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STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
Division of Remediation - Oak Ridge
761 Emory Valley Road
Oak Ridge, Tennessee 37830

July 30, 2018

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

Re: Formal Dispute; Proposed Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Waste (DOE/OR/01-2695&D2)

Dear Mr. Japp

The Tennessee Department of Environment and Conservation (TDEC) – Division of Remediation (DoR) invokes formal dispute regarding the D2 Proposed Plan (Plan) in accordance with Section XXVI of the Federal Facility Agreement (FFA) for the Oak Ridge Reservation (ORR) and elevates the dispute to the Dispute Resolution Committee (DRC). The Plan presents the Onsite Disposal Alternative located at Central Bear Creek Valley (CBCV) as the preferred remedy for disposal of waste from the U.S. Department of Energy (DOE) – Oak Ridge Office of Environmental Management (OREM) ORR CERCLA cleanup program.

For the reasons explained in our letter of July 6, 2018, TDEC cannot support issuing the Plan to the public as currently written. The Plan does not accurately reflect the State of Tennessee's position and does not adequately communicate several key State concerns with the Preferred Alternative. The parties met on July 12, 2018 and July 17, 2018 in an effort to resolve the dispute informally. Reasonable efforts failed to resolve the dispute and meet the objectives stated in the July 6 letter. OREM's formal dispute document dated July 20, 2018 elevated the informal dispute to formal status. OREM's Formal Dispute Document implies substantive issues with the Proposed Plan and the proposed alternative have been addressed and that the FFA parties are working through design and operation of the proposed facility. However, TDEC contends that substantive issues remain, and those issues have not been clearly presented for public consideration in the Proposed Plan. TDEC provides the enclosed statement to elevate the disputed matters to a formal dispute for resolution by the DRC.

This notice of formal dispute is provided as established by FFA Section XXV. The composition of the DRC described in Section XXVI D does not reflect the current organizational structure and/or position titles for any of the FFA parties. Therefore, TDEC requests that each party forward the enclosed statement of formal dispute to the attention of the designated DRC representative. Per the FFA, DRC members are intended to serve at a policy level. This would be consistent with Senior Executive Service (SES) status or equivalent.

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In addition, TDEC recognizes the December 7, 2018 Dispute Resolution Agreement (DRA) says the Parties agreed to work jointly to issue a Proposed Plan identifying CBCV Site 7c as the preferred location for onsite disposal. The DRA also states that TDEC review of the field investigation results shall be prior to execution of the Record of Decision (ROD), and TDEC will provide comments before the ROD. However, initial evaluation and comparison of measured water levels with proposed approximate landfill construction elevations indicates areas where groundwater may be in the geologic buffer, liner, or waste.

This high groundwater would limit disposal capacity by requiring the cells and underlying buffer to be elevated above the water. In addition to limiting disposal capacity by placement of a thicker engineered buffer beneath the landfill, there are other significant concerns associated with the use of permanent underdrains to manage groundwater. The Proposed Plan identifies that regulatory exemptions/waivers would be required for siting requirements under the Toxic Substances Control Act (TSCA) and Tennessee radiological health rules. Reliance on permanent underdrains or drains under the waste cells would limit the justification for such waivers.

Sincerely

Randy Young
FFA Manager

Enclosure: TDEC Statement of Formal Dispute

xc: Dave Adler, DOE-OREM
John Blevins, DOE-OREM
Jay Mullis, DOE-OREM
Patricia Halsey, DOE-OREM
Rich Campbell, EPA
Carl Froede, EPA
Franklin Hill, EPA
Connie Jones, EPA
Don Rigger, EPA
Pete Osborne, SSAB
Amy Fitzgerald, ORRCA
Ron Woody, ORRCA
Traci Cofer, ORRCA

Written Statement of Formal Dispute
Proposed Plan for the
Environmental Management Disposal Facility

Enclosure for TDEC Letter of July 30, 2018

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

DIVISION OF REMEDIATION – OAK RIDGE

FEDERAL FACILITY AGREEMENT PROGRAM

Tennessee Department of Environment & Conservation
Written Statement of Formal Dispute:
Proposed Plan for the Environmental Management Disposal Facility

Pursuant to Section XXVI of the Federal Facility Agreement for the Oak Ridge Reservation (FFA), this written statement of dispute provides the position of the Tennessee Department of Environment & Conservation for:

1) not approving a primary document, a Proposed Plan, recommending a Preferred Alternative for the development of an on-site disposal facility referred to as the Environmental Management Disposal Facility (EMDF);

2) elevating the dispute to the Dispute Resolution Committee (DRC); and

3) initiating formal dispute.

Nature of the Dispute

In *the Proposed Plan for Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) *Oak Ridge Reservation* (ORR) *Waste Disposal, Oak Ridge, Tennessee* (DOE/OR/01-2535&D2), the Department of Energy (DOE) evaluated and proposed a preferred alternative for the EMDF as a second on-site waste disposal facility for the disposal of CERCLA waste on the ORR. As proposed, the EMDF would primarily be a Low Level Radioactive Waste (LLRW) Disposal Facility, but it would also be authorized under CERCLA to receive hazardous and chemical wastes regulated under the Resource Conservation and Recovery Act (RCRA) and the Toxic Substances Control Act (TSCA).

TDEC received the D2 revision of the Proposed Plan document (Attachment A) on June 7, 2018. TDEC notified DOE that the State cannot support issuing the Plan to the public as currently written and invoked informal dispute on July 6, 2018 (Attachment B).

40 CFR §300.430(e)(9)(iii)(H) requires the Proposed Plan to contain an assessment of state concerns including the state's position and its key concerns:

> **(H)***State acceptance.* Assessment of state concerns may not be completed until comments on the RI/FS [Remedial Investigation/Feasibility Study] are received but may be discussed, to the extent possible, in the proposed plan issued for public comment. The state concerns that shall be assessed include the following:
>
> *(1)* The state's position and key concerns related to the preferred alternative and other alternatives; and
>
> *(2)* State comments on ARARs or the proposed use of waivers.

While the Proposed Plan presented a summary of the State Acceptance language that TDEC provided to DOE on May 3, 2018 (Attachment C), the Proposed Plan failed to adequately characterize the State's position and key concerns. As such, the primary document is not in accordance with Section XXI of the FFA governing review and approval of primary documents and requiring consistency with the federal CERCLA statute and its regulations at 40 CFR Part 300, referred to as the National Contingency Plan (NCP).

The parties met on July 12, 2018 and July 17, 2018 in an effort to resolve the dispute informally. Reasonable efforts failed to resolve the matters in dispute. Hence, TDEC provides this statement to elevate the disputed matters to a formal dispute. During the dispute, DOE issued an ultimatum and would not engage in any discussion or negotiation of the actual language for State Acceptance that it had previously refused to include in the Proposed Plan. The ultimatum was that the full State Acceptance language would be included in an Appendix to the proposed Plan and accompanied by a "rebuttal" prepared by DOE that would not be subject to State review and approval. DOE representatives were unwilling to discuss their actual concerns by reviewing the State Acceptance text.

The Environmental Protection Agency (EPA) initiated a separate informal dispute by a letter dated July 10, 2018 (Attachment D). The EPA letter notes correctly that—in addition to the more general concerns articulated by the State about discharge limits—there was an agreement that issues related to water treatment for the EMDF and discharges to Bear Creek would be resolved in the *Focused Feasibility Study [FFS] for Water Management for the Disposal of CERCLA Waste on the Oak Ridge Reservation* (DOE/OR/01-2664&D2). The shared intent of the FFA parties was to finalize the FFS in parallel to the RI/FS for EMDF and then merge the content of the documents to support the EMDF decision. However, the FFS is in informal dispute, and the Proposed Plan does not reference that document. Paragraph 6 of the December 7, 2017 Dispute Resolution Agreement (DRA) (Attachment E) incorporates the FFS through its attachment of the preliminary list of Applicable or Relevant and Appropriate Requirements (ARARs) and To be Considered (TBC) requirements derived from Appendix G in the D5 RI/FS. The DRA attachment includes several references to the FFS, including the following from Section 7.4:

> 7.4 WASTEWATER COLLECTION AND DISCHARGE
>
> Non-contact storm water generated during construction, operations, closure and post-closure will be collected in sedimentation basins to allow solids to settle out, and then will be released to surface streams.
>
> At the request of TDEC and the EPA, a separate FFS that addresses landfill wastewater management for both the EMWMF and the EMDF has been prepared in parallel with this RI/FS. The FFS identifies several landfill wastewater management alternatives and provides appropriate ARARs. The preferred alternative and ARARs from this [D5] RI/FS and the FFS will be merged into a selected remedy and ARARs in the ROD.

As discussed in TDEC's informal dispute letter of July 6, 2018 (Attachment B), there is a fundamental disagreement between OREM and TDEC about discharge limits for wastewater from the proposed landfill. TDEC approval of the ROD will require that OREM show that future wastewater discharges meet CERCLA Threshold Criteria and do not degrade waters of the State per Tennessee Rules 0400-40-05-.10(4) and 0400-40-03-.06. These requirements are necessary to protect receiving streams, as well as the people eating fish downstream. The DRA attachment lists these requirements, as does the FFS. The FFS is a fundamental component of the RI/FS that serves as a basis for OREM's Plan. OREM has deferred components of the FFS and the RI/FS to be resolved prior to signing the ROD. Therefore, the Proposed Plan must be transparent about the path forward for resolving water management issues and protective discharge limits.

Work Affected by the Dispute

Section XXVI.H of the FFA provides that the pendency of any dispute under this Section shall not affect the DOE's responsibility for timely performance of the work required by this Agreement, except that the time period for completion of work affected by such dispute shall be extended for a period of time usually not to exceed the actual time taken to resolve any good faith dispute in accordance with the procedures specified herein. The Proposed Plan is a document in the CERCLA remedy selection process to be followed by a Record of Decision (ROD). It is unlikely that any work other than the Proposed Plan would be affected by this dispute. But if a draft ROD milestone were subject to delay, the other FFA parties would be required to extend the deadline.

To the extent that the purpose of a Proposed Plan is to lead to a ROD, this dispute could arguably delay the ROD. However, that argument is not persuasive because the ROD scheduled for this fall is only a draft. Moreover, the terms of a Dispute Resolution Agreement (DRA) signed by the parties on December 7, 2017 require the final ROD to await completion of other work in parallel to the development of the ROD. It is unlikely that any delay from this dispute would impact the final ROD, as the parallel work committed to in the DRA will take longer than the dispute over the Proposed Plan, even if the dispute slightly delays the draft ROD.

For the reasons described in the preceding paragraphs, TDEC believes the only work substantively affected by the dispute is the Proposed Plan and not the final ROD or the overall EMDF project schedule, assuming that the proposed EMDF remains economically viable after the evaluation of information from work completed in accordance with the DRA.[1]

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[1] TDEC recognizes that DOE's position is that abundant on-site disposal capacity is integral to timely cleanup and response actions. DOE has argued that interruption of the EMDF project will severely delay cleanup of environmental contamination and redevelopment of the ORR. DOE has argued that because design and construction of EMDF will take a number of years, delaying the project imposes a risk that the closure of the existing Environmental Waste Management Facility (EMWMF) could occur before completion of the EMDF. DOE also argues more subjective political risks such as losing support in Congress or in the DOE headquarters. Such concerns are speculative, and the risk of delay associated with this dispute is for a draft ROD; the ROD cannot be finalized until completion of other tasks that will take well into next year to accomplish. These other ongoing tasks parallel to the development of the ROD will provide a time buffer to resolve this important dispute.

Position Respecting Dispute

Normally under CERCLA, detailed information about the alternatives is presented in the Remedial Investigation/Feasibility Study (RI/FS). Hence, the RI/FS provides the basis for the Proposed Plan, which documents how the remedial alternatives meet threshold and other CERCLA evaluation criteria. No remedy can legally be selected through CERCLA without first meeting the threshold criteria and then being evaluated using other criteria to justify a decision.[2]

The EMDF RI/FS was not approved and was subsequently disputed by DOE.[3] The State of Tennessee, Environmental Protection Agency (EPA), and Department of Energy (DOE) signed a DRA on December 7, 2017, that allowed issuance of the Proposed Plan identifying the Central Bear Creek Valley (CBCV) Site (7c) as the most promising <u>location</u> for onsite disposal. The Proposed Plan implies more than was agreed in the DRA; it implies that the State conditionally approves not only the <u>location</u>, but also several alternatives for on-site disposal based only on DOE's assumptions about acceptable volume for disposal, given the types and characteristics of waste and the hydrogeologic setting of the sites.[4] Put another way, it is evident, based on cost comparisons for off-site and on-site disposal in the unapproved RI/FS, that DOE would reduce its future disposal costs through on-site disposal <u>if</u> on-site disposal is approved at a certain volume.[5] However, the supporting assumptions may not be validated by the

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[2] 40 CFR 300.430(f)(1)(i)(A) & (f)(1)(ii)(A) & (B) require that all remedial alternatives in the Proposed Plan meet threshold criteria to demonstrate protectiveness and compliance with applicable or relevant and appropriate requirements (ARARs). Selection of a remedy under CERCLA must be done by evaluating a set of alternatives, all of which are based on a firm foundation of having met the threshold criteria. And the DRA allowed moving forward to the Proposed Plan while deferring information normally contained in a RI/FS until later in the process. As a logical consequence, DOE assumes the risk (to schedule and otherwise) of proceeding without critical information.

[3] The formal dispute addressed by the DRA dated December 7, 2017 related to an informal dispute initiated by TDEC and EPA in 2016 regarding the D5 RI/FS. Normal practice under CERCLA involves regulatory review and subsequent approval of a RI/FS before issuing a Proposed Plan. However, DOE's statement of dispute interjected concerns about the Proposed Plan which had not been reviewed by TDEC or EPA pending approval of the RI/FS. While the DRA references the RI/FS in the introductory paragraph, the resolution points do not mention the RI/FS. As best as the parties could "move the CERCLA process forward" without a completed RI/FS, the Proposed Plan has been developed. However, TDEC understood the DRA as an attempt to defer, not avoid, critical decisions on threshold criteria normally supported by a complete and approved RI/FS. The DRA does not supersede federal regulations that require alternatives considered in a Proposed Plan, and certainly the Preferred Alternative, to satisfy threshold criteria. Therefore, it is imperative that the Proposed Plan clearly document the State's position on the deferred information.

[4] This dispute is not just over a Proposed Plan but also about what the DRA from December 2017 means. As explained in the previous footnote, the background of the previous dispute was about a protracted process to complete an RI/FS acceptable to TDEC and EPA. Ultimately, the DRA reflected a compromise by TDEC, EPA and DOE; the compromise was not over the information TDEC and EPA considered necessary for selecting a remedy but rather the timing for providing the necessary information.

[5] See Figure 10 on page 15 in the D2 Proposed Plan (Attachment B) showing the breakeven point in cost per cubic yard for on-site disposal compared to off-site disposal and the further benefit realized by greater economy of scale leading to lower per cubic yard costs. The breakeven on-site disposal volume is given as approximately 750,000 cubic yards. But on-site disposal becomes increasingly attractive as volume increases and the costs per cubic yard continue dropping until leveling off at about 1.5 million cubic yards. The cost differential is several hundred dollars per cubic yard, translating into several hundreds of millions of dollars in total estimated disposal costs if on-site disposal is maximized. Maximizing on-site disposal as a remedial alternative must satisfy the primary tests of threshold criteria first. Under CERCLA, a remedy must meet threshold criteria before considering cost.

hydrogeologic investigation, Waste Acceptance Criteria (WAC) developed under DOE Orders, and TDEC's "independent verification" to ensure consistency with CERCLA requirements.

While the DRA recognizes that the Proposed Plan will advance a remedial (disposal) alternative based on CBCV Site 7c, the DRA defers much of the information needed to evaluate threshold and other CERCLA criteria to the Record of Decision (ROD). To be transparent to the community, TDEC provided "State Acceptance" language to DOE on May 3, 2018, documenting the State's position and key concerns. Those State concerns are merely elaborations of the same issues expressed in the DRA.

DOE has summarized the State Acceptance language in a manner that inaccurately portrays the State's position to the public as "conditional support". Actually, the DRA defers potential State support for DOE's preferred alternative until the ROD, based on DRA commitments for providing additional information after the Proposed Plan. Moreover, the summary of State concerns provided by DOE in the Proposed Plan does not adequately list and express the key concerns of the State. Therefore, the State cannot support issuing the Proposed Plan for public review until DOE incorporates the complete State Acceptance language. In addition, the State cannot agree to an alternative until DOE shows that the alternative, including the preferred alternative, meets CERCLA requirements including threshold criteria.

Information Supporting Position

The following documents referenced herein are attached in support of the State's position and may be identified by the following by letters:

A - DOE D2 Proposed Plan (June 5, 2018)
B - TDEC Informal Dispute Letter (July 6, 2018)
C - TDEC State Acceptance Language (Submitted to DOE May 3, 2018)
D - EPA Informal Dispute Letter (July 10, 2018)
E - Dispute Resolution Agreement (DRA) with Appendix G Draft ARAR List (December 7, 2017)

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Attachment A

DOE D2 Proposed Plan

United States Department of Energy
Environmental Management Program DOE/OR/01-2695&D2

Proposed Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Waste

June 2018

This Proposed Plan describes:

- The need for a decision on the disposal of waste from the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) cleanup of the Oak Ridge National Priority List site (referred to as the Oak Ridge Reservation [ORR] in this document)
- Waste disposal alternatives considered
- Onsite disposal locations considered
- Preferred alternative for waste disposal
- How to participate in the selection or modification of the preferred alternative
- Where to get more information

This Proposed Plan presents the Onsite Disposal Alternative located at Central Bear Creek Valley as the preferred remedy for disposal of waste from the U.S. Department of Energy's (DOE's) ORR CERCLA cleanup program. This Proposed Plan presents the following rationale for the preferred alternative:

1. Onsite disposal facilitates timely cleanup of the ORR by providing a cost-effective, protective disposal option. An onsite disposal facility within Central Bear Creek Valley protects human health and the environment and achieves or waives all applicable or relevant and appropriate requirements (ARARs), while obtaining the best balance of the remaining CERCLA remedy selection criterion. This Proposed Plan includes a summary explanation of proposed waivers.

YOUR OPINION IS INVITED

DOE invites you to express your opinion of the presented remedial alternatives and the preferred alternative for disposing of future waste generated from the continued cleanup of the Oak Ridge Site. You are encouraged to read the information in the administrative record, including the Remedial Investigation/Feasibility Study (RI/FS), and any additional reports that follow the RI/FS and precede the Record of Decision, for background and more detailed technical information. A comment form is attached to this Proposed Plan, but you are not restricted to this form. Decision makers will consider any comments received before the end of the public comment period.

Community involvement is critical to the CERCLA process. DOE has established a 30-day public comment period, during which time local residents and interested parties can express their views and concerns on all aspects of this plan. DOE has scheduled a public meeting to discuss cleanup alternatives and to address questions and concerns the public may have. Upon timely request, DOE will extend the public comment period by an additional 30 days.

2. Onsite disposal optimizes utilization of government funds available for environmental cleanup efforts at the ORR.
3. The proposed site is located well within the DOE reservation in an area not considered for reindustrialization or reuse.
4. Onsite disposal presents the lowest risks to humans through waste transportation.

INTRODUCTION

This Proposed Plan presents DOE's preferred alternative for the disposal of waste generated from cleanup actions under CERCLA at the DOE ORR for which additional capacity is necessary beyond the currently approved CERCLA disposal facility (Environmental Management Waste Management Facility [EMWMF]). The Proposed Plan is a document that DOE, as the lead CERCLA agency, is required to issue to fulfill the public participation requirement under CERCLA § 117(a) and the National Contingency Plan (40 *Code of Federal Regulations* [*CFR*] 300.430[f][2]). The Environmental Protection Agency Region 4 (EPA) and the State of Tennessee Department of Environment and Conservation (TDEC) support the issuance of this Proposed Plan as Federal Facility Agreement (FFA) (DOE 1992) parties. In accordance with the National Contingency Plan (40 CFR 300.430(9)(iii)(H)), the State Acceptance section addresses the state's positions and key concerns.

It is important to the remedy selection process to obtain public input on all alternatives and on the rationale for the Preferred Alternative. New information or arguments the lead agency receives during the public comment period could result in the selection of a final remedial action that differs from the Preferred Alternative.

This Proposed Plan documents DOE's rationale for the preferred alternative within the framework of CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 *United States Code* Sect. 96-1 et seq.) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 *CFR* 300). In accordance with the DOE "Secretarial Policy Statement on the National Environmental Policy Act" (DOE 1994), National Environmental Policy Act of 1969 (NEPA) values have been incorporated into the CERCLA documentation prepared for this project.

BACKGROUND

The 33,477-acre DOE-owned ORR is located within the city limits of Oak Ridge, Tennessee, in Roane and Anderson counties (Figure 1). The three major industrial, research, and production facilities originally constructed on the ORR as part of the World War II-era Manhattan project and currently managed by DOE are the East Tennessee Technology Park (ETTP), the Oak Ridge National Laboratory (ORNL), and the Y-12 National Security Complex (Y-12) (Figure 1).

The principal mission of ETTP was uranium enrichment, which ended in 1985. ETTP is now being cleaned up to allow reuse of the land and infrastructure. ORNL has historically hosted and continues to host a variety of research and development facilities, including the use of research nuclear reactors for DOE. Y-12 has served several missions, including uranium enrichment, lithium refining, nuclear weapons component manufacturing, and weapons disassembly, and has a continuing mission in some of these areas. These historical operations on the ORR have led to different types and amounts of contamination in soil, surface water, sediment, groundwater, and buildings, and have resulted in burial of material.

The DOE Oak Ridge Office of Environmental Management Program's focus has been CERCLA remediation at all three facilities. While most

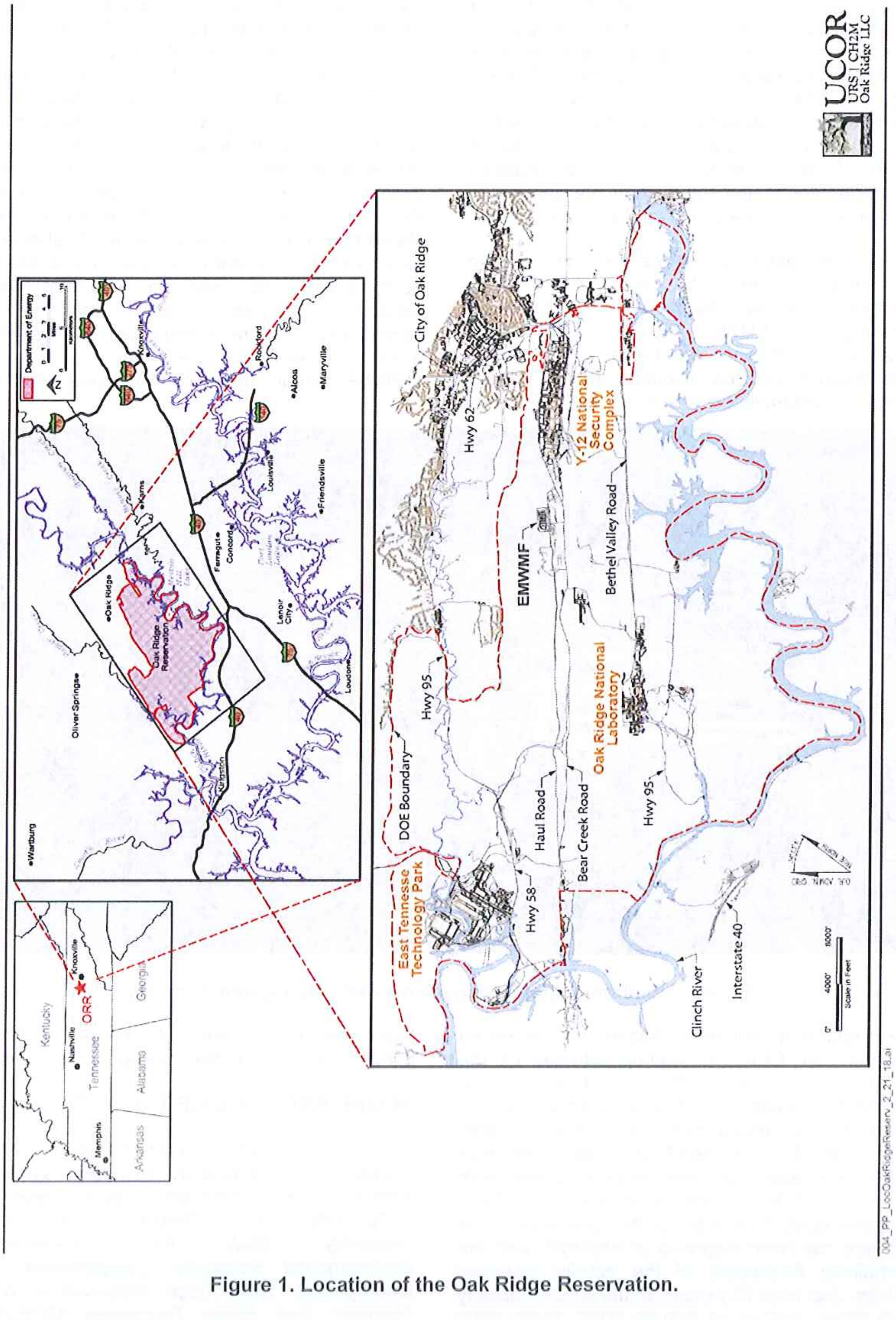

Figure 1. Location of the Oak Ridge Reservation.

cleanup activities are complete at ETTP, finishing the cleanup mission at all three facilities is projected to take several decades and is anticipated to result in large volumes of waste requiring disposal. While the most highly contaminated radioactive and chemical waste generated by cleanup activities will be managed at offsite facilities, large volumes of building demolition debris and soil material are anticipated that can be protectively managed in onsite landfills.

In 1997, based upon a State recommendation to expand community involvement, DOE sponsored the establishment of the End Use Working Group (EUWG). The group, composed of citizens from diverse stakeholder organizations, was asked to develop recommendations for end uses of contaminated areas on the ORR and community values that could be used to guide the cleanup decision-making process. As documented in the EUWG Stakeholder Report on Stewardship (DOE 1998a), recommendations on the end use of Bear Creek Valley and for siting an onsite CERCLA waste disposal facility were made. The end use recommendation for Bear Creek Valley included the establishment of a restricted waste disposal zone in the area of existing long-term waste disposal areas. The EUWG recommendation stated that any CERCLA waste facility should be located on or adjacent to an area that is already contaminated and used for long-term waste disposal. Consistent with the EUWG recommendation, the current onsite EMWMF is located in East Bear Creek Valley (Figure 2). The EMWMF began operations in 2002 and has

Figure 2. Environmental Management Waste Management Facility.

been receiving radioactive, hazardous, and mixed wastes from CERCLA cleanup activities on the ORR continuously for the last 16 years. The EMWMF consists of six disposal cells with a total capacity of 2.2 million cubic yards. Approximately 95 percent of the volume of wastes associated with cleanup to date has been disposed onsite, with 5 percent of the volume being disposed offsite. Approximately 15 percent of the radioactive curie content has been disposed at EMWMF, with the remaining 85 percent of the activity disposed offsite. Just over 75 percent of the landfill capacity has been used as of January 2018. There have been over 160,000 waste shipments to EMWMF, primarily on the dedicated (non-public) haul road.

SCOPE AND ROLE OF THE DECISION

The scope of the ORR CERCLA cleanup program has significantly increased since the original waste estimates were developed (DOE 1999). *The Remedial Investigation/ Feasibility Study for Comprehensive Environmental Response, Compensation, and Liability Act Oak Ridge Reservation Waste Disposal, Oak Ridge Tennessee* (DOE 2017) (herein referred to as the RI/FS) was prepared to evaluate several possible alternatives for disposal of CERCLA waste that would be generated during ongoing and future cleanup of the ORR.

