needed for most/all of the sites for subparagraph (e) of paragraph (1) of this rule which states:

"The disposal site must be generally well drained and free of areas of flooding or frequent ponding. Waste disposal shall not take place in a 100-year flood plain or wetland, as defined in Presidential Executive Order 11988, "Floodplain Management Guidelines."

Equally important from a TDEC perspective as the issues of groundwater discharge, connection of groundwater to surface water, and topography is the question of how to address subparagraph (b) of this rule, which states: *"The disposal site shall be capable of being characterized, modeled, analyzed and monitored."* The statement in the rule is general, and it might be possible to characterize and monitor these sites to the degree needed to assure protection of human health and the environment. However, it is TDEC's position that DOE would need to justify waiving this ARAR for any of the evaluated sites because of the modeling requirement and lessons learned from modeling groundwater levels for the EMWMF. TDEC has written extensive comments on all drafts of the RI/FS explaining why it is not appropriate to apply traditional modeling approaches to evaluate contaminant transport in BCV. Assuming sufficient conservatism is built into facility design and performance modeling, this requirement might be waived, but TDEC has cautioned that such conservatism could impact the economic viability of on-site disposal. DOE has not adequately responded to these comments, deferring all issues of modeling to the future.

Siting requirements that might require waiver justifications at one or more of the sites are discussed in the following paragraphs. Siting EMDF at some of the candidate sites would require justification for waiver(s) of one or both of the following TSCA ARARs, which are discussed in General Comments 19 and 20.

1. TSCA 40 CFR 761.75(b)(3): *"Hydrologic conditions. The bottom of the landfill shall be above the historical high groundwater table as provided below. Floodplains, shorelands, and groundwater recharge areas shall be avoided. There shall be no hydraulic connection between the site and standing or flowing surface water. The site shall have monitoring wells and leachate collection. The bottom of the landfill liner system or natural in-place soil barrier shall be at least fifty feet from the historical high water table."*
2. TSCA 40 CFR 761.75(b)(5): *"Topography. The landfill site shall be located in an area of low to moderate relief to minimize erosion and to help prevent landslides or slumping."*

DRH rules for siting a radioactive waste landfill that might require waiver justifications at some or all sites include the following:

1. Tennessee Rule 0400-20-11-.17(1)(b): *"The disposal site shall be capable of being characterized, modeled, analyzed and monitored."*

This rule may need to be waived at all sites, because of the difficulty in modeling groundwater levels in BCV.

2. Tennessee Rule 0400-20-11-.17(1)(c): *"Within the region where the facility is to be located, a disposal site should be selected so that projected population growth and future developments are not likely to affect the ability of the disposal facility to meet the performance objective of Rule 0400-20-11-.16."*

This rule says *should*, rather than *must*. There is room for debate about whether a waiver would be required, as the emphasis is on population growth. However, BCV sites do not strictly comply with NRC guidance (NUREG-0902, NRC 1982) which states: *"Disposal sites should be located in an area which has low population density and limited population growth potential. Disposal sites should be at least two kilometers from the property limits of the closest population centers."*

3. Tennessee Rule 0400-20-11-.17(1)(e): *"The disposal site must be generally well drained and free of areas of flooding or frequent ponding. Waste disposal shall not take place in a 100-year flood plain or wetland, as defined in Presidential Executive Order 11988, 'Floodplain Management Guidelines'."*

Again, the ability to meet this ARAR differs from site to site, depending on proximity to streams and wetlands. No site is in the 100 year floodplain, but almost all are associated with minor wetlands, and some are not well drained in all parts of the proposed landfill footprint.

4. Tennessee Rule 0400-20-11-.17(1)(g): *"The disposal site must provide sufficient depth to the watertable that ground water intrusion, perennial or otherwise, onto waste will not occur. The Department will consider an exception to this requirement to allow disposal below the watertable if it can be conclusively shown that disposal site characteristics will result in*

molecular diffusion being the predominant means of radionuclide movement and the rate of movement will result in the performance objectives of Rule 0400-20-11-.16 being met. In no case will waste disposal be permitted in the zone of fluctuation of the water table."

DOE contends that EMDF will be above grade to prevent groundwater intrusion into the waste. This is better justification for waiving the siting requirement than arguing that it meets the requirement. On parts of many of these sites, the water table may fluctuate many feet seasonally, and the high water table is near ground surface. This represents a worst-case scenario with regard to the potential for groundwater to fluctuate into the waste.

5. Tennessee Rule 0400-20-11-.17(1)(h): *"The hydrogeologic unit used for disposal shall not discharge ground water to the surface within the disposal site."*

This ARAR would need to be waived at the EBCV site, the WBCV site, and possibly others, depending on the proximity of the final footprint to seeps, springs, and gaining streams.

6. Tennessee Rule 0400-20-11-.17(1)(j): *"Areas must be avoided where surface geologic processes such as mass wasting, erosion, slumping, landsliding or weathering occur with such frequency and extent to affect the ability of the disposal site to meet the performance objectives of Rule 0400-20-11-.16, or may preclude defensible modeling and prediction of long-term impacts."*

As with the similar TSCA requirement on topography listed above [TSCA 40 CFR 761.75(b)(5)], this ARAR would need to be waived at the EBCV site, and possibly at Site 6b. The WBCV and CBCV sites are less steep.

7. Tennessee Rule 0400-20-11-.17(1)(k): *"The disposal site must not be located where nearby facilities or activities could impact the ability of the site to meet the performance objectives of Rule 0400-20-11-.16 or mask the environmental monitoring program."*

Because groundwater and surface water in BCV are widely impacted by legacy disposal sites, this ARAR might need a waiver justification for all sites, except perhaps the WBCV site.

Tennessee Rule 0400-11-01-.04(3)(b): There might also be a waiver need for the solid waste buffer requirement for Class II industrial landfills, which references 0400-11-01-.04(3)(a)(4) for Class I landfills:

"...200 feet from the normal boundaries of springs, streams, lakes, (except that this standard shall not apply to any wet weather conveyance nor to bodies of water constructed and designed to be a part of the facility)".

Tennessee Rule 0400-12-02-.03: There are many siting requirements in 0400-12-02-.03 Siting Criteria for New Commercial Hazardous Waste Management Facilities that would not be met at

BCV sites. Since these requirements apply to commercial facilities, they are not applicable. Whether or not they are relevant and appropriate would be a matter of debate, but most are largely redundant to the requirements in Tennessee Rule 0400-20-11-.17(1), which is discussed above. One such requirement, 0400-12-02-.03(2)(e)(1)(i)(III), is included as an ARAR in the D5 report along with the following note: *"The demonstration referred to here will be a description of how corrective action would be implemented."* No such demonstration has been submitted to date, and a waiver justification would be necessary without a valid demonstration that groundwater remediation can be accomplished in BCV in a cost-effective manner.

Tennessee Rule 0400-12-02-.03(2)(e)(1)(i)(III): New land-based units are prohibited in areas where the owner or operator cannot demonstrate, to the satisfaction of the commissioner:

"The technical practicability of a corrective action program at the site, based on the availability of current or new and innovative technologies that could practicably achieve ground water remediation. The demonstration shall specify how a corrective action response will be effectively implemented to remediate a release to ground water within the facility property boundary and shall illustrate all the factors that are necessary to be in compliance with the corrective action requirements under Rule 0400-12-01-.06(6)."

In Appendix G, Section 7.9 (page G-31) effluent limits set under 40 CFR 445.11 are said to be exempt because the landfill is a "captive landfill," an argument TDEC and EPA have rejected. It seems more appropriate to include 445 and argue that the specific monitoring requirements should be waived because they are not appropriate.

26. Performance Objectives required for low level waste disposal in Tennessee are defined in Tennessee Rule 0400-20-11-.16. Substantive DRH rules are ARARs, and ARAR compliance is needed for TDEC to concur that the proposed remedial action is or will be protective of human health and environment. Specific technical information and analyses required by TDEC Rule 0400-20-11-.08(3) are required to determine whether performance objectives required in TDEC Rule 0400-20-11-.16 are met. Concentration limits or other criteria required to comply with DRH requirements should be included in an administrative WAC. Independent modeling/analysis may be needed to verify that these requirements are met. Performance Objectives in TDEC-DRH rules and the process to determine whether the performance objectives are met are ARARs. According to the D5 RI/FS, WAC consistent with ARARs should be included in the administrative WAC.

27. The process described in the D5 RI/FS report to develop WAC consistent with CERCLA requirements is unclear. Section 6.2.3 requires an Analytic WAC that calculates limits and demonstrates compliance with RAOs established pursuant to CERCLA. RAOs are included in Chapter 4 of the RI/FS. Section 6.2.3 also specifies that the Administrative WAC will exclude waste streams and establish limits on waste as a result of ARARs or other policy issues. Finally, Section 6.2.3 (page 6-91) states: *"For a DOE LLW facility, WAC are also required by DOE Order 435.1. Compliance with DOE Order 435.1 ensures, per DOE requirements, that the facility is protective and meets performance objectives of the Order."* DOE Order (DOE O) 435.1 is an internal DOE policy.

Therefore, the concentration limits and other criteria developed to comply with DOE Order 435.1 should be included in the administrative WAC.

DOE Order 435.1 is not the foundation of analytic WAC that calculates limits and demonstrates compliance with RAOs. A process to develop an analytic WAC that calculates limits and demonstrates compliance with RAOs identified in Chapter 4 of the RI/FS is required.

Figure 6-31 (CERCLA and DOE Order 435.1 Progression and Interaction for On-Site Disposal Alternatives) specifies that "*Final WAC are presented in the WAC Compliance Plan and codified in the ROD. Final WAC will be determined based on final site location, PA model improvements, additional PA scenarios (intruder, pathways), preliminary characterization.*" The PA is an internal DOE process under DOE Order 435.1. It is not an ARAR or TBC for EMDF and is outside the CERCLA process.

The process described in Section 6.2.3 and the process depicted in Figure 6-31 are not consistent. Figure 6-31 only includes the DOE Order 435.1 PA model in developing the final WAC that assure DOE Order performance objectives are met. It does not include modeling to calculate limits and demonstrate compliance with RAOs as part of developing the WAC Attainment (Compliance) Plan.

The D4 version of the EMDF RI/FS assigned preliminary administrative WAC numbers to 28 of 32 radionuclides instead of providing limits that would be consistent with CERCLA risk criteria. See TDEC General Comment 9 on the D4 RI/FS. (The table included in TDEC General Comment 9 was omitted from DOE's compilation of TDEC D4 comments and DOE responses.) TDEC's comment compares DOE's preliminary administrative WAC with CERCLA risk criteria calculated using the methodology DOE provided in Appendix H. Administrative and Analytic WAC limits should be developed and presented separately. The D4 report demonstrates that it is confusing and misleading to mix Administrative WAC limits and Analytic WAC limits and designate the results as analytic WAC. This approach will cause dispute of the WAC Attainment (Compliance) Plan if it is not clear that CERCLA RAOs will be achieved.

28. The D5 RI/FS proposes screening radionuclides from the analytic WAC based on whether the constituent is expected in waste to be disposed in EMDF. The characterization of waste in the D5 RI/FS is based on waste already disposed at EMWMF, which was derived primarily from demolition activities at the former K-25 (now ETP) gaseous diffusion plant. Future waste streams will be generated primarily from the demolition and cleanup activities at Y-12 and X-10 (now Oak Ridge National Laboratory [ORNL]), where waste streams are expected to be different from K-25 waste. A more inclusive analytic WAC should be developed to assure there are comparison values for a wide range of radionuclides and hazardous substances likely to exist in those future waste streams. (For example, iodine-129 (I-129) appears to have been omitted from the D5 analytic WAC table.) Comparison values for potential contaminants of concern are needed to assure that RAOs are not violated in the future.

29. Although the title of Appendix E changed from the D4 ("*Description of Bear Creek Valley and Proposed Landfill Sites*") to the D5 ("*Detailed Site Descriptions and Characterizations*") version,

the D5 report still does not include the detailed site-specific characterization data necessary to support evaluation of the protectiveness of the waste disposal alternatives.

30. In contrast to previous version of the RI/FS, the D5 report introduces the 100-year institutional control period discussed in General Comments 2 and 4. Cost assumptions limit future DOE financial liability to 100 years after closure. DOE Order 435.1 specifies that *"[i]nstitutional control measures shall be integrated into land use and stewardship plans and programs, and shall continue until the facility can be released pursuant to DOE 5400.5, Radiation Protection of the Public and the Environment."* Apparently, the D5 report assumes this release occurs 100 years after closure.

NRC regulations and TDEC Rule 0400-20-11-.17(10) specify that institutional controls may not be relied upon for more than 100 years following transfer of control of the disposal site to the owner, where the owner is the federal or state government. Under CERCLA and the NCP *"if a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less than every five years after initiation of the selected remedial action."* Section XXXI of the FFA for the ORR assigns the responsibility to TDEC and EPA for performing five-year reviews after initiation of final remedial action(s).

Further, the FFA specifies that if TDEC or EPA determine that additional action or modification is appropriate in accordance with CERCLA, TDEC or EPA shall require DOE to submit a proposal to implement such additional or modified action(s), which shall be subject to TDEC and EPA review, approval, and dispute resolution. It is not guaranteed that DOE will perform perpetual institutional controls for the length of time necessary for long-lived radionuclides (and potentially high concentrations of shorter half-life radionuclides) to decay until they pose no threat, if released. To manage this uncertainty, WAC development should be consistent with the 100-year institutional control period specified in the D5 report and the TDEC/NRC requirement that institutional controls may not be relied upon for more than 100 years following transfer of the disposal site to the owner.

31. Finally, even though Tennessee is an NRC agreement state, the DOE ORR is a federal facility, and proposed EMDF is a federal disposal facility, not a commercial facility. Any transfer of the property, with future obligations to fund surveillance, monitoring, maintenance, and/or other future costs related to EMDF shall be to another federal entity and not the State of Tennessee.