The scope of this Proposed Plan is to recommend an alternative for continued disposal of CERCLA waste that would be generated from the cleanup efforts planned for the ORR. If at some future time DOE ORR CERCLA remediation waste off the ORR, but within the state, requires disposal, advance FFA triparty approval would be needed to incorporate that waste in this remedy.

The associated RI/FS analyzed the following primary alternatives: (1) no action, (2) onsite disposal in a newly constructed facility on the ORR, (3) a combination of onsite and offsite disposal, and (4) offsite disposal at authorized facilities. Several possible onsite disposal locations were evaluated in the RI/FS for various siting options in Bear Creek Valley.

This Proposed Plan serves the following four primary purposes:

1. Summarizes the volume projections and waste types/characteristics for waste to be generated from future CERCLA cleanup actions on the ORR.
2. Summarizes alternatives and compares them against the CERCLA remedy selection criteria and relevant NEPA values.
3. Identifies and provides the rationale for the preferred alternative.
4. Facilitates public involvement in the remedy selection process.

This Proposed Plan is based on data and information presented in the RI/FS as well as the Administrative Record, and is being published to solicit public review and comment on all information presented herein, specifically on information pertaining to the preferred action. The lead agency for ORR remedial activities, DOE, is issuing this Proposed Plan as part of public participation requirements under Sect. 117(a) of CERCLA and the NCP 300.430(f)(2).

WASTE CHARACTERIZATION AND VOLUME

The evaluation of onsite disposal requires the development of assumptions on how much landfill capacity is needed. The final capacity assumed to be needed for completion of ORR cleanup is estimated at 2.2 million cubic yards. Waste types will include soil, sediment, and sludge, along with demolition debris. The majority of the waste (just over two thirds) is anticipated to be debris.

Projections of future waste streams are based on available data for wastes disposed at EMWMF combined with available information on the facilities and environmental media yet to be remediated. An estimate of the amount of radiological and chemical contamination that may be in future waste streams was developed from information about future remedial actions. Information from remedial investigations of soil, scrap, and sediment contamination and information from building sampling efforts were used along with process knowledge of activities that occurred in the buildings. In general, the total amount of radioactivity that may be placed in the landfill is dominated by ORNL wastes, even though ORNL waste is estimated to contribute less than 30 percent of the total forecast waste volume. ORNL waste is projected to account for approximately 80 percent of the radioactivity, and Y-12 debris and soil is projected to contribute the remaining approximately 20 percent. Cesium-137, nickel-63, uranium-234, and strontium-90 account for greater than 50 percent of the total activity. Also significant in terms of relative contributions to total activity are plutonium-238 and -241, uranium-235 and -238, and curium-244. The estimated Environmental Management Disposal Facility (EMDF) hazardous contaminant inventory includes metals such as barium, beryllium, chromium, lead, manganese, mercury, and uranium. Also present are common industrial chemicals such as polychlorinated biphenyls, pesticides, cleaning solvents, and lead paint. Several waste types generated on the ORR will be excluded from disposal at a proposed EMDF because they do not meet the anticipated acceptance criteria (e.g., transuranic waste, liquid waste, and hazardous waste that does not meet land disposal restrictions).

The specific volume and composition of waste that would be generated from the implementation of future CERCLA actions cannot be fully defined at this time. Development of waste volume estimates and waste characteristics rely on reasonable assumptions for proposed remedial actions. Uncertainty is accounted for in the waste volume estimates by adding a straight percentage (25 percent, increase only to be conservative) to the projected volumes. Future CERCLA documents (e.g., Waste Handling Plans) will address the management of the projected wastes for each cleanup activity. These Waste Handling

Plans are reviewed and approved by all three FFA parties for consistency with ARARs and other requirements.

BASELINE RISK SUMMARY

Under the typical CERCLA RI/FS process, baseline human health risk assessments are conducted to determine the need and extent for specific cleanup action at a remediation site to protect human health and the environment. However, this is not a typical CERCLA remediation action. The purpose of the disposal RI/FS is to evaluate the need for and merits of a comprehensive waste management and disposal process for multiple cleanup projects across the ORR. While cleanup decisions for the remediation sites have been made or will be made in separate, individual CERCLA decision documents, the decision being addressed in this case is the disposal of the projected volume of waste to be generated by these actions. Therefore, a conventional baseline risk assessment does not apply to this evaluation.

SITE CHARACTERISTICS

Bear Creek Valley is considered to be the most appropriate area on the ORR for locating an onsite disposal facility due its current and planned land use, geology, and groundwater flow conditions. A considerable amount of information is available documenting the environmental conditions of Bear Creek Valley. Much of the available information is based on surface and subsurface investigations and reports of contaminant source areas and groundwater plumes, including the drilling and installation of hundreds of monitoring wells and sampling and analysis of soils, sediment, groundwater, and surface water. Geotechnical investigations and reports and engineering design documents have been developed for proposed waste management sites such as the Low-Level Waste Disposal Development and Demonstration site in West Bear Creek Valley and EMWMF in East Bear Creek Valley. The results of over three decades of investigations, information from the remediation of some sites near Y-12, and ongoing monitoring of surface water and groundwater are all available to support development and planning for the proposed EMDF site in Bear Creek Valley. Findings from available reports have been incorporated into Appendix E of the RI/FS (DOE 2017). The reports referenced in the RI/FS are also available in the Administrative Record.

Bear Creek Valley is approximately 8 miles long and extends from the west end of the Y-12 site southwest to the Clinch River. Bear Creek drains the entire Bear Creek Valley watershed, which includes the potential EMDF sites and historical Y-12 waste sites in the middle and upper portions of the valley (see Figure 3). The valley lies northeast to southwest and is bounded by Pine Ridge on the northwest and Chestnut Ridge on the southeast. Several smaller tributaries, designated as the North Tributaries (numbered sequentially as NT-1, 2, etc. from the Y-12 plant) drain off Pine Ridge to Bear Creek. Elevations range from highs near 1260 ft along the crest of Pine Ridge to around 800 ft at Bear Creek near State Route 95.

The current valley subsurface appears relatively stable. Available satellite images and field reconnaissance at the East Bear Creek Valley site suggest there is no visible evidence of recent large-scale mass movement at the proposed EMDF sites in Bear Creek Valley. None of the potential EMDF locations evaluated in the RI/FS lie directly on the Maynardville Limestone where groundwater flow through karst conduits is well documented. While the evaluated locations lie immediately upstream of the Maynardville Limestone, a buffer area would be maintained between that limestone layer and all waste disposal and wastewater management operations.

Groundwater migrates from the upland areas and discharges along valley floors supporting base flow along the north tributary stream channels and Bear Creek. Although there is contaminated groundwater in Bear Creek Valley, the RI/FS shows that none of the proposed EMDF sites are located over known groundwater contamination plumes (DOE 2017).

REMEDIAL ACTION OBJECTIVES

CERCLA guidance defines remedial action objectives (RAOs) as "medium-specific or operable-unit-specific goals for protecting human health and the environment" (EPA 1988). According to the NCP (40 *CFR* 300.430[e][2][i]), RAOs should specify the media involved, contaminants of concern, potential exposure pathways, and remediation goals. The scope of this Proposed Plan is limited to evaluating alternatives for the disposition of future-generated CERCLA waste resulting from CERCLA cleanup actions on the ORR. Remediation goals for those cleanup actions are established at the project-specific level in existing CERCLA decision documents or would be made in future CERCLA decision documents.

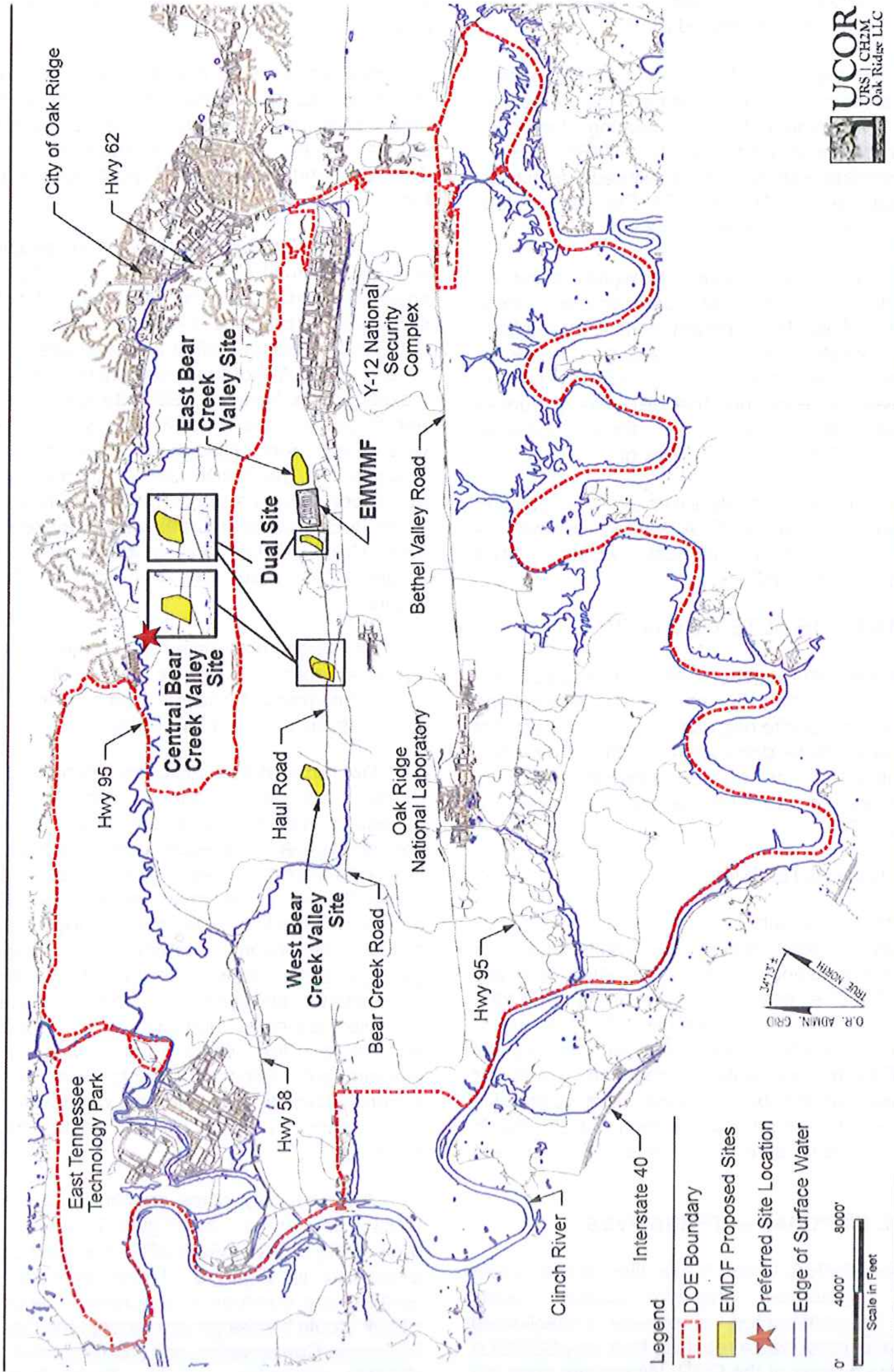

Figure 3. Proposed sites for the Environmental Management Disposal Facility.

The following RAOs were employed in the development of this Proposed Plan:

- Prevent exposure of people to CERCLA waste (or contaminants released from the waste into the environment) through meeting chemical-, location-, and action-specific ARARs, and by preventing exposure that exceeds a human health risk of 10^{-4} to 10^{-6} Excess Lifetime Cancer Risk or Hazard Index of 1.
- Prevent adverse impacts to water resources (surface water and groundwater) from CERCLA waste or contaminants released from the waste through meeting chemical-, location-, and action-specific ARARs, and by preventing exposure that exceeds a human health risk of 10^{-4} to 10^{-6} Excess Lifetime Cancer Risk or Hazard Index of 1.
- Prevent unacceptable exposure to ecological receptors from CERCLA waste contaminants through meeting chemical-, location-, and action-specific ARARs.

SUMMARY OF ALTERNATIVES

Seven alternatives were developed and evaluated, including no action, four alternatives using different onsite disposal locations, a hybrid of onsite and offsite disposal, and offsite disposal. Below is a summary of these alternatives. These alternatives are more fully described in the RI/FS (DOE 2017).

NO ACTION ALTERNATIVE

Under this alternative, no comprehensive site-wide strategy would be implemented to address the disposal of waste resulting from any future CERCLA response actions at the ORR after EMWMF capacity is reached. Future waste streams from site cleanup that require disposal after EMWMF capacity is reached would be addressed at the project level. This alternative provides a baseline for comparison with the action alternatives and is required under CERCLA and NEPA.

ONSITE DISPOSAL ALTERNATIVES

Description. Under these alternatives, a new onsite, engineered, long-term disposal facility would be constructed to provide consolidated disposal of most waste resulting from any CERCLA response actions at the ORR. Waste that does not meet acceptance criteria for protective onsite disposal would be treated to meet requirements or shipped to authorized offsite treatment and/or disposal facilities.

Key elements of this alternative are natural characteristics of proposed site locations, design and construction, operation, waste acceptance criteria (WAC), water management, offsite disposal, and closure and post-closure of the facility.

Site Locations. To select a protective and suitable site for EMDF, an evaluation of potential sites was performed. The evaluation of potential sites used a previous 1996 site screening study (DOE 1996) that identified and evaluated 35 sites on the ORR. A thorough examination of 16 sites, including sites from the 1996 site screening study and three from the EMWMF RI/FS (DOE 1998b), was performed. Ultimately, four sites were presented in the EMDF RI/FS. Alternatives were developed around a site in East Bear Creek Valley, a site in Central Bear Creek Valley, a site in West Bear Creek Valley, and a combination of two smaller sites (called the Dual Site) as shown in Figure 3.

All Bear Creek Valley sites considered have some amount of characterization data. Details concerning that data may be found in the RI/FS and Administrative Record for all sites.

Design and Construction. Plans for the four onsite disposal locations provide disposal capacities up to 2.8 million cubic yards. The conceptual plans for each location are shown in Figures 4 through 7. Key facility elements include a clean-fill dike to laterally contain the waste, a multilayer base liner system with a double leachate collection/detection system and underlying geologic buffer zone to isolate the waste from groundwater, and a multilayer cover installed over a stable base-contouring layer to reduce infiltration and isolate the waste from people and the environment. Other elements are necessary support facilities (e.g., a landfill wastewater [water that comes in contact with waste] treatment system).

A preliminary cross section of the disposal facility is shown in Figure 8 while typical, preliminary cross sections of the liner and cover are presented in Figure 9. These disposal facility features are common to all onsite locations. The EMDF would be designed to accept the disposal of Resource Conservation and Recovery Act of 1976 (RCRA) hazardous waste, Toxic Substances Control Act of 1976 (TSCA) toxic waste,

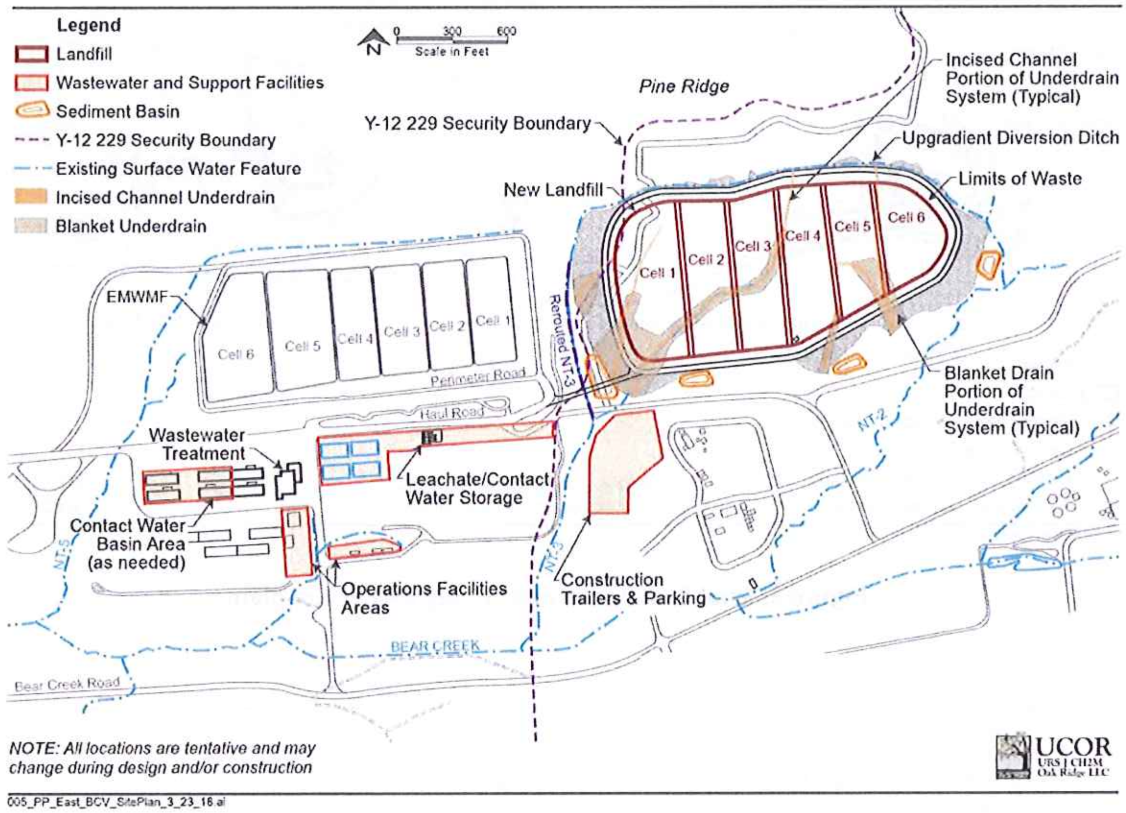

Figure 4. East Bear Creek Valley EMDF site plan.

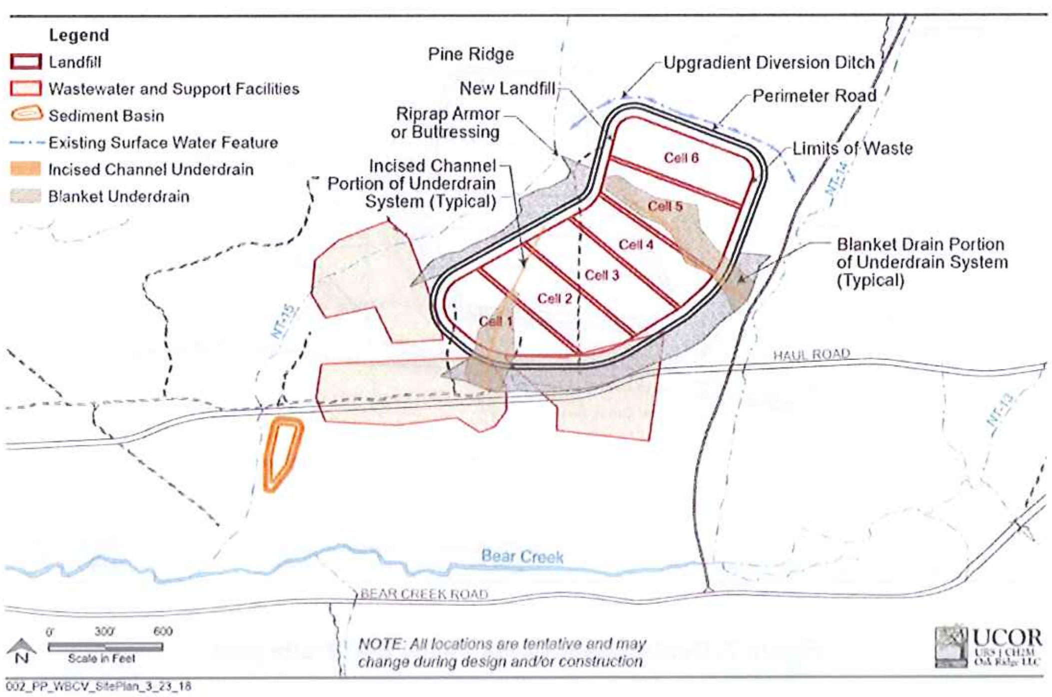

Figure 5. West Bear Creek Valley EMDF site plan.

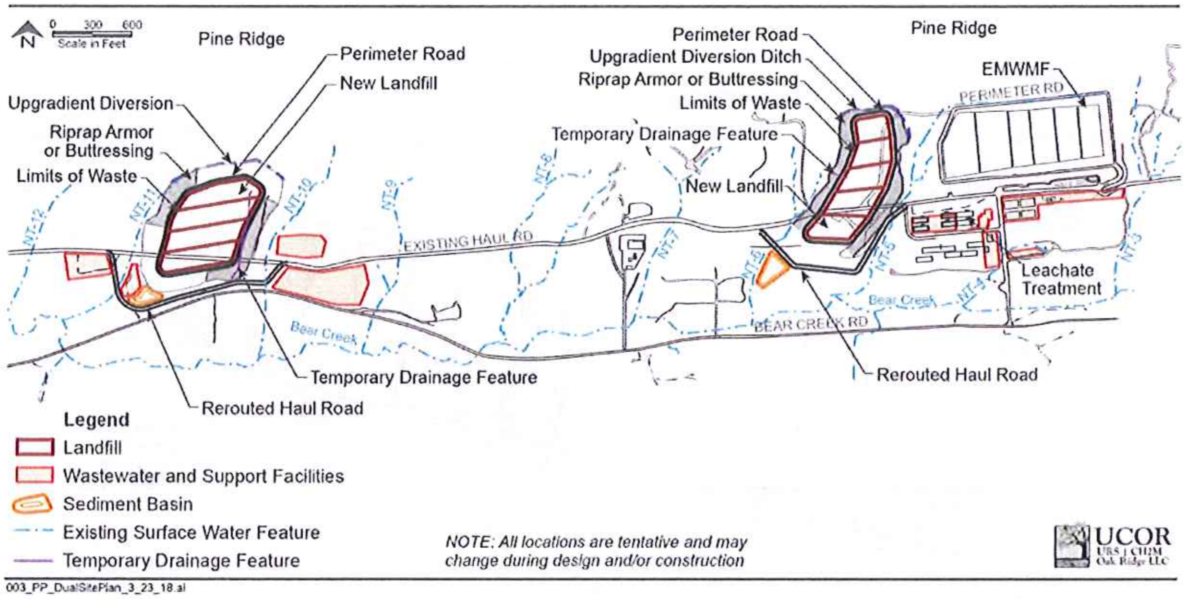

Figure 6. Dual Site Bear Creek Valley EMDF site plan.

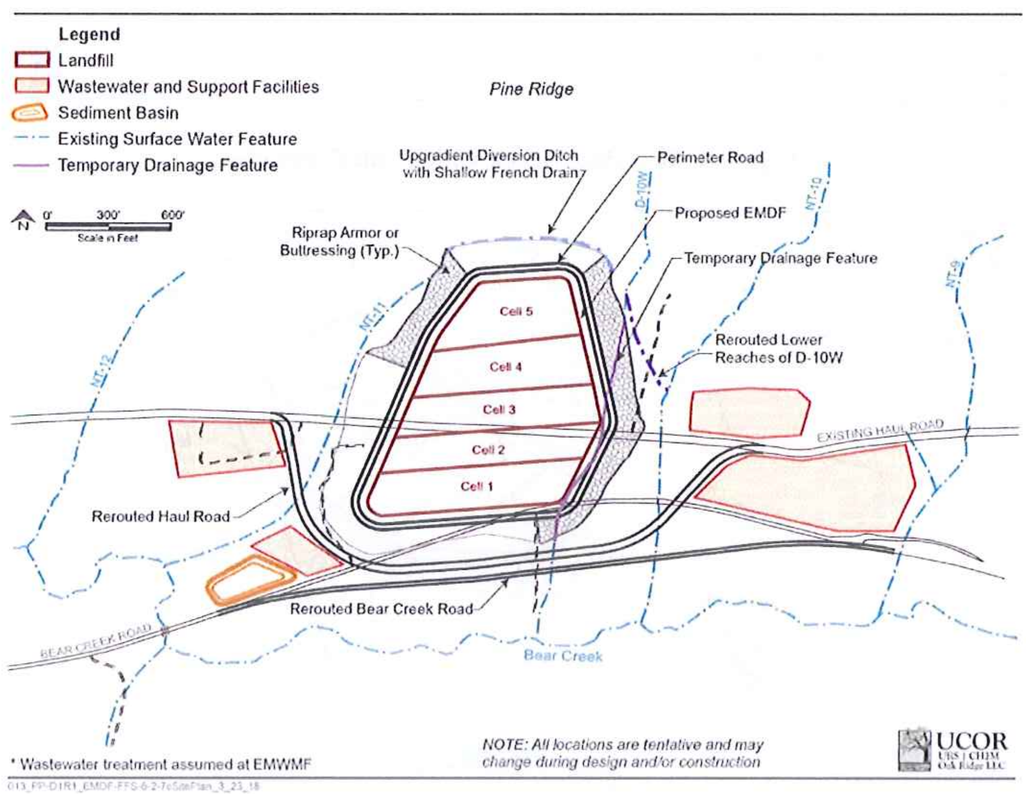

Figure 7. Central Bear Creek Valley EMDF site plan.

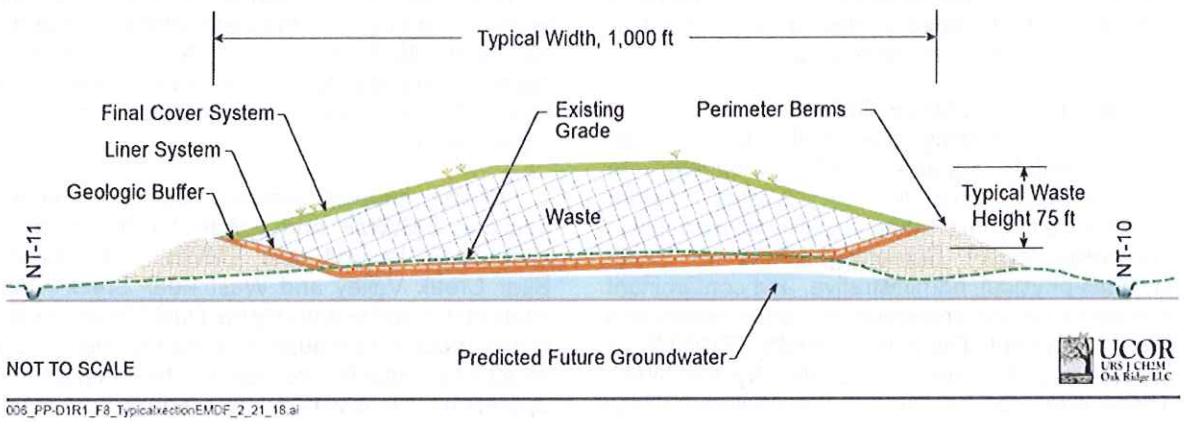

Figure 8. Typical cross section of EMDF.

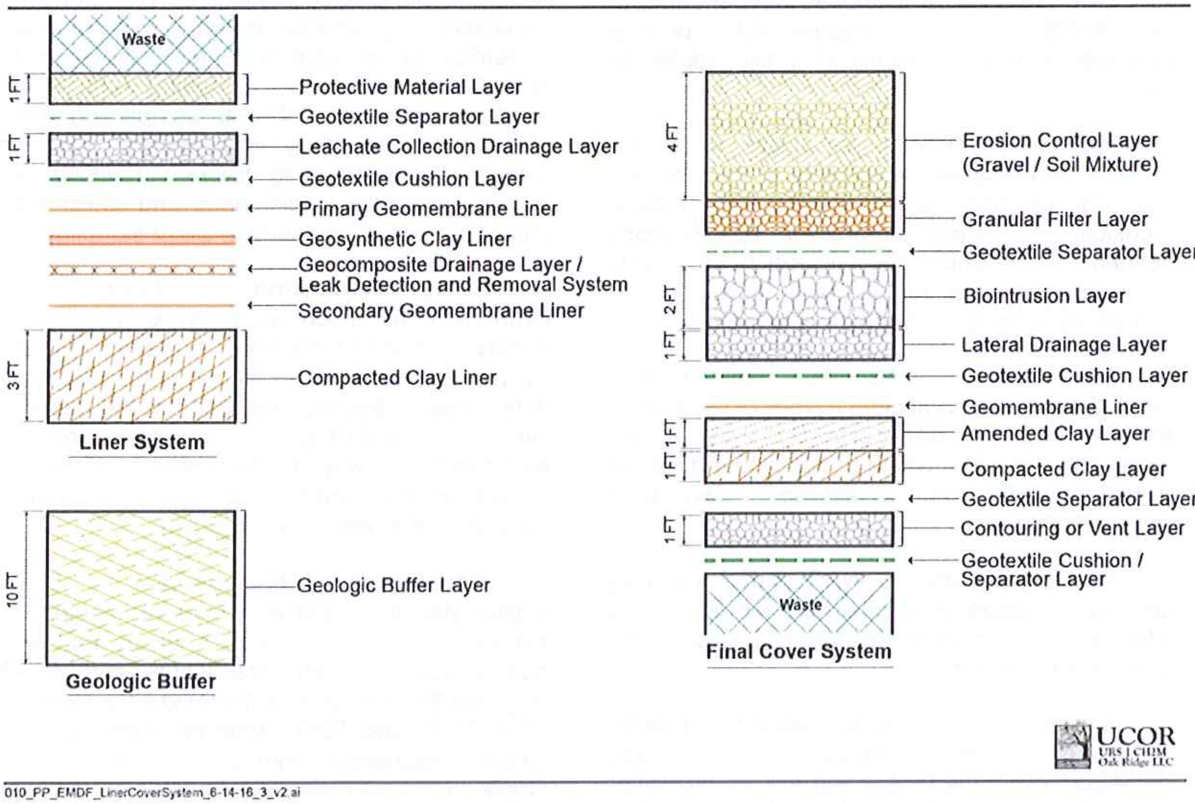

Figure 9. Preliminary EMDF liner and cover system.

low-level radioactive waste (LLW), and mixed LLW (hazardous/toxic and LLW).

The EMDF would be constructed in phases, only building the projected capacity needed at that time. The wastewater treatment system and the infrastructure for each proposed landfill location would be constructed in the first phase. For the East and West Bear Creek Valley sites, significant portions of Bear Creek tributaries that cross the landfills would be rerouted to accommodate the landfills. Drain systems would be placed under the liners in the original locations of the tributaries at these two sites.

The Dual Site option and Central Bear Creek Valley site could use temporary drainage features outside the boundaries of the waste footprint to control water flow from seeps or springs.

Waste Acceptance Criteria. In addition to siting and designing the facility to minimize environmental impacts, DOE proposes to conservatively evaluate all wastes before acceptance to confirm their eligibility for disposal in the onsite facility. Screening criteria, or WAC, includes physical, administrative, and contaminant limitations for the protection of human health and the environment. The existing landfill, EMWMF, is operating under controls provided by the WAC. These WAC can be found in the *Attainment Plan for Risk/Toxicity-Based Waste Acceptance Criteria at the Oak Ridge Reservation* (DOE 2001) which can be found in the Administrative Record. While the EMDF WAC will be developed independently of the EMWMF WAC, the existing WAC provide examples of what encompasses a disposal facility WAC.

Physical restrictions on waste would be imposed to preserve the integrity of the disposal cell. For example, some wastes may require modification to meet compaction specifications defined to minimize the potential for waste subsidence and size requirements for debris may be defined to facilitate disposal operations.

Administrative WAC are environmental regulations that prevent certain types of waste from being allowed in the disposal facility. These include waste such as liquid waste or waste that does not meet RCRA land disposal restrictions (e.g., ARARs).

Contaminant-specific WAC and/or inventory limits will be established consistent with RAOs and ARARs to ensure protectiveness of human health and the environment.

The purpose of WAC is to allow the disposal of only those wastes that could be protectively managed within the facility and ensure protection of human health and the environment. Wastes that do not meet the WAC will require offsite disposal or receive treatment. The final WAC will be attached to the Record of Decision (ROD) prior to signature and will be one of many factors used by DOE to assure protection of human health and the environment. A process – to be reviewed and approved by DOE, EPA, and TDEC that ensures the wastes generated by CERCLA response action projects meets the EMDF WAC – will be developed before operation of the facility begins.

Operation. Initially, it is assumed that both EMWMF and EMDF would be operating, with waste being placed in the last EMWMF cell and in the initial EMDF cells. Once EMWMF is filled to capacity, disposal operations would cease at that facility. A final cover will be constructed to isolate the waste long-term.

Some support systems would be shared between EMWMF and EMDF for those landfill alternatives located near EMWMF. The Central Bear Creek Valley and West Bear Creek Valley alternatives and eventually the Dual Site alternative would require new support systems (meaning all structures outside the landfill that support its operation such as wastewater management ponds, offices, utilities, roads).

Operations at EMDF would include activities such as waste receipt, inspection, WAC attainment verification (e.g., process by which a waste stream is verified to be acceptable for disposal in the facility), recordkeeping, unloading and placing waste into the disposal cells, compacting waste, covering waste, filling void spaces, surveying incoming and outgoing trucks, providing dust control, managing landfill water and storm water, and groundwater and surface water sampling.

Waste Minimization. Sequencing of waste generation, as much as possible, would be a priority, to reduce the amount of clean fill required by utilizing soil waste as fill during the disposal of debris waste. Segregating waste at the generator site and maximizing recycling also would be employed. For any onsite location selected for pursuit as the remedy, the ROD will contain a commitment to waste minimization.

Wastewater Management. Landfill wastewater from EMDF would be staged and sampled. If sampling results indicate that water quality complies with the RAOs and ARARs (e.g., CERCLA discharge limits) to be agreed to by EPA, DOE, and TDEC, then the water would be directly discharged without treatment to Bear Creek. If the sampling results indicate the water quality is unacceptable for discharge, then the staged water would be treated prior to release. As part of the remedy, a treatment system would be provided adjacent to the EMDF facility. The system would be sized to accommodate the estimated wastewater volume to be treated and designed to remove contaminants projected to exceed discharge limits.

Offsite Disposal. Waste that does not meet WAC and cannot be effectively treated to meet acceptance criteria will be shipped to an approved offsite facility for disposal.

Closure and Post-Closure. After completion of waste disposal, EMDF closure activities will include construction of the final cover system as shown in Figures 8 and 9. Post-closure activities will also include collection and treatment of landfill wastewater, surveillance and maintenance, environmental monitoring of groundwater and surface water, and land use controls.

Since the Onsite Disposal Alternatives leave hazardous substances in place at levels that do not allow for unrestricted use, land use controls will be required to prevent people and environmental receptors from encountering the residual hazard. The objectives of land use controls during operation and after closure are to:

- Prevent unauthorized excavation into EMDF
- Restrict access to the EMDF site from unauthorized entry
- Preclude alternate use of the EMDF site or underlying groundwater

Table 1 provides the type of controls, purpose of controls, implementation, and affected areas for all of the Onsite Disposal Alternatives. Land use controls would be maintained to ensure long-term protectiveness and maintain integrity of the landfill.

Key ARARs. Key location-specific ARARs include those that protect sensitive environments. Construction of EMDF would impact wetlands and streams. These impacts would need to be minimized and mitigated where impacts are unavoidable in accordance with State and Federal regulations.

Action-specific ARARs affect how EMDF will be designed and operated. Key aspects of the RCRA, TSCA, and state radioactive waste regulations are used to determine how to ensure long-term protectiveness of EMDF, both through the design and during operations and closure. There also are ARARs associated with how EMDF would be maintained in the future after closure and how land use controls are required and maintained. The onsite alternatives would meet all ARARs and no CERCLA waivers will be necessary. An exemption under the state radioactive waste disposal rules and a waiver under TSCA will, however, be requested as part of the CERCLA remedy selection process as described further below. The basis of the waivers or exemptions to be requested for onsite locations will be included in the ROD if an Onsite Disposal Alternative is selected.

TSCA requires that there be no hydraulic connection between the site and standing or flowing surface water and that the bottom of the landfill liner system or natural in-place soil barrier of a chemical waste landfill be at least 50 feet above the historical high water table (40 *CFR* 761.75[b][3]). Construction of a disposal facility anywhere in Bear Creek Valley would not meet this requirement. A TSCA waiver from this requirement will be required under that statute for all of the onsite alternatives. Such a waiver is granted through 40 *CFR* 761.75(c)(4) by providing "*...evidence to the EPA Regional Administrator that operation of the landfill will not present an unreasonable risk of injury to health or the environment from polychlorinated biphenyls (PCBs)....*"

A state radioactive waste disposal rule (TDEC 0400-20-11-.17[1][h]) requires that the hydrogeologic unit used for disposal shall not discharge groundwater to the surface within the disposal site. At each alternative location in Bear Creek Valley, groundwater discharges to the surface within the proposed disposal site and will not meet this requirement. An exemption under the state rules will be requested by DOE, as allowed through the state rule TDEC 0400-20-04-.08, whereby the Division of Radiological Health (Department) may "*...grant exemptions, variances, or exceptions from the requirements of these regulations which are not prohibited by statute and which will not result in undue hazard to public health and safety or property.*"

HYBRID DISPOSAL ALTERNATIVE

Hybrid disposal refers to significant disposal at both onsite and offsite disposal facilities using elements of both the Onsite Disposal Alternative and Offsite Disposal Alternative. As with the other alternatives, the starting waste volume for the Hybrid Disposal Alternative is the volume of waste created by CERCLA actions on the ORR that could theoretically be disposed onsite. The Hybrid Disposal Alternative proposes consolidated disposal of CERCLA waste in a newly constructed, much smaller capacity landfill on ORR, still referred

Table 1. Land use controls for all Onsite Disposal Alternatives

Type of control	Purposes of control	Implementation	Affected areas[a]
1. Property record restrictions[b]	Restrict use of certain property by restricting soil and groundwater use in perpetuity	Drafted and implemented by DOE upon closure of EMDF and/or transfer	EMDF landfill and site
2. Property record notices[c]	Provide information to the public about the existence and location of waste disposal areas and applicable restrictions in perpetuity	General notice of Land Use Restrictions recorded in Roane County Register of Deeds office upon completion of the remedial activity	EMDF landfill and site
3. Access controls (e.g., signs, fences, gates, portals, etc.)	Control and restrict access to the public in perpetuity	Maintained by federal government and its contractors	EMDF landfill and site

[a]Affected areas – Specific locations will be identified in the completion documents where hazardous waste has been left in place.

[b]Property record restrictions – Includes conditions and/or covenants that restrict or prohibit certain uses of real property and are recorded along with original property acquisition records of DOE and its predecessor agencies.

[c]Property record notices – Refers to any informational document recorded that alerts anyone searching property records to important information about residual contamination/waste disposal areas on the property (TCA requirement).

DOE = U.S. Department of Energy
EMDF = Environmental Management Disposal Facility
TCA = Tennessee Code Annotated

to as EMDF. Waste volumes that exceed the capacity of the facility, regardless of whether those wastes meet the onsite disposal WAC, would be disposed offsite. A single onsite disposal option is analyzed (one of the two sites included in the Dual Site that is located immediately west of EMWMF) with components (e.g., buffer, liner, berms, cells, final cover) the same as that discussed under the Onsite Disposal Alternatives.

The onsite portion of the Hybrid Disposal Alternative includes designing and constructing the landfill, support facilities, and roadways; developing plans and procedures; receiving waste that meets the WAC; unloading and placing waste into the landfill; surveying and decontaminating as needed; and closing the landfill once the capacity is reached. Also included is post-closure maintenance and land use controls for as long as the waste remains a threat to human health or the environment. Due to the limited capacity of the onsite disposal element of this alternative, a size reduction facility to reduce disposal volumes has been added to the onsite portion of the Hybrid Disposal Alternative.

Onsite Disposal Location. The onsite landfill location selected for use in the Hybrid Disposal Alternative had to meet the following two criteria:

- Minimum capacity that allows onsite disposal to be more cost effective than offsite disposal (see Figure 10)
- Minimize hydraulic connections between groundwater and surface water (e.g., minimize dependency on underdrains)

A brief analysis was completed to determine the minimum landfill capacity at which onsite disposal is no longer cost effective compared to offsite disposal. Offsite disposal cost (in 2016 present worth dollars) per cubic yard is considered fairly constant, ~$675 per cubic yard (see Figure 10). In contrast, the cost per cubic yard for onsite disposal varies within this range; the greater the volume disposed, the lower the cost per cubic yard. Unit costs were evaluated for a series of as-disposed volumes ranging from 440,000 cubic yards to roughly 2,200,000 cubic yards, with the higher two volumes representing specific evaluated alternatives. The volume at which the offsite and onsite costs are essentially equivalent, i.e., the breakeven volume, is roughly 750,000 cubic yards.

Volume Reduction. Volume reduction (mechanical size reduction of waste) is assumed for the onsite portion of the Hybrid Disposal Alternative. An analysis in the RI/FS demonstrated that the use of a centralized volume reduction system at the Hybrid Disposal Alternative EMDF would provide an additional 145,000 cubic yards of disposal capacity in the onsite facility. This additional capacity results in a reduction in the number of offsite shipments necessary under this

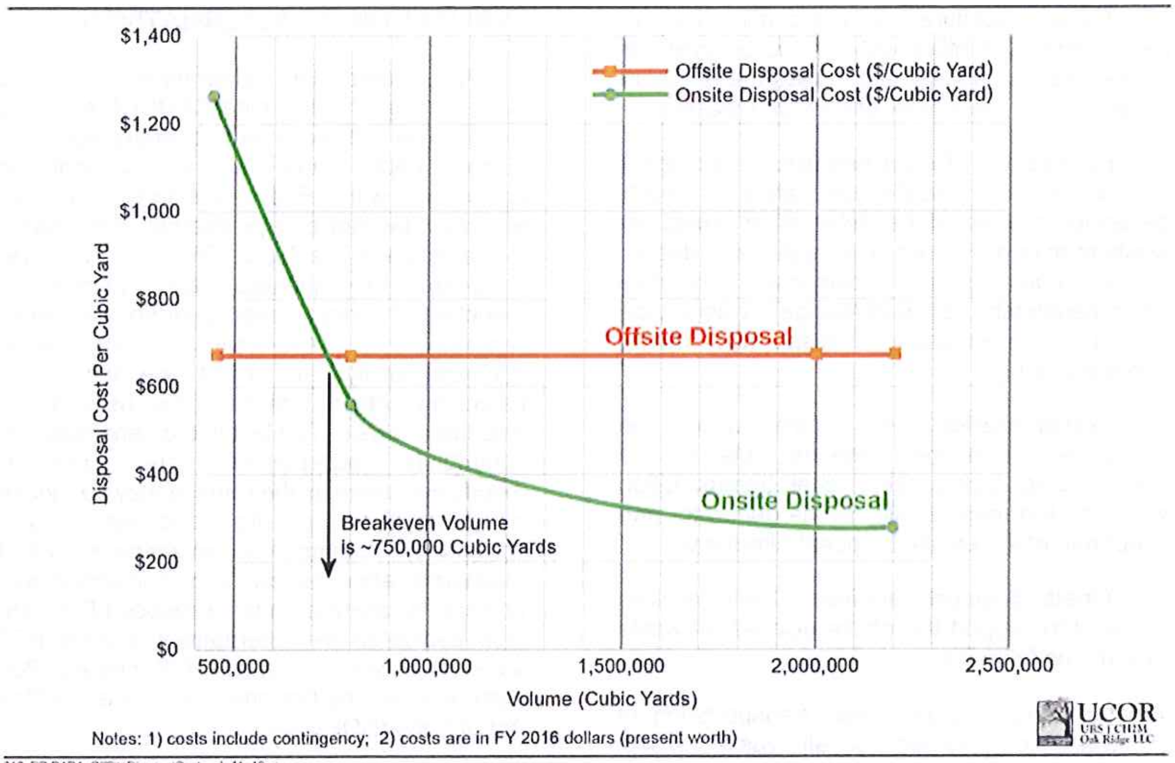

Figure 10. Estimate of minimum onsite capacity required to reduce unit cost of onsite disposal below offsite disposal.

alternative, saving overall costs and reducing the risk of transportation accidents.

Regardless of the disposal method used, all onsite remediation activities implement recycling and segregation of waste at the generator site (e.g., prior to the waste entering this disposal facility) to identify non-hazardous/non-radioactive waste that may be able to be disposed in less costly industrial landfills operated by DOE. Projected volumes of industrial waste are not contained in this analysis.

Sequencing of remediation activities to take advantage of using waste soil as fill (to fill voids while disposing of waste debris) is practiced by DOE, and benefits onsite disposal by reducing the need for clean soil to serve as fill during debris disposal (reducing cost and conserving landfill capacity).

OFFSITE DISPOSAL ALTERNATIVE

Under this alternative, waste resulting from any CERCLA response actions at the ORR and/or associated sites exceeding the capacity of the existing EMWMF would be transported off the reservation for disposal at approved disposal facilities, primarily by rail. Waste disposed under this alternative must meet the WAC of the offsite disposal facility.

Offsite Disposal Facilities. For CERCLA actions that treat, store, or dispose of waste offsite, appropriate licenses and/or permits are required by the receiving facility. In general, the following conditions must be met to use an offsite receiving facility in accordance with the Offsite Rule at 40 *CFR* 300.440 and CERCLA Sect. 121(d)(3):

- The proposed receiving facility must be operated in compliance with all applicable Federal, state, and local regulations; there must be no relevant violations at or affecting the receiving facility.
- There must be no releases from the receiving unit and contamination from prior releases at the receiving facility must be addressed as appropriate.
- For mixed LLW/RCRA material, offsite commercial treatment, storage, or disposal facilities must have an approved Nuclear Regulatory Commission license and RCRA Part B permit.

These procedures require confirmation by the regional EPA office with jurisdiction over the chosen disposal facility that indeed the facility is acceptable for the receipt of CERCLA waste.

Packaging Requirements. Packaging requirements for waste originating at each generator site would be determined based on waste form (e.g., treated or untreated soil, debris, miscellaneous solids, personal protective equipment/trash, sediment/sludge), waste type (e.g., LLW, mixed waste), transportation mode, and destination.

Transportation. All waste would be transported from the generator site to the trans-loading facility. This local transportation would be the responsibility of the generator and is not part of the Offsite Disposal Alternative.

Onsite Support Facilities. Onsite facilities required to support the offsite disposal of waste include the following:

- Trans-load facility – Rail transportation of waste is assumed for all waste (except classified) being shipped for offsite disposal. The existing trans-load facility at ETTP would facilitate the transfer and staging of waste containers from trucks to railcars. Waste delivered by truck from generator sites would be staged at an existing docking area for rail shipment. Packages for waste such as intermodals would be loaded onto articulated bulk container railcars or the waste may be placed directly into super gondolas. When ready for shipment, one or more railcars would be transferred from the rail spur to the railroad system and from there would travel by rail to the disposal facility.
- Size-reduction facility – A size-reduction facility would be constructed and operated near the ETTP trans-load station. Waste targeted for size reduction would be transported by dump truck to ETTP and unloaded into the size-reduction unit feed system for processing. Processed material would be loaded by conveyor or excavator into intermodals that would be staged for loading onto railcars. Size reduction was found to be cost effective where packaging/transport methods are not weight limited and reductions in volume affect the number of transportation trips.

EVALUATION OF ALTERNATIVES

All remediation alternatives must be evaluated against the nine CERCLA evaluation criteria. The first two criteria (overall protection of human health and the environment and compliance with ARARs) are threshold criteria and must be met by any alternative considered for selection in the ROD. The next five criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost) are the primary balancing criteria that form the basis for the detailed analysis. The last two criteria (state and community acceptance) are considered modifying criteria as the remedy may be modified as a result of input from the state and the community. Community acceptance will be evaluated after review and consideration of comments received on this Proposed Plan. DOE also evaluated the alternatives against NEPA values consistent with the DOE Secretarial Policy Statement on the National Environmental Policy Act of 1969 (DOE 1994).

The comparative analyses of alternatives are summarized in Appendix A and are discussed below.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The No Action Alternative is the least protective if the lack of a coordinated disposal program results in an increased reliance on management of waste in place at CERCLA remediation sites or if the pace of cleanup were slowed. Selection of any of the action alternatives would be protective of human health and the environment in the long term. The Onsite Disposal Alternatives would be protective primarily through design and construction to required specifications and compliance with the WAC to be established for a new onsite CERCLA waste disposal facility. The Offsite Disposal Alternative also would be protective through design and construction to required specifications and compliance with the WAC for each of the offsite existing authorized facilities. The Hybrid Disposal Alternative would be protective through the design, construction, and WAC of an onsite disposal facility and an offsite disposal facility.

Explanation of Nine CERCLA Evaluation Criteria

-Threshold Criteria-

1. **Overall Protection of Human Health and the Environment** addresses whether a remedial action provides overall protection of human health and the environment. This criterion must be met for a remedial alternative to be eligible for selection.
2. **Compliance with Applicable or Relevant and Appropriate Requirements** addresses whether a remedial action meets all of the applicable or relevant and appropriate Federal and state environmental requirements, or provides grounds for invoking a waiver of the requirements. This criterion must be met for a remedial alternative to be eligible for selection.

-Balancing Criteria-

3. **Long-term Effectiveness and Permanence** considers the ability of an alternative to protect human health and the environment over time.
4. **Reduction of Toxicity, Mobility, or Volume Through Treatment** evaluates an alternative's use of treatment to reduce harmful effects of contaminants, their ability to move in the environment, and the amount of contamination present.
5. **Short-term Effectiveness** refers to potential adverse effects on workers, human health, and the environment during the construction and implementation phases of a remedial action.
6. **Implementability** refers to the technical and administrative feasibility of a remedial action alternative, including the availability of materials and services needed to implement the alternative.
7. **Cost** refers to an evaluation of the capital, operation, and maintenance, and monitoring costs for each alternative, including present-worth costs.

-Modifying Criteria-

8. **State Acceptance** indicates whether the state concurs with the preferred alternative.

The following is applied after comments are received on the Proposed Plan.

9. **Community Acceptance** assesses the general public response to the Proposed Plan following a review of public comments received during the public comment period. The remedial action is selected only after consideration of this criterion.

All action alternatives would be protective of human health and the environment in the short term. However, the Onsite Disposal Alternatives, regardless of the location of the landfill, would present the lowest short-term impact to the public primarily due to shipping waste shorter distances. Offsite disposal would require local and long-distance transportation of waste, treatment of some waste streams, and waste handling. Because of the greater volumes of wastes shipped over long distances, transportation risks are significantly higher for the Hybrid and the Offsite Disposal Alternatives.

COMPLIANCE WITH ARARS

The No Action Alternative has no ARARs. The Offsite Disposal Alternative and the offsite disposal element of the Hybrid Disposal Alternative meet the required chemical-, location-, and action-specific ARARs, and no CERCLA statutory waivers are requested.

No CERCLA statutory waivers are requested for the Onsite Disposal Alternatives. It is important to note that both a TSCA waiver and a Tennessee Department of Radiological Health (TDRH) exemption would be requested for the selected Onsite Disposal Alternative. The parts of TSCA and TDRH that will need to be waived are as follows:

- A TSCA specific waiver for 40 *CFR* 761.75(b)(3) and (b)(5) would be invoked as provided in 40 *CFR* 761.75(c)(4).
- A TDRH specific exemption for TDEC 0400-20-11.17(1)(h) would be invoked as provided for in TDEC 0400-20-04-.08.

These determinations will be made in the ROD based on available data.

For the Offsite Disposal Alternative and offsite component of the Hybrid Disposal Alternative, compliance with ARARs and with facility licenses and/or permits will be determined prior to transport in accordance with the CERCLA offsite rule.

LONG-TERM EFFECTIVENESS AND PERMANENCE

The No Action Alternative may or may not be effective as it would depend on multiple future individual waste disposal decisions. Because the decisions would be under CERCLA, they would be required to be protective. For the Hybrid and the Onsite Disposal Alternatives, preventing exposure to contaminants placed in EMDF over the long term depends on the success of the facility's waste containment features, characteristics of waste placed in EMDF, and land use controls. The multilayer cover system would be designed to decrease migration of liquids, minimize erosion, accommodate settling and subsidence, and prevent burrowing animals and plant root systems from penetrating the cover system. The cover also would reduce the likelihood of inadvertent intrusion by humans by increasing the difficulty of digging or drilling into the landfill. With proper design and installation of the landfill liner and leachate systems, the bottom of the landfill would contain any contaminants from future unacceptable releases to the environment. During operation when landfill wastewater is generated, that wastewater would be treated as required for removal of contaminants above discharge limits. Upon closure, when the landfill cover is placed, landfill wastewater generation would cease.

The WAC would restrict what waste could be placed in the landfill. These criteria would be set assuming some failure of the manmade components of the underlying liner system and would be determined to ensure that even under these conditions, the release of contamination from the landfill would not harm human health or the environment.

The major difference among the onsite locations would be the long-term land use changes. The sites in Central and West Bear Creek Valley are currently undisturbed forest and both are identified to remain uncontaminated under the Bear Creek Valley ROD (DOE 2000). Use of either of these sites would have the greatest land use change as the forest would be removed and the land use would have to be changed to industrial use. The Dual Site Disposal Alternative also would have a notable land area (one of the two locations) that would be cleared of any forest and be reclassified to a future waste management area where none is currently planned.

Land use controls would restrict access to the site and prohibit actions that could penetrate the cover and expose the waste. Barring extraordinary efforts to penetrate the cover, the landfill would be designed to remain effective for over 1000 years.

The Offsite Disposal Alternative and offsite disposal element of the Hybrid Disposal Alternative also rely on engineering and land use controls at the offsite disposal facilities to prevent inadvertent intrusion, including engineered barriers to intrusion and waste migration. Offsite disposal of waste to locations in the western United States may in the long-term be considered more reliable at preventing exposure than onsite disposal on the ORR. Arid environments reduce the likelihood of contaminant migration or exposure via groundwater or surface water pathways. While the climate in Tennessee is wetter and could be considered less protective, this factor is considered both in determining what waste can be safely placed in a disposal cell to ensure long-term protection and how that cell would be constructed.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

The No Action Alternative does not reduce toxicity, mobility, or volume through treatment.

Onsite Disposal Alternatives would provide landfill wastewater treatment needed to meet ARARs, including portions of the Clean Water Act that address hazardous chemicals. That treatment would reduce contaminants to levels required for discharge.

Waste generators would be required to treat wastes as needed to meet the EMDF WAC and ARARs before onsite disposal; however, that treatment is not part of this onsite remedy.

For waste disposed offsite, size reduction is assumed and results in some volume reduction. Treatment, while provided by offsite facilities to meet their disposal requirements, is not accounted for in the offsite remedy in terms of cost so that equal comparisons may be made to onsite alternatives.

The Hybrid Disposal Alternative also would reduce the volume of waste prior to offsite shipment through assumed size reduction.

SHORT-TERM EFFECTIVENESS

Short-term effectiveness includes protection of the community and workers during remedial action, short-term environmental effects, and the duration of remedial activities. Because the No Action Alternative includes no activity, there are no short-term impacts.

For the action alternatives, risk to human health is the most differentiating element. Under all disposal alternatives evaluated, risks to workers and the community from actions at the disposal facilities would be controlled to acceptable levels through compliance with regulatory requirements and health and safety plans.