32. TDEC highlights several ARARs:

- TDEC Rule 0400-20-11-.17(1)(b) requires that the disposal site shall be capable of being characterized, modeled, analyzed, and monitored.
- Rule 0400-20-11-.17(4)(d) requires that monitoring after closure must be capable of providing early warning of release of radionuclides from the disposal unit before the radionuclides leave the site boundary.

- Rule 0400-20-11-.16(5): The TDEC performance objective in this rule and DOE Order 435.1 requires that the disposal facility achieve long-term stability and minimize the need for ongoing active maintenance after closure. Active maintenance includes remedial actions such as pumping and treating groundwater and one-time costs such as replacing the disposal unit cover.
- TDEC 0400-12-02-.03(2)(e)(1)(i)(III): This relevant and appropriate requirement for the disposal facility based on requirements for new commercial hazardous waste management facilities is that new land based units are prohibited if they cannot demonstrate the technical practicability of a corrective action program at the site, based on the availability of current or new and innovative technologies that could practicably achieve ground water remediation.

The WAC must include protective total inventory limits for individual isotopes to minimize the potential for ongoing active maintenance, as evidenced by the following:

1. uncertainty in monitoring at EMWMF
2. complex geology in BCV and associated groundwater flow patterns, including conduit flow
3. lack of a feasible approach to remediate BCBG, and
4. potential for disposal of large quantities of waste at the proposed EMDF (2 million cubic yards of waste).

The WAC should be developed so that any releases more than 200 years after closure would not require ongoing active maintenance. TDEC agrees with the position expressed in NRC rules and guidance that, for wastes with hazards that will persist more than 500 years, the ability of a disposal facility to protect human health should be based more on the natural characteristics of the site and less on facility design.

33. Section 6.2.3, Waste Acceptance Criteria includes Figure 6-31 illustrating DOE's proposed path to resolving TDEC comments on modeling and the WAC. This approach would rely solely on DOE performing additional modeling pursuant to DOE Order 435.1 and guidance to develop a WAC that achieves performance objectives and other requirements of the DOE Order. That process is separate from CERCLA and is completely controlled by DOE. Review would be performed by DOE's LFRG. Although there has been discussion of allowing observation by TDEC and EPA in the LFRG review, that is an internal DOE process that does not allow formal approval and dispute under the FFA. The process is not performed under CERCLA and is not as a substitute for modeling under CERCLA to address RAOs, risk, ARARs, and TDEC-DRH Rules 0400-20-11-.08(3)(b) and 0400-20-11-.16. Even though the D5 report states that modeling would be performed to calculate limits and demonstrate compliance with RAOs as part of the WAC Attainment (Compliance) plan, that modeling is included in neither DOE's proposed process

(Figure 6-31) nor the accompanying discussion. Specifically, Section 6.2.3 states that requirements under DOE Order 435.1 will help guide development of a final WAC for a site. RAOs such as noncarcinogenic effects of uranium are not performance objectives under DOE Order 435.1. There is no clear process for developing WAC limits compliant with RAOs and ARARs in the process outlined in Figure 6-31.

TDEC performance objectives for low-level waste disposal are promulgated in TDEC-DRH Rules 0400-20-11-.16 that are substantively equivalent to NRC rules 10 CFR § 61.40, 10 CFR § 61.41, 10 CFR § 61.42, and 10 CFR § 61.44. If a party applied for a permit to dispose radioactive waste in Tennessee, the DRH would use the permit application fee to hire a consultant to perform the necessary evaluation to verify that performance objectives will be met pursuant to TDEC rules.

Performance objectives under DOE Order 435.1, TDEC Rule 0400-20-11-.16, and EMDF D5 Chapter 4 RAOs are not the same. The final WAC is required to meet all three sets of requirements.

TDEC's rule for protection of the general population from releases of radioactivity (Rule 0400-20-11-.16(2)) specifies that concentrations of radioactive material released to the general environment in groundwater, surface water, air, soil, plants, or animals must not exceed an annual dose exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public; and reasonable effort shall be made to maintain releases of radioactivity to the general public as low as reasonably achievable (ALARA). It will be necessary to calculate the 25/75/25 dose that corresponds to each radionuclide WAC limit and to conduct an ALARA analysis for this comparison.

34. Section 6.2.3, Waste Acceptance Criteria discusses the process for developing future WAC if there is another onsite disposal facility. The proposed process is based on the EMWMF WAC and includes, but is not limited to, administrative WAC and analytic WAC. The administrative WAC is stated to incorporate excluded waste streams and limits on waste streams as a result of ARARs or other policy issues. The analytic WAC is stated to include isotope-specific activity concentration limits and total facility inventory limits designed to meet CERCLA RAOs and to limit residual risk. Utilizing this WAC categorization, an analytic WAC would be developed to assure compliance with RAOs. Since DOE Orders are internal DOE policy outside the CERCLA process, an administrative WAC would be developed to document DOE Order 435.1 requirements. Likewise, another administrative WAC would be developed to document limits consistent with TDEC-DRH rules and other ARARs. The final WAC would include isotope-specific activity concentration limits and total facility inventory limits that comply with the analytic WAC based on RAOs, the administrative WAC based on DOE Orders, and the administrative WAC based on ARARs. Once more, the final WAC would be required to meet all three sets of requirements.

35. In addition to being a major factor in assuring long-term protection of human health and the environment, the WAC can drastically affect the size of a facility based on restrictions it could impose on the volume allowed for disposal. This issue not only has the potential to affect

design, but it could eliminate the reported cost advantage of on-site disposal. Moreover, the RI/FS does not provide adequate information to support selection of a preferred alternative/remedy due to incomplete description of waste that may be disposed, coupled with modeling failure to determine the quantity of that waste that may be disposed. A particular concern is that the WAC limiting total depleted uranium disposal makes it difficult to differentiate among any of the large, single-site options and the hybrid option.

36. In lieu of a baseline risk assessment, the D5 RI/FS includes “placeholder” preliminary waste limits (Table 6-5) with the expectation of modeling and determining WAC in the future. FFA Section XXI specifies which documents are primary documents and which documents are secondary documents. RI reports are primary documents and subject to review, comment, and approval or dispute resolution. The FFA cites Baseline Risk Assessment reports as examples of secondary documents. Secondary documents are not subject to dispute under the FFA. Pursuant to the NCP, baseline risk assessments are integral to the RI/FS process. TDEC asserts that any WAC modeling to be developed at a future step under any agreed-upon caveated approach proposed by DOE shall be incorporated in a primary document subject to review, comment, and approval or dispute under the FFA.

37. DOE’s proposed caveated approach includes submittal of a Proposed Plan prior to finalization of the modeling and WAC. The NCP requires that the Proposed Plan comment period provide reasonable opportunity for submission of written and oral comments on the Proposed Plan and the supporting analysis and information located in the information repository, including the [approved] RI/FS. The public is not offered a reasonable opportunity for meaningful comment on the supporting analysis if they are presented with a range of WAC values that have not been determined to be protective. If the final WAC is developed after the Proposed Plan, additional public comment, with any comments received evaluated during final WAC development, is necessary to allow the community to comment on the WAC and supporting analysis prior to finalization of the WAC.

38. To establish the feasibility of alternatives and to support the selection of a preferred alternative for disposal of CERCLA waste at Oak Ridge, the Remedial Investigation (RI) and Feasibility Study (FS) should provide much of the same information that would be required in an application to permit disposal of radioactive, hazardous, or toxic waste. The RI/FS should provide reasonable assurance, through risk assessment, that CERCLA threshold criteria (protection of human health and the environment and compliance with law) can be met for each alternative considered. However, the specific details of how this demonstration should be performed for waste disposal authorized under CERCLA, a statute that was intended to guide environmental restoration actions rather than waste disposal, should be prescribed in RAOs and ARARs that are incorporated into the CERCLA decision documents.

As the RI and FS are primarily intended to evaluate the feasibility of disposal alternatives for radioactive waste, a RI/FS should include, in large part, the same information and analyses that would be required to issue a permit for a radioactive waste disposal facility. General information required in a permit application for land disposal of radioactive waste in Tennessee is given in paragraph (2) of TN Rule 0400-20-11-.08. The Tennessee licensing requirements for

land disposal of radioactive waste list both the specific technical information and the technical analyses needed to demonstrate protection of the general population from releases of radioactivity and compliance with the requirements for issuance of a license to dispose radioactive waste in paragraph (3) of TN Rule 0400-20-11-.08. While it might be argued that some of the content of these rules are administrative in nature, portions of these rules are substantive requirements and should be included in the RI/FS as relevant and appropriate.

The various versions of the RI/FS do not provide as much detail on the types and amounts of waste to be disposed as would be necessary to satisfy TN Rule 0400-20-11-.08 (2)(c)(3), which anticipates waste streams from less diverse sources than those to be generated by ORR CERCLA actions. These documents have other provided information that is substantively equivalent to the general information requested under paragraph (2) of TDEC Rule 0400-20-11-.08.

In contrast, these documents have not provided information equivalent to the specific technical requirements given in paragraph (3), subparagraph (a), or the technical analyses given in paragraph (3), subparagraph (b), that must be included in a land disposal permit application. These requirements are listed below and most should be included as relevant and appropriate requirements in the RI/FS. In addition, the list below indicates whether the D5 or other CERCLA documents submitted to date have provided information equivalent to that required by state rules, including the appropriate level of detail or analysis.

(a) The specific technical information must include the following information needed for demonstration that the performance objectives and the applicable technical requirements of this Chapter will be met:

1. A description of the natural and demographic disposal site characteristics as determined by disposal site selection and characterization activities. The description must include geologic, geotechnical, hydrologic, meteorologic, climatologic and biotic features of the disposal site and vicinity.

Descriptions of natural and demographic characteristics in the latest version (D5) of the RI/FS are still deficient with respect to water level and geotechnical data at most of the sites. No water level data are available for the sites that appear to be most promising for long-term waste isolation.

2. A description of the design features of the land disposal facility and the disposal units. The description must include those design features related to infiltration of water; integrity of covers for disposal units; structural stability of backfill, wastes and covers; contact of wastes with standing water; disposal site drainage; disposal site closure and stabilization; elimination to the extent practicable of long-term disposal site maintenance; inadvertent intrusion; occupational exposures; disposal site monitoring; and adequacy of the size of the buffer zone for monitoring and potential mitigative measures.

Descriptions of design features are limited to conceptual design and have been used for input into modeling and estimations of waste volume. Conceptual design descriptions presented in the D4 and D5 reports may be sufficient to inform infiltration, site drainage, inadvertent intrusion, occupational exposures, and buffer zone adequacy at the level needed to choose a preferred alternative, but the level of detail in the design has not been adequate to address stability of waste, contact of water with waste, monitoring, or long-term maintenance.

3. A description of the principal design criteria and their relationship to the performance objectives.

The D5 report provides insufficient design criteria detail to properly formulate realistic failure scenarios to guide risk assessment analyses, thus demonstrating how RAOs and ARARs (which would include performance objectives) would be met.

4. A description of the design basis natural events or phenomena and their relationship to the principal design criteria.

These have sometimes been incorporated into the RI/FS as ARARs, an approach which may be adequate to allow the choice of a preferred alternative. Information from stability analyses on the EMWMF, which is similar to the conceptual design of the proposed facility, might be summarized or included by reference.

5. A description of codes and standards which the applicant has applied to the design and which will apply to construction of the land disposal facilities.

Some of these have been incorporated into the RI/FS as ARARs (primarily hazardous waste rules), which may also provide sufficient detail to allow the choice of a preferred alternative.

6. A description of the construction and operation of the land disposal facility. The description must include as a minimum the methods of construction of disposal units; waste emplacement; the procedures for and areas of waste segregation; types of intruder barriers; onsite traffic and drainage systems; survey control program; methods and area of waste storage; and methods to control surface water and ground water access to the wastes. The description must also include a description of the methods to be employed in the handling and disposal of wastes containing chelating agents or other nonradiological substances that might affect meeting the performance objectives in this Chapter.

Much of this information has not been presented in the D5 or previous versions of the RI/FS, but may not be necessary to show that the alternatives are feasible or to provide a basis for selecting a preferred alternative. However, design and

operational plans to control surface water and ground water access to the waste and demonstrate compliance with ARARs for water management should be included in the RI/FS.

7. A description of the disposal site closure plan, including those design features which are intended to facilitate disposal site closure and to eliminate the need for ongoing active maintenance.

Descriptions of cover design have been limited to the conceptual level, but with sufficient detail to inform infiltration rates and intruder analyses. Minimum requirements have been incorporated into ARARs as well.

8. An identification of the known natural resources at the disposal site, the exploitation of which could result in inadvertent intrusion into the low-level wastes after removal of active institutional control.

Natural resources that might be exploited are minimal and similar at all sites. This is adequately addressed in the documents that have been submitted.

9. A description of the kind, amount, classification and specifications of the radioactive material proposed to be received, possessed and disposed of at the land disposal facility.

Information provided on characteristics of the anticipated waste materials is inadequate to assess the suitability of much of the waste for land disposal in Oak Ridge.

10. A description of the quality control program, developed and applied by the applicant to:

- (i) The determination of the natural characteristics of the disposal site,*
- (ii) The design, construction, operation and closure of the land disposal facility; and the receipt, handling, and emplacement of waste.*
- (iii) Audits and managerial controls must be included.*

This information is largely incorporated as ARARs via the quality control requirements of RCRA and may be sufficient for the purposes of the RI/FS.

11. A description of the radiation safety program for control and monitoring of radioactive effluents to ensure compliance with the performance objectives of this Chapter and occupational radiation exposure to ensure compliance with the requirements of Chapter 0400-20-05 and to control contamination of personnel, vehicles, equipment, buildings and the disposal site. Both routine operations and accidents must be addressed. The program description must include procedures, instrumentation, facilities and equipment.

This information is not provided, but is probably not necessary to include in the RI/FS since any on-site facility will have to operate under DOE radiation protection requirements. This information could easily be included by reference to radiation protection rules and DOE Orders.

12. A description of the environmental monitoring program to provide data to evaluate potential health and environmental impacts and the plan for taking corrective measures if migration of radionuclides is indicated.

This information is not provided. Data available from other sources, such as the BCV watershed RI or the EMWMF environmental monitoring plan, might be included by reference. Plans for environmental monitoring and corrective measures that might be used if a release was indicated are complicated by the complex hydrogeology in the fractured bedrock that underlies the sites. It is unlikely that a limited number of wells will be able to adequately monitor the dominant migration pathways from the proposed facility.

13. A description of the administrative procedures that the applicant will apply to control activities at the land disposal facility.

This information has been presented in terms of land-use controls and might be adequate for the purposes of choosing a preferred alternative.

(b) The specific technical information must also include the following analyses needed to demonstrate that the performance objectives of this Chapter will be met:

1. Pathways analyzed in demonstrating protection of the general population from releases of radioactivity must include air, soil, groundwater, surface water, plant uptake and exhumation by burrowing animals. The analyses must clearly identify and differentiate between the roles performed by the natural disposal site characteristics and design features in isolating and segregating the wastes. The analyses must clearly demonstrate that there is reasonable assurance that the exposures to humans from the release of radioactivity will not exceed the limits set forth in this Chapter.

Scenarios and pathways analyzed in the previous versions of the RI/FS have so far been limited to those involving protection of groundwater and surface water resources. The results of these analyses, as presented in the WAC, have varied by orders of magnitude from one version of the document to another. As stated frequently in other comments, these analyses are absent from the D5 version of the RI/FS. Due to differences of opinion between TDEC and DOE concerning the selection of risk assessment scenarios and pathways, as well as the use of outdated transport models and questionable modeling assumptions in the various versions of the RI/FS submitted to date, TDEC has recommended defensible independent modeling/verification by recognized experts. Given the lack of a location on the ORR that can meet the siting requirements in ARARs without excessive reliance on engineering and perpetual maintenance or significant

limitations on disposal capacity, authorization of the proposed EMDF should be based on protective WAC, developed through defensible risk assessment, that will demonstrate reasonable assurance that performance objectives and remedial action alternatives will be met.

2. Analyses of the protection of individuals from inadvertent intrusion must include demonstration that there is reasonable assurance the waste classification and segregation requirements will be met and that barriers to inadvertent intrusion will be provided.

The reference to waste classification and segregation is problematic for inclusion in the RI/FS, as the waste classification may not be appropriate for DOE remediation waste. Regardless, minimum requirements for cover design should be approved by the regulators prior to a ROD to demonstrate that there will be physical as well as administrative barriers to inadvertent intrusion.

3. Analyses of the protection of individuals during operations must include assessments of expected exposures due to routine operations and accidents during handling, storage and disposal of waste. The analyses must provide assurance that exposures will be controlled to meet the requirements of Chapter 0400-20-05.

Presumably this requirement will be met through DOE operational requirements and will be enforced equally with respect to all on-site alternatives. It would not need to be included as an ARAR, since it might be argued that it is redundant and hence, not appropriate.

4. Analyses of the long-term stability of the disposal site and the need for ongoing active maintenance after closure must be based upon analyses of active natural processes such as erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses must provide assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.

These analyses have not been performed to date, nor have long-term failure scenarios other than limited leakage from the facility through infiltrating water been incorporated into risk assessment.

39. The DOE Order 435.1 process requires both a PA and a CA. The D5 report only references the PA informing the WAC. It is possible that EMWMF and EMDF may release contamination at about the same time in the future. (The D5 report also assumes that the landfill water treatment system would be decommissioned 10 years after closure of the EMDF.) Moreover, BCBG is already releasing contamination to Bear Creek. The WAC must be informed by the results of the CA, *in addition to* the PA. If the CA for EMDF takes credit for remediation of

sites such as BCBG, the schedule for such remediation must be documented as milestones in Appendix J of the FFA.

40. Radon is in the decay chain for uranium and radium. Radon flux is included as an ARAR and radon may pose risk through vapor intrusion or off-gassing from groundwater used for a water supply.

Specific Comments

Specific Comments 1 through 46 are updated versions of TDEC's corresponding comments on the D4 RI/FS report. In most cases, report revisions in the D5 version do not adequately address previous comments. Beginning with Specific Comment 47 below, TDEC offers additional observations and/or recommendations based on review of the D5 report.

1. **Chapter 4, Remedial Action Objectives, Page 4-1, RAO #2:** TDEC Specific Comment 1 on the D4 report notes that the RAO to protect ecological receptors includes ARARs that may not include radionuclides. Protection of ecological receptors from radionuclides should also be established through ecological risk assessment. DOE's response states that Chapter 4 has been revised to include the following statement concerning Remediation Goals (RGs) in response to this comment: *"In addition, there will be risk-based RGs calculated for surface water (for uranium, as an example) or ground water to protect future surface water aquatic species or potential human receptors."* The RGs should be included in the RI/FS report, but they are not listed in the D5 version.

2. **Section 6.2.1.1, EBCV (Site 5), Page 6-9, 2nd paragraph:** *"Northern long-eared bats..."* TDEC acknowledges and appreciates DOE's responsiveness to Specific Comment 2 on the D4 report. The comment is addressed by DOE's documentation of consultation with U.S. Fish and Wildlife Service (USFWS) regarding timber recovery at Site 5 and revised text that indicates T&E surveys will be conducted for any site selected for EMDF construction. Also, the D5 report more accurately reflects the identification of threatened Northern long-eared bats in BCV.

On February 28, 2017, TDEC provided DOE with a report documenting the findings of a TDEC bat survey completed during 2016 at Site 7a/7c. The TDEC report provides information and recommendations to help DOE plan tree clearing activities associated with the proposed EMDF. Specifically, DOE should consult with the USFWS and remove timber only during the fall/winter season (bat hibernation period). In other words, trees should not be harvested during spring/summer season when bats are using trees (and forests) for foraging, roosting, and while females are raising their young. The TDEC report also recommends that DOE conduct a tree habitat assessment and summer bat survey between May 15 and August 15. Verbal reports from DOE contractor personnel to TDEC staff during March 2017 indicate that efforts are being made to identify and remove trees only during the appropriate season in preparation for road building at Site 7c.

3. **Section 6.2.1.2, WBCV (Site 14), Page 6-14, paragraph titled: Ecological/cultural resources:** *"No recent site-specific surveys to identify T&E species have been completed for Site 14,*

*although previous investigations on the ORR (McCracken, et al. 2015) in general have confirmed the presence of Indiana and gray bats, both endangered species, and the northern long-eared bat, which was detected at the EBCV site (see Appendix E for details). Ecological conditions for the WBCV area were reported in an environmental impact statement data package for the LLWDDD [Low-Level Waste Disposal Development and Demonstration] program published in 1988." **Section 6.2.1.3 Dual Site (Sites 6b/7a), Site Characteristics – Site 7a, Ecological/cultural Resources, Page 6-23** contains similar language that also applies to Site 7c by reference.*

TDEC Specific Comment 3 on the D4 RI/FS notes that the 1988 study is outdated for the purpose of establishing current T&E species status and agrees that detailed assessments to evaluate potential impacts to wetlands and identify T&E species are warranted for any site selected for construction. Furthermore, TDEC expects a thorough evaluation of ecological and cultural resources at any candidate site before approval of an alternative that would authorize construction of a disposal facility on the site.

DOE's response indicates agreement that the study is outdated and that detailed surveys are required early in the planning process to satisfy applicable regulations and statutes and DOE requirements. However, DOE also states that such surveys would not preclude the use of a site under most circumstances and would only be completed after a site has been selected. TDEC agrees, as long as such studies are completed prior to any construction.

4. Section 6.2.1.3, Dual Site (Sites 6b/7a), Page 6-20, paragraph titled: Ecological/cultural resources: *"Two separate surveys to identify T&E species of vascular plants and fish were completed in 1998 for the EMWDF that included the Site 6b area (see Appendix E for details). Neither survey identified T&E species in the Site 6b area, although recommendations were made to preserve habitats and implement best management practices to protect the Tennessee Dace in downstream areas. ORR ecological surveys mapped a "natural area 28" across and adjacent to the Site 6b area (see Appendix E) that includes wetlands delineated east and west of the site. Wetlands on the east and west sides of Site 6b along the NT-5 and NT-6 tributaries were delineated by Rosensteel and Trettin (1993) that could be impacted by EMDF construction (see maps and details in Appendix E). Surveys to evaluate potential impacts to wetlands and other T&E species may be warranted at Site 6b if the site is selected for EMDF construction."*

TDEC Specific Comment 4 on the D4 RI/FS notes that the documents cited in this paragraph are outdated for the purposes of establishing the current status of T&E species. Given the documented presence of the threatened Northern long-eared bat, TDEC also recommends the collection of bat survey data for any site prior to facility construction.

DOE's response indicates agreement that the study is outdated and that detailed surveys are required early in the planning process to satisfy applicable regulations and statutes and DOE requirements. However, DOE also states that such surveys would not preclude the use of a site under most circumstances and would only be completed after a site has been selected. TDEC agrees, as long as such studies are completed prior to any construction.

5. Section 6.2.3 Waste Acceptance Criteria, Page 6-89, Table 6-5: TDEC Specific Comment 5 and General Comment 6 on the D4 report discuss significant problems with DOE's risk assessment approach, including the calculation of preliminary WAC limits based on a HI of 3. TDEC also recommends preliminary WAC for the noncarcinogenic threat from uranium metal should be determined by EPA approved analytical methods and reported as total uranium in units of mg/kg instead of speciation into the various uranium isotopes. Finally, TDEC points out the confusion caused by DOE's presentation of a noncarcinogenic preliminary WAC for U-238 of 52.2 mg/kg, which is about 17.7 pCi/g, or about one-half of the 35 pCi/g allowed for disposal in the ORR Landfill.

During comment resolution meetings, DOE presented a draft response stating that a calculation error was made that caused preliminary WAC values in the D4 to be a factor of two lower than the correct values. At that time, DOE planned to provide corrected tables in the D5 report and address EPA's request that the risk assessment should not be based on an HI of 3.

As noted in DOE's final response, the D5 RI/FS presents "placeholders" in lieu of WAC and total inventory limits. The D5 report does not model radionuclide fate and transport. Therefore, the D5 RI/FS report does not include the risk assessment necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives. The significant modeling error in the D4 report and DOE's decision to exclude modeling and risk assessment from the D5 report underscore the need for modeling/verification by an independent entity. It is TDEC's position that such independence would be more likely to produce WAC and total inventory limits that will allow CERCLA waste to be disposed in a compliant and protective manner.

6. Section 6.2.2.4.8. Longevity of Engineered Features. Cover/ Liner Systems, Page 6-54: *"Geomembrane liners of the landfill liner system at all sites would control releases of leachate to ground water for their design life reported to extend from 500 to 1000 years or more (Koerner, et al. 2011, Rowe, et al. 2009a, Benson 2014, EPA 2000). Both cap and liner systems contain geomembranes to prevent water infiltration into the waste, reduce contact of water and waste, and minimize leachate production and migration. As described by Bonaparte et al. (2016), it appears that HDPE geomembranes of the type being used in some MLLW disposal facilities are relatively unaffected at total alpha doses of 5 megarad (Mrad), or more. These geomembranes are also reportedly unaffected by radiation from gamma and/or beta sources until total doses reach on the order of 1 to 10 Mrad, which is much higher than what would be expected to be disposed in the EMDF."*

TDEC Specific Comment 6 on the D4 report agrees that properly designed and installed geocomposite barriers may control leachate releases to groundwater for many decades or even centuries but notes that the difference between a service life of a few hundred years and a thousand years might be critical for isolation of an isotope like Sr-90, which would require 30 to 40 half-lives, or about 1,000 years to decay from the proposed limit set by the administrative WAC to levels that would be innocuous in leachate.

TDEC also agrees that disposal of waste that could produce a total dose of 1 Mrad to the geomembrane in either cap or liner is unlikely, due in part to the small amount of waste that is likely to be generated with high concentrations of beta/gamma emitters and in part to shielding by clay and drainage layers. However, TDEC points out that dose calculations would be necessary to estimate whether radiation fields would damage the liner, given that the administrative WAC proposed in the D4 report would allow 4,600 Curies per cubic meter of Cs-137 and places no limits on cobalt-60 (Co-60).

As noted in DOE's final response, the D5 RI/FS presents "placeholders" in lieu of WAC and total inventory limits. The D5 report does not model radionuclide fate/transport or dose. Therefore, the D5 RI/FS report does not include the risk assessment necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives. Again, modeling errors in the D4 report and DOE's decision to exclude modeling and risk assessment from the D5 report underscore the need for modeling/verification by an independent entity. It is TDEC's position that such independence would be more likely to produce WAC and total inventory limits that will allow CERCLA waste to be disposed in a compliant and protective manner.