Offsite transportation carries a much higher risk to human health than onsite transportation due to vehicular accidents and emissions associated with public roads/railroads travelled and the long distances involved. Estimates range from 7 to 24 injuries/fatalities depending on the offsite facility where waste is transported for disposal, while onsite disposal risk is less than 1 over the lifecycle of the remedy for the same volume of waste.

Short-term environmental effects would be the greatest for the Onsite Disposal Alternatives. Construction and operation of EMDF would create local short-term environmental effects typically associated with a large construction project. Sensitive human receptors (e.g., residence, church, school) would not be impacted because of the distance of the proposed EMDF sites from these receptors. Disturbance to terrestrial resources would be expected, with land use resulting in losses/changes of habitat and displacement of wildlife from the construction areas. The greatest impact would be installation of the EMDF in Central or West Bear Creek Valley where up to 94 acres of forested land are expected to be impacted. The other onsite alternatives have less, but still notable, impact on environmental habitat.

Environmental effects could result from a spill during transport and handling for the Offsite Disposal Alternative.

IMPLEMENTABILITY

Implementability for the No Action Alternative is not applicable, but all disposal alternatives are administratively and technically feasible. Currently, services and materials needed for pre-construction investigations, construction, and operation of the Onsite Disposal Alternatives and transportation and disposal capacity for the Offsite Disposal Alternative are available. No impediments to future operation of the Onsite Disposal Alternatives are likely to arise. The onsite EMDF of both the Onsite Disposal Alternatives and the Hybrid Disposal Alternative is more complex to implement than shipping waste offsite. However, the technology is well proven and onsite disposal capacity has already been constructed at the ORR. Use of both onsite and offsite disposal in the Hybrid Disposal Alternative does introduce operational complexity as decisions about what is disposed onsite versus offsite would be needed. The East Bear Creek Valley site has the most notable implementation issues of the Onsite Disposal Alternatives as it is the steepest of the sites and has little room for support systems. Many other Y-12 facilities and operations are close to the site. However, this site has the greatest use of existing EMWMF infrastructure.

Reliance on offsite disposal facilities introduces an element of uncertainty into the continued availability of offsite disposal during the anticipated operational period. Offsite disposal introduces risks of interruptions caused by events outside the control of DOE. Because CERCLA waste generation on the ORR is projected to continue for roughly three decades, onsite disposal would provide greater certainty that sufficient disposal capacity is actually available at the time the wastes are generated.

COST

There are no costs associated with the No Action Alternative since there is no coordinated disposal effort.

The projected cost for the Offsite Disposal Alternative is approximately two times that of the Onsite Disposal Alternatives as seen in Table 2. The estimated total project costs for onsite disposal range from $732M to $928M and $1,567M to $1,799M for the Offsite Disposal Alternative, with the Hybrid Disposal Alternative in between at $1,391M. Both costs have the same assumed uncertainty of 25 percent in waste volumes and account for cost uncertainties. Selection of two smaller sites (the Dual Site Disposal Alternative) is the high range ($928M) onsite disposal estimate. Total estimated costs for capital investment includes planning, construction/closure, and operation as well as long-term maintenance (e.g., maintenance, surveillance, and monitoring for a 100-year period following closure). Costs shown in Table 2 are given in Fiscal Year 2016 dollars along with Present Worth values.

Table 2. Estimated costs for disposal alternatives

	$ million					
Cost element	**East Bear Creek Valley**	**Central Bear Creek Valley**	**West Bear Creek Valley**	**Dual site**	**Hybrid**	**Offsite**
Capital cost (construction, operation, to closure)	733.6	732.0	750.4	928.0	1,391	1,567 to 1,799
Long-term maintenance[a]	45.7	45.7	46.1	74.4	34.3	NA
Present worth[b]	538.3	537.2	553.3	667.4	1,145	1,315 to 1,494

[a]Long-term maintenance includes 100 years of maintenance, monitoring, and surveillance.
[b]Present worth calculations use a discount rate of 1.5% per the Office of Management and Budget (OMB 2016).

STATE ACCEPTANCE

The State of Tennessee recognizes the importance of selecting a waste disposal option to support environmental cleanup and building demolition on the ORR by DOE.

The State conditionally supports identification of the Central Bear Creek Valley Alternative as the preferred alternative. This conditional support of Central Bear Creek Valley as the preferred alternative is based on its potential to meet the estimated disposal capacity needs without relying on engineered systems for collecting and discharging groundwater under the waste. Until the State has the opportunity to review additional data related to: site characterization, final ARARs identification, and the WAC, the State is unable to provide its unconditional support of Central Bear Creek Valley as the preferred alternative. The State will make its final determination in the ROD.

As with Central Bear Creek Valley as the preferred alternative, the State conditionally supports the Hybrid Option Alternative and the Dual Site Alternative. The State does not support the East Bear Creek Valley Alternative, the West Bear Creek Valley Alternative or the No Action Alternative. The State fully supports the Offsite Disposal Alternative.

NEPA VALUES

There are no NEPA values to evaluate for the No Action Alternative as the future waste disposal decisions are unknown and would be addressed for NEPA compliance as appropriate.

NEPA values were evaluated for the disposal alternatives. Those values associated with sensitive resources were discussed in the RI/FS (DOE 2017) under compliance with ARARs or Short-term Effectiveness and are not key differentiating values.

NEPA impacts on land use are summarized in Table 3 for the Onsite Disposal Alternatives.

Table 3. NEPA considerations for Onsite Alternatives

	Onsite EMDF locations				
NEPA element (impacted areas)	**East Bear Creek Valley[a]**	**Central Bear Creek Valley**	**West Bear Creek Valley**	**Dual Site**	**Hybrid[a]**
Acreage for development	71	82	94	127	53
Footprint of disposal facility	48	47	52	68	27
Area of permanent commitment	70	67	71	109	50

[a]These locations assume some use of existing facilities/committed acreage; therefore, acreage for development/permanent commitment is lower.

Land use within the permanent institutional control boundary of all disposal locations, both onsite and offsite, would be restricted. Support areas used during construction and operations of disposal facilities could be released for other uses after facility closure. The Onsite Disposal Alternatives would cause a permanent loss of land for alternate uses of up to 109 acres (for the Dual Site Disposal Alternative).

All disposal alternatives would irreversibly and irretrievably use resources. The Hybrid and Onsite Disposal Alternatives would use material for the construction of the landfill; however, none of the material is considered difficult to replace. Fuel would be used for all alternatives, but to a much greater extent with the Hybrid and the Offsite Disposal Alternative.

Implementation of the Offsite Disposal Alternative would have a lower socioeconomic impact in East Tennessee compared to the Onsite Disposal Alternatives. However, the additional truck and/or rail traffic through the area may be a detriment to the quality of life of some residents. The perception that there is an increased local traffic risk may be an issue for future development, but this is likely to be a small impact.

Onsite disposal would have the greatest effect on local socioeconomic factors. From design and engineering to construction and 20 plus years of operation, and then to closure and many years of post-closure care, local jobs would be created in the east Tennessee area.

The East Bear Creek Valley location adjacent to existing waste disposal sites minimizes the potential impact of the presence of a new facility on future development nearby in Oak Ridge or on the ORR. There would be increased potential negative perception as the site is moved down the valley toward West Bear Creek in areas originally deemed to be uncontaminated.

Programmatic cost savings in implementing onsite disposal instead of offsite disposal would enable quicker remediation progress at individual sites, allowing reuse of property at Y-12 and ORNL and resulting in additional benefits to the local community.

The areas immediately surrounding the proposed EMDF sites are currently unpopulated DOE-controlled property. The nearest residential area is approximately 0.8 mile (Country Club Estates) from the Dual Site or Central Bear Creek Valley sites and approximately 1 mile from the West Bear Creek Valley site. The Scarboro Community, located approximately 1.5 miles northeast of the East Bear Creek Valley site would not be impacted by the construction, operation, or closure of EMDF. All nearby communities are separated by a large ridge (Pine Ridge) from the proposed EMDF sites. Additionally, surface water and groundwater originating in the proposed disposal areas in Bear Creek Valley move away from these residential areas. The mile plus distance, and Pine Ridge, provide a visual and sound barrier between the residents and the waste disposal construction and operational activities. The surrounding communities would not be affected by construction traffic since access to Bear Creek Valley is restricted by ORR security. Waste is shipped to the disposal facilities on dedicated haul roads operated on the ORR, so there is no interaction between the public and the transport trucks. These dedicated haul roads also would minimize public interaction with trucks transporting waste to the trans-load facility for offsite disposal.

Environmental justice is the fair treatment and meaningful involvement of all communities with respect to the planning, development, and siting of the preferred alternative for onsite CERCLA waste disposal. Environmental justice concerns have been raised regarding communities immediately north of the main Y-12 industrial area. Based on the proposed locations for alternatives, coupled with the proximities and locations of these proposed locations when compared with surrounding communities, it is demonstrated that no community is disproportionately affected by the potential environmental consequences presented by the onsite alternatives.

PREFERRED ALTERNATIVE AND RATIONALE

Based on the considerations and the information currently available, the Onsite Disposal Alternative located in Central Bear Creek Valley is the preferred alternative to manage remediation waste generated by future CERCLA actions at the ORR. Wastes under consideration for disposal include any waste generated under a CERCLA action on the ORR. If at some future time DOE ORR CERCLA remediation waste off the ORR (but within the state) requires disposal, advance FFA tripartу approval would be needed to incorporate that waste in this remedy.

The preferred alternative meets CERCLA threshold criteria and provides the best balance of all other criteria (see Appendix A). DOE has determined that the preferred alternative satisfies the requirements of CERCLA 121(b) to: (1) be protective of human health and the environment, (2) appropriately comply with ARARs, (3) be cost effective, (4) use permanent solutions and resource recovery technologies to the extent practicable, and (5) satisfy the preference for treatment as a principal element of the remedy. Element 5 would be addressed through treatment required on individual waste lots generated under CERCLA decision documents, as needed, to meet the EMDF WAC before onsite disposal. For example, waste containing mercury above regulatory limits must be treated to meet ARARs prior to disposal.

DOE is proposing the Central Bear Creek Valley site as the preferred site location for the following reasons:

1. The site facilitates timely CERCLA remediation of the ORR by providing a dedicated onsite disposal location that is protective of human health and the environment, cost-effective, compliant with all Federal and State requirements, and effectively balances the CERCLA remedy selection criteria.

2. The site is located in a secure location (under DOE control) within the ORR in an area not considered for reindustrialization or reuse.

3. The site minimizes short-term risks to humans through transportation or industrial accidents.

4. The site is adjacent to an existing area designated as a future CERCLA waste management area (i.e., EMWMF) along with several other CERCLA areas in Bear Creek Valley.

5. The overall terrain is not as steep as other proposed locations and there is room for collocated support systems installation as there are no other activities nearby.

6. The need for underdrains is minimized. Any/all underdrains in use during disposal operations are conceptualized as not necessary or operational following closure.

The site offers distinct advantages in relation to the management of technical challenges related to surface water and groundwater in Bear Creek Valley. As part of the evaluation of the suitability of this particular location, EPA, TDEC, and DOE agreed that collection and analyses of additional field data would be important to inform this Proposed Plan and ultimately the selection of the preferred alternative for future remediation waste management at the ORR (see Appendix B). The additional data supplements data contained in the RI/FS (available as part of the Administrative Record). The additional field data focuses on the Central Bear Creek Valley site to help define the location-specific hydrologic properties (both surface and subsurface) and support the determination in the ROD whether key ARARs (identified in previous the *Key ARARs* section) can be complied with or whether regulatory exemptions/waivers will be required as part of the remedy selection documented in the ROD. The additional data also will be used to evaluate the ability of the remedy to meet CERCLA statutory requirements. Attached to this Proposed Plan (Appendix B) is an approved copy of the Field Sampling Plan used in the data collection effort that occurred between the conclusion of the RI/FS and this Proposed Plan. The results of the Field Sampling Plan activities are contained in Technical Memorandum #1 (discussed in the Field Sampling Plan) which provides DOE's analysis of the data in relation to the hydrologic properties of Central Bear Creek Valley. Technical Memorandum #1 is available in the Administrative Record.

Surface water and groundwater data would continue to be collected and reported (Technical Memorandum #2) to support remedy selection in the ROD and to ensure that the design protects human health and the environment and complies with ARARs. All data collected to support the ROD or design will be available to the public.

Other activities that will be implemented as the ROD is being developed include an assessment of the long-term performance of the landfill as required by DOE Order 435.1. While this assessment is not required under CERCLA, DOE is required to develop two documents that complement those developed during the CERCLA process. The first document, a Performance Assessment, evaluates the potential for releases of radioactivity from a LLW disposal facility and resultant impacts on future members of the public and the environment. The second document, a Composite Analysis, evaluates the impact of a new LLW disposal facility in aggregate with other sources of radioactivity in the area on members of the public and the environment. These documents will be reviewed under DOE's independent regulatory authority, and approval to proceed with construction will be granted before signature of the ROD. Additionally, development of the final WAC with EPA and TDEC will occur while DOE is drafting the ROD, and the final WAC (approved by the three FFA parties) will be attached to the ROD prior to signature and will be one of many factors used by DOE to assure protection of human health and the environment.

The preferred alternative can change in response to public comments on this Proposed Plan or based on new information collected prior to the ROD. Any new information collected after this Proposed Plan and prior to the signature of the ROD will be placed in the Administrative Record. Selection of the Central Bear Creek Valley site for long-term waste disposal in the ROD will necessitate a change to the future land use designation of the location and surrounding area, from the current recreational and future unrestricted use designation to DOE-industrial use designation.

NATURAL RESOURCE DAMAGES

Hazardous substances known to be above health-based levels based on residential use will remain in the disposal cell after landfill closure. It is recognized by DOE, TDEC, and EPA that natural resource damage claims, in accordance with CERCLA, may be applicable. Neither DOE nor TDEC waive any rights or defenses they may have under CERCLA Sect. 107(1)4(c).

COMMITMENT TO LONG-TERM STEWARDSHIP

This proposed remedy will result in leaving hazardous material at the EMDF site that will remain hazardous in perpetuity. DOE is committed to long-term stewardship to protect future users of the site.

DOE will be responsible for maintaining, reporting, and enforcing, as necessary, land use controls. DOE will retain ultimate responsibility for the integrity and protectiveness of the remedy. Monitoring of the approved land use controls will be conducted annually and any identified issues will be reported in the annual ORR remediation effectiveness reports.

COMMUNITY PARTICIPATION

DOE, EPA, and TDEC encourage the public to review this document and other relevant documents in the Administrative Record to gain an understanding of the proposed waste disposal action. A copy of this Proposed Plan, as well as the entire Administrative Record, is located at the DOE Information Center, at the Office of Scientific and Technical Information, 1 Science.gov Way, Oak Ridge, Tennessee 37830. The Center is open Monday through Friday, 8 a.m. to 5 p.m.; the telephone number is (865) 241-4780.

Community involvement is critical to the CERCLA process. A public meeting has been scheduled by DOE to discuss cleanup alternatives and address questions and concerns the public may have about all alternatives. DOE has established a 30-day public comment period, which allows the public time to review the document and submit comments on the preferred and other alternatives. DOE will document, evaluate, and respond to comments as part of the subsequent ROD. Upon request, DOE will engage the public in additional public outreach efforts. Comments may be addressed to John Michael Japp, FFA Project Manager, Oak Ridge Environmental Management, DOE Oak Ridge Operations, Post Office Box 2001, Oak Ridge, Tennessee 37831.

The preferred alternative identified in this Proposed Plan represents the recommended alternative for the disposal of future waste generated from cleanup actions under CERCLA at the DOE ORR. This Proposed Plan provides stakeholders the information necessary to determine if action is warranted and to provide comments on the potential alternatives. DOE may modify the preferred alternative or select a different alternative in response to public input. Therefore, the public is encouraged to review and comment on all information in this Proposed Plan. After considering public comments, DOE will prepare a ROD that presents the selected remedy. Following the approval of the ROD, DOE will prepare plans and implement the selected action.

REFERENCES

DOE 1992. *Federal Facility Agreement for the Oak Ridge Reservation*, DOE/OR-1014, January, U.S. Environmental Protection Agency Region 4, Atlanta, GA; U.S. Department of Energy Office of Environmental Management, Oak Ridge, TN; and Tennessee Department of Environment and Conservation, Nashville, TN, January.

DOE 1994. *Secretarial Policy Statement on the National Environmental Policy Act of 1969*, U.S. Department of Energy, Washington, D.C.

DOE 1996. *Identification of Candidate Sites for the Environmental Management Waste Management Facility, Oak Ridge, Tennessee,* DOE/OR/01-1508&D1, U.S. Department of Energy, Oak Ridge Office of Environmental Management, Oak Ridge, TN.

DOE 1998a. *Oak Ridge Reservation Stakeholder Report on Stewardship*, Stewardship Working Group, U.S. Department of Energy, Oak Ridge Office of Environmental Management, Oak Ridge, TN, July.

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DOE 1999. *Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee,* DOE/OR/01-1791&D3, U.S. Department of Energy, Oak Ridge Office of Environmental Management, Oak Ridge, TN, November.

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DOE 2001. *Attainment Plan for Risk/ Toxicity-Based Waste Acceptance Criteria at the Oak Ridge Reservation, Oak Ridge, Tennessee,* DOE/OR/01-1909&D3, U.S. Department of Energy, Oak Ridge Office of Environmental Management, Oak Ridge, TN, October.

DOE 2017. *Remedial Investigation/Feasibility Study for Comprehensive Environmental Response, Compensation, and Liability Act Waste Disposal, Oak Ridge, Tennessee*, DOE/OR/01-2535&D5, U.S. Department of Energy, Oak Ridge Office of Environmental Management, Oak Ridge, TN, April.

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EPA 2000. *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study,* EPA 540 R-00-002, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C., July

OMB 2016. *Memorandum for the Heads of Departments and Agencies from Shaun Donovan*, Office of Management and Budget Director, 2016 Discount Rates for OMB Circular No. A-94, February 12, 2016.

GLOSSARY

Administrative Record – The administrative record is the set of non-deliberative documents that the decision-maker considered, directly or indirectly (e.g., through staff), in making the final (CERCLA ROD) decision. The record includes all the factual, technical, and scientific material or data considered in making the decision, whether or not those materials or data support the decision.

Applicable or relevant and appropriate requirement (ARAR) – Those cleanup standards and other substantive requirements, criteria, or limitations promulgated under federal or more stringent state environmental or facility siting laws that are either legally "applicable" or "relevant and appropriate" to the hazardous substances, pollutant, contaminant, remedial action, location, or other circumstance found at the CERCLA site.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) – The federal law that establishes, among other requirements, a program for parties (including federal agencies) to identify, investigate, and, if determined necessary, remediate inactive site facilities contaminated with a hazardous substance, pollutant, or contaminant. It is also known as the "Superfund law."

Excess Lifetime Cancer Risk – Excess Lifetime Cancer Risk considers the cumulative probability of humans developing cancer as a result of a lifetime of exposure to a particular level of a contaminant, above the normal cancer rates from the natural environment. Cumulative means adding the carcinogenic risk from all contaminants and ways a person can be exposed.

Feasibility Study (FS) – The step in the CERCLA process in which alternatives for remediation of a contaminated site or of other remediation decisions are developed and evaluated.

Hazard Index – The ratio of the level of exposure to an acceptable level of exposure for contaminants that may cause adverse health effects to humans. A cumulative hazard index greater than 1 indicates that there may be a concern for adverse health effects. The hazard index is used to assess contaminants that may cause health effects other than cancer. Some contaminants (e.g., uranium, arsenic) can have both carcinogenic and non-carcinogenic effects.

National Environmental Policy Act of 1969 (NEPA) – A federal law that requires federal agencies to consider and evaluate environmental impacts associated with any significant proposed actions or activities. For CERCLA actions undertaken by DOE, any impacts to NEPA values associated with the proposed action are considered along with other factors required to be evaluated.

Present Worth – Present worth costs reflect the quantity of money that would need to be placed in a bank today at a set interest rate, termed the discount rate, to pay for the remedial action over the life of the project. The present worth approach for cleanup decision making and comparison of alternatives is recommended by EPA in its cost estimating guidance for Superfund sites (EPA 2000).

Proposed Plan – The formal document in which the lead agency identifies its preferred alternative for remedial action, explains why this alternative was preferred, and solicits comments from the public.

Record of Decision (ROD) – The formal document in which the lead agency sets forth the selected remedial action and the reasons for its selection.

Remedial Investigation (RI) – A CERCLA environmental study that identifies the nature and extent of contamination. The RI also provides an assessment of the potential risks associated with the contaminants.

Waste Acceptance Criteria (WAC) – Requirements that waste must meet before being placed in a disposal cell to ensure protection of human health, safety, and the environment. The criteria include limits on the amount of chemical and radiological contamination that can be present in the waste, requirements for size and shape of waste, and lists of wastes prohibited from disposal based on regulations or agreements. The WAC take into consideration the design of the disposal facility, the underlying geologic conditions, and the nature of the contamination.

ACRONYMS

ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
EMDF	Environmental Management Disposal Facility
EMWMF	Environmental Management Waste Management Facility
EPA	U.S. Environmental Protection Agency
ETTP	East Tennessee Technology Park
EUWG	End Use Working Group
FFA	Federal Facility Agreement
LLW	low-level (radioactive) waste
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act of 1969
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act of 1976
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
TDEC	Tennessee Department of Environment and Conservation
TDRH	Tennessee Department of Radiological Health
TSCA	Toxic Substances Control Act of 1976
WAC	waste acceptance criteria
Y-12	Y-12 National Security Complex

Proposed Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Waste
Public Comment Sheet

DOE is interested in your comments on the alternatives being considered in the *Proposed Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Waste,* including the preferred alternative. The mailing address is preprinted on the back of this form. You may use this form to submit your comments. We must receive your comments on or before the close of the public comment period. If you have questions, please contact Mr. John Michael Japp, FFA Project Manager; Oak Ridge Environmental Management; DOE Oak Ridge Operations; P.O. Box 2001, Oak Ridge, TN 37831; (865) 576-6344.

Name: __________

Address: __________

City: __________ State/Zip: __________

Phone: __________

MAILING LIST ADDITIONS:

Please add my name to the Environmental Management Program mailing list to receive additional information on the progress at the Oak Ridge Reservation: ☐ Yes ☐ No

Place stamp here

Mr. John Michael Japp, FFA Project Manager
Oak Ridge Environmental Management
DOE Oak Ridge Operations
P.O. Box 2001
Oak Ridge, TN 37831

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APPENDIX A.
SUMMARY OF CERCLA EVALUATION CRITERIA FOR DISPOSAL ALTERNATIVES

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APPENDIX A. SUMMARY OF CERCLA EVALUATION CRITERIA FOR DISPOSAL ALTERNATIVES

<table>
<tr><th rowspan="2">Evaluation Criterion</th><th rowspan="2">No Action Alternative</th><th colspan="4">Onsite Alternatives</th><th rowspan="2">Offsite Alternative</th><th rowspan="2">Hybrid Disposal Alternative</th></tr>
<tr><th>East Bear Creek Valley</th><th>Central Bear Creek Valley</th><th>West Bear Creek Valley</th><th>Dual Site</th></tr>
<tr><td rowspan="2">Overall protection of human health and the environment</td><td rowspan="2">• May not be protective of human health and the environment if remediation not accomplished due to extensive time frames to complete remediation and extensive funding required.</td><td colspan="4">• Would meet all remedial action objectives.
• Protective because waste would be disposed of in a landfill designed for long-term containment to be protective of human health and the environment through application of land use controls, application of waste acceptance criteria, and application of ARARs.</td><td rowspan="2">• Would meet all remedial action objectives.
• Protective because waste would be disposed of in a landfill designed for long-term containment, application of waste acceptance criteria, and must meet CERCLA offsite rule.
• More protective than the Onsite or Hybrid Disposal Alternatives in preventing releases on the ORR because waste is permanently removed and disposed in unpopulated regions with greater depths to groundwater.
• Less protective in the short term because of increased transportation risks.</td><td rowspan="2">• Would meet all remedial action objectives.
• Protective because waste would be disposed of in a landfill (either onsite or offsite) designed for site-specific conditions to be protective of human health and the environment through application of land use controls, application of waste acceptance criteria, and application of ARARs or CERCLA offsite rule.
• Site-specific conditions relevant to siting consideration and potentially affecting design at the onsite location are:
- Hydrologic buffer (i.e., depth of waste to pre-construction groundwater levels) is estimated based on wells adjacent to the landfill footprint and within the same subsurface formations to range from ~ 0 ft (waste within pre-construction water levels) to ~30 ft bgs.
- Groundwater flow direction is predominantly south to southwest. This analysis is based on identified topography and multiple Bear Creek Valley well results.
- Distance to 500 year floodplain is ~ 600 ft.
- Distance to karst formation is ~ 600 ft.
- Constructed with berm over seeps- would be addressed through engineered structure.
• Shortest distance to the DOE property line is ~ 4,400 ft.
• Size of permanent commitment for landfill footprint: up to 50 acres.</td></tr>
<tr><td>• Site-specific conditions relevant to siting consideration and potentially affecting design at this candidate site are:
- Hydrologic buffer (i.e., depth of waste to pre-construction groundwater levels) within landfill footprint ranges from 0 ft (waste within pre-construction water levels) to ~80 ft bgs based on wells characterized within the footprint in 2015.
- Distance to 500-year floodplain is ~1,300 ft.
- Distance to karst formation is ~1,270 ft.
- Constructed with waste over stream; would be addressed through engineered structure.
• Shortest distance to the DOE property line is ~1,200 ft.
• Size of permanent commitment for landfill footprint: up to 70 acres.</td><td>• Site-specific conditions relevant to siting consideration and potentially affecting design at this candidate site are:
- Hydrologic buffer (i.e., depth of waste to pre-construction groundwater levels) is estimated to range from ~0 ft (waste within pre-construction water levels) to ~30 ft bgs based on wells characterized within the footprint in 2018.
- Distance to 500-year floodplain is ~500 ft.
- Distance to karst formation is ~300 ft.
- Constructed with berm over stream; would be addressed through engineered structure.
• Shortest distance to the DOE property line is ~4,200 ft.
• Size of permanent commitment for landfill footprint: up to 67 acres.</td><td>• Site-specific conditions relevant to siting consideration and potentially affecting design at this candidate site are:
- Hydrologic buffer (i.e., depth of waste to pre-construction groundwater levels) within landfill footprint ranges from 10-30 ft bgs based on wells characterized within the footprint in 1988.
- Distance to 500-year floodplain is ~1000 ft.
- Distance to karst formation is ~660 ft.
- Constructed with waste over stream; would be addressed through engineered structure.
• Shortest distance to the DOE property line is ~3,900 ft.
• Size of permanent commitment for landfill footprint: up to 71 acres.</td><td>• Site-specific conditions relevant to siting consideration and potentially affecting design at this candidate site are:
- Hydrologic buffer (i.e., depth of waste to pre-construction groundwater levels) is estimated based on wells adjacent to the landfill footprint and within the same subsurface formations to range from ~0 ft (waste within pre-construction water levels) to ~60 ft bgs.
- Distance to 500-year floodplain is ~600 ft (smaller site) and 500-800 ft (larger site).
- Distance to karst formation is ~600 ft (smaller site) and 450-600 ft (larger site).
- Constructed with berm over seeps; would be addressed through engineered structure.
• Shortest distance to the DOE property line is ~4,000 ft.
• Size of permanent commitment for landfill footprint: up to 109 acres (combined sites).</td></tr>
<tr><td>Compliance with ARARs</td><td>• No action, therefore, no ARARs apply. ARARs for remedial actions at individual sites are specified in separate CERCLA documents.</td><td colspan="4">• Would comply with all ARARs. No CERCLA waivers invoked. A TSCA specific waiver for 40 CFR 761.75(b)(3) and (b)(5) would be requested as provided in 40 CFR 761.75(c)(4). A Tennessee Division of Radiological Health exemption for TDEC 0400-20-11.17(1)(h) may be invoked as provided in TDEC 0400-20-04-.08. These determinations will be made in the Record of Decision based on available data.</td><td>• Would comply with all chemical-, location-, and action-specific ARARs.</td><td>• Same as Onsite Alternatives.</td></tr>
</table>

APPENDIX A. SUMMARY OF CERCLA EVALUATION CRITERIA FOR DISPOSAL ALTERNATIVES (cont.)