7. Section 7.2.2.3.3 Action-specific ARARs, Page 7-15, first bullet, TDEC 0400-20-11-17(1)(b): *"All sites selected for consideration meet this ARAR. All sites under consideration in this RI/FS as locations for an on-site disposal facility – EBCV Site, WBCV Site, CBCV Site, Dual Site (Site 6b and Site 7a) – are located in BCV, which has been extensively characterized over the last 40-50 years. More than 1,000 groundwater wells have been installed and monitored many of which continue to be monitored, multiple characterization events have been executed and documented, and over 900 acres of the valley are incorporated in the BCV model, which was used in modeling the existing EMWMF landfill. Additionally, an effort is underway within OREM to develop a more detailed groundwater model of BCV outside of this RI/FS. Further modeling efforts will be undertaken should one of the on-site locations be selected as the proposed remedy in the Proposed Plan."*

Although the text has been modified for the D5 report, TDEC Specific Comment 7 on the D4 report notes that the approach cited above and other parts of the document assume the existence of an equivalent porous medium, which is far from applicable in BCV or elsewhere on the ORR. The comment also offers suggestions for selecting model parameters characteristic of the fractured rock actually present in BCV.

As noted in DOE's final response, the D5 RI/FS presents "placeholders" in lieu of WAC and total inventory limits. The D5 report does not model radionuclide fate and transport. Therefore, the D5 RI/FS report does not include the risk assessment necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives. The significant modeling error in the D4 report and DOE's decision to exclude modeling and risk assessment from the D5 report underscore the need for modeling/verification by an independent entity. It is TDEC's position that such independence would be more likely to produce WAC and total inventory limits that will allow CERCLA waste to be disposed in a compliant and protective manner.

8. Section 7.2.2.3.3 Action-specific ARARs, Page 7-18, third bullet, TDEC 0400-20-11-17(1)(f): TDEC Specific Comment 8 on the D4 report questions the accuracy of the statement that *"All proposed sites are situated such that upland drainage areas are minimized by locating the footprints as far upslope as possible."* DOE's response states that *"The language has been reworded to clarify how this is accomplished for each site."* While the D5 report includes revised text stating that *"Proposed sites are situated such that upland drainage areas are minimized,"* this response does not indicate other text revisions that may *"clarify how this is accomplished for each site."*

9. Section 7.2.2.4 Long-term Effectiveness and Permanence (On-site), Page 7-23: TDEC Specific Comment 9 on the D4 report notes that the residual risk discussion is limited to the 1,000-year compliance period and that residual risk beyond 1,000 years is not addressed. DOE's response states that language has been added to this section to address functioning of underdrain systems over longer periods of time. However, the D5 report does not appear to contain that text. Rather, it merely removes the reference to the 1,000-year compliance period and promises that design, ARARs, WAC, and inventory limits would ensure that RAOs are met.

DOE's response states further that *"site characterization will be considered in moving forward with characterization through the CERCLA process."* It appears that DOE intended to state that *"modeling and/or preliminary WAC will be considered in moving forward with modeling and WAC development through the CERCLA process."* Regardless, it is TDEC's position that the D5 report is deficient because it includes neither the site characterization data *nor* the modeling and risk assessment results needed to determine WAC and total inventory limits that will allow CERCLA waste to be disposed in a compliant and protective manner.

10. Page E-13, Figure E-1, BCV Phase I ROD land use zones...: TDEC Specific Comment 10 on the D4 report requests that the map include a complete legend that describes all map symbology, including existing streams, roads, and gray polygons west of Site 6B. DOE responds that the grey shaded areas have been added to the legend and that roads and creeks are not symbols. While it is common cartographic practice to include all symbology in map legends, including roads and streams, TDEC agrees with this response, given that the names of some roads and streams are labeled on the map.

11. Page E-15, Figure E-2, Existing contaminant source areas...: TDEC Specific Comment 11 on the D4 report requests that the map include a complete legend that describes all map symbology and define acronyms (e.g., HCDA). DOE responds that the map cannot be modified because it is from another source and that the acronym HCDA has been added to the Appendix E acronym list. TDEC agrees with the response.

12. Page E-23, Figure E-7, Potential EMDF sites in BCV with respect to the northern DOE site boundary and nearest Oak Ridge residents: TDEC Specific Comment 12 on the D4 report requests that the map portray distances between potential disposal sites and the DOE site boundary and that DOE revise any calculations or estimates based on the distances portrayed on the map. TDEC also requested revision of the figure title to accurately reflect that the map only addresses *current* residents. In the D5 report, the map and siting criterion language in

Section 7.2.2.3.3 (not 7.2.2.3 as stated in DOE's response) have been improved sufficiently to address the comment.

13. Page E-26, Section 2.7 Watershed Topography, Drainage, and Land Use Zones.

Paragraph 2: TDEC Specific Comment 13 on the D4 report noted the potential inaccuracy of the statement that Site 5 is "*physically and hydrologically separated from this community by Pine Ridge.*" As noted in DOE's response, the potentially incorrect statement has been removed from Appendix E in the D5 report. TDEC agrees with this revision.

14. Page E-28, Section 2.8.1 Hydrogeological Conceptual Model for Bear Creek Valley:

TDEC Specific Comment 14 on the D4 report identifies several problems with the hydrogeological concepts discussed in this section of the document—e.g., porous medium assumption and the resulting underestimation of groundwater velocity, contaminant transport, and other potentially problematic modeled predictions. DOE responds that the text of Section 2.8.1 in Appendix E was revised. However, the minor revisions do not address the comment.

15. Page E-30, Section 2.8.2, Hydrogeological Conceptual Models for EMDF Sites in Bear Creek Valley:

TDEC Specific Comment 15 on the D4 report requests evidence to support the implication that Bear Creek is a hydrogeologic boundary to groundwater flow in the karstic Maynardville limestone. Text suggesting that Bear Creek serves as a base level for groundwater flow has been removed from the D5 report, and TDEC agrees with this revision.

16. Page E-30, 2.8.2 Hydrogeological Conceptual Models for EMDF Sites in Bear Creek Valley:

TDEC Specific Comment 16 on the D4 report cites the need for site-specific data from a thorough hydrogeological investigation of the candidate sites, given that 1) releases of radioactive constituents from EMDF have the potential to impact human health and the environment for thousands of years and 2) groundwater flow is one of the most significant potential transport pathways.

DOE's response states: "*This comment dealing with site characterization will be considered in moving forward with characterization through the CERCLA process.*" DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the site-specific characterization information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

17. Page E-30, 2.8.2 Hydrogeological Conceptual Models for EMDF Sites in Bear Creek Valley:

TDEC Specific Comment 17 on the D4 report requests the citation of references to support the statement that "*Detailed water budget research on ORR watersheds that are similar to those of the EMDF sites...*". TDEC notes that the D4 text is confusing, as it presents different findings from two studies and then speculates about groundwater flow conditions at various depths and future impacts of landfill construction on groundwater flow. DOE responded by removing the quoted statement from the document and clarifying the locations of studies mentioned in the text. While TDEC agrees with these revisions, the larger issue remains that the D5 RI/FS report does not include the site-specific characterization information necessary to fully

address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

18. Page E-41, Figure E-18, Predicted changes to surface and groundwater hydrology at EBCV Site 5: TDEC Specific Comment 18 on the D4 report stated that it is not clear how the relatively shallow upslope diversion channel will divert upgradient groundwater around the landfill. The diagram does not indicate how groundwater flow will be prevented from crossgradient (along-strike) areas into the area beneath the landfill, where the water table is predicted to be lowered. DOE responds that "*Appendix E Section 2.9 has been revised, including revision of Figure E-18.*" The figure title and caption have been changed, and text revisions have been made in Section 2.9 of Appendix E. However, it is not apparent how any of the revisions address the TDEC's comment.

19. TDEC Specific Comment 19 on the D4 report cites page E-46 and Figure E-19 in that document and requested information detailing how the single year of water level data collected at Site 5 represent the potentiometric surface range over the long-term existence of EMDF. DOE removed the entire section containing the quoted statement. DOE's response states: "*This comment dealing with site characterization will be considered in moving forward with characterization through the CERCLA process.*" DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the site-specific characterization information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

20. TDEC Specific Comment 20 on the D4 report cites two sentences that acknowledge the need for more site characterization and hydrogeological data if Site 5 is selected for the EMDF. The comment notes that such fundamental baseline groundwater conditions should be characterized *before* selecting a site and developing conceptual designs.

DOE removed the entire section containing the first sentence and deleted the second sentence. DOE's response states: "*This comment dealing with site characterization will be considered in moving forward with characterization through the CERCLA process.*" DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the site-specific characterization information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

21. Pages E-65 and E-68, 2.12.3.2 Bedrock Fractures in Predominantly Clastic Formations of the Conasauga Group: TDEC Specific Comment 21 on the D4 report cites two sentences that, collectively, state that 1) geologic structures provide the fundamental pathways for groundwater flow and contaminant transport, 2) the nature of such systems remains nebulous and undefined at EMWMF and the proposed EMDF sites, and 3) these uncertainties and limitations are reflected in fate and transport modeling. The comment notes that the fracture systems should be defined to a higher standard than "nebulous" to reduce uncertainties and limitations of the fate and transport modeling.

DOE's response states: *"This comment dealing with site characterization will be considered in moving forward with characterization through the CERCLA process."* DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the site-specific characterization information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

22. Page E-65, Section 2.12.3.2 Bedrock Fractures in Predominantly Clastic Formations of the Conasauga Group: TDEC Specific Comment 22 on the D4 report recommends tracing to evaluate the extent to which characterization data from boreholes is representative of site conditions.

DOE's response states: *"This comment dealing with site characterization will be considered in moving forward with characterization through the CERCLA process."* DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the site-specific characterization information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

23. Page E-65, Section 2.12.3.2 Bedrock Fractures in Predominantly Clastic Formations of the Conasauga Group: TDEC Specific Comment 23 on the D4 report highlights the importance of groundwater flow parallel to geologic strike, convergent flow in larger fractures, and the inadequacy of boreholes to detect fractures that may carry contaminants long distances to receptors.

DOE's response states: *"This comment dealing with site characterization will be considered in moving forward with characterization through the CERCLA process."* DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the site-specific characterization information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

24. TDEC Specific Comment 24 on the D4 report requests that the RI/FS report include a reference (Lutz and Dreier, 1988) cited on page E-74 of that document. DOE responds that the reference could not be located, so a similar reference (Dreier and Koerber, 1990) was substituted in the D5 report. TDEC agrees with this resolution of the comment.

25. Page E-69, Section 2.12.3.3. Karst Hydrology in the Maynardville Limestone and Copper Ridge Dolomite: TDEC Specific Comment 25 on the D4 report recommends consideration that dissolution occurs in noncarbonate bedrocks—not just carbonate rocks.

DOE's response states: *"This comment dealing with site characterization will be considered in moving forward with characterization through the CERCLA process."* DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the site-specific characterization information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

26. Section 2.13.1 Unsaturated Zone Hydraulic Characteristics, Page E-71: TDEC Specific Comment 26 on the D4 report cites a sentence on page E-78 of that document that states: "*The maximum thickness of this unsaturated zone between the top of the waste and the post closure water table is in the range of 100-150 ft thick at Site 5 (See conceptual design cross sections in Chapter 6 of the EMDF RI/FS Report)*". The comment requested that DOE rephrase this sentence to state the minimum predicted thickness of the unsaturated zone between the bottom of the waste and the post-closure water table, which is the relevant thickness. DOE's response states that Appendix E no longer includes the sentence cited in the original comment.

While TDEC agrees with removing the irrelevant statement, the larger issue remains that the D5 RI/FS report does not include the site-specific characterization information (e.g., groundwater level data) necessary to fully address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

27. Pages E-71 and E-72, Section 2.13.1 Unsaturated Zone Hydraulic Characteristics: TDEC Specific Comment 27 on the D4 report cites two sentences that state that 1) hydraulic characteristics of geologic materials at the evaluated sites can be estimated, 2) most field investigations have not involved any direct measurements, and 3) if such characteristics are required to support modeling or design, they can be addressed in future work plans for site characterization. The comment notes that collection of such data is warranted to support a defensible evaluation of site suitability even before it is needed for detailed engineering design.

DOE's response states: "*This comment dealing with site characterization will be considered in moving forward with characterization through the CERCLA process.*" DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the site-specific characterization information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

28. TDEC Specific Comment 28 on the D4 report identifies a technical reference (Worthington, 1999) for which an online reprint (Worthington, 2003) was cited and that was used incompletely on page E-94 in the D4 report and omitted from the list of references. DOE's response states that Appendix E no longer includes the sentence cited in the original comment. TDEC agrees with removing the misinterpreted statement.

29. Page E-92, Section 2.13.4 Groundwater Geochemical Zones: TDEC Specific Comment 29 on the D4 report identifies technical citations that incompletely quote a series of references. DOE's response indicates that the D5 includes the correct final citation. However, the D5 report should cite that Nativ et al. (1998) contradicts the comment by Moline et al. (1998) and supports their original interpretation. Currently, the D5 report cites the original Nativ et al. (1997) paper where it should cite the Nativ et al. (1998) response to the Moline et al. (1998) comment.

30. Page E-92, Section 2.13.5 Tracer Tests, First paragraph, 10th line: TDEC Specific Comment 30 on the D4 report provides DOE with the correct reference and a copy of that report (TDEC, 2001) for a document identified in the D4 report as "informal unpublished

document". The D5 report cites the reference correctly, and DOE's response indicates that TDEC provided the report electronically.

31. Appendix E (D4 Attachment A, page 1): TDEC Specific Comment 31 on the D4 report cites text in Attachment A of Appendix E of that document which states: "...*the water table can be effectively managed and lowered during and after construction to ensure that the water table does not encroach on the geologic buffer or waste materials placed above the buffer and liner systems.*" The comment requests that the RI/FS report include any lessons learned from the failure of groundwater modeling to predict post-construction groundwater levels at the EMWMF, as well as how any such lessons are incorporated in the EMDF conceptual design to ensure that the water table does not encroach on the geologic buffer or waste materials. DOE's response is that Attachments A and B have been removed from Appendix E and incorporated into a separate DOE report, which is referenced in the document. However, this response does not address the comment, which requests that the RI/FS report address how lessons learned from failure of groundwater modeling at the EMWMF are incorporated in the EMDF conceptual design to ensure that the water table does not encroach on the geologic buffer or waste materials.

32. Appendix E (D4 Attachment A, Figure 1, Phase I Monitoring Locations at the Proposed EMDF Site): TDEC Specific Comment 32 on the D4 report requests corrections of the Rome formation symbol in the legends for several maps in the RI/FS, including Appendix E, Attachment A, Figure 1; and Appendix E, Attachment B, Plates 5 and 6. DOE's response is that Attachments A and B have been removed from Appendix E and incorporated into a separate DOE report, which is referenced in the document. TDEC agrees that this response resolves the comment with respect to the D5 RI/FS.

33. Appendix E (D4 Attachment B, Cut/Fill Thickness Map): TDEC Specific Comment 33 on the D4 report requests corrections of legends for Appendix E, Attachment B, Cut/Fill Thickness Map. DOE's response is that Attachments A and B have been removed from Appendix E and incorporated into a separate DOE report, which is referenced in the document. TDEC agrees that this response resolves the comment with respect to the D5 RI/FS.

34. Appendix G, Section 7.3, Page G-22: TDEC Specific Comment 34 on the D4 report points out that a PCB limit of 50 ppm should be established in the WAC for the future EMDF, given the RI/FS statement that all on-site disposal of PCB waste at EMWMF and future EMDF is limited to <50 ppm. DOE's response is that the D5 report requests a CERCLA waiver instead of a TSCA waiver, stating that the request in the D4 report was not appropriate. However, the response does not address the comment that a PCB limit of 50 ppm should be established in the WAC for the future EMDF.

35. Appendix F, Chapter 3, Natural Phenomena Hazards, Page F-20: "*Two natural hazards, tornados and earthquakes, are considered in this evaluation, since these are the most likely potential natural phenomena that could affect the EMDF.*" TDEC Specific Comment 34 on the D4 report commends DOE for evaluating an air dispersion scenario. However, the comment also points out that the modeling is based on the assumption that EMDF waste characteristics are similar to those in EMWMF. Therefore, the evaluation does not provide a basis for setting

concentration limits on radionuclides that might contribute to on-site or off-site risk if a tornado were to strike a future EMDF facility. DOE's response states: "...*modeling of radionuclide fate and transport will not be presented in the D5 RI/FS. Rather, a placeholder range (low to high) of analytic Waste Acceptance Criteria limits for radionuclides will be presented, along with placeholder (total) inventory limits.... This comment dealing with modeling and/or preliminary WAC will be considered in moving forward with modeling and WAC development through the CERCLA process.*" DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

36. D4 Page H-24, Paragraph 3, Second Bullet: TDEC Specific Comment 36 on the D4 report identifies that the specified thickness of the composite barrier layer is inconsistent between the text and Table H-2 and notes that the geomembrane thickness in the cover layer should be the same as that in the liner. DOE's response states: "...*modeling of radionuclide fate and transport will not be presented in the D5 RI/FS. Rather, a placeholder range (low to high) of analytic Waste Acceptance Criteria limits for radionuclides will be presented, along with placeholder (total) inventory limits.... This comment dealing with modeling and/or preliminary WAC will be considered in moving forward with modeling and WAC development through the CERCLA process.*" DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

37. D4 Page H-30, Table H-3, Amended Clay Hydraulic Conductivity, Stage 4: TDEC Specific Comment 37 on the D4 report states that the RI/FS should provide the basis for adjusting the hydraulic conductivity of the amended clay layer by a factor of two. DOE's response states: "*Appendix H has been modified to present information on contaminants of potential concern. All modeling has been removed. ...modeling of radionuclide fate and transport will not be presented in the D5 RI/FS. Rather, a placeholder range (low to high) of analytic Waste Acceptance Criteria limits for radionuclides will be presented, along with placeholder (total) inventory limits.... This comment dealing with modeling and/or preliminary WAC will be considered in moving forward with modeling and WAC development through the CERCLA process.*" DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

38. D4 Model Boundary Conditions (Page H-32, Section 4.2.1.2 and Page H-38, Figure H-9): TDEC Specific Comment 38 on the D4 report states that assigned boundary conditions (e.g., the no-flow boundary modeled to exist north of the facility) should be tested to determine whether it has a significant influence on calculated water levels, given its proximity to the facility. This is particularly important since the model is used to estimate post-construction water level declines at the EMDF for comparison to the base of the landfill liner system, and a no-flow boundary can enhance calculated declines by inhibiting modeled flux into the area. The assumption of a no-flow boundary underlying the ridge is a theoretical guideline, but field data has not been presented to support the boundary definition. DOE's response states: "*Appendix H no longer contains modeling. It has been modified to present information on contaminants of*

potential concern. ...modeling of radionuclide fate and transport will not be presented in the D5 RI/FS. Rather, a placeholder range (low to high) of analytic Waste Acceptance Criteria limits for radionuclides will be presented, along with placeholder (total) inventory limits.... This comment dealing with modeling and/or preliminary WAC will be considered in moving forward with modeling and WAC development through the CERCLA process." DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

39. D4 Page H-43, Section 4.2.1.4 Model Calibration: TDEC Specific Comment 39 on the D4 report indicates that the RI/FS is deficient because it does not present calibration details for the modeling used to establish pre-design components of the landfill facility and preliminary WAC values. Basic calibration information should be included in the RI/FS to allow confirmation that the model calibration is adequate for this application. DOE's response states: *"Appendix H no longer contains modeling. It has been modified to present information on contaminants of potential concern. ...modeling of radionuclide fate and transport will not be presented in the D5 RI/FS. Rather, a placeholder range (low to high) of analytic Waste Acceptance Criteria limits for radionuclides will be presented, along with placeholder (total) inventory limits.... This comment dealing with modeling and/or preliminary WAC will be considered in moving forward with modeling and WAC development through the CERCLA process."* DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

40. D4 Page H-50, Section 4.3.2 MT3D Model Assumptions: TDEC Specific Comment 40 on the D4 report requests clarification regarding an apparent discrepancy in the modeling of a water supply well. DOE's response states: *"Appendix H no longer contains modeling. It has been modified to present information on contaminants of potential concern. ...modeling of radionuclide fate and transport will not be presented in the D5 RI/FS. Rather, a placeholder range (low to high) of analytic Waste Acceptance Criteria limits for radionuclides will be presented, along with placeholder (total) inventory limits.... This comment dealing with modeling and/or preliminary WAC will be considered in moving forward with modeling and WAC development through the CERCLA process."* DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

41. D4 Page H-64, second complete paragraph: TDEC Specific Comment 41 on the D4 report questions the comparability of modeled values for surface water and groundwater, given the use of different scaling calculations. DOE's response states: *"Appendix H no longer contains modeling. It has been modified to present information on contaminants of potential concern. ...modeling of radionuclide fate and transport will not be presented in the D5 RI/FS. Rather, a placeholder range (low to high) of analytic Waste Acceptance Criteria limits for radionuclides will be presented, along with placeholder (total) inventory limits.... This comment dealing with modeling and/or preliminary WAC will be considered in moving forward with modeling and WAC development through the CERCLA process."* DOE advocates an approach that is not consistent with the CERCLA

decision-making process. The D5 RI/FS report does not include the information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

42. D4 Page H-69, Table H-7: TDEC commented on settling and erosion in the D3 and D4 versions of the RI/FS and this remains a concern. This list of comments includes, and may not be limited to, Comments 35, 102, 105, and 106 in TDEC's August 6, 2015 letter on the D3 and Specific Comments 16 and 42 in TDEC's May 16, 2016 letter on the D4. TDEC is not in agreement with the way previous modeling incorporated or failed to incorporate erosion and settling/differential settling in previous modeling. Likewise, assuming erosion stops at some point in the future and differential settling will not potentially materially affect water entering the landfill for the first 1,000 years after closure are very optimistic.

One of TDEC's D4 comments requested an explanation of the technical basis for postponing differential settling 1,000 years after closure. DOE's response states: *"Appendix H no longer contains modeling. It has been modified to present information on contaminants of potential concern. ...modeling of radionuclide fate and transport will not be presented in the D5 RI/FS. Rather, a placeholder range (low to high) of analytic Waste Acceptance Criteria limits for radionuclides will be presented, along with placeholder (total) inventory limits.... This comment dealing with modeling and/or preliminary WAC will be considered in moving forward with modeling and WAC development through the CERCLA process."* DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

Further, the performance objective in TDEC rule 0400-20-11-.16(5) concerns stability of the disposal site after closure and requires *"The disposal facility must be sited, designed, used, operated and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring or minor custodial care are required."* The analysis that is required to determine whether this TDEC required performance objective is met as specified in TDEC rule 0400-20-11-.08(3)(b)4. Specifically, this rule requires *"Analyses of the long-term stability of the disposal site and the need for ongoing active maintenance after closure must be based upon analyses of active natural processes such as erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses must provide assurance that there will not be a need for ongoing active maintenance of the disposal site following closure."* This analysis and compliance with this performance objective are required by TDEC.

43. D4 Appendix H, Attachment B, Table 1: TDEC Specific Comment 43 on the D4 report highlights an apparent error in the risk assessment, noting that the table does not appear to include the risk from livestock watering and consumption of meat and produce grown on the farm. DOE's response states: *"Appendix H no longer contains modeling. It has been modified to present information on contaminants of potential concern. ...modeling of radionuclide fate and transport will not be presented in the D5 RI/FS. Rather, a placeholder range (low to high) of analytic*

Waste Acceptance Criteria limits for radionuclides will be presented, along with placeholder (total) inventory limits.... This comment dealing with modeling and/or preliminary WAC will be considered in moving forward with modeling and WAC development through the CERCLA process." DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

44. D4 Appendix H – Attachment B, Page 7, Section 2.1.3 General Design and Evaporative Zone Data: TDEC Specific Comment 44 on the D4 report notes that the SCS runoff curve number of 49.3 appears low. DOE's response states: *"Appendix H no longer contains modeling. It has been modified to present information on contaminants of potential concern. ...modeling of radionuclide fate and transport will not be presented in the D5 RI/FS. Rather, a placeholder range (low to high) of analytic Waste Acceptance Criteria limits for radionuclides will be presented, along with placeholder (total) inventory limits.... This comment dealing with modeling and/or preliminary WAC will be considered in moving forward with modeling and WAC development through the CERCLA process."* DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

45. D4 Appendix H – Attachment B, Page 7, Section 2.2 HELP Model Output, Paragraph 1: TDEC Specific Comment 45 on the D4 report states that the document text indicates HELP model results for the long-term scenario are presented in Section 2.2.2; however, no Section 2.2.2 is provided in Appendix H – Attachment B. The comment also requests that DOE provide output data for at least one run of the HELP model. DOE's response states: *"Appendix H no longer contains modeling. It has been modified to present information on contaminants of potential concern. ...modeling of radionuclide fate and transport will not be presented in the D5 RI/FS. Rather, a placeholder range (low to high) of analytic Waste Acceptance Criteria limits for radionuclides will be presented, along with placeholder (total) inventory limits.... This comment dealing with modeling and/or preliminary WAC will be considered in moving forward with modeling and WAC development through the CERCLA process."* DOE advocates an approach that is not consistent with the CERCLA decision-making process. The D5 RI/FS report does not include the information necessary to address the D4 comment or support an evaluation of the protectiveness of the waste disposal alternatives.

46. D4 Response to D3 Comment TDEC.S.001: TDEC Specific Comment 46 on the D4 report clarifies that TDEC Specific Comment 1 on the D3 report was intended to identify problems (listed in the D3 and D4 comments) with the current disposal facility (EMWMF) that have not been resolved. The response included with the D4 report debates or denies the significance of these problems, and the D4 does not incorporate revisions that reflect progress on the problems.

TDEC appreciates that DOE has made progress toward acknowledging some of these problems in the year since TDEC offered the D4 comment. Specifically, DOE has installed water-level loggers to record groundwater levels around the EMWMF on a more frequent basis. TDEC will

continue to work with DOE to resolve questions regarding the potential for groundwater intrusion into the facilities geobuffer. TDEC also acknowledges that DOE has established milestones for revising the sampling and analysis plan (SAP) for EMWMF and is making very important progress toward correcting serious deficiencies in the detection monitoring program.

47. Executive Summary, Page ES-3: *"Because detailed characterization data do not exist for many of the individual deactivation and decommissioning and remediation projects, characterization of future waste streams for this RI/FS is based on available data for waste disposed at EMWMF. This methodology relies on the assumption that available data for waste disposed at EMWMF approximately represent the waste characteristics of future waste streams with the exception of mercury-contaminated waste.*

Demolition of several large facilities at the Y-12 National Security Complex will result in large volumes of mercury-contaminated debris. This debris is assumed to be treated for mercury contamination under the project scope (as opposed to treatment occurring under the consolidated disposal scope of this RI/FS)."

As noted in General Comment 28, future waste streams to be generated primarily from Y-12 and X-10 (now ORNL) are expected to be different from waste derived from the K-25 (now ETP) gaseous diffusion plant. The statement that waste from Y-12 will contain "large volumes of mercury-contaminated debris" is a key indication that future waste streams will differ from those disposed historically. The analytic WAC should be developed to include limits for the radionuclides and hazardous substances likely to be disposed in any future CERCLA waste landfill. Such limits are needed to assure that RAOs are not violated in the future.