<table>
<tr><th rowspan="2">Evaluation Criterion</th><th rowspan="2">No Action Alternative</th><th colspan="4">Onsite Alternatives</th><th rowspan="2">Offsite Alternative</th><th rowspan="2">Hybrid Disposal Alternative</th></tr>
<tr><th>East Bear Creek Valley</th><th>Central Bear Creek Valley</th><th>West Bear Creek Valley</th><th>Dual Site</th></tr>
<tr><td rowspan="2">Long-term effectiveness and permanence</td><td rowspan="2">• As the no action remedy does not meet one CERCLA threshold criterion (protection of human health and the environment), no additional summary analysis will be provided.</td><td colspan="4">• Provides long-term effective and permanent waste disposal because of landfill design (designed to RCRA and TSCA) standards and use of waste acceptance criteria consistent with DOE Orders and ARARs.
• Potential non-acute residual hazards may be slightly greater for the waste disposed of onsite than for that disposed of offsite because of higher regional population, wetter climatic conditions, and shallower depth to groundwater. However, land use controls and monitoring at the onsite disposal location would mitigate this risk.</td><td rowspan="2">• The offsite facility locations in arid environments reduce the likelihood of contaminant migration, and fewer receptors exist in the vicinity of EnergySolutions and NNSS than near the ORR.</td><td rowspan="2">• Provides long-term effective and permanent waste disposal onsite because of landfill design and use of risk-based WAC. Also provides long-term effective and permanent waste disposal for waste meeting the offsite facility WAC.
• Potential non-acute residual hazards may be slightly greater for the waste disposed onsite than for that disposed offsite because of higher regional population, wetter climatic conditions, and shallower depth to groundwater. However, land use controls and monitoring at the onsite disposal location should mitigate this risk.
• The offsite facility locations in arid environments reduce the likelihood of contaminant migration, and fewer receptors exist in the vicinity of EnergySolutions and NNSS than near the ORR.
• Destruction of up to 50 acres of woodland habitat within facility footprint.
• No wetlands are affected.
• Temporary drainage features are not expected to be used long-term. Temporary drainage features are as shown in the smaller of the two footprints shown in Figure 6.</td></tr>
<tr><td>• Destruction of up to approximately 70 acres of woodland habitat within facility footprint.
• Up to approximately 1.6 acres of wetlands impacted. Impacts would be minimized through use of Best Management Practices or mitigated in accordance with ARARs.
• Surface water features, including a tributary creek, would require relocation; however, impacts would be minimized through use of Best Management Practices or mitigated in accordance with ARARs.
• Impacts to environmental features would be minimal as the site is located within the secured portion and industrial area of Y-12.
• Underdrains are permanent as shown in Figure 4.</td><td>• Destruction of up to approximately 67 acres of woodland habitat within facility footprint.
• Up to approximately 4.9 acres of wetlands impacted. Impacts would be minimized through use of Best Management Practices or mitigated in accordance with ARARs.
• Surface water features, including a tributary creek, would require relocation; however, impacts would be minimized through use of Best Management Practices or mitigated in accordance with ARARs.
• Temporary drainage features are not expected to be used long-term. Temporary drainage features are as shown in Figure 7.</td><td>• Destruction of up to approximately 71 acres of woodland habitat within facility footprint.
• Up to approximately 2.5 acres of wetlands impacted. Impacts would be minimized through use of Best Management Practices or mitigated in accordance with ARARs.
• Surface water features, including a tributary creek, would require relocation; however, impacts would be minimized through use of Best Management Practices or mitigated in accordance with ARARs.
• Underdrains are permanent as shown in Figure 5.</td><td>• Destruction of up to approximately 109 acres of woodland habitat within facility footprint.
• Up to approximately 5.8 acres of wetlands impacted. Impacts would be minimized through use of Best Management Practices or mitigated in accordance with ARARs.
• Surface water features would not require relocation.
• Temporary drainage features are not expected to be used long-term. Temporary drainage features are as shown in Figure 6.</td></tr>
<tr><td rowspan="2">Short-term effectiveness</td><td rowspan="2"></td><td colspan="4">• All onsite facilities require management of landfill wastewater through collection in the leachate collection system.
• Transportation risks are significantly lower for the public than those under the offsite alternatives (onsite < 1.0 fatality/injury) over the disposal life cycle (DOE 2017).</td><td rowspan="2">• No notable environmental effects would occur at the existing offsite facilities from increased ORR waste disposal.
• Transportation risks are significantly greater for the public than for the Onsite Alternatives. Injuries/fatalities from transportation accidents estimated to range from 7 to 24 over the disposal life cycle (DOE 2017).
• Offsite facilities are located in arid regions and have minimal wastewater management requirements.</td><td rowspan="2">• Adverse environmental effects during construction are much lower than for other onsite facility options if the onsite location is used because it was used as a borrow area previously.
• Transportation risks to the public and workers are greater than onsite facility alternatives, but less than those encountered for the Offsite Disposal Alternative. Up to 3 injuries/fatalities from transportation accidents may occur over the disposal life cycle.
• Onsite facility requires management of landfill wastewater through collection in the leachate collection system. Less wastewater volume due to smaller footprint than full size onsite facilities.</td></tr>
<tr><td>• Wetland mitigation of up to approximately 1.6 acres.</td><td>• Wetland mitigation of up to approximately 4.9 acres.</td><td>• Wetland mitigation of up to approximately 2.5 acres.</td><td>• Wetland mitigation of up to approximately 5.8 acres.</td></tr>
</table>

APPENDIX A. SUMMARY OF CERCLA EVALUATION CRITERIA FOR DISPOSAL ALTERNATIVES (cont.)

Evaluation Criterion	No Action Alternative	Onsite Alternatives				Offsite Alternative	Hybrid Disposal Alternative
		East Bear Creek Valley	Central Bear Creek Valley	West Bear Creek Valley	Dual Site		
Reduction of toxicity, mobility, or volume through treatment		• Landfill wastewater treatment would reduce contaminants to levels required for discharge.				• Reduction in volume provided for disposal at NNSS.	• Reduction of volume is provided through mechanical volume minimization.
Implementability		• Implementation is technically feasible; landfill design and construction of the type presented in this conceptual design is commonly carried out. • Services and materials required for design, construction, and operation of the landfill are readily available, as are qualified personnel, specialists, and vendors. Construction would involve the use of standard construction equipment, trades, and materials; no new technology development is required.				• Administrative and technical requirements are implementable as demonstrated by the current offsite shipment effort from ORR. • However, disposal of waste at commercial and DOE facilities relies on continued availability of offsite disposal capacity. Future changes in the states' acceptance of waste transport and disposal could challenge implementation of the alternative. Travel through multiple states could raise challenges.	• Implementation of the onsite disposal portion is technically feasible; landfill design and construction of the type presented in this conceptual design is commonly carried out. • Less new construction is required. The landfill is smaller and much of the existing infrastructure at EMWMF may be usable. • Services and materials required for design, construction, and operation of the landfill are readily available, as are qualified personnel, specialists, and vendors. Construction would involve the use of standard construction equipment, trades, and materials; no new technology development is required.
		• Greater use of underdrain system required at this site. • Construction on steeper slopes. • Some new construction is required including support facilities.	• Reliance on drainage systems expected to be required only during construction. • No reliance on underdrains beneath waste footprint required. • Slopes less pronounced than those at East Bear Creek Valley, so construction easier. • New construction is required, including support facilities.	• Greater use of underdrain system required at this site. • Slopes less pronounced than those at East Bear Creek Valley, so construction easier. • New construction is required, including support facilities.	• Reliance on drainage systems expected to be required only during construction. • No reliance on underdrains beneath waste footprint required. • Slopes less pronounced than those at East Bear Creek Valley, so construction easier. • Some new construction is required for support facilities and through construction of two landfills.		
Cost		• Cost per cubic yard of as-generated waste disposed is \$276 (present worth 2016 dollars). • Total cost \$538.3M (present worth 2016 dollars).	• Cost per cubic yard of as-generated waste disposed is \$276 (present worth 2016 dollars). • Total cost \$537.2M (present worth 2016 dollars).	• Cost per cubic yard of as-generated waste disposed is \$284 (present worth 2016 dollars). • Total cost \$553.3M (present worth 2016 dollars).	• Cost per cubic yard of as-generated waste disposed is \$343 (present worth 2016 dollars). • Total cost \$667.4M (present worth 2016 dollars).	• Cost per cubic yard of as-generated waste disposed of is \$675–\$767 (present worth 2016 dollars). • Total cost is \$1,315–\$1,494M (present worth 2016 dollars).	• Cost per cubic yard of as-generated waste disposed is \$587 (present worth 2016 dollars). • Total cost is \$1,145M (present worth 2016 dollars).
State Acceptance	• The State does not support the no action alternative.	• The State does not support the East Bear Creek Valley Alternative based on the understanding that a greater reliance on an underdrain system is required at this site.	• The State conditionally supports identification of the Central Bear Creek Valley site as the preferred alternative. This conditional support of Central Bear Creek Valley is based on its potential as the preferred site to meet DOE's estimated disposal capacity needs without relying on engineered systems for collecting and discharging groundwater beneath the waste footprint.	• The State does not support the West Bear Creek Valley Alternative based on the understanding that a greater reliance on an underdrain system is required at this site.	• The State conditionally supports identification of the Dual Site Alternative. This conditional support of the Dual site is its potential to meet DOE's estimated disposal capacity needs without relying on engineered systems for collecting and discharging groundwater beneath the waste footprint.	• The State supports the offsite disposal alternative, because the offsite facilities have approved permits that comply with applicable regulations and are located in relatively flat, dry, unpopulated locations with deep water tables.	• The State conditionally supports the Hybrid Alternative. This conditional support of the Hybrid Disposal Alternative is based on: 1) the potential to meet DOE's estimated disposal capacity needs without relying on engineered systems for collecting and discharging groundwater beneath the waste footprint; and 2) the offsite facilities have already been permitted in relatively flat, dry, unpopulated locations with deep water tables.
Public Acceptance	To be determined upon submittal of the Proposed Plan						

APPENDIX A. SUMMARY OF CERCLA EVALUATION CRITERIA FOR DISPOSAL ALTERNATIVES (cont.)

Evaluation Criterion	No Action Alternative	Onsite Alternatives				Offsite Alternative	Hybrid Disposal Alternative
		East Bear Creek Valley	Central Bear Creek Valley	West Bear Creek Valley	Dual Site		

ARAR = applicable or relevant and appropriate requirement
bgs = below ground surface
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR = *Code of Federal Regulations*
DOE = U.S. Department of Energy
EMWMF = Environmental Management Waste Management Facility
M = million
NNSS = Nevada Nuclear Security Site
ORR = Oak Ridge Reservation
RCRA = Resource Conservation and Recovery Act of 1976
TDEC = Tennessee Department of Environment and Conservation
TSCA = Toxic Substances Control Act of 1976
WAC = waste acceptance criteria

APPPENDIX B.
FIELD SAMPLING PLAN

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DOE/OR/01-2739&D2

Phase 1 Field Sampling Plan for the Proposed Environmental Management Disposal Facility for Comprehensive Environmental Response, Compensation, and Liability Act Oak Ridge Reservation Waste Disposal, Oak Ridge, Tennessee

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DOE/OR/01-2739&D2

Phase 1 Field Sampling Plan for the Proposed Environmental Management Disposal Facility for Comprehensive Environmental Response, Compensation, and Liability Act Oak Ridge Reservation Waste Disposal, Oak Ridge, Tennessee

Date Issued—March 2018

Prepared for the
U.S. Department of Energy
Office of Environmental Management

URS | CH2M Oak Ridge LLC
Safely Delivering the Department of Energy's Vision
for the East Tennessee Technology Park Mission
under contract DE-SC-0004645

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CONTENTS

FIGURES

TABLES

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ACRONYMS

BCV	Bear Creek Valley
CBCV	Central Bear Creek Valley
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
D	Drainage
DOE	U.S. Department of Energy
DQO	data quality objective
E	East
EMDF	Environmental Management Disposal Facility
EMWMF	Environmental Management Waste Management Facility
EPA	U.S. Environmental Protection Agency
FLUTe	Flexible Liner Underground Technologies, LLC
FFA	Federal Facility Agreement
NT	North Tributary
OREIS	Oak Ridge Environmental Information System
OREM	Oak Ridge Office of Environmental Management
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RDWP	Remedial Design Work Plan
RI/FS	Remedial Investigation/Feasibility Study
SME	subject matter expert
TDEC	Tennessee Department of Environment and Conservation
UCOR	URS | CH2M Oak Ridge LLC
UPF	Uranium Processing Facility
USGS	U.S. Geological Survey
W	West

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1. INTRODUCTION

The mission of the U.S. Department of Energy (DOE) Oak Ridge Office of Environmental Management (OREM) is to decommission and demolish numerous facilities and conduct remedial actions under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) on the Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee, and associated sites. This effort requires an estimated 2.2 million cy of landfill disposal capacity beyond what is available in the existing Environmental Management Waste Management Facility for the disposal of wastes from CERCLA cleanup actions. The *Remedial Investigation/Feasibility Study for the Comprehensive Environmental Response, Compensation, and Liability Act Oak Ridge Reservation Waste Disposal, Oak Ridge, Tennessee* (RI/FS) (DOE 2017) evaluated several alternatives for the disposal of this waste, including no action, off-site disposal, and onsite disposal.

An approximately 70-acre tract in the Central Bear Creek Valley (CBCV) site appears to be the best site in terms of available capacity and location. This site is used as the basis for the planned characterization efforts.

This Field Sampling Plan describes the objectives, requirements, and approach to collecting groundwater elevations and surface water flow data, and conducting geotechnical testing and exploration to characterize Site 7c, the current preferred location for the proposed Environmental Management Disposal Facility (EMDF) (Fig. 1) on the DOE ORR. This Field Sampling Plan presents the site characterization activities (Phase 1) identified in the Statement of Work provided by the U.S. Environmental Protection Agency (EPA) and Tennessee Department of Environment and Conservation (TDEC) for Site 7c/CBCV site. The Federal Facility Agreement (FFA) parties have agreed that the results of this Field Sampling Plan will be documented in Technical Memorandum 1 and included in the Administrative Record prior to the public comment period on the preferred EMDF alternative (prior to completion of the Proposed Plan).

Additional investigations will be conducted in the future to obtain additional hydrogeological, geotechnical, and geophysical data for the EMDF design, including data collection to support design of the support facilities and required relocation of the Haul Road and Bear Creek Road. In addition, baseline sampling to determine the baseline analytical data will be performed as part of a future investigation phase. Longer-term monitoring of groundwater and surface water monitoring locations identified in this Field Sampling Plan also will be conducted in the May 2018 through February 2019 timeframe and documented in Technical Memorandum 2.

The data collection described in this Field Sampling Plan will contribute to understanding the hydrogeologic setting for the CBCV site during the planning process and preferred alternative selection. These data will be used to better understand and validate the underlying groundwater assumption for this site to support the FFA parties (EPA, TDEC, and DOE) in selecting and codifying a decision in a Record of Decision.

This plan uses the results of the data quality objective (DQO) process as specified in *Guidance on Systematic Planning Using the Data Quality Objectives Process - EPA QA/G-4* (EPA 2006). The DQO process focused on the use of the data for engineering design. The FFA parties agreed that subsets of this data could be used to validate underlying assumptions used for selecting the remedy.

The project-specific Quality Assurance Project Plan (QAPP) for the Proposed EMDF Design Investigation (Appendix A) identifies the procedures that will be followed in the collection, custody, sample handling, data management, and quality control (QC) activities for all anticipated EMDF investigation activities, including future design investigation activities not described in this document.

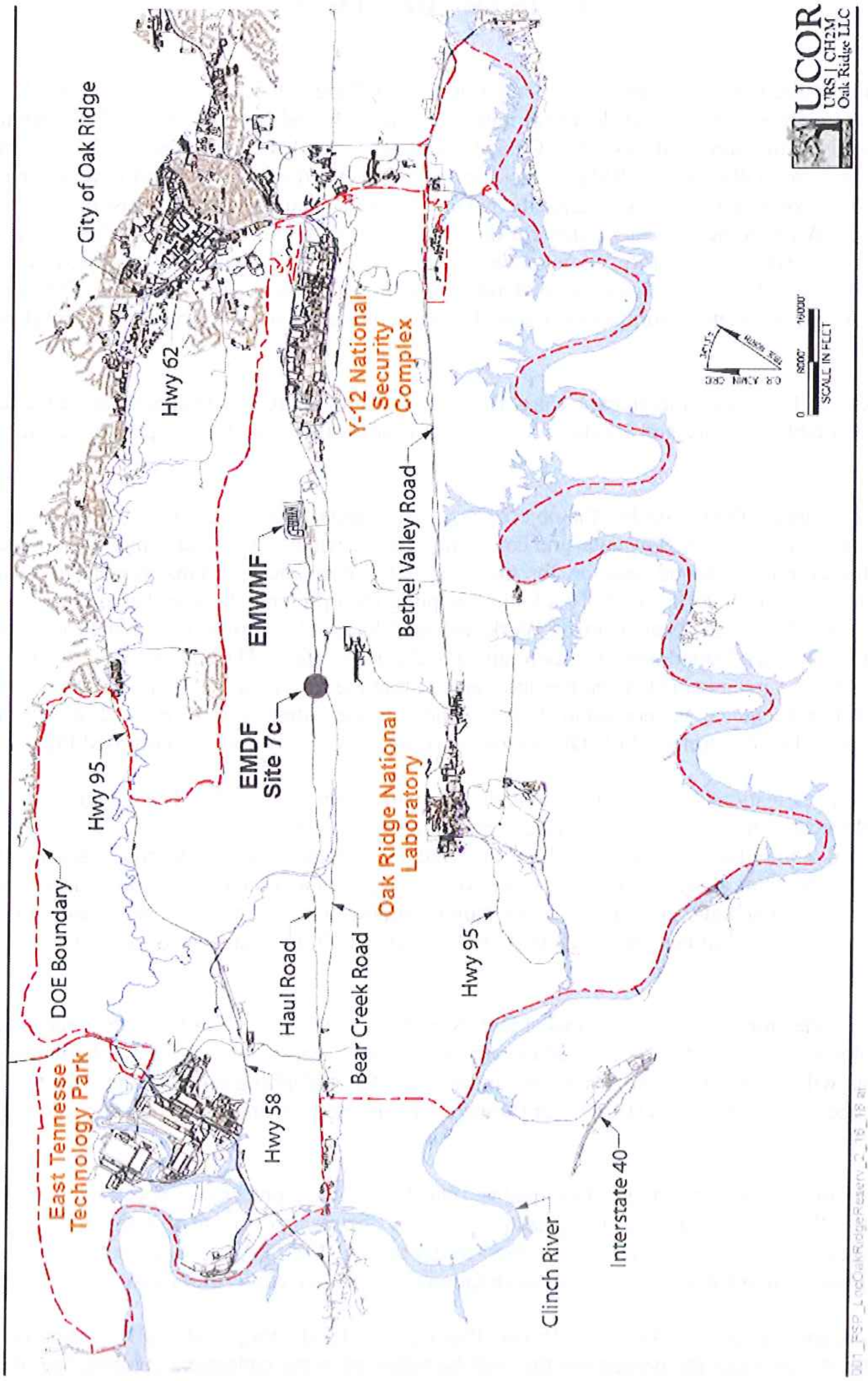

Fig. 1. ORR—proposed EMDF CBCV site location.

Safety concerns associated with the sampling will be addressed in contractor-prepared, task-specific work packages that will be approved by the appropriate disciplines. These work packages and contract documents will contain the detailed work scope for implementing this work.

This plan intends to deliver usable data within current constraints posed by physical site conditions and contractual obligations. The overall objective of this plan is to provide the strategy to collect sufficient representative data to address the DQOs. The specific scope of this plan is to obtain the following data:

- Groundwater elevation data
- Surface water flow data
- Geotechnical data

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2. HYDROGEOLOGIC SETTING

2.1 GENERAL SITE CONDITIONS

The CBCV site is situated within an upland area located between north-south trending valleys of North Tributary (NT)-10 and NT-11. Drainages within the site are Drainage (D)-10 West (W), parallel to and just west of NT-10, and D-11 East (E), an east-west trending feature that drains westward into NT-11 near the center of the site (Fig. 2).

An additional shallow east-west trending drainage was present in the southern part of the area prior to construction of the Uranium Processing Facility (UPF) wet spoils pile. This drainage was noted as dry when previously observed. The drainage is now covered by the UPF wet spoils pile; however, there is a downgradient seep within this drainage area.

The CBCV site and surrounding area are forested, except for areas along the south side between the Haul Road and Bear Creek Road, where the area has been cleared. The cleared area includes a recent soil staging area along the southern margin and two wetland basins completed in 2015 for the Y-12 National Security Complex compensatory wetland mitigation. The Haul Road and Bear Creek Road are located at the southern edge of the site and will need to be relocated prior to EMDF construction.

The Bear Creek Valley (BCV) has been extensively investigated. Geologic, hydrogeologic, and groundwater contamination conditions have been characterized extensively and there is routine monitoring of surface water conditions. There also have been additional investigations conducted for BCV to identify wetlands, ecological species of concern, and cultural resources. However, no CBCV site-specific investigations have been conducted.

The available hydrogeologic data for various potential EMDF sites in BCV are described in Appendix E and Sects. 2 and 5 of the RI/FS (DOE 2017). The information available for BCV was used to summarize various potential CBCV site conditions discussed below.

2.2 GEOLOGY/HYDROGEOLOGY

The general subsurface hydrogeological conditions at the CBCV site are known from previous characterization performed of the BCV watershed (DOE 2014). The general hydrogeological setting is provided in Fig. 3.

The waste footprint at the CBCV site predominantly overlies bedrock of the Conasauga Group (Fig. 3), including the Rogersville Shale, Dismal Gap/Maryville Formation, and Nolichucky Shale. Recent alluvium is present on the valley floor along D-10W (eastern side of the site).

These formations are dominantly shales, siltstones, and mudstones. There is little limestone present in the bedrock underlying the proposed disposal cells, even in the Maryville Formation. The crest of the knoll below the north center of the footprint is underlain by the erosion-resistant Dismal Gap/Maryville Formation. The typical weathering profile of topsoil, silty/clayey soil residuum, saprolite, and fractured bedrock are expected across the undisturbed site areas.

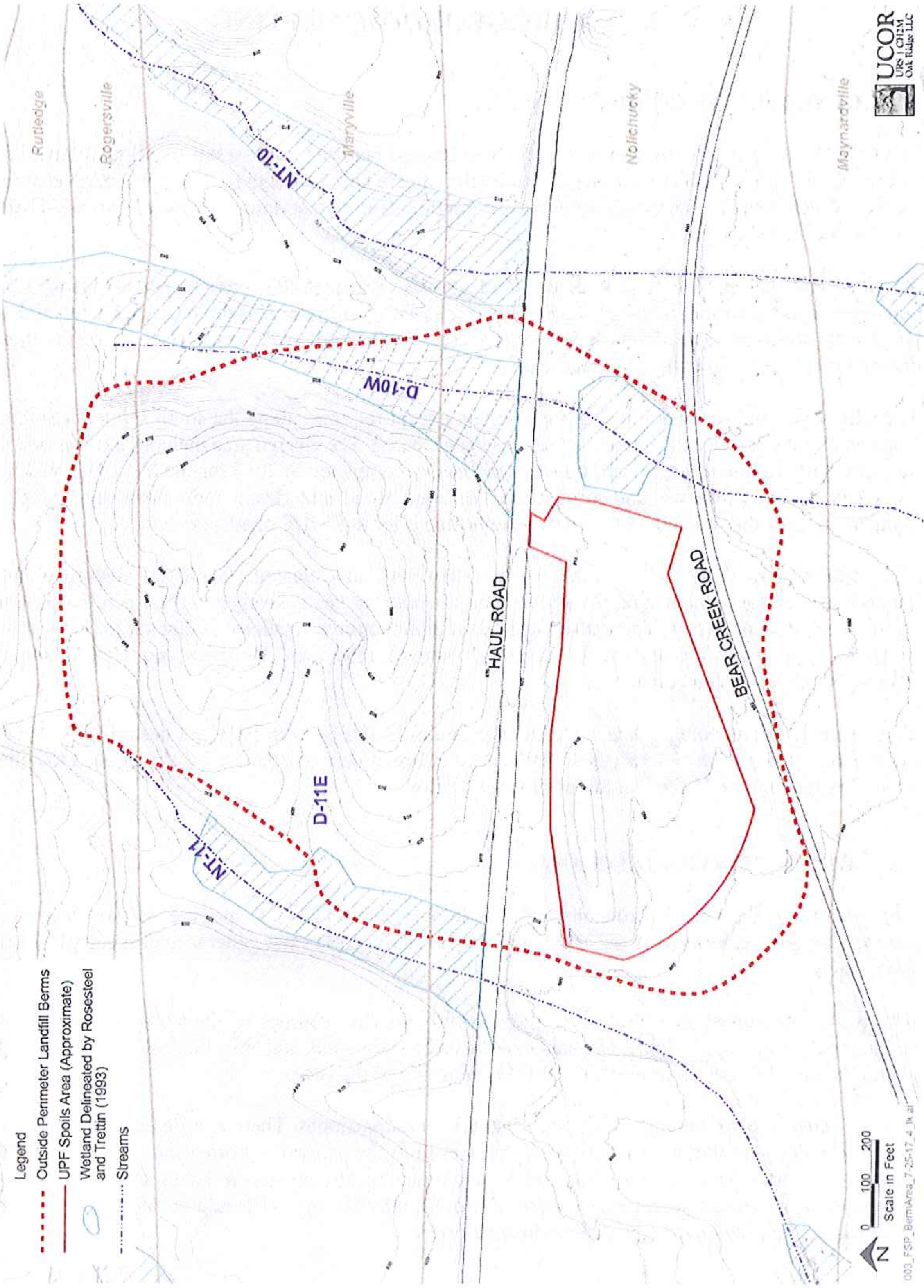


Fig. 2. CBCV site topographic setting.