48. Executive Summary, Page ES-5: *"If on-site disposal is the proposed remedy as determined by the CERCLA process and subsequently presented in a Proposed Plan, Waste Acceptance Criteria (WAC) that will be protective of human health and the environment would be determined for the selected candidate site only. This RI/FS presents an initial WAC range for individual radiological contaminants of potential concern in place of site-specific WAC, since this investigation involves multiple sites/alternatives. Likewise, some key assumptions regarding site-specific water table elevations are made for those sites lacking in site-specific characterization. Site-specific characterization will be collected and site-specific WAC will be developed for the preferred candidate site (that is presented in the Proposed Plan). The data and the WAC will be used to evaluate key RI/FS assumptions (the site can be protective of human health and the environment, and sufficient waste can be placed to make the remedy cost-effective) before approval of the Record of Decision (ROD). This course of action (evaluation of key assumptions) will adhere to the CERCLA process for documentation and decision-making, including appropriate public input opportunities."*

These statements assert DOE's proposed "caveated" approach. Despite the declaration that this approach "will adhere to the CERCLA process," the CERCLA decision-making process actually requires that the RI/FS present the information necessary to characterize the problem and objectively evaluate the protectiveness of each alternative and its compliance with ARARs. The D5 RI/FS report does not include adequate information regarding the waste to be disposed, the

specific sites under evaluation, the modeling and risk assessment needed for WAC development, or the WAC themselves to support such evaluations.

49. Executive Summary, Page ES-6: *"The two final modifying criteria, state and community acceptance, will be addressed in the Proposed Plan and ROD. This RI/FS version as submitted has not been reviewed by the state; therefore, information to evaluate state acceptance of this RI/FS version does not exist. While state input has been received on previous versions of this document, those comments are documented and addressed in separate records, the results of which have been incorporated into this RI/FS version."*

As documented throughout this letter, TDEC disagrees that state input has been addressed adequately and incorporated into the D5 RI/FS report.

50. Executive Summary, Page ES-7: *"All action alternatives will be protective of human health and the environment. All ARARs will be complied with by the action alternatives."*

For the On-site Disposal Alternatives (and on-site portion of the Hybrid Disposal Alternative), the conceptual designs developed at each site will ensure protection of the public and environment and will meet all ARARs, with one exception for which a CERCLA waiver is requested. Engineered features are designed to function for very long times, allowing many radioactive and organic contaminants to decay or degrade in place. If the On-site Disposal Alternative is presented as the preferred remedy in a Proposed Plan, site-specific WAC (including radiological contaminant-specific inventory limits) will be developed and included in the ROD to ensure protection of human health and the environment. A detailed analysis addressing the ability of each candidate site to remain protective and meet ARARs is included in the document....

The greatest differentiator between disposal alternatives is the role site characteristics play in the effectiveness and permanence of an alternative. Off-site disposal of waste at EnergySolutions, WCS, and NNSS in the long-term would be more reliable at preventing exposure than on-site disposal on the ORR, because they are located in arid environments that reduce the likelihood of contaminant migration or exposure via groundwater or surface water pathways. Fewer receptors exist in the vicinity of EnergySolutions, WCS, and NNSS than on the ORR."

As indicated throughout this comment letter, the D5 RI/FS report does not demonstrate that *"all action alternatives will be protective of human health and the environment"* or that *"all ARARs will be complied with by the action alternatives"*.

TDEC staff disagree that the D5 report demonstrates that ARARs will be met through conceptual designs. TDEC's position is that siting ARARs like TDEC 0400-20-11-.17(1)(h) are intended to limit waste disposal to sites with hydrogeologic conditions that are protective and that design considerations add additional protection—not the only line of environmental defense. Sites that meet the siting criterion in TDEC 0400-20-11-.17(1)(h) would not require design features such as underdrains to alleviate problems caused by shallow groundwater.

Appendix G, Section 4.3 states that a waiver of TDEC 0400-20-11-.17(1)(h) is not needed. This statement confuses siting requirements with design requirements. In Section 4.2 of Appendix G, DOE applies similar reasoning, stating that no waiver of 40 CFR 761.75(b)(5) is needed for any site evaluated in the RI/FS, despite the steep slopes at EBCV (site 5). Similar reasoning is also applied to the rationale for requesting a waiver of TSCA 40 CFR 761.75(b)(3) in section 4.1 of Appendix G. However, there is no mention that a waiver would presumably be needed for most/all of the sites for subparagraph (e) of paragraph (1) of this rule which states that *"The disposal site must be generally well drained and free of areas of flooding or frequent ponding."*

TDEC agrees with the statement that off-site disposal at EnergySolutions, WCS, or NNSS *"would be more reliable at preventing exposure than on-site disposal on the ORR, because they are located in arid environments that reduce the likelihood of contaminant migration or exposure via groundwater or surface water pathways"* and that fewer receptors (human beings) exist in those areas.

51. Executive Summary, Page ES-8: *"Individual site hydrology features are controlled by engineered subsurface and surface drainage systems included in the conceptual designs of the EMDF at all sites. The extent of those drainage systems differs, depending on site-specific hydrologic characteristics and topography. The drainage systems can either be permanent (must remain to lower the water table in the area through operation and closure of the facility) or temporary (used during construction to temporarily lower the water table). Surface drainage features provide diversion of upgradient flow, reduce potential erosion and subsidence of the cover and promote stability, all of which support the isolation of the waste from contact with water. All drainage systems are designed as passive systems with graded filtration and non-weathering materials to provide long-lived performance and protectiveness. Very detailed discussions of these features and individual site characteristics that influence them, as well as expected longevity are provided herein.*

As indicated in General Comment 3, TDEC has substantial concerns with the potential risks posed by permanently flowing underdrains. Underdrains are engineered pathways for releasing contaminants from the landfill, and they provide direct conduits to surface water. At a minimum, exposure pathways associated with a flowing underdrain should be evaluated to verify whether a site with a flowing underdrain meets the CERCLA Section 121(d)(1) threshold requirement for control of further release at a minimum which assures protection of human health and the environment. Further, these exposure pathways should be evaluated during the development of WAC to assure that future waste disposed does not pose an unacceptable risk due to a flowing underdrain. None of the RI/FS versions have addressed these concerns to date.

DOE needs to present site-specific data demonstrating that any underdrain will be temporary and not flow upon liner completion. TDEC expects that the ROD will clearly specify that any flow from an underdrain after liner construction will trigger additional investigation and landfill reconfiguration to eliminate the underdrain.

52. Executive Summary, Page ES-8: *"For action alternatives, the most significant risk to human health would result from waste transportation."* This may be true in the short term, but CERCLA requires assessment of the risk for as long as the hazard exists. TDEC does not agree

that the D5 report assesses the long-term risks to human health associated with the disposal of long-lived radionuclides in the humid environment of a populated region like Oak Ridge.

53. Executive Summary, Page ES-10, Table ES-3: The D5 report contains little or no information to support the subjective assertions made in Table ES-3. These assumptions bias the risk assessments (in previous versions of the RI/FS), alternative evaluations, and cost comparisons presented in the D5 report. For on-site and hybrid disposal alternatives, TDEC staff believe that:

1. The cost implications *and* the probability of occurrence are both very high (instead of moderate) for increased long-term S&M costs.
2. The cost implications *and* the probability of occurrence are both very high (instead of high and unlikely, respectively) for post-closure, extreme maintenance issues.

TDEC agrees that there is an opportunity for significant cost savings through volume shipping/disposal discounts and that costs could increase in the future. This is a key reason that TDEC supports on-site disposal of CERCLA waste to the extent that such disposal can be demonstrated to be protective of human health and the environment and compliant with ARARs. However, TDEC staff also believe that the D5 report presents cost estimates that are biased in favor of on-site disposal while minimizing the protectiveness and compliance advantages of off-site disposal.

Likewise, TDEC agrees that the significant cost savings identified in this opportunity may be temporary but does not have evidence to support the more general claim made in the table that the delay in ORR clean-up due to increased off-site disposal costs will be very high for a hybrid alternative. Waste requiring off-site shipment under the hybrid alternative would presumably be mostly waste that would be problematic for on-site disposal, requiring significant characterization efforts and/or treatment. The cost differential between on-site and off-site disposal for such waste might be quite small compared with the cost differential between waste that could be shown to meet waste acceptance limits for on-site disposal without treatment or an expensive characterization effort.

TDEC also maintains that the risk reduction gained by on-site disposal of much of the waste listed in Appendix A as slated for disposal at EMDF does little to alter the significant risks posed by legacy burial grounds on the ORR or the necessity for land use controls. The cost differential associated with disposal is likely to be small in comparison with the overall cost of the demolition actions that will generate the majority of the waste. The cost of the demolition actions will be small in comparison with the costs of actions at the burial grounds in Melton Valley and at burial sites elsewhere that would effectively change the long term risk to human health and the environment posed by legacy operations at Oak Ridge.

54. Section 1.2 Purpose: The redlined (tracked changes) version of the D5 report includes the following comment: "*Comment SMD1: This is a remenant [sic] of EMWMMF RI/FS!! To my knowledge, there is no local site outside of the ORR that is planned for disposal in this RI/FS.*" TDEC

suggests that DOE consider retaining the language deleted from the D4 (*"including local sites outside the ORR boundary, but within OREM's domain of responsibility"*). Recently, TDEC has discussed with DOE the potential need to remediate legacy contaminated material(s) from the ORR and contaminated soil that is present at the Witherspoon Screen Arts site in Knoxville. Other similar sites may be discovered in the future.

55. Section 2 Waste Volume Estimates and Waste Characterization: *"The approach to waste volume estimates and waste characterization in this RI/FS takes into account substantial additional information available for ORR CERCLA cleanup. However, the specific volumes and composition of waste that will be generated from the implementation of future CERCLA actions cannot be fully defined at this time. Development of waste volume estimates and characterization for this RI/FS relies on reasonable assumptions for proposed future remedial actions. Uncertainty is accounted for in the waste volume estimates based on a modified approach to that taken in the Fiscal Year (FY) 2014 PCCR. Uncertainty for this analysis is added as a straight percentage (increase only, to be conservative) to the annual predicted volumes. Uncertainty/sensitivity assumptions are not applied to waste characterization since it serves mainly as an input to risk calculations for on-site versus off-site alternatives (refer to Table 2-1), and that comparison may be made using only a deterministic data set. Looking at variability in that data set would not alter the comparison conclusions."*

See TDEC General Comments 2 and 7.

56. Section 2.1.2 Waste Types and Material Types: *"As discussed in Section 2.3 and Section 6.2.3, two points are made: (1) The characteristics of future CERCLA waste are anticipated to be similar to CERCLA waste generated since EMWMF began operating in FY 2002, with the exception of the introduction of mercury-contaminated waste expected from Y-12 cleanup projects. Small amounts of ORNL and Y-12 demolition and remediation waste have been received at EMWMF, and have introduced a broader variety of isotopes than ETP waste alone. It is expected that with ORNL contributing a higher volume of waste in the future facility those isotopic concentrations will increase, but the representative isotopes are accounted for by the current EMWMF waste profile. (2) WAC at a new on-site disposal facility would allow most CERCLA waste to be disposed."*

As noted in General Comment 28, TDEC believes that a more inclusive Analytical WAC should be developed to assure there are comparison values for a wide range of radionuclides and hazardous substances likely to exist in future waste streams. For example, I-129 appears to have been omitted from the D5 Analytical WAC table (Table 6-5). The isotopes chlorine-36 (Cl-36) and zirconium-93 (Zr-93) are screened out. While it is true that little analytical data on environmental media around the ORR include isotopic analyses for these radionuclides, both have half-lives that would allow them to be present in waste generated from future CERCLA actions on the ORR. Cl-36 was apparently present in waste disposed at EMWMF, as it has been found in EMWMF wastewater. While Zr-93 is less mobile than Cl-36, it seems certain to be present on the ORR in some quantity, since the fission yield is on the same order as the abundant fission products Sr-90, Tc-99, and Cs-137.

A more thorough analysis of potential contaminants of concern is needed to assure that RAOs are not violated. Without an adequate assessment of potential contaminants of concern, there is little basis to ensure that human health and the environment will be protected by the statement that "WAC at a new on-site disposal facility would allow most CERCLA waste to be disposed."

57. Section 2.2.2 As-disposed Waste Volume Estimate (On-site Disposal Alternatives):

"For purposes of this RI/FS analysis, it was conservatively assumed that volume uncertainty would result in increased rather than decreased need for landfill space. A straight 25% uncertainty on waste volumes is assumed in this document." The assumption that landfill capacity would increase rather than decrease from the estimated volume introduces a fundamental bias into the evaluation that could result in selection of an alternative that is not the best remedy.

58. Section 2.3 RI/FS Waste Characterization:

"This section discusses characterization of future generated CERCLA waste streams. Because detailed characterization data do not exist for many of the individual D&D and remediation projects, characterization of future waste streams is based on available data for waste disposed at EMWMF to establish contaminants of potential concern (COPCs) and estimate contaminant concentrations. This methodology relies on the assumption that available data for waste disposed at EMWMF approximately represent the waste characteristics of future waste streams. Use of characterization data for waste disposed at EMWMF is limited in the RI/FS to serving as a basis for the transportation risk and natural phenomena risk calculations. Additionally, these transportation and natural phenomenon risk analyses consider the risk posed by release of radioactively contaminated waste as far exceeding the risk posed to the public by any contained chemical hazards, and therefore only the radioactive portion of the waste is considered in those assessments.

A WAC range for each potential radionuclide contaminant has been developed for the proposed on-site disposal facility concepts. As shown in Table 2-1, a discussion of potential WAC and engineered features helps determine the following:

- *Does the WAC range (and thus potential future WAC) allow most future CERCLA waste to be disposed?*
- *Does the proposed conceptual design provide adequate assurance that disposed contaminants would pose acceptable risks?*

The projection that waste characteristics of future waste will be similar to waste disposed to date at the EMWMF, specifically those disposed from cleanups at Y-12 and ORNL, is a key assumption in the analysis."