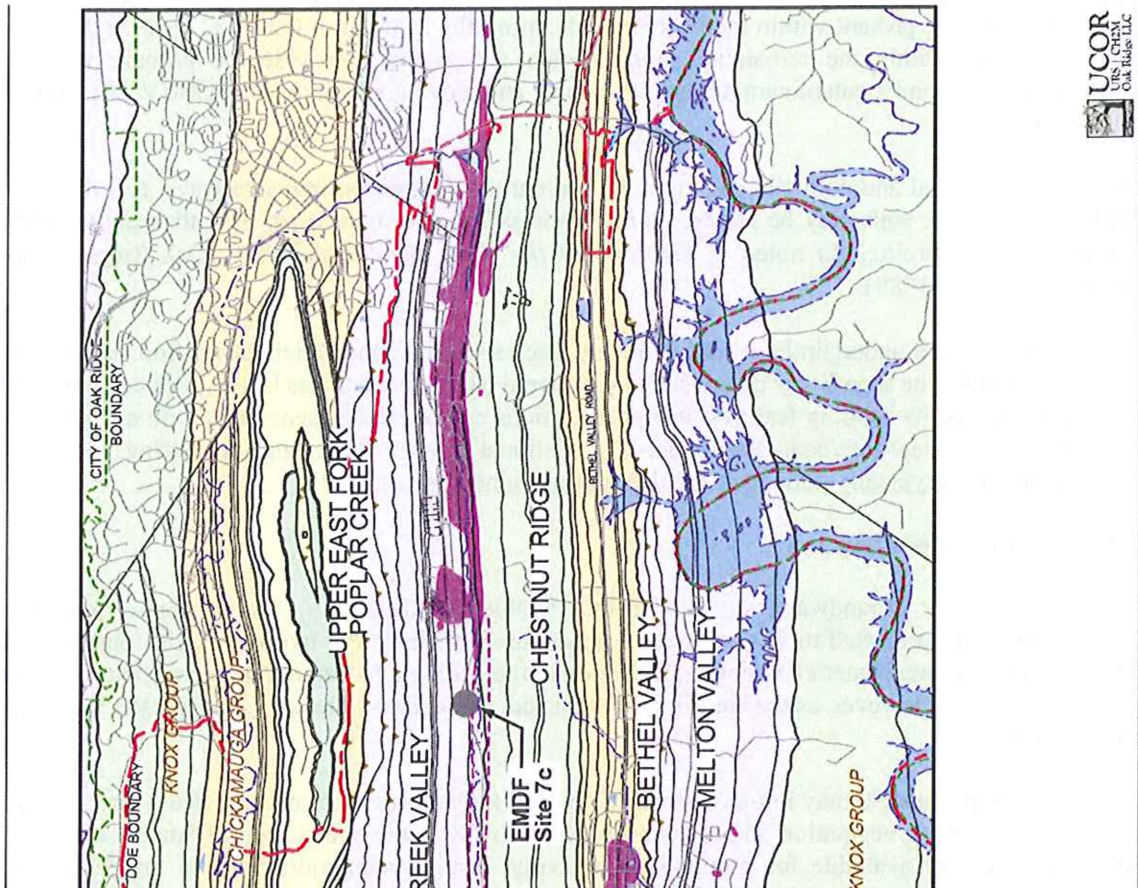


Fig. 3. General geology of the Bear Creek Valley.

In BCV, the average dip of the formations is 45° southeast (Fig. 4). Some microfolds to mesofolds are present. Fractures are present within the bedrock and control the location of the NTs. These fractures and macro/micropores within the remaining soils/saprolite and bedrock provide the primary routes for groundwater flow (and contaminant transport) below and downgradient of the CBCV site footprint (DOE 2016).

Thin layers of alluvial and colluvial soils may be present along streams, drainage ways, and the base of steeper slopes. These soils may be looser, more compressible, and more permeable than the underlying residual soils or saprolite. As noted in *Geology of the West Bear Creek Site* (Oak Ridge National Laboratory [ORNL] 1989):

> "The soils are underlain by a comparatively thick saprolite zone which varies from 10 to 20 ft thick. The saprolite is composed of weathered bedrock which has lost its rock cement but retained its bedding features. Its upper portions can be readily penetrated with a hand auger. The saprolite/bedrock contact is gradational due to decreasing weathering with depth but is typically defined as the depth of machine auger refusal."

2.2.1 Groundwater Elevation

There are no current groundwater elevation data available for the CBCV site. Available groundwater elevation data were projected to this site from adjacent areas with similar hydrogeologic conditions. The current projected groundwater elevations and relation to the geologic buffer and projected bottom of waste are shown in Fig. 5. However, as the landfill is constructed, the surface water and groundwater flow regime will be modified.

Construction of the landfill may initially result in elevated groundwater elevations if heavy precipitation is encountered following vegetation and topsoil removal. However, the completion of landfill construction will reduce the area available for groundwater recharge from precipitation. Topsoil materials will be removed and replaced with engineered fill and geologic buffer clays that will reduce infiltration. While groundwater within undisturbed in situ natural materials will continue to migrate downgradient, the elimination of significant portions of the former natural recharge area will greatly reduce the overall groundwater flux. As a result, the groundwater elevation will be reduced and will be maintained lower than the geologic buffer, including reduction to the elevation of the groundwater mound below the central knob/spur ridge (DOE 2017, Appendix E).

2.2.2 Potential for Karst Features

Karst features such as sinkholes, sinking streams, and resurgent springs have not been documented within the formations underlying the proposed footprint of the CBCV site. Karst features are documented within the Maynardville outcrop belt south of the CBCV site. Contact between the Nolichucky Shale and Maynardville Limestone is located approximately 300 ft from the proposed southernmost waste limit (DOE 2017).

2.3 SURFACE WATER HYDROLOGY

The CBCV site surface water systems are fed by precipitation, surface runoff and shallow stormflow, and both shallow and deeper groundwater that discharges via springs and seeps. In areas underlain by Conasauga Group shales, as much as 90 percent of the water entering the groundwater system flows rapidly through highly porous, shallow soil. In areas underlain by soluble, massive carbonate bedrock of the Maynardville Limestone, a larger fraction of the water enters the groundwater system by conduit flow through deeper flow pathways (DOE 2016).

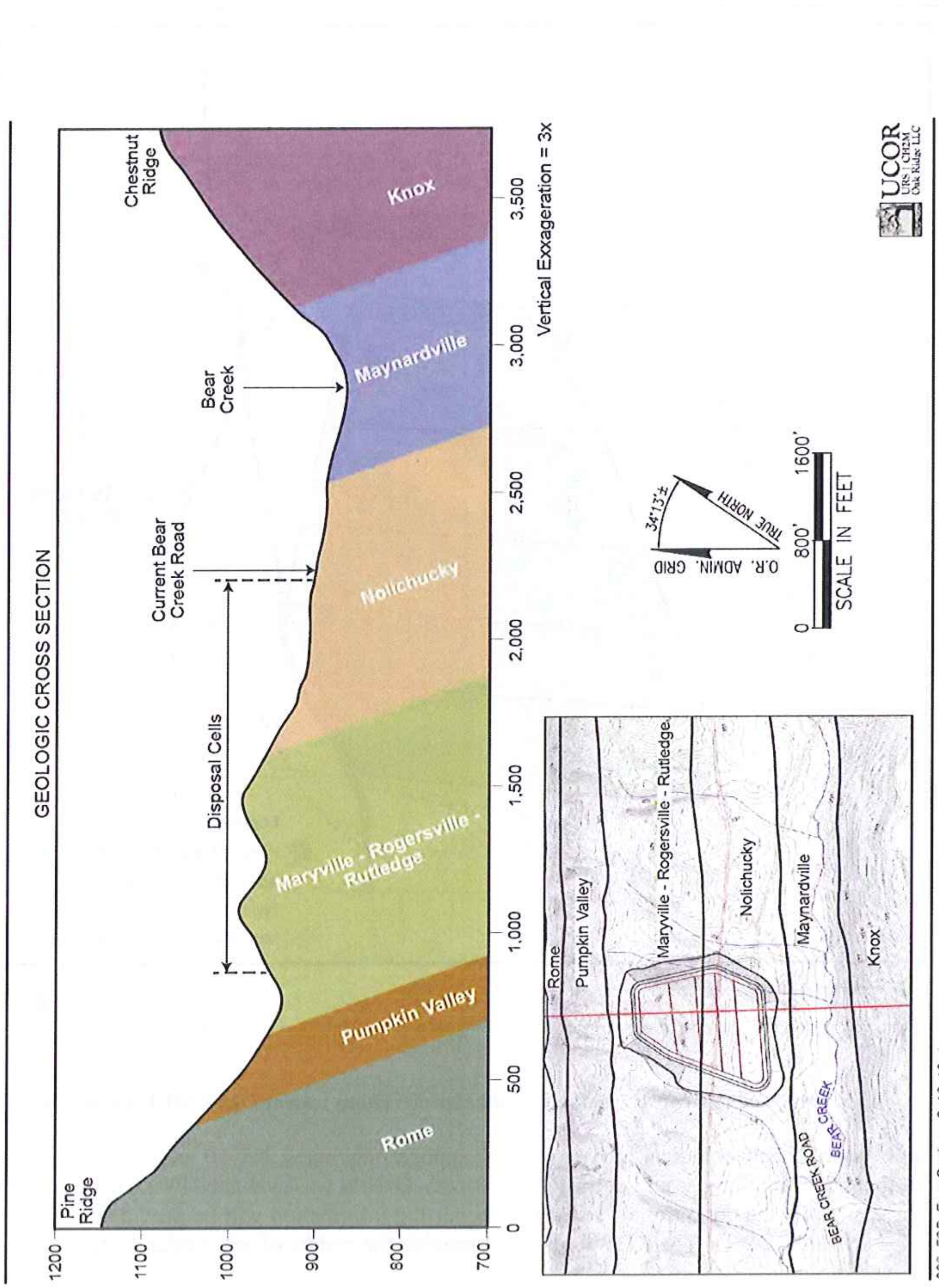


Fig. 4. Generalized cross-section of the CBCV site.

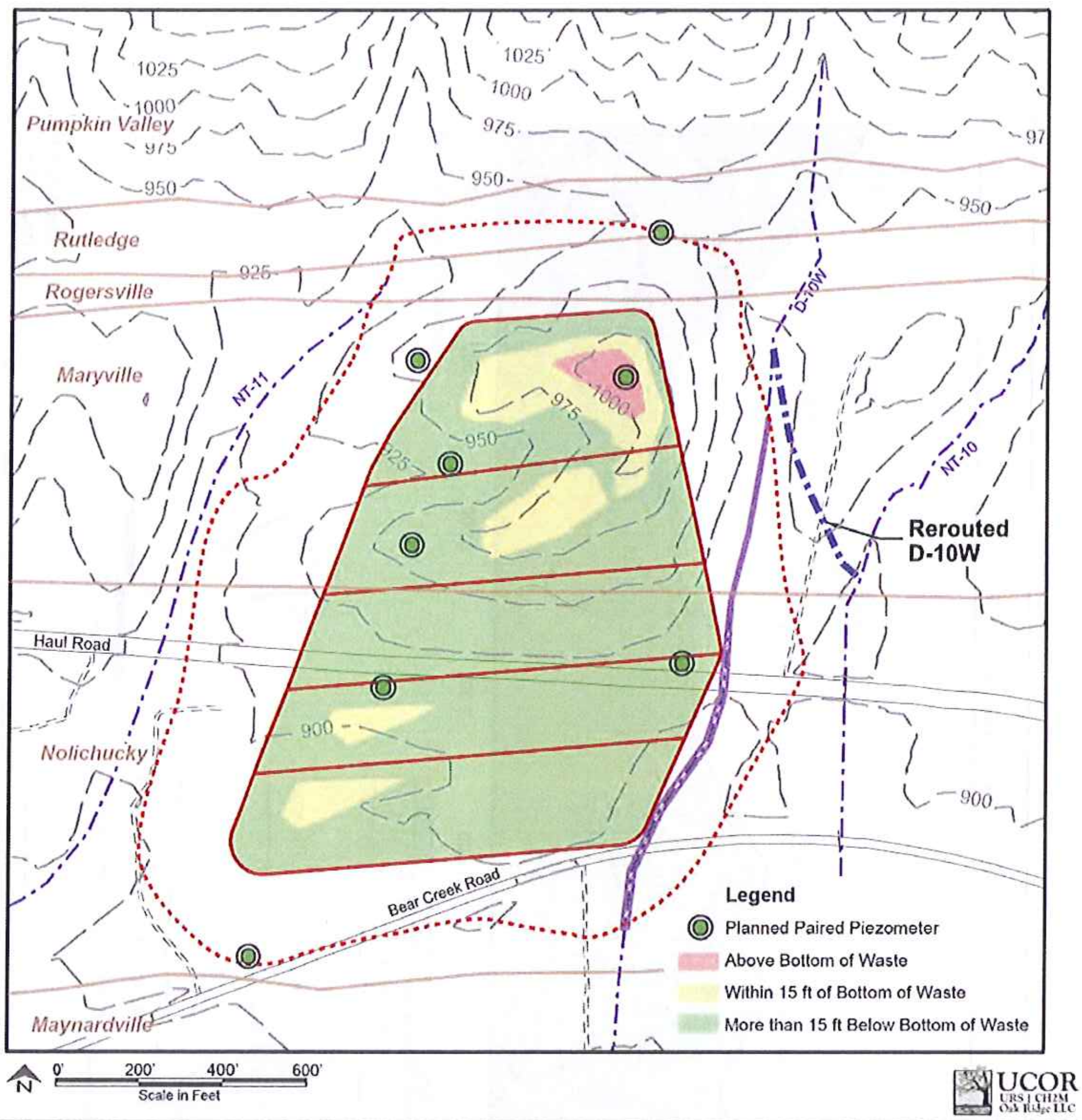


Fig. 5. Projected pre-construction groundwater elevations beneath the EMDF waste cells.

Based on existing U.S. Geological Survey (USGS) topographic maps, NT-10 and NT-11 are considered blue line streams. In addition, as part of the RI/FS process, D-10W was evaluated by a Qualified Hydrologic Professional and met the definition of a stream. Supporting information will be provided in the Remedial Design Work Plan (RDWP). The RDWP also will provide the results of any wetlands determinations for this area.

2.3.1 Surface Flow Data

Continuous flow monitoring data are not available for NT-10, NT-11 or D-10W. The available USGS base flow data indicate that base flow is continuous along the D-10W and NT-11 stream channels during the winter/spring non-growing wet season. During the summer/fall growing season with warm and often dry conditions, base flow is negligible and limited to pulsed flow associated with significant storm rainfall events. Flow monitoring for Bear Creek downstream of CBCV site indicates continuous flow in Bear Creek (DOE 2017).

Wet season base flows are relatively low along D-10W and vary from 0.01 cfs (4.5 gpm) at a headwater location to a maximum rate 0.04 cfs (18 gpm) southeast of the site. Wet season base flows along NT-11 are slightly higher ranging from 0.01 cfs (4.5 gpm) at a headwater spring location to 0.14-0.16 cfs (63-72 gpm) southwest and downstream of CBCV site (DOE 2017).

2.3.2 CBCV Site Preliminary Investigation

A limited site walkover of surface water conditions at the CBCV site was conducted on July 7, 2016, by a subject matter expert (SME) from the URS | CH2M Oak Ridge LLC (UCOR) Water Resources Restoration group to observe stream channels and other relevant features of NT-10, D-10W, and NT-11. The site visit occurred approximately 2-3 hours after a thundershower and following approximately 0.8 in. of rain the previous day.

The areas of the three surface water basins between the crest of Pine Ridge on the northwest and the geologic contact between the Maynardville Limestone and the Nolichucky Shale on the southeast are shown in Fig. 6. The Maynardville/Nolichucky geologic contact is recommended as the most downstream flow measurement location because further downstream surface water tends to sink into the Maynardville karst, causing a low bias to the flow data.

The NT-11 stream channel in the Nolichucky Shale outcrop area typically has a discontinuous outcrop of somewhat weathered bedrock (Figs. 7 and 8).

The walkover included NT-11 from approximately the "dog-leg" bend in the Nolichucky Shale to its head of flow in the Rogersville Shale. Next, the walkover route crossed the saddle to D-10W and proceeded southeast to approximately the Haul Road, across the weak ridge in the Maryville Limestone, and into the lower NT-10 basin above the Haul Road. Surface water features in these areas were difficult to see due to the heavy vegetation that covers much of the area to the southeast and along the Haul Road.

The CBCV site area slopes to the south-southeast. As described in the *Oak Ridge Reservation Physical Characteristics and Natural Resources* (ORNL 2006), sloping land surfaces on the ORR exhibit the characteristics of hillslope hydrology. In undisturbed, naturally vegetated areas such as the CBCV site, an estimated 80 to 90 percent of precipitation is captured and discharged from the 3- to 6.5-ft (1- to 2-m) storm-flow zone/root zone and does not infiltrate into the groundwater table. During November through March when plants are not consuming water and shallow soils are saturated, lateral drainage of water occurs on slopes through macropores (e.g., holes left by the decay of dead plant roots and animal burrows) as well as through vertical seepage to the water table through pervious zones (Clapp 1997).

Several noteworthy soil macropore and channel features were observed in the upper 3 ft of soil in the Nolichucky Shale. A shallow macropore/soil channel that transmits percolation water from soils on the east to the NT-11 stream channel in the Nolichucky Shale outcrop area is shown in Fig. 9. Overland surface water flow into a soil macropore/channel is shown in Fig. 10. The location where that subsurface channel is daylighted a short distance downstream due to collapse and downstream transport of shallow soils is shown in Fig. 11. There was a small amount of water flow emanating from the channel as shown in Fig. 11. This feature joined another branch of subsurface flow from an unnamed western valley. These types of soil drainage features are common in undisturbed ORR soils and are a part of the stormflow system that rapidly conducts percolation water laterally downslope to stream channels.

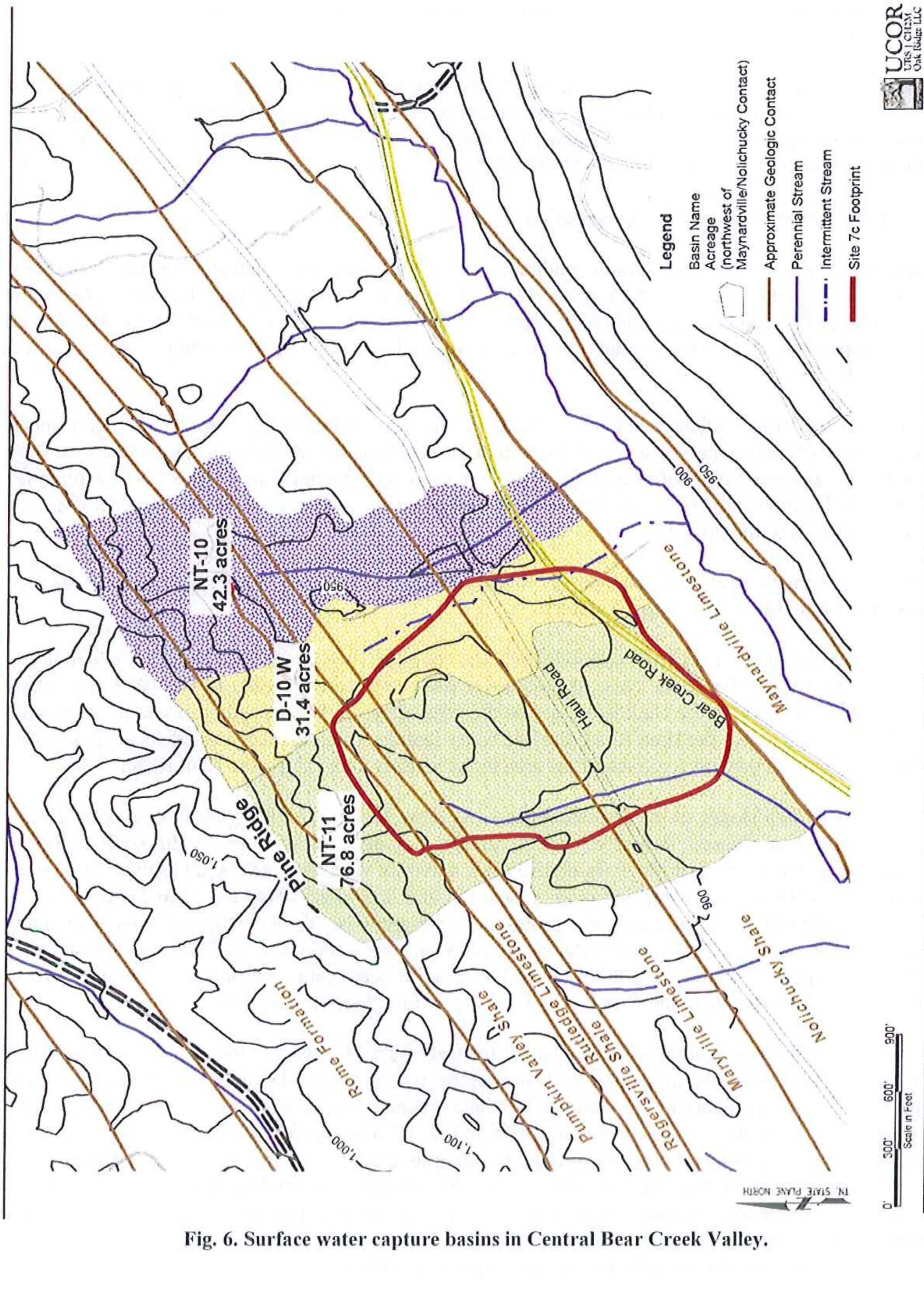
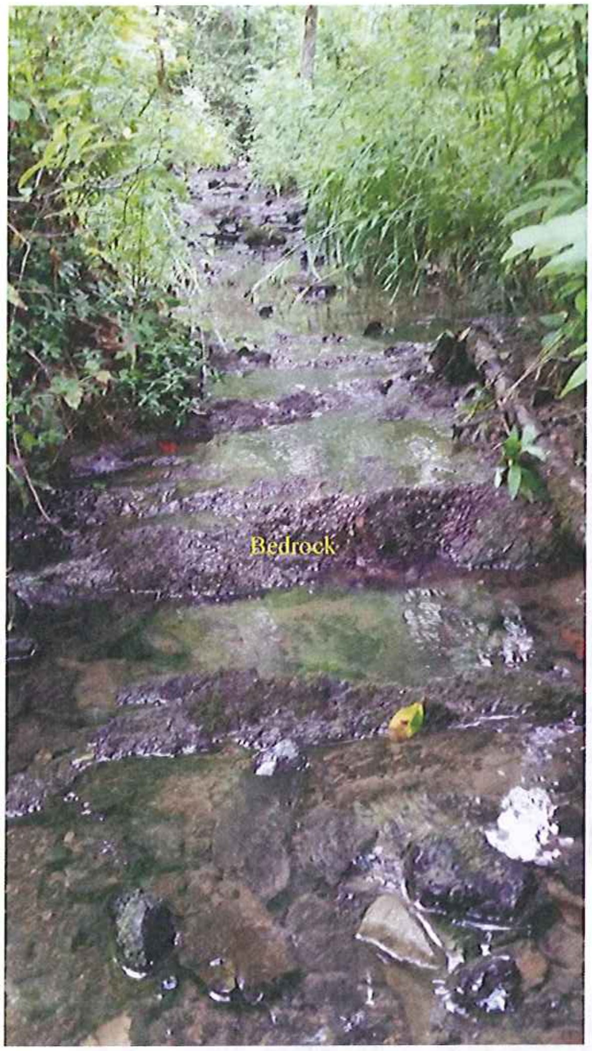


Fig. 6. Surface water capture basins in Central Bear Creek Valley.



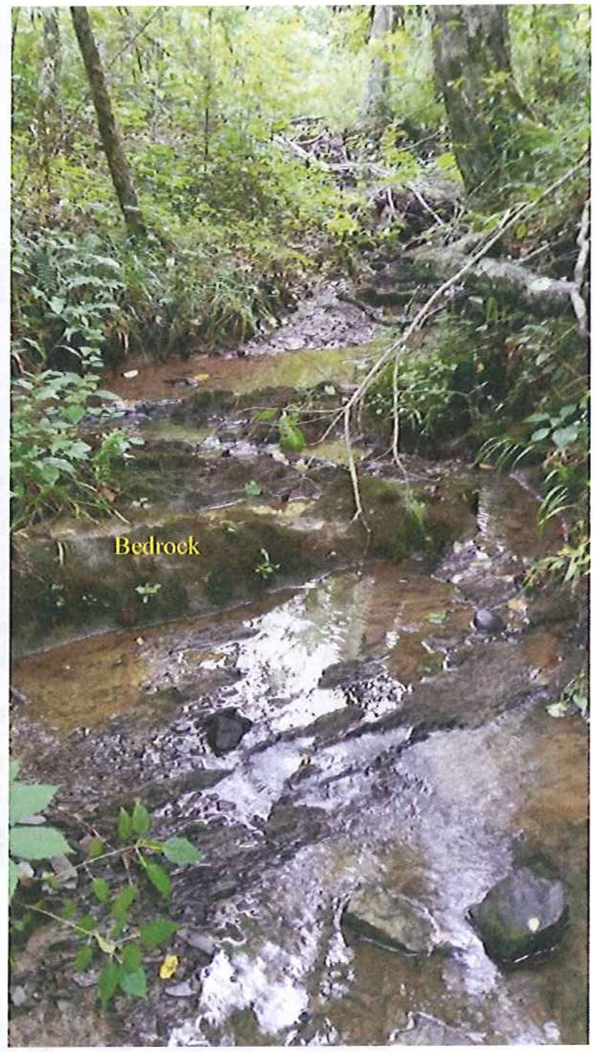


Fig. 7. Bedrock observed in the Nolichucky Shale outcrop area of the NT-11 stream channel.

Fig. 8. Nolichucky Shale outcrop in NT-11 stream channel.

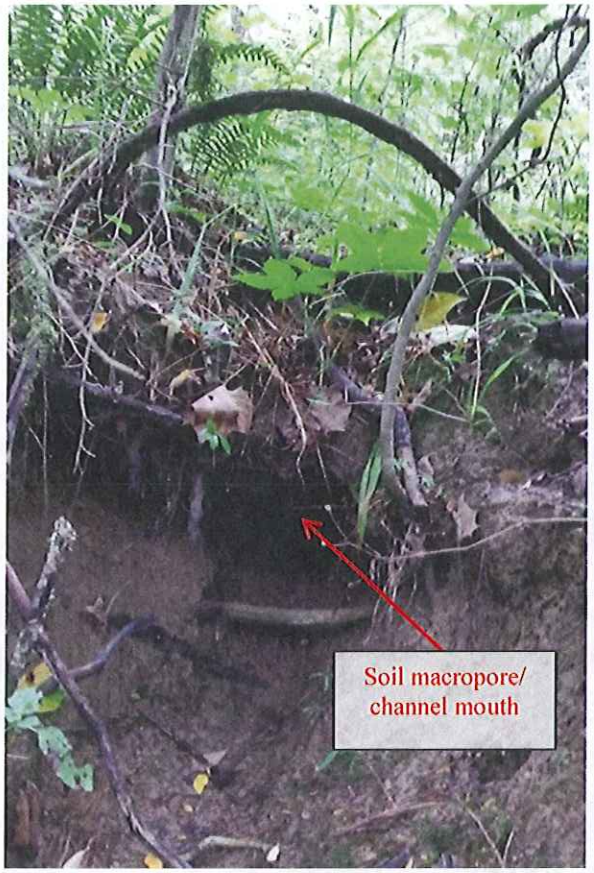


Fig. 9. Large macropore channel in soil.

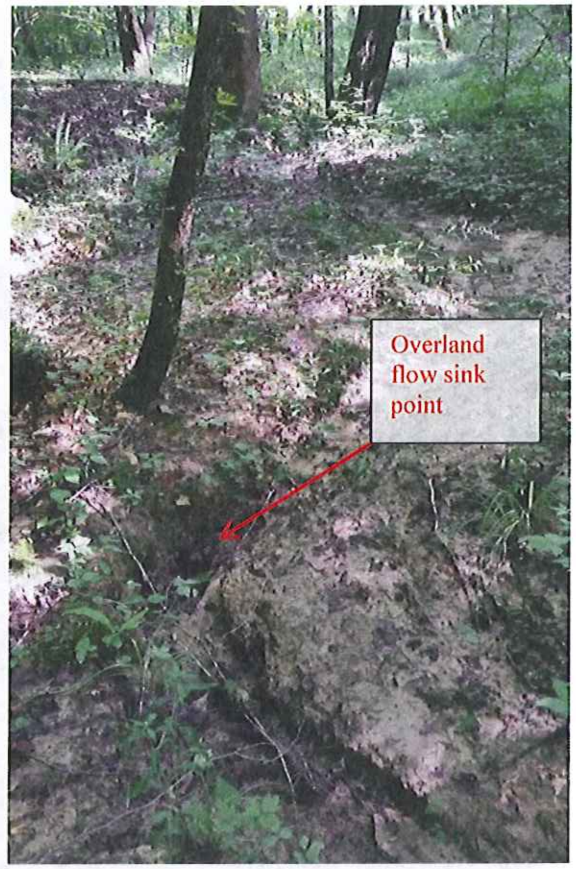


Fig. 10. Overland flow inlet to soil channel.

Fig. 11. Headwater soil channel daylighting point.

The east-west valley draining to NT-11 (Figs. 2 and 6), also referred to as D-11E, located on the western slope of the high knob in the Maryville Limestone, was inspected for evidence of surface water features. It was apparent that overland flow occurs in the valley, however, no defined surface water channel was observed.

A well-established surface channel approximately 1-ft wide by 1-ft deep was encountered in the D-10W valley. The channel contained isolated pools of standing water, but no flow was occurring. The D-10W valley is approximately 50 percent less incised than the adjacent NT-10 and NT-11 valleys and has a much narrower headwater basin.

2.4 SITE CONCEPTUAL MODEL

Key general elements of the site conceptual model for the EMDF CBCV site are shown in Fig. 12.

The majority of flow from upland areas is directed towards the valley axis by the north tributaries. Groundwater in bedrock that does not discharge directly to surface water (e.g., within a confined system) has an upward gradient because of the pressure gradient of recharge from Pine Ridge and discharges into the Bear Creek–Maynardville Limestone drainage system.

Bear Creek flows more or less continuously over non-karst bedrock, but loses flow to subsurface conduits where it crosses karst features in the Maynardville Limestone. Underflow conduits in the Maynardville Limestone continuously convey base flow, while overflow conduits and Bear Creek carry high flows during the wet season and heavy rainfall events.

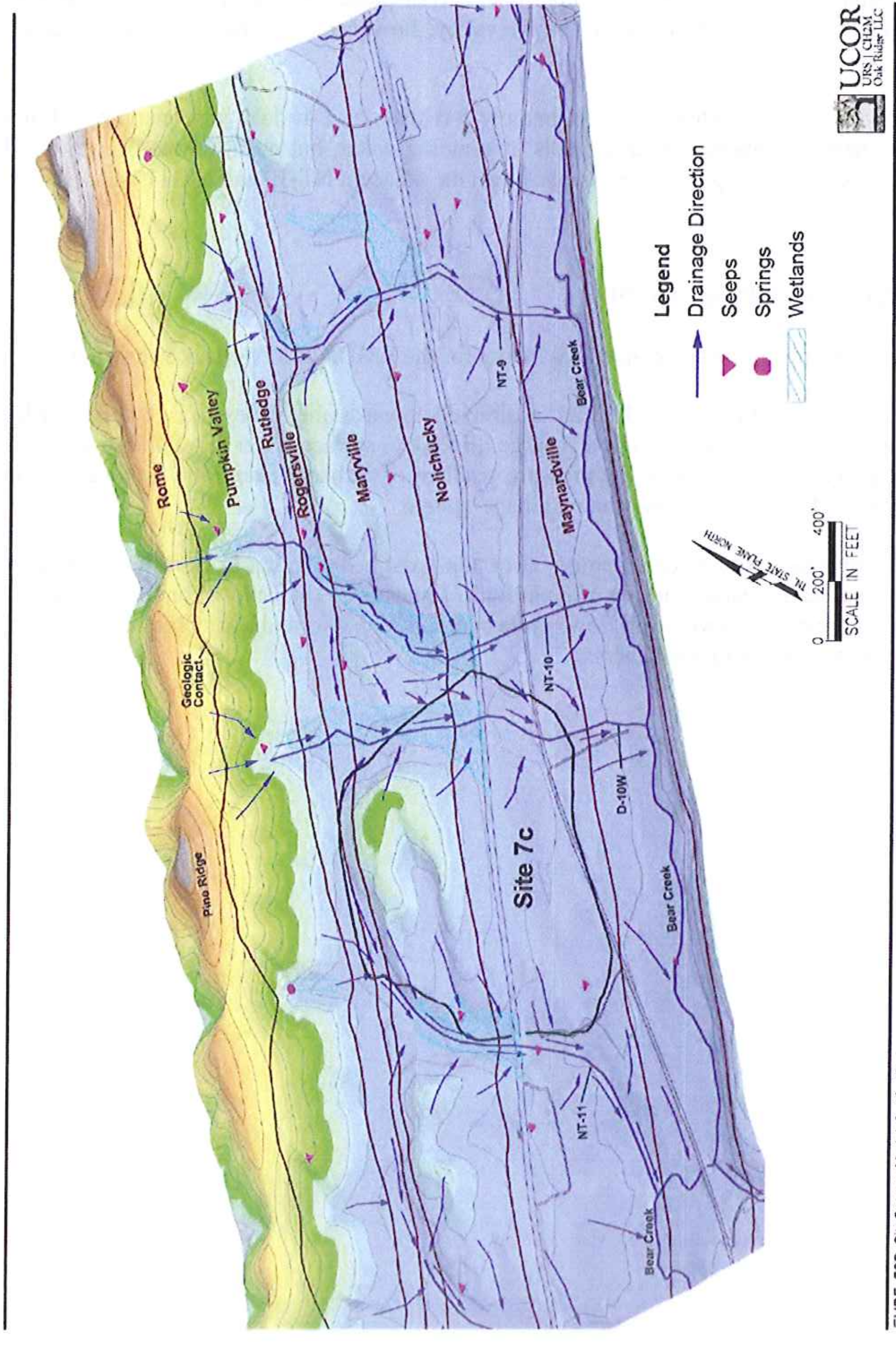


Fig. 12. Generalized flow paths for shallow/intermediate groundwater toward Bear Creek.

3. PROJECT ORGANIZATION

The organizational structure for this project is presented in Fig. 13.

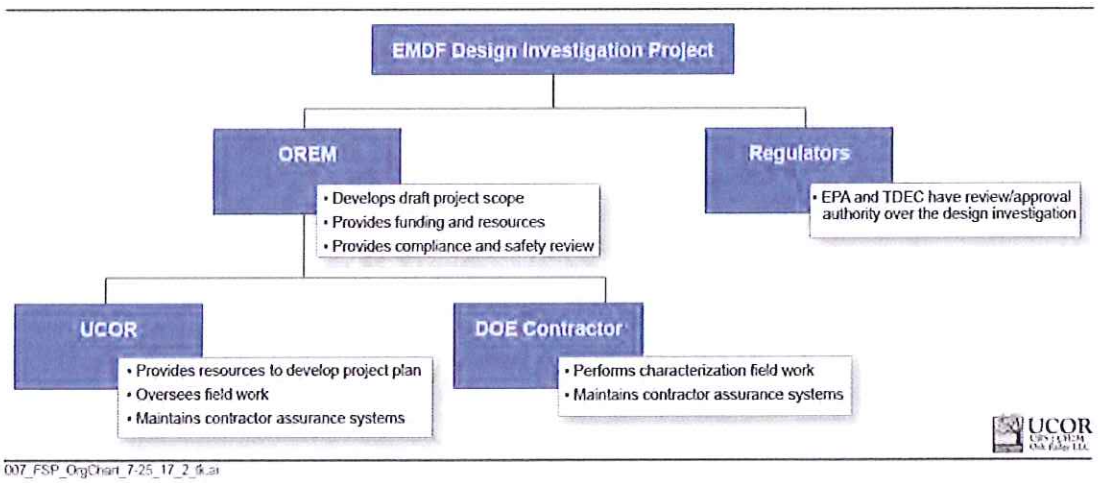


Fig. 13. Project organization.

OREM or their designees are responsible for ensuring that the field activities are performed as described in this plan. OREM expects to fulfill these responsibilities through UCOR or other contractor staff, with additional review, oversight, and guidance provided by OREM personnel to ensure these activities are performed safely and compliantly. Additional information on the project organization is provided in the QAPP (Appendix A, Sect. A.2).

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4. DATA QUALITY OBJECTIVES

This plan builds upon previous activities and, through the use of the DQO process (EPA 2006), identifies data needs that become the focus for this investigation. The DQOs are summarized in Tables 1 through 3.

Table 1. DQO summary for groundwater data acquisition

DQO step	Groundwater data for design
State the Problem	The CBCV site is being proposed for disposal of soils and demolition debris that may contain mixed metals, PCBs, and radioactive constituents (Fig. 1). Additional contaminants (e.g., volatile organic compounds) could also be present in materials disposed in EMDF. If the proposed lined waste disposal facility fails, then those constituents could migrate to groundwater and eventually to surface water in Bear Creek, where they may pose a risk to human or ecological receptors.
Identify the Decision (the Design Criteria)	Design criteria for hydrogeologic (groundwater) conditions at the CBCV site include maintaining groundwater elevations beneath a geologic buffer at least 10 ft below the liner system. The FS assumes that the predicted pre-construction groundwater table may be higher than this design criterion. The principal study questions include (1) Where is the natural seasonal high groundwater table and where does it currently encroach into the design elevations? (2) Where groundwater is higher than the design criteria, will design adjustments will be required (e.g., increased elevation of the liner system)? (3) Are subsurface pathways present with relatively higher hydraulic conductivities? (4) Where is the Maynardville contact with the Nolichucky? and (4) Where surface water diversions are used, what is the predicted groundwater flow to be captured and how does the permeability of unconsolidated material above bedrock affect that flow? Note: The FS design assumes that groundwater is uncontaminated and may be discharged directly to surface water without treatment.
Identify Inputs to the Decision (to the Design Calculations)	For determining where the seasonal high groundwater table may encroach into the design elevations, the following design information is needed: • Seasonal high groundwater table (potentiometric surface, piezometric levels, or static groundwater pressures) across the site • Adjustment for post-construction conditions For determining the location of the Maynardville Formation sufficiently for the design: • Bedrock stratigraphy at the surface and beneath the site • Field walkdowns to identify contact between the Nolichucky and Maynardville Formations For determining the predicted groundwater elevation and flow to surface water diversions sufficient for the design purposes, the following is needed: • Hydraulic conductivity, soil stratigraphy, and hydraulic gradients/groundwater flow rates (both horizontal and vertical) in the regolith and bedrock beneath the site
Define the Study Boundaries	The spatial boundaries of the study are hydraulic divides (e.g., Pine Ridge upgradient of EMDF to the north, NT-10 stream to the east, NT-11 to the west, and Bear Creek to the south). The vertical subsurface boundary extends into the uppermost bedrock below the proposed liner to assess vertical gradients. The temporal boundaries of the study are seasonal hydrologic changes that would affect the groundwater table and groundwater flow, including (1) typical wet precipitation season/anticipated high groundwater season (December-April) and (2) typical dry season (August-October). Piezometers installed in similar conditions at EMWMF, along with associated precipitation data, will be used for long-term monitoring of precipitation and groundwater elevations. Similarly located piezometers at EMWMF will be used to provide input and insight into the conditions at the CBCV site.
Develop a Decision Rule	Design criteria include maintaining a geologic buffer of 10 ft above seasonal high groundwater. The geologic buffer must have a maximum saturated hydraulic conductivity of 10^{-5} cm/sec. In situ materials may be used as part of the 10-ft-thick geologic buffer layer if these are demonstrated to satisfy the conductivity requirement.

Table 1. DQO summary for groundwater data acquisition (cont.)

DQO step	Groundwater data for design
Develop a Decision Rule (cont.)	If the predicted post-construction groundwater table is above the geologic buffer, then the design elevation must be increased or other groundwater control system must be included in the design. If the predicted post-construction groundwater elevations and flows using the planned groundwater controls are insufficient to lower the groundwater table to this allowable level, then the design must be revised to maintain the geologic buffer layer. If the measured hydraulic conductivity is higher than this allowable level (10^{-5} cm/sec), then the design must be modified by raising the liner grades to provide a compensatory thicker geologic buffer for hydraulic conductivity equivalency, increasing the thickness of the clay liner, or other means.
Specify Performance/ Acceptance Limits (Error Range)	Data collection and analyses shall be as established using the ASTM procedures and guidance and UCOR procedures provided in Appendix B, Sect. B.3. The current version of these documents will be used. • Collect core using split spoons or equivalent core collection devices for the deep piezometers continuously throughout the deepest boring at each paired piezometer location, including through the soil and saprolite. Core will be continuously logged/described. • Laboratory samples will provide additional information to correlate with field measurements and recompacted bulk soil samples can be used to replicate as-placed values. Because of the small sample size, these samples may underestimate the permeability of the in situ materials. These sample results will be used in conjunction with the slug tests and FLUTe tests to develop a more complete picture of the hydraulic conductivity present in situ. Potentiometric levels need to be determined to at least 0.1 ft accuracy (objective is 0.05 ft). • FLUTe transmissivity profiling will be used to measure the flow paths from bedrock boreholes that will be developed as piezometers. About 1 percent of the transmissivity remaining below the descending liner at any depth in the hole is the limit of resolution. For that reason, the resolution in the bottom portion of the hole is better than in the upper portion of the hole. Hydraulic conductivities need to be determined within one order of magnitude since the natural variations within the formations are likely high. Spatial variations are not expected to greatly affect design results because of the known low hydraulic conductivities within the residuum. At least 7 locations spatially covering the cell footprint will be appropriate. However, if the measured hydraulic conductivity is variable across the CBCV site, or if there are uncertainties in the hydraulic conductivity due to small sample size, additional protective measures (e.g., a thin layer of low permeability material) may be considered as part of the design in addition to native materials.
Optimize the Design	The regolith (soils/saprolite) stratigraphy will be characterized within the EMDF design area: • Complete 8 boreholes within the EMDF footprint (Fig. 14) to characterize regolith lithology, thickness, and uppermost bedrock interfaces by collecting and logging core samples. Boreholes will extend from the surface to approximately at least 10 ft below the top of bedrock. Test borings will be conducted in accordance with UCOR procedures or equivalent. • Characterize temporal variation in water levels in the shallow and intermediate soils/saprolite currently at the projected elevation of the geologic buffer zone. Locations of new water-level measurement locations are shown in Fig. 14. Piezometers will be screened and sand packed. • Perform laboratory hydraulic conductivity tests on representative undisturbed soil samples. Soil samples subjected to laboratory hydraulic conductivity testing also will be tested to determine grain size, Atterberg limits (liquid limit, plastic limit, and plasticity index), USCS, and specific gravity.

Table 1. DQO summary for groundwater data acquisition (cont.)

DQO step	Groundwater data for design
Optimize the Design (cont.)	• FLUTe testing will be performed in accordance with the vendor's specifications and operating procedures for bedrock piezometers to evaluate hydraulic conductivity and detect zones of relatively higher conductivity (if present). • Piezometer installations will be completed in accordance with UCOR procedures or equivalent. • Water-level measurements will be obtained in accordance with UCOR procedures or equivalent.

ASTM = American Society for Testing and Materials
CBCV = Central Bear Creek Valley
DQO = data quality objective
EMDF = Environmental Management Disposal Facility
EMWMF = Environmental Management Waste Management Facility
FLUTe = Flexible Liner Underground Technologies, LLC
FS = Feasibility Study
NT = North tributary
PCB = polychlorinated biphenyl
UCOR = URS | CH2M Oak Ridge LLC
USCS = Unified Soil Classification System

Table 2. DQO summary for surface water flow data acquisition

DQO step	Surface water data for design
State the Problem	The CBCV site is being considered for disposal of soils and demolition debris that may contain mixed metals, PCBs, and radioactive constituents (Fig. 1). Additional contaminants (e.g., volatile organic compounds) could also be present in materials disposed in EMDF. The proposed footprint is located in an area of several surface water features, including two streams (NT-10 and NT-11) and other natural drainages. The landfill design must address these surface water features adequately to prevent potential impacts to the landfill liner and structure and to prevent a pathway for potential leakage migration and potential risk to human or ecological receptors.
Identify the Decision (the Design Criteria)	Design criteria for surface water conditions at the CBCV site include controlling the stormwater/surface water flow around the facility. The principal study questions include the following: • Does surface water in NT-10, D-10W, D-11E, and NT-11 (Fig. 14) result from precipitation/overland flow, groundwater, or both? This information will be used to determine the appropriate approach for surface water controls. • Are sections of these streams gaining and losing stretches? This information will be used to design appropriate surface water controls. What are the surface water runoff/flow volumes at NT-10, D-10W and NT-11? The calculated runoff (using the estimated runoff coefficient) will be used in conjunction with the groundwater measurements to address the surface water design criteria.
Identify Inputs to the Decision (to the Design Calculations)	The following design information is needed to determine the design for surface water controls: • Surface water capture basin areas, surface water budgets, and potential runoff volumes for NT-10, D-10W, and NT-11 • Location of groundwater seeps, springs, or other sources of groundwater contribution in the channels • Current and predicted groundwater elevations • Site topography and features • Analysis and characterization of the current stream channel morphology to provide guidance as to the dimension, pattern, and profile of any planned diversions for long-term stability • Local climate information

Table 2. DQO summary for surface water flow data acquisition (cont.)

DQO step	Surface water data for design
Define the Study Boundaries	The spatial boundaries of the study are the surface water capture basins as shown in Fig. 6.
Develop a Decision Rule	If localized storm/precipitation events result in storm flows with the streams/drainages of NT-11, NT-10, and/or D-10W, then the design must consider such storm flows in sizing of diversion or surface water conveyances. If shallow groundwater flow results in gaining conditions in the streams/drainages near the perimeter embankments, then the design must consider the vertical and lateral influences of shallow groundwater flow on diversion or surface water conveyances. The proposed data gathered from the site (primarily in the form of surface vegetation, surface soil conditions, site features, and stream measurements) will be used to support an estimate of the runoff coefficient to use in stormwater generation modeling. No specific measurements are proposed to calculate that coefficient. The calculated runoff (using the estimated runoff coefficient) will be used in conjunction with groundwater measurements to address the surface water design criteria.
Develop a Decision Rule (cont.)	If deeper groundwater flow results in encroachment into the geologic buffer, then the design must consider the influences of such deeper groundwater flow on the surface water diversion.
Specify Performance/ Acceptance Limits (Error Range)	Data collection and analyses shall be as established using the UCOR procedures provided in Appendix B, Sect. B.4. The current versions of these procedures will be used.
Optimize the Design	Place surface water flow measurement stations in the Nolichucky Shale outcrop areas in the lower reaches of NT-11. A second surface water flow measurement station will be placed along NT-11, south of the Haul Road, downstream of the estimated EMDF disposal site buffer zone. A third station will be placed upgradient of the estimated EMDF disposal site buffer zone (Fig. 14). Locations will be selected following a site walkover. Place two surface water flow measurement stations in D-10W: (1) downstream of the Haul Road where there is a well defined channel, and (2) downstream of Bear Creek Road downstream of the estimated EMDF disposal site buffer zone in the Nolichucky Shale near the projected Nolichucky Shale/Maynardville Limestone geologic contact (Fig. 14). Perform two detailed site walkovers during the wet season (December-April) to identify seeps, springs, and other expressions of shallow groundwater in NT-10, D-10W, and NT-11. The walkovers will include a description every 50 ft (as safe access allows) and field measurements of temperature, specific conductivity, and pH. Perform two additional site walkovers (May/June) following the wet season to collect field measurements of temperature, specific conductivity, and pH.

CBCV = Central Bear Creek Valley
D = drainage
DQO = data quality objective
E = east
NT = North Tributary
PCB = polychlorinated biphenyl
UCOR = URS | CH2M Oak Ridge LLC
W = west

Table 3. DQO summary for geotechnical data acquisition

DQO step	Foundation analysis
State the Problem	The CBCV site is being proposed for disposal of soils and demolition debris that may contain mixed metals, PCBs, and radioactive constituents (Fig. 1). Additional contaminants (e.g., volatile organic compounds) also could be present in materials disposed in EMDF. If the proposed lined waste disposal facility fails, then those constituents could migrate to groundwater and eventually to surface water in Bear Creek, where they may pose risk to human or ecological receptors.
Identify the Decision (the Design Criteria)	Design criteria for geotechnical foundation and stability analyses at the EMDF site include determining the suitability for construction of the landfill cells, constructed embankments, and support facilities. The analysis principal study questions include (1) What is the bearing capacity of the soils? (2) Where must soil be removed/replaced to support design features? (3) Where can removed soils be used as structural fill? and (4) Will the subsurface conditions support the engineered landfill (embankments) and waste under static loading conditions?
Identify Inputs to the Decision (to the Design Calculations)	The following is used to determine the geotechnical characteristics to support the decisions: • Geotechnical soil parameters, including consolidation properties and stress history, shear strength of in-place and recompacted soils, compaction density (Proctor) of embankment components, and index properties, including moisture contents, Atterberg limits, grain-size analyses, unit weights, and specific gravities. • Geotechnical properties of bedrock, including bedrock strength, compressibility, interface strength, rock type, fracture size and spacing, and RQD. • Groundwater levels and spatial and temporal variations in the soil and bedrock.
Define the Study Boundaries	• The spatial boundaries of the study are shown in Fig. 14. Geotechnical explorations and tests for facility design will extend across the site. Geotechnical explorations and tests for embankment design will focus on the areas beneath the planned embankments. • The vertical subsurface boundary extends into bedrock approximately 10–50 ft below the current ground surface.
Develop a Decision Rule	Design criteria include the following: • If the structural fill meets industry standards (e.g., Tennessee Department of Transportation Standard Specifications) for gradation, plasticity, durability and compactability, then the design is acceptable. If not, then the material must be conditioned or fill must be imported. • If the magnitude and rate of both differential and total settlement of underlying materials meets industry standards, then the design is acceptable. If not, then the material must be conditioned or fill must be imported. • If the static factor of safety against embankment failure is ≥ 1.5 for long-term conditions, then the design is acceptable as proposed. Otherwise, the design or underlying materials must be modified to meet the embankment global stability requirements.
Specify Performance/ Acceptance Limits (Error Range)	• Data collection and analyses shall be as established using the ASTM guidance/test methods provided in Appendix B, Sect. B.5.2. • Geotechnical laboratories must be accredited by the U.S. Army Corps of Engineers or American Association of State Highway and Transportation Officials for the specific ASTM laboratory testing procedures referenced in this field sampling plan (Appendix B, Sect. B.5.2). • Vertical variations are expected to affect design results with depth and soil type; test locations on 5-ft intervals are adequate to bound this error.

Table 3. DQO summary for geotechnical data acquisition (cont.)

DQO step	Foundation analysis
Optimize the Design	1. Characterize soils/saprolite and bedrock stratigraphy within the EMDF design area using subsurface information gathered from the core obtained from the hydrogeologic borings. In addition, historical geotechnical information from previous studies performed for EMWMF and other projects in Bear Creek Valley in similar geology will be used, as appropriate. Proposed locations are shown on Fig. 14. 2. SPTs will be performed in piezometer boreholes. Each borehole will be drilled to machine refusal, followed by core drilling to a depth of at least 10 ft into slightly weathered to fresh bedrock. It is anticipated soil drilling depths will vary from about 10-30 ft and the total depths of the geotechnical borings (soil drilling plus rock coring) will vary from about 20-50 ft. The boreholes will be used to characterize the regolith (soils/saprolite) and uppermost bedrock layers. 3. Laboratory index tests (e.g., Atterberg limits, grain-size analyses, moisture contents, unit weights, and specific gravities) will be conducted on disturbed and undisturbed soil samples as shown in Appendix B, Sect. B.5.2, including from each distinct soil type. In addition, laboratory corrosion tests will be performed on several representative samples of soil/saprolite. 4. Characterize the shear strength and compressibility properties of soils as follows using the ASTM guidance/test methods and UCOR procedures provided in Appendix B, Sect. B.5.2. 5. SPT data will be used to estimate shear strength and compressibility properties of the soils/saprolite. In addition, laboratory shear strength and consolidation tests will be performed on representative soil samples. 6. Relatively undisturbed samples will be obtained from soil borings using a thin-walled (Shelby) tube sampler (Appendix B, Sect. B.3). Undisturbed soil samples are needed to perform laboratory unit weight, shear strength, hydraulic conductivity (previously described), and consolidation testing of in-place soils. Recovery and sample quality can be poor in harder, rocky residual soils, which will require care and multiple sample attempts to acquire sufficient quantities of undisturbed samples for laboratory testing. Typically, the saprolite is too hard to obtain undisturbed samples by pushing Shelby tubes. Previous experience indicates soil cores of the saprolite obtained by Dennison and Pitcher samplers are not testable in the laboratory because the saprolite retains the structure of the parent bedrock and is very weak along the numerous bedding planes, joints, and fractures. However, the in-place saprolite behaves as a weak rock and is significantly stronger than the overlying soils. Strength and compressibility properties of the saprolite can be determined based on its Geologic Strength Index or other published correlations. 7. Laboratory consolidated-undrained triaxial testing will be performed on both recompacted and undisturbed samples (Appendix B, Sect. B.5.2). 8. Laboratory testing will be performed to determine if soil compressibility characteristics may be performed on both recompacted and undisturbed samples (Appendix B, Sect. B.5.2). 9. Prior to extrusion of undisturbed soil samples, the thin-walled tubes will be subjected to X-ray imaging to identify candidate zones for testing and avoid zones with disturbance, voids, large pieces of gravel (or weathered rock), and natural or induced fissures or shear planes that may interfere with testing. 10. The number of tests may be adjusted depending on the type and condition of materials encountered and the location of bedrock. 11. Undisturbed soil samples will be collected in offset borings based on review of the SPTs recorded in the geotechnical, hydrogeological, and seismic borings. Based on previous experience in Bear Creek Valley, it is anticipated direct push will only be possible in the upper approximately 5-10 ft bgs. Typically, below these depths, the residual soils are too hard to obtain undisturbed soil samples by pushing thin-walled tubes. Push tubes will not work well in these materials and recoveries are at best 75-85 percent in the upper portions.

Table 3. DQO summary for geotechnical data acquisition (cont.)

DQO step	Foundation analysis
Optimize the Design (cont.)	12. Characterize moisture-density relationship of sampled soils (compaction, moisture content, specific gravity) as follows using the ASTM guidance/test methods and UCOR procedures provided in Appendix B, Sect. B.5.2. • Disturbed samples obtained from auger cuttings and representative of each unique soil type will be selected for testing for compaction and specific gravity. • The number of tests may be adjusted depending on the type and condition of materials encountered and the location of bedrock. 13. Obtain properties of bedrock as follows: • Rock type, hardness, weathering, bedding, discontinuities, fracturing, percent core recovery, and RQD will be obtained during core logging and borehole logging. • Uniaxial compression with measurement of elastic modulus laboratory tests will be performed on selected bedrock cores as described in Appendix B, Sect. B.5. Rock core specimens subjected to compressive strength testing also will be tested to determine unit weight and "as-received" moisture content. 14. Sample packaging and shipping will follow the ASTM guidance/test methods provided in Appendix B, Sects. B.5.1 and B.5.2. 15. Groundwater levels will be measured in the boreholes during drilling and taken from piezometers as part of the hydrogeologic investigation.