As discussed in General Comment 28 and Specific Comment 56, TDEC staff disagree with the key assumption that future waste will be similar to historical waste. The WAC should address the radionuclides and hazardous substances likely to exist in future waste streams, which requires better characterization of those future wastes. Moreover, TDEC believes that focus should be on the protectiveness of waste disposal rather than "Does the WAC range (and thus potential future WAC) allow most future CERCLA waste to be disposed?" The question should be,

"How much of the future CERCLA waste can be disposed on site in a protective manner—either in an existing permitted landfill or the proposed EMDF?"

59. Section 2.3.1 Radionuclide Characterization: *"It is recognized that radionuclide COPCs from future cleanup projects may differ in concentrations; however, the list of radionuclides received at EMWMF (includes waste received from all three ORR facilities) and on which this analysis is based is extensive and reflects the nuclides expected in future waste lots."* As noted in General Comment 28 and Specific Comments 55 and 57, TDEC staff disagree that the evaluation in the D5 report is based on a reasonably accurate estimate of radionuclides to be disposed in the future. In fact, the radionuclide inventory given in Table A-5 does not begin to adequately represent the radioactive waste inventory in EMWMF. There are scant data available except for the isotopes that had analytic WAC established for the facility.

In Table A-5, neither the surface impoundment bricks (waste lot 87.01) nor any of the Tank W1-A boxed soil (including lot 84.4, which had high values for fission products) includes any value for Sr-90 or Cs-137 in the inventory. The actions that generated these waste lots were driven in large part as an effort to reduce the source of Sr-90 migrating through groundwater to surface water in Bethel Valley. There was also no Sr-90 inventory given for HRE pond sediments, another action driven primarily by the goal of reducing the Sr-90 loading to groundwater and surface water. Since very little data were required to demonstrate compliance with the Auditable Safety Analysis (ASA) WAC, especially if the material was containerized, and since little in the way of isotopic analysis was ever obtained for carbon-14 (C-14) or I-129 disposed in the EMWMF, the inventory of activity for most radionuclides reported in Table A-5 is uncertain. The exceptions would be for the uranium isotopes, Tc-99, and possibly plutonium-239/240 (Pu-239/240).

60. Section 2.3.2 Chemical Characterization: *"As stated previously, the chemical contaminants for future waste streams to be disposed of at EMDF are assumed to be similar to those of waste disposed of at the EMWMF."* See General Comment 28 and Specific Comments 56, 58, and 59.

61. Section 6.2.2.4.5 Facility Underdrains. Permanent Underdrain Systems, Page 6-42. Last Paragraph. Lines 16-17: The phrase "very low, but elevated" is contradictory and confusing.

62. Section 3.2 Evaluation of Risk for the On-site Alternatives: *"This document relies on a key assumption that final WAC and inventory limits developed for a proposed candidate site(s) provide protection of human health and the environment. That key assumption must be verified through subsequent development of final WAC and inventory limits."*

If an On-site Disposal Alternative is proposed, site-specific characterization would occur in parallel to final WAC development, and an implementation process for that WAC would be determined and documented in a primary FFA document, the WAC Compliance Plan. It is expected, due to scheduling, that a Proposed Plan would be presented to the public prior to full completion of the WAC protocol

and site characterization. Therefore, this RI/FS presents key assumptions concerning the WAC and site characterization, which the Proposed Plan will be predicated on."

As noted in Specific Comment 48, the CERCLA decision-making process requires that the RI/FS present the information necessary to characterize the problem and objectively evaluate the protectiveness of each alternative and its compliance with ARARs. Under CERCLA, RI/FS reports document the relative protectiveness and compliance of the alternative remedies being evaluated through characterization, modeling, and risk assessment.

63. Section 3.2 Evaluation of Risk for the On-site Alternatives, Tables 3-2, 3-3, and 3-4:

These tables evaluate short-term risks to human health that might result from waste transportation. However, CERCLA requires assessment of the risk for as long as the hazard exists. TDEC does not agree that the D5 report assesses the long-term risks to human health associated with the disposal of long-lived radionuclides in the humid environment of a populated region like Oak Ridge.

64. Chapter 4 Remedial Action Objectives: *"According to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), (40 CFR 300.430[e][2][i]), RAOs should specify...contaminants of concern, potential exposure pathways.... Specificity on exposure pathways will be part of the development of a future WAC."* The D5 RI/FS presents neither a reasonably complete list of contaminants of concern nor an evaluation of potential exposure pathways. DOE needs to present such information.

65. Section 5.2.3.2 Existing LLW and Mixed-Waste Facilities: *"LLW and MLLW disposal sites evaluated included EnergySolutions in Clive, Utah; NNSS in Nye County, Nevada..., and WCS in Andrews, Texas. All these sites would effectively isolate wastes that meet their respective WAC, but would incur high transportation/disposal costs as well as risk liabilities until waste reaches its destination. ORR wastes are currently being shipped to the EnergySolutions and NNSS facilities, and shipment and disposal at these sites is readily implementable."* As noted in General Comments 2, 4, and 8a, as well as Specific Comments 50, 52, and 64, TDEC agrees that these facilities far from population centers in arid environments of the western U.S. would isolate long-lived radionuclides far more effectively and with lower long-term costs than the on-site alternatives in the humid environment of Oak Ridge.

66. Section 5.2.3.3 Existing RCRA/TSCA Facilities: *"The Waste Management, Inc. (WMI)-Emelle (Emelle, Alabama), US Ecology-Beatty (Beatty, Nevada), Clean Harbors (Deer Park, Texas), and Clean Harbors (Clive, Utah) facilities were identified as existing RCRA/TSCA facilities. All of the facilities are eliminated because the facilities are no longer on the approved active treatment, storage, disposal, and recycling facilities (TSDRFs) list for ORR cleanup."* Please clarify who maintains the list of facilities approved to receive waste from ORR cleanup and why these facilities are no longer on that list.

67. Section 6.2.1.1 EBCV (Site 5), Karst and Seismicity, Page 6-9: The RI/FS report should acknowledge recent research (Hatcher et al., 2012) regarding nearby long, deep-seated faults, their documented movement and magnitudes. A deep-seated fault (7-26 km depth) cuts

Quaternary terrace alluvium, the saprolite, and the underlying Middle Ordovician shale bedrock. According to R.D. Hatcher, Jr. (personal communication), the fault extends from Dandridge, Tennessee beyond Tellico Plains, and almost to Chattanooga. Exposures of the fault at Dandridge and Vonore and optically-stimulated luminescence dates suggest ages of 73,000 to 112,000 years before present (Hatcher et al., 2012), and more recent research indicates movement less than 12,000 years before present (R.D. Hatcher, Jr., personal communication). Observations of clastic sediment injection and other fracturing and faults at these localities suggest they were produced by earthquakes with magnitudes of about 6.5, and possibly as intense as 7.5.

68. Section 6.2.1.2 WBCV (Site 14). Site Characteristics. Previous Investigations. Page 6-10: *"Extensive site characterization activities and research were conducted in the WBCV area at and west of Site 14 in support of the Low-Level Waste Disposal Development and Demonstration (LLWDDD) program in the 1980's and 1990's. The proposed LLWDDD above ground "tumulus" facility was never constructed but surface and subsurface conditions were investigated and culminated in a Performance Assessment report in 1997 for a location within the current Site 14 footprint."* Please explain why the above-ground LLWDDD was never constructed after DOE invested in extensive site characterization and a PA.

69. Section 6.2.1.3 Dual Site (Sites 6b/7a). Site Characteristics – Site 7a. General site conditions. Page 6-21: TDEC notes the substitution of alternative terminology for *underdrain*.

The D4 report states: *"The eastern areas of the footprint would cover much of the valley formed by NT-10W and would warrant an underdrain system to ensure proper drainage of shallow groundwater. An east-west trending ravine drains westward into NT-11 near the center of the footprint that also warrants an underdrain segment."*

The revised (D5) report states: *"The eastern areas of the footprint would cover much of the valley formed by D-10W and may warrant a temporary drainage feature to ensure proper drainage of shallow groundwater during construction combined with rerouting the flowpath to discharge into NT-10."*

TDEC maintains the position that these exposure pathways should be evaluated during the development of WAC to assure that future waste disposed does not pose an unacceptable risk due to a flowing underdrain. DOE needs to present site-specific data demonstrating that any underdrain will be temporary and not flow upon liner completion. TDEC expects that the ROD will clearly specify that any flow from an underdrain after liner construction will trigger additional investigation and landfill reconfiguration to eliminate the underdrain.

70. Section 6.2.1.3 Dual Site (Sites 6b/7a). Site Characteristics – Site 7a. General site conditions. Previous Investigations. Page 6-21: Note that **Section 6.2.1.4 CBCV (Site 7c). Page 6-23** states, *"The site plan for the EMDF at the CBCV Site, Site 7c, is presented in Figure 6-6. The proposed EMDF site is an extension of the footprint offered as Site 7a, which is part of the Dual Site."* On page 6-21, Site 7a (and Site 7c by reference) is described as follows: *"Except for surface water, wetland, ecological, and cultural surveys that encompass all of BCV including the Site 7a area, almost*

no site characterization data exists for this site. Maps in the Y-12 subsurface database for BCV show a paucity of active/inactive wells at or near Site 7a. Isolated from the waste sites in EBCV, there are no neighboring site investigations in close proximity to Site 7a." As noted in numerous comments in this letter, the D5 report is deficient because it does not include the site-specific characterization information necessary to support an evaluation of the protectiveness of the waste disposal alternatives.

71. Section 6.2.1.3 Dual Site (Sites 6b/7a), Site Characteristics – Site 7a, Surface Water Hydrology, Page 6-21: *"Detailed site reconnaissance has not been conducted to assess the details of surface water hydrology at Site 7a. However, the available USGS base flow data suggest that stream flow along DNT-10W and NT-11 directly adjacent to Site 7a, and the smaller sub-tributary stream channels draining the site is seasonally intermittent, and influenced by pulses of runoff associated with storm events." See General Comments 18c and 18d.*

72. Section 6.2.1.3 Dual Site (Sites 6b/7a), Site Characteristics – Site 7a, Surface Water Hydrology, Page 6-21: *"The wetlands delineated at and near Site 7a encompass the majority of D-10W along the entire eastern margins of the footprint and much of NT-11 along the west side of Site 7a." The following sentence was deleted from the RI/FS upon submittal of the D5 version: "These wetland areas also represent zones of groundwater discharge to surface water directly adjacent to Site 7a."*

73. Section 6.2.1.3 Dual Site (Sites 6b/7a), Site Characteristics – Site 7a, Geology/Hydrogeology, Pages 6-21 and 6-22: *"The detailed subsurface hydrogeological conditions at Site 7a are unknown based on the very limited amount of available site-specific characterization data (see Appendix E for a review of the limited available data and inactive wells in the area). Fundamental site characterization data will be required if Site 7a is selected for EMDF construction." As noted in numerous comments, the D5 report is deficient because it does not include the site-specific characterization information necessary to support an evaluation of the protectiveness of the waste disposal alternatives.*

74. Section 6.2.1.3 Dual Site (Sites 6b/7a), Site Characteristics – Site 7a, Geology/Hydrogeology, Page 6-22: *"The fractures and macro/micro pores within the remaining soils/saprolite and bedrock will provide the primary routes for groundwater flow below and downgradient of the Site 7a footprint." The phrase "(and contaminant transport)" was deleted from the RI/FS upon submittal of the D5 version.*

75. Section 6.2.1.3 Dual Site (Sites 6b/7a), Site Characteristics – Site 7a, Groundwater conditions and flowpaths, Page 6-22: The following sentence was deleted from the RI/FS upon submittal of the D5 version: *"The wetlands noted above along the NT valley floors indicate areas where groundwater discharges to the surface."*

76. Section 6.2.1.3 Dual Site (Sites 6b/7a), Site Characteristics – Site 7a, Groundwater conditions and flowpaths, Page 6-22: The following sentence was revised as indicated below upon submittal of the D5 version of the RI/FS report.

"The remainder of this southward draining groundwater from Pine Ridge would migrate toward the southeast into the headwater area of D-10W and be captured and drained via the proposed ~~underdrain-rerouted drainage path system following the path of NT-10W discharging into NT-10. Without this underdrain network, natural groundwater flow from Pine Ridge would be inhibited, increasing hydraulic heads, and resulting in an elevated water table below the northeast corner of the 7a footprint.~~"

77. Section 6.2.1.3 Dual Site (Sites 6b/7a). Site Characteristics – Site 7a. Relationships to contaminated areas in EBCV. Page 6-23: *"Site 7a is located well southwest of and outside the Zone 3 area that includes historical waste sites in EBCV. Figure E-2 in Appendix E shows that the nearest groundwater contaminant plumes are located around 2,500 ft southeast of Site 7a along the path of Bear Creek and the Maynardville Limestone well upstream of Site 7a. The figure does indicate a zone along Bear Creek and the Maynardville directly south of Site 7a denoted as an 'area of periodic plume extension' that extends all the way to near SR 95."*

Among the lessons learned from ongoing detection monitoring efforts at EMWMF is the problematic nature of distinguishing contamination released from the landfill from plumes of contamination originating at other sources. The "periodic" extension of a plume past Site 7a/7c in the Maynardville Limestone poses challenges for future detection monitoring at that location and would require a waiver of TDEC 0400-20-11-.17(1)(b), which states: *"The disposal site shall be capable of being characterized, modeled, analyzed and monitored."* As noted in General Comment 25, this rule would need to be waived because of the difficulty of modeling groundwater predictably in BCV, even if it is possible to characterize and monitor these sites to the degree needed to assure protection of human health and the environment. Also, it appears the text quoted in this comment should indicate that the plumes are located 2,500 ft northeast of Site 7a—not southeast.