ASTM - American Society for Testing and Materials
bgs = below ground surface
CBCV = Central Bear Creek Valley
DQO = data quality objective
EMDF = Environmental Management Disposal Facility
EMWMF = Environmental Management Waste Management Facility
PCB = polychlorinated biphenyl
RQD = rock quality designation
SPT = standard penetration test
UCOR = URS | CH2M Oak Ridge LLC

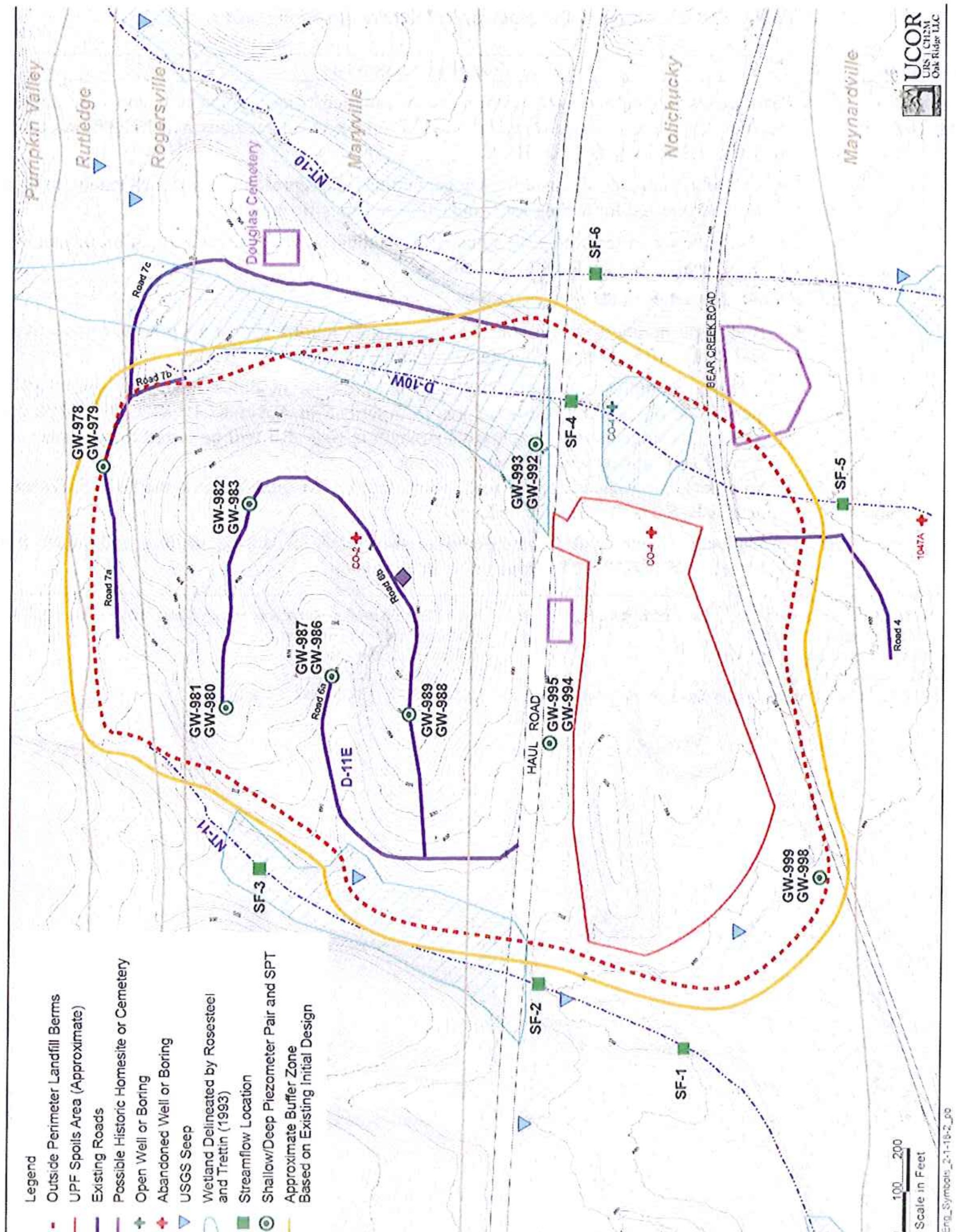

Fig. 14. Approximate Phase 1 measurement and testing locations for CBCV site.

5. INVESTIGATION SCHEDULE/APPROACH

The investigation schedule will depend on the availability of specialty subcontractors and the site-specific conditions encountered. The field activities can be performed in phases, with only a subset of activities performed at any given time. However, the following sequence is anticipated for Phase 1 work during the first half of calendar year 2018:

- Procurement of specialty contractors (as required for the investigation phase)
- Development of specific project plans, work control documents, and internal work permits (e.g., excavation/penetration permits)
- Hold point – ensure project plans, work control documents, specialty contractors and designated personnel qualifications and training meet the requirements in the Field Sampling Plan and QAPP, including the DQOs, prior to performing specified work scope
- Performance of two walkovers and evaluation of surface water – Winter 2018
- Performance of two walkovers and evaluation of surface water following the wet season– May/June 2018
- Mobilization of specialty contractors (as required for the investigation phase) – Winter 2018
- Installation of surface water flow meters (independent activity from drilling, may occur before, during, or after drilling) – Spring 2018
- Drilling for piezometers and geotechnical samples, and geotechnical samples collected during drilling operations – Winter/Spring 2018
- Downhole hydrogeologic testing (Flexible Liner Underground Technologies, LLC [FLUTe] and slug tests) – Winter/Spring 2018
- Installation of piezometers – Winter/Spring 2018
- Plugging and abandonment of open boreholes (if any) – Spring 2018
- Demobilization – Spring 2018
- Monitoring (following piezometer installation) – March-April 2018 (monitoring will continue through February 2019, with results documented in Technical Memorandum 2 [will be available prior to the RDWP]; preliminary data will be made available to the FFA parties as it becomes available)
- Technical Memorandum 1 – March-April 2018 (data will be added to the Administrative Record prior to completion of the Proposed Plan)

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6. SAMPLING REQUIREMENTS AND DOCUMENTATION

The approximate investigation locations are presented in Fig. 14. Actual investigation locations and support facility footprints will be determined in the field based on existing site conditions. The subsurface sampling locations are summarized in Table 4. Locations will be surveyed by a licensed land surveyor, including horizontal position and ground surface elevation at each piezometer within 0.1 ft and top-of-casing elevation of each piezometer within 0.01 ft.

All field activities shall comply with UCOR procedures or equivalents, including, but not limited to, environmental safety and health, radiation control, facility management, access, excavation/penetration permits, and waste management. The project-specific QAPP (Appendix A) developed for both the current planned activities and for future planned activities will implement quality assurance (QA) requirements for use in sample collection, laboratory analysis, and data management of groundwater assessments, geotechnical testing, and geophysical studies needed to support design of the proposed EMDF.

These requirements ensure that appropriate levels of QA and QC are achieved and maintained. This plan identifies the procedures that will be followed in the collection, custody, and handling of samples as well as environmental/laboratory data used in the Field Sampling Plan.

The investigation approach and measurement and testing requirements are provided in Appendix B, along with the procedure, test method, or guidance that will be used to obtain data from the specified location.

Documentation requirements are provided in Sect. 9.

6.1 GROUNDWATER EVALUATION

To support the design, groundwater levels and hydraulic conductivity measurements will be required from the uppermost aquifer. Groundwater data acquisition will be performed with oversight by a qualified geologic technician or geologist under the supervision by a senior hydrogeologist.

6.1.1 New Piezometers

Eight pairs of shallow/intermediate piezometers will be installed to monitor the geologic buffer zone within the cell boundary (Fig. 14).

The estimated horizontal buffer zone around the EMDF waste cells is provided in Fig. 14. As defined in TDEC 0400-20-11-.03 the buffer zone is "portion of the disposal site that is controlled by the licensee and that lies under the disposal units and between the disposal units and the boundary of the site."

The buffer zone is estimated based on the design presented in the FS and will be refined as the engineering design is developed. As currently drawn, this estimated buffer zone is sufficient for monitoring and future remedial actions (if necessary).

The piezometer along the southern boundary of the disposal cell berms will provide downgradient groundwater elevations. No wells are located within the area south of the Haul Road, currently occupied by the UPF Spoils Area (as designated on Fig. 1), to avoid interfering with ongoing operations.

Table 4. Summary of subsurface sample collection locations

Location	Deep piezometer	Shallow piezometer	Residuum and bedrock core	Slug tests	FLUTe	GW levels	SPTs	Potential geotechnical lab samples
GW-978	•		•		•	•	•	•
GW-979		•		•		•		
GW-980	•		•		•	•	•	•
GW-981		•		•		•		
GW-982	•		•		•	•	•	•
GW-983		•		•		•		
GW-986	•		•		•	•	•	•
GW-987		•		•		•		
GW-988	•		•		•	•	•	•
GW-989		•		•		•		
GW-992	•		•		•	•	•	•
GW-993		•		•		•		
GW-994	•		•		•	•	•	•
GW-995		•		•		•		
GW-998	•		•		•	•	•	•
GW-999		•		•		•		

GW = groundwater
FLUTe = Flexible Linder Underground Technologies, LLC
SPT = standard penetration test

Piezometers will obtain representative lithologic and groundwater data from across the site and in representative formations. Piezometers specifically will be placed to monitor locations where pre-construction groundwater levels are projected to be within the geologic buffer. Because these piezometers could be preferential pathways to groundwater, all piezometers within the footprint of the disposal cells will be plugged and abandoned per UCOR procedures prior to construction of the EMDF (Appendix B, Sect. B.2).

Piezometers will be installed in each designated borehole by Tennessee-qualified monitoring well drillers in accordance with ORR requirements as described in Appendix B, Sect. B.3. Depths and testing requirements for each piezometer are provided in Table 5.

Table 5. Groundwater-level, location-specific target depths and tests

Location	Formation	Shallow/ deep	Estimated ground elevation	Estimated target elevation	Estimated drilling footage	Expected hydrologic tests	Purpose
GW-978	Rutledge	D	960	885	75	FLUTe	Hydrogeologic conditions in the upgradient saddle
GW-979	Rutledge	S	960	930	30	Slug	Hydrogeologic conditions in the upgradient saddle
GW-980	Maryville	D	955	885	70	FLUTe	Establish general hydrogeologic conditions
GW-981	Maryville	S	955	905	50	Slug	Establish general hydrogeologic conditions
GW-982	Maryville	D	1005	885	120	FLUTe	Groundwater levels where projected within waste
GW-983	Maryville	S	1005	905	100	Slug	Groundwater levels where projected within waste
GW-986	Maryville	D	940	885	55	FLUTe	Hydrogeologic conditions along D11-E
GW-987	Maryville	S	940	905	35	Slug	Hydrogeologic conditions along D11-E
GW-988	Maryville	D	960	885	75	FLUTe	Establish general hydrogeologic conditions
GW-989	Maryville	S	960	905	55	Slug	Establish general hydrogeologic conditions
GW-992	Nolichucky	D	910	860	50	FLUTe	Determine groundwater contribution to D-10W
GW-993	Nolichucky	S	910	885	25	Slug	Determine groundwater contribution to D-10W
GW-994	Nolichucky	D	895	845	50	FLUTe	Groundwater levels where projected near waste
GW-995	Nolichucky	S	895	880	15	Slug	Groundwater levels where projected near waste
GW-998	Nolichucky	D	885	845	40	FLUTe	Establish general hydrogeologic conditions
GW-999	Nolichucky	S	885	870	15	Slug	Establish general hydrogeologic conditions

D = deep (bedrock) or drainage
E = east
FLUTe = Flexible Liner Underground Technologies, LLC
N/A = not applicable
S = shallow (residuum/soil)
West = west

Piezometers shall be developed no sooner than 24 hours after installation and shall continue until the piezometer responds to water-level changes and produces clear, sediment-free water to the extent possible (Appendix B, Sect. B.3).

Hydraulic conductivity (horizontal) will be measured by performing slug tests for piezometers completed in the residuum. FLUTe testing will be performed for bedrock piezometers to maximize the amount of hydraulic conductivity information obtained and obtain more precise data. FLUTe testing will not be as effective in residuum. The procedures and test methods used to collect these data are found in Appendix B, Sect. B.3.

In addition, laboratory analysis of hydraulic conductivity will be performed on select samples. Because of the small sample size, these samples may underestimate the permeability of the in situ materials. These sample results will be used in conjunction with the slug tests and FLUTe tests to develop a more complete picture of the hydraulic conductivity present in situ. The test method used to collect these data are provided in Appendix B, Sect. B.3.

Groundwater elevation, conductivity, pH and temperature data will be collected using downhole monitors placed in each piezometer. Data will be collected continuously and recorded every 30 minutes with downloads every 2 weeks. Technical Memorandum 1 will include continuous monitoring of these 16 piezometers during the March/April timeframe. Monitoring will continue for at least 1 year to ensure seasonal high- and low-water levels are captured.

Groundwater elevations determined from depth-to-water measurements will be used to (1) estimate the groundwater surface elevations across the entire footprint of EMDF (and immediate areas upgradient/downgradient), and (2) assess and design the difference between the water table and the proposed geobuffer beneath all disposal cells.

The results of these tests also will support estimates to be made of hydraulic conductivity, groundwater flow rates, and historical high groundwater levels for use in optimizing the design.

6.1.2 Comparable Existing Piezometers

To aid in interpreting the results, long-term monitoring of precipitation and groundwater elevations for similarly located piezometers at the Environmental Management Waste Management Facility (EMWMF), and other BCV locations, will be used to provide input into the conditions at the CBCV site, specifically the groundwater elevations during the wet season. The data from these piezometers will be used to predict groundwater elevations at the CBCV by noting the magnitude of the change during the wet season and applying a similar factor to CBCV piezometer readings.

The specific additional BCV wells that will support forecasting groundwater elevations within the EMDF footprint are provided on Table 6 and the locations of these wells are shown on Fig. 15.

Table 6. Comparable Bear Creek Valley wells

Well No.	Location	Formation	Depth (ft bgs)	Screened interval	Historical data	Frequency/ downhole monitor?	Description of comparable conditions
GW-077	BCBG – west side	Nolichucky	100.5	90.3-100.3	From 1991	2/years	In the same formations and similar topography as EMDF piezometers, closest appropriate wells to the EMDF location, and similar precipitation expected in a given event
GW-078	BCBG – west side	Nolichucky	21.1	16.1-21.1	From 1991	2/years	In the same formations and similar topography as EMDF piezometers, closest appropriate wells to the EMDF location, and similar precipitation expected in a given event

Table 6. Comparable Bear Creek Valley wells (cont.)

Well No.	Location	Formation	Depth (ft bgs)	Screened interval	Historical data	Frequency/ downhole monitor?	Description of comparable conditions
GW-079	BCBG – west side	Rogersville	60	59.9-64.9	From 1991	2/years	Equivalent to EMDF well cluster on the saddle (GW-978/979), close to EMDF, and similar precipitation expected in a given event
GW-080	BCBG – west side	Rogersville	30	24.7-29.7	From 1991	2/years	Equivalent to EMDF well cluster on the saddle (GW-978/979), close to EMDF, and similar precipitation expected in a given event
EMWMF multiple	EMWMF	Maryville Nolichucky	various	various	Yes	Quarterly from ~2002, downhole monitors since 03/17	In the same formations, although steeper topography, several choices available because of the number of instrumented wells/piezometers; will determine most suitable when EMDF data are available
GW-976	EMDF-Site 5	Maryville	101	27.8-100.3	11/14-11/15	Continuous data from 11/14-11/15	Deeper well on the knoll will represent similar conditions at Site 7c and match with GW-982, also in the Maryville; topography is steeper than CBCV site
GW-437	WBCV	Maryville	~64	53.2-63.1	Very limited	Not monitored	Downhole monitor will be installed if well is viable. Appears in good condition. Maryville near Nolichucky contact, moderate slope. Similar to GW-994/995 area.
GW-438	WBCV	Maryville	~23	13.05-22.95	Very limited	Not monitored	Downhole monitor will be installed if well is viable, appears in good condition; Maryville near Nolichucky contact, moderate slope, similar to GW-994/995 area
GW-439	WBCV	Nolichucky	~60	49.7-59.65	Very limited	Not monitored	Downhole monitor will be installed if well is viable, appears in good condition; slight slope similar to GW-998/999
GW-440	WBCV	Nolichucky	~27	16.5-26.65	Very limited	Not monitored	Downhole monitor will be installed if well is viable, appears in good condition; slight slope similar to GW-998/999

Note: Downhole conditions for the West Bear Creek Valley wells have not been verified. Additional, similar wells were identified to use as replacements for the selected wells if necessary.

BCBG = Bear Creek Burial Ground
CBCV = Central Bear Creek Valley
EMDF = Environmental Management Disposal Facility
EMWMF = Environmental Management Waste Management Facility
WBCV = West Bear Creek Valley

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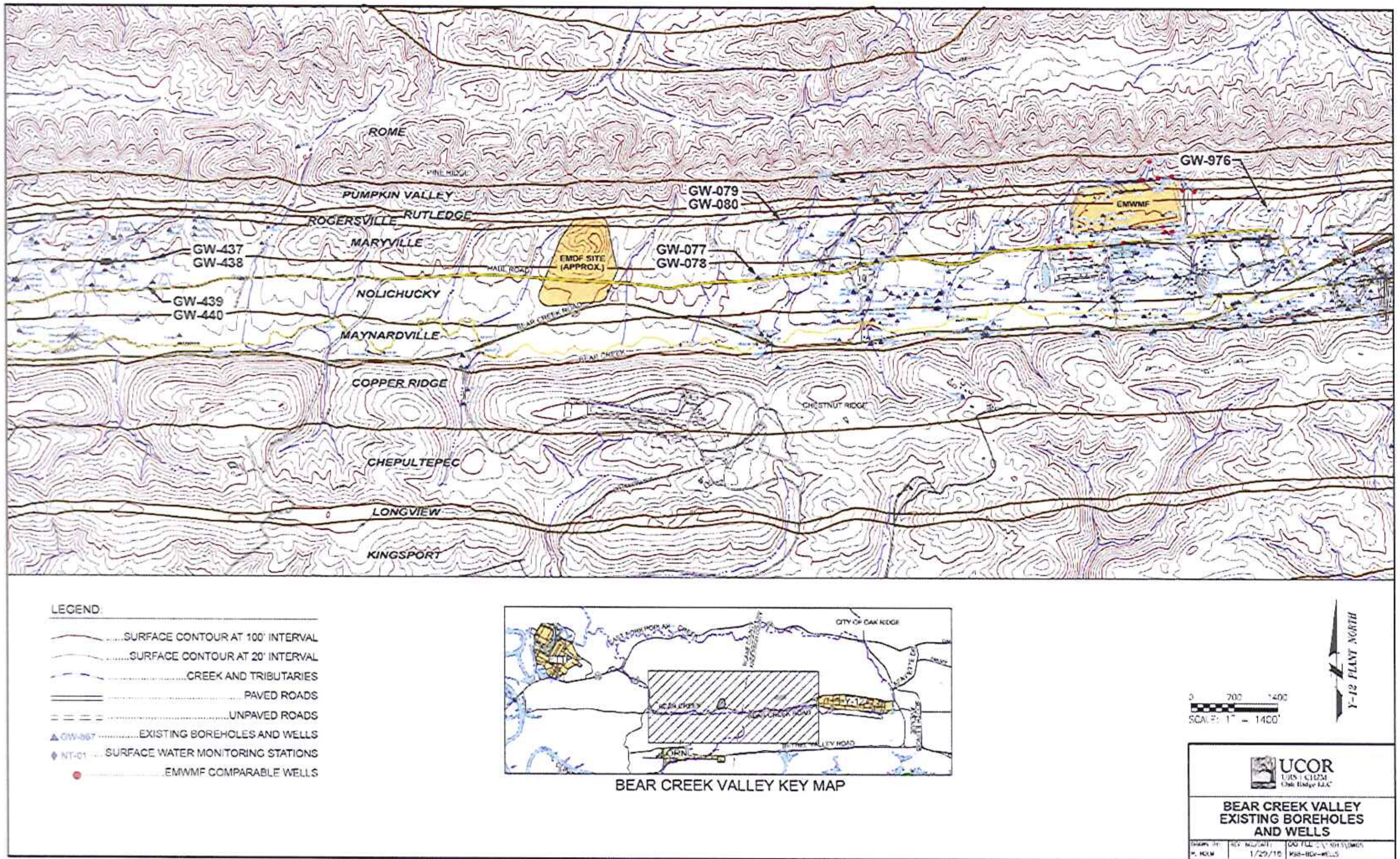

Fig. 15. Comparable Bear Creek Valley wells.

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Quarterly groundwater elevation data are available for many of the EMWMF wells since 2002 or before, including recent wetter periods. Twice a year groundwater elevations are available for the Bear Creek Burial Ground wells (GW-077 to GW-080). These groundwater elevations will be used to provide the relative magnitude change in groundwater elevations during wetter and drier periods.

Continuous groundwater elevation monitors were installed in March 2017 in EMWMF wells. Therefore, these wells have more specific data to forecast specific responses to precipitation over the year. Specific groundwater elevation data for an appropriate EMWMF well will be matched to the groundwater elevation data for a given EMDF well to predict the wet season data for that well.

Continuous groundwater elevation data for GW-976, located on a knoll in the previous EMDF Site 5 location, is expected to be comparable to the expected groundwater elevations in bedrock piezometers on the knoll in the CBCV site (GW-980, GW-982, and GW-986). This information will augment EMWMF well data for developing projected groundwater elevations for these wells. The shallow piezometer paired with GW-976 is GW-977. This piezometer was dry during drilling and remained dry during the project. It will be checked and groundwater elevations measured (if present) when data are downloaded from GW-976.

No groundwater elevations are available for locations GW-437 through GW-440. However, continuous groundwater elevation monitors will be installed in these (and the other locations noted in Table 4) prior to completion and instrumenting the CBCV piezometers. These wells will provide additional comparable wet season data to augment what is collected for the CBCV piezometers.

6.2 SURFACE WATER EVALUATION

6.2.1 Field Identification of Surface Water Features

Two detailed site walkovers will be performed during the wet season (winter 2018) to further characterize surface geology, identify geotechnical areas of interest, and identify seeps, springs, and other expressions of shallow groundwater in NT-10, D-10W, D-11E, and NT-11. Observations of flow in macropores and similar features during the wet season also will occur to determine potential impacts on design. The walkover will include a description every 50 ft of NT-10, D-10W, and NT-11 (as safe access allows) and field measurements of temperature, specific conductivity, and pH (seeps/springs to be included). The specific conductivity measurements will be performed to determine the potential influence from groundwater. A qualified hydrologic professional (TDEC 2011) will participate in the walkovers. The results of these wet weather walkovers will be documented in Technical Memorandum 1 along with results of two additional walkovers in May and June. Additionally, two dry season walkovers will be performed during September/October 2018 and documented in the Technical Memorandum 2.

6.2.2 Surface Water Flow Measurements

Based on the site walkovers, three surface water flow measurement stations are planned for installation at appropriate locations in the Nolichucky Shale outcrop areas in NT-10 and NT-11. These stations are planned for locations where the tributaries enter or leave the buffer zone (Fig. 14). The specific locations and measurement apparatus sizing will be based on results of the additional fieldwork outlined above.

For the D-10W valley, a surface water flow measurement station is planned for installation upstream of Haul Road in an area where surface water flow diversion may be considered during design. A station is also planned for installation downstream of the existing Bear Creek Road near the Nolichucky

Shale/Maynardville Limestone geologic contact where D-10W leaves the buffer zone (Fig. 14). Another surface water flow measurement station will be placed as indicated by the site walkover.

Surface water flow measurements will be performed as described in Appendix B, Sect. B.4, and will include continuous flow, temperature, pH, and conductivity measurements collected at 30-minute intervals. Phase 1 characterization will begin in the spring 2018 (March-April timeframe).

Because surface water flow is not present/cannot be measured with conventional flow measurement devices in the D-11E area, and subsurface flow merges with NT-11 prior to leaving the site/buffer zone, the already established flume locations located upstream and downstream of the D-11E area discharge into NT-11 will be used to approximate the D-11E discharge as requested.

6.3 STABILITY TESTING

Standard penetration test data provides the most typical values used for liquefaction analyses and will be collected as described in Sect. 6.4 and Appendix B, Sect. B.5.2, as the boreholes for the piezometer pairs are drilled.

6.4 GEOTECHNICAL EXPLORATION AND LABORATORY TESTING

Geotechnical tests for landfill design will be collected at the piezometer locations (Fig. 14) and will include areas within the landfill footprint. The vertical subsurface boundary extends into bedrock, approximately 30–50 ft below current ground surface (approximately 10 ft into bedrock).

Geotechnical data acquisition will be performed by qualified subcontractors with continuous field oversight by a geotechnical engineer or geologist with geotechnical experience. Geotechnical data will be used for the design, including stability analyses. These data will be collected and analyzed as described in Appendix B, Sect. B.2.1 and Sect. B.5.

6.5 SAMPLE COLLECTION, IDENTIFICATION, AND LABELING

Sampling data generated during all phases of this project must be of acceptable quality. The appropriate contractor characterization team lead is responsible for implementation and performance of sample collection, quality checks, and monitoring activities.

The QAPP (Appendix A) contains the requirements for field documentation, sample containers, sample packaging, decontamination of equipment and devices, sample identification and traceability, and field variance systems integral to the collection of samples.

6.6 LABORATORY ANALYSIS

Geotechnical sample analysis will be performed by a geotechnical laboratory accredited by the U.S. Army Corps of Engineers or American Association of State Highway and Transportation Officials for the specific American Society for Testing and Materials laboratory testing procedures called out in Appendix B, Sect. B.5.2.

7. DATA MANAGEMENT

The Oak Ridge Environmental Information System (OREIS) is the centralized, standardized, quality-assured, and configuration-controlled data management system used as the long-term repository for environmental data (measurements and geographic) for all projects performed pursuant to the FFA. OREIS is comprised of hardware, commercial software, customized integration software, an environmental measurements database, a geographic database, and associated documentation.

OREIS, the primary component of the data management program for restoration projects, provides consolidated, consistent, and well-documented environmental data and data products to support planning, decision making, and reporting activities. OREIS provides a direct electronic link of ORR monitoring and remedial investigation results to EPA Region 4, TDEC Division of Remediation–Oak Ridge, and interested members of the public. Waste characterization data is not included in OREIS.

For applicable numeric data, reports and data will be developed in accordance with the OREIS Ready-to-Load Format Document to allow successful uploading into the OREIS database. Remaining data will be provided in a format suitable for uploading into the OREIS database.

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8. DATA VERIFICATION AND REVIEW

The project SME will review the data to verify that the results are reasonable. Results that appear anomalous will be evaluated in greater detail, including discussions with the laboratory as appropriate, to confirm the validity of the results.

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9. DATA REPORTING

The results of the March-April field investigation data will be presented in Technical Memorandum 1 and will be submitted to the Administrative Record prior to the public comment period on the EMDF preferred alternative. Technical Memorandum 1 will also include the results of two additional surface water walkovers in May and June. Results from longer-term monitoring (May 2018 through February 2019) and the dry season surface water walkdowns will be documented in Technical Memorandum 2.

The following data, evaluations, calculations, and reports will be included in the Administrative Record.

- Groundwater data, including borehole logs, piezometer construction logs, groundwater table maps, charts of groundwater elevation fluctuations over time, hydraulic conductivity data (including FLUTe borehole transmissivity profiling), soil stratigraphy, groundwater gradients, and groundwater flow rates. Data will be collected during March-April 2018 and will be considered part of the field data collection to be provided in Technical Memorandum 1 prior to the public comment period.
- Surface water data, including surface water flow rates, locations of seeps/springs (as well as temperature, conductivity, and pH in streams and seeps/springs), groundwater elevations impacting surface waters, site topography, stream morphology, and climate information. The March-April 2018 surface water data will be considered part of the field data collection to be documented in Technical Memorandum 1 and provided prior to the public comment period.

In addition, a geotechnical data report will be prepared that will include soil consolidation, shear, density, and index properties (moisture content, Atterberg Limits, grain size, and specific gravity); bedrock strength, interface strength, rock type, fractures, and rock quality; and groundwater elevations and variations.

The QAPP (Appendix A, Sect. A.10) contains the specific requirements for data reporting.

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APPENDIX A.
QUALITY ASSURANCE PROJECT PLAN FOR THE PROPOSED EMDF DESIGN INVESTIGATION, OAK RIDGE, TENNESSEE

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CONTENTS

FIGURES

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ACRONYMS

AR	Administrative Record
AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
CBCV	Central Bear Creek Valley
CFR	*Code of Federal Regulations*
CO	Contracting Officer
COC	chain-of-custody
COR	Contracting Officer Representative
DMC	Document Management Center
DOE	U.S. Department of Energy
DOE O	DOE Order
DOT	U.S. Department of Transportation
DQO	data quality objective
EDD	electronic data deliverable
EMDF	Environmental Management