78. Section 6.2.1.4 CBCV (Site 7c). Karst and Seismicity. Page 6-25: *"The contact between the Nolichucky Shale and Maynardville Limestone is located approximately 300 ft south of the southern waste limit boundary at Site 7c, which is closest to the contact among the candidate sites."* Please confirm this statement, as TDEC staff measured a distance less than 250 feet, based on Lemiszki, et al. (2013).

79. Section 6.2.2 Early Actions. Baseline Groundwater and Surface Water Monitoring. Page 6-28: *"As part of site characterization, groundwater levels and surface water and groundwater quality parameters (for example, specific conductivity, pH, temperature, dissolved oxygen and oxidation-reduction potential) would be monitored continuously for one year, if feasible, and contaminants [radionuclides, metals, volatile organic compounds, and polychlorinated biphenyls (PCBs)] would be monitored quarterly for one year, to establish a baseline for any of the possible sites. Groundwater flow will be determined by down-hole measurements and surface water flow rates would be monitored by flume measurements for at least one year. These activities would be performed before construction of the landfill to establish pre-disposal baseline conditions, support design, and support WAC finalization."*

As noted in Specific Comment 46, TDEC acknowledges that DOE has established milestones for revising the SAP for EMWMF and is making progress toward correcting serious deficiencies in the detection monitoring program. As stated on page 6-29, among the lessons learned from EMWMF is the importance of collecting quality background characterization data, particularly with respect to analytical detection limits and defensible statistical evaluations. TDEC urges DOE to involve analytical and statistical resources early in the planning of such efforts to determine the amount and quality of data needed. One year of quarterly pre-construction data may be the absolute minimum necessary. DOE may elect to apply trend analyses similar to those being contemplated for use at EMWMF to leverage the benefits of a larger "baseline" data set.

80. Section 6.2.2.4.4 Geologic Buffer Layer: *"The EMDF conceptual design includes at least a 10 ft thick geologic buffer between the landfill liner and groundwater table per TDEC Rule 0400-11-01-.04(4)(a)(2). This ARAR is cited as a design requirement in Table G-4 in Appendix G." See General Comment 19 regarding TDEC's position that this ARAR is a siting requirement—not a design requirement.*

81. Section 6.2.2.4.5 Facility Underdrains, Pages 6-40 and 6-41: *"Facility underdrains are incorporated in the conceptual designs for all site locations.... Infilling of existing ravines and valleys below and adjacent to the EMDF footprints with low permeability soils can prevent the natural drainage and underflow of groundwater below the site resulting in a potential backup of groundwater that can encroach upon and into the geobuffer and liner systems.... Even at proposed sites with the least extensive underdrain networks (e.g., Site 6b and Site 7c), a portion of shallow groundwater will still continue to discharge toward and into adjacent NT stream valleys east and west of the footprints."*

See General Comments 3, 10, 11, 18, and 19, as well as Specific Comments 9, 50, 51, 62, 69, and 76 regarding TDEC's position on underdrains.

82. Section 6.2.2.4.5 Facility Underdrains, Temporary Drainage Features, Pages 6-43: *"Sites 6b, 7a, and 7c, which do not have known seeps/springs or drainage paths within the waste footprints are conceptualized with temporary drainage features under berm areas to accommodate existing natural drainage paths, which are described in more detail for each site below.... Temporary drainage features, over the long-term, would not be required to limit water table elevations at Sites 6b, 7a, and 7c, and would not be located under the waste; therefore, they would not provide preferential flow paths for contaminant travel to surface water." How does DOE support this assertion in the absence of site-specific hydrogeological characterization information?*

83. Section 6.2.2.4.5 Facility Underdrains, CBCV Site Temporary Drainage Features, Pages 6-48: *"D-10W flow is re-routed around the landfill on the eastern side (into the NT-10 channel), and a temporary trench drain in the southeastern corner for the remaining lower D-10W channel is provided beneath the berm of the landfill footprint. The drainage feature is predicted to be needed only during construction. The conceptual layout plan for the CBCV temporary drainage features is shown in Figure 6-17. As designed, with the upper portion of D-10W re-routed to discharge into the NT-10 channel, this portion of the drain system beneath the berm is not expected to be*

required to perform long-term groundwater suppression." How does DOE support this assertion in the absence of site-specific hydrogeological characterization information?

84. Section 6.2.2.6.3 Predicting Seasonal High Groundwater Elevations, Page 6-80: *"Just as important as surface constraints to design layouts as described in the approach above, is the constraint set by the groundwater table under any site. The EBCV and WBCV Sites have enough monitoring data available to give a reasonable indication of the seasonal high water table elevations at those sites, but this information is lacking for Sites 6b and 7a/7c.... Understanding expected seasonal high groundwater levels is a key element to designing a landfill.... How the water table would be altered over time with landfill construction was also a consideration."* TDEC agrees with these statements but notes that understanding site hydrogeology is a key element for demonstrating the suitability of site characteristics and compliance with (or need for waivers of) siting ARARs.

85. Section 6.2.2.6.3 Predicting Seasonal High Groundwater Elevations, Dual Site: Site 7a and CBCV: Site 7c, Page 6-82: *"Similar to Site 6b, almost no site-specific data are available for Site 7a or Site 7c for estimating a seasonal high water table.... Engineering judgment was used to estimate a seasonal high water table for Site 7a and 7c...."* TDEC staff believe that the RI/FS should present the site characterization information, including hydrogeological data, necessary to demonstrate the suitability of site characteristics and compliance with (or need for waivers of) siting ARARs.

86. Section 6.2.3 Waste Acceptance Criteria, Page 6-86, Third Paragraph and Appendix H: The preliminary screening of potential radiological contaminants is based on mobility and (to a lesser extent) half-life. However, the EPA Risk Assessment Guidance for Superfund (RAGS, Part A, Section 5.9.5) outlines a process that uses concentration and toxicity for screening constituents to identify those constituents most likely to contribute to significant risk. Additionally, there is no screening (or discussion of screening) for chemical constituents; such screening is needed since many of the radionuclides are also metals, and metals toxicity is a component of the overall site risk.

87. Table 6-5, Page 6-90: Quite a few constituents are screened out *"because negligible inventory is expected"*. However, the RI/FS text states that the *"...types and amounts of contaminants are not yet fully known"*. Thus, it is premature to exclude contaminants from consideration for WAC determination.

88. Section 7. Detailed Analysis of Alternatives: *"In terms of the state agency input, this current RI/FS document has not been seen in its entirety by the state. The state has seen earlier versions of the RI/FS, which differ significantly from this version, and documenting the state's input on an earlier version could be misinterpreted as applying to the current document; their input is documented separately in submitted comments to which DOE has responded to in developing this RI/FS."* As noted in Specific Comment 49 and documented throughout this letter, TDEC disagrees that state input has been addressed adequately and incorporated into the D5 RI/FS report.

89. Section 7.2.2 On-site Disposal Alternatives Analysis: *"...key assumptions also necessarily serve as a basis for an on-site alternative if one is put forth in the Proposed Plan. As discussed elsewhere in the document, if one of the On-site Disposal Alternatives is selected for the proposed remedy, site-specific characterization for that site would be completed in parallel with other activities (e.g., WAC determination) following a Proposed Plan, caveated to note the progression of characterization and need for validation prior to a ROD."*

As stated in General Comment 8b, this is a component of DOE's proposed "caveated approach" (described in the introductory text above) that TDEC did not accept. DOE's transmittal letter for the D5 RI/FS (dated February 28, 2017) also states: "Current plans are to provide a revised draft Proposed Plan, based on the findings of the enclosed Feasibility Study, for your review and approval in the next 30-45 days." Submittal of a Proposed Plan without regulatory approval of the D5 RI/FS report or agreement of the FFA parties would not be consistent with the CERCLA decision-making process. Under CERCLA, a Proposed Plan identifies a preferred alternative and presents it to the public after completion of the evaluations presented in the RI/FS, including regulatory approval (or agreement of the FFA parties).

90. Section 7.2.2.1 Key Assumptions, Page 7-7: *"The overarching assumption for this analysis of the On-Site Disposal Alternatives is that the final landfill design will maintain a 15 ft unsaturated buffer zone between the waste and the seasonal high water table, while providing sufficient on-site disposal capacity for forecasted waste volumes."* Such assumptions should not be needed in a RI/FS, but the D5 report does not include the site-specific characterization information necessary to support an evaluation of the protectiveness of the waste disposal alternatives. As noted in Specific Comment 58, TDEC believes the focus of a CERCLA RI/FS should be on the protectiveness of waste disposal rather than *"providing sufficient on-site disposal capacity for forecasted waste volumes"*. The question should be, "How much of the future CERCLA waste can be disposed on site in a protective manner—either in an existing permitted landfill or the proposed EMDF?"

91. Section 7.2.2.2 Overall Protection of Human Health and the Environment (On-site): *"The On-site Disposal Alternative (all sites) would meet risk-based RAOs and protect human health and the environment by consolidating most future generated CERCLA waste exceeding the capacity of the existing EMWMF from the cleanup of ORR and associated sites into an engineered waste disposal facility, isolating the wastes from the environment. Additional protection would be provided indirectly by treatment of some waste streams to meet the EMDF WAC. Prior to placement in the EMDF, wastes would be evaluated for compliance with the facility WAC; placement of that waste would result in an overall net reduction of risks associated with environmental contamination at the ORR and associated sites."*

The statements above do not appear to be consistent with the RI/FS purpose, as stated on page ES-1 under **RI/FS Approach**: *"The purpose of this RI/FS is to develop, screen, and evaluate the alternatives for waste disposal against CERCLA criteria designed to address statutory requirements and feasibility. The RI/FS provides support for an informed selection decision about disposal of CERCLA waste."* Based on this statement, it appears the purpose of the RI/FS is to determine which waste disposal alternative best meets the nine CERCLA decision-making criteria. If the

purpose of the RI/FS is to document an overall risk reduction on the ORR by disposing CERCLA waste in the proposed EMDF, as suggested in Section 7.2.2.2, the D5 report fails to make that case. This is particularly true in the D5 report, which presents no modeling or risk assessment information to demonstrate the protectiveness of the "placeholder" WAC.

92. Section 7.2.2.7 Implementability (On-site), Future Remediation Considerations, Pages 7-34 and 7-35: *"Future remedial actions at EMDF should not be required because waste treatment to meet ARARs is accomplished by generators as necessary to meet the disposal facility WAC, protectiveness is provided by compliance with the disposal facility WAC (to be provided in a future WAC Compliance Plan), and a high level of isolation is provided by the engineered landfill. Only limited additional actions would be possible once the landfill is capped because of the relative permanence and massive nature of the disposal facility. Additional actions would be warranted only if major deviations from the expected performance of the landfill features occurred. For example, remedial actions would be triggered by releases of contaminants to groundwater or erosion of the cap and exposure of the waste to the environment. Releases to groundwater would be managed using existing and implementable methods such as pumping and/or diversion trenches combined with water treatment. Cap repair, while costly, is fully implementable and technically feasible."*

The RI/FS report should support these assertions with appropriate and defensible evaluations.

93. Section 7.2.2.9 NEPA Considerations (On-site), Cumulative Impacts, Page 7-39: *"Construction of EMDF would not result in any significant cumulative impacts to the surrounding environment if BMPs, including engineering and administrative controls, are used."* How does DOE support this assertion in the absence of a CA under DOE Order 435.1?

94. Section 7.2.2.9 NEPA Considerations (On-site), Cumulative Impacts, Page 7-40: *"Construction of the EMDF in BCV could contribute to the cumulative degradation of Bear Creek."* TDEC agrees with this assertion which supports the need for a CA under DOE Order 435.1.

95. Section 7.2.3.1 Overall Protection of Human Health and the Environment (Off-site), Pages 7-40 and 7-41: TDEC agrees with the following statements.

"The Off-site Disposal Alternative would protect human health and the environment by removing wastes generated at ORR CERCLA sites, transporting them off-site, and isolating them from the environment by disposal in engineered facilities. Implementation of this alternative would prevent access to contaminated media and reduce the overall potential for releases from multiple sites on the ORR. Remediation of ORR and associated sites could result in human health or environmental benefits, depending on the eventual land use of these sites.

Human health and the environment would be protected in the vicinity of the receiving facilities by disposing of contaminated material appropriately. Operation of these facilities is not likely to result in exposure to waste or releases to the environment because the facilities are designed, licensed, monitored, and maintained to ensure reliable waste containment. The

addition of CERCLA waste from ORR to these facilities would result in a negligible increase in risk above that resulting from disposal of other wastes at the facilities. The EnergySolutions, WCS, and NNSS facilities are located in isolated arid environments with few nearby human receptors."

96. Section 7.3.1 Overall Protection of Human Health and the Environment, Page 7-56: TDEC agrees with the following statements and notes that the off-site facilities meet siting criteria and have been authorized for disposal of the types of waste to be generated during CERCLA cleanup on the ORR, whereas a new on-site facility would need waivers of siting criteria and other ARARs.

"The Off-site and Hybrid Disposal Alternatives would be more effective in preventing potential future releases on the ORR because most of the CERCLA waste (majority in the case of the Hybrid Disposal Alternative) would be disposed of in off-site permitted facilities...."

The Off-site Disposal Alternative and off-site portion of the Hybrid Disposal Alternative would be protective through compliance with the WAC for each of the off-site existing permitted facilities."

97. Section 7.3.3 Long-term Effectiveness and Permanence, Engineered Containment Features, Pages 7-57 and 7-58: The following statements from the D5 report highlight the need for site-specific characterization and site-specific justifications for ARAR waivers, as appropriate.

"While the underdrain networks are necessary and effective in isolating wastes from the underlying saturated zone, they do provide avenues for localized and relatively rapid transport of contaminants in groundwater that could be released below the footprint and discharge at underdrain outfall locations...."

Long-term effectiveness between the proposed sites in the On-site Disposal Alternatives is differentiable by the reliance on underdrain performance."

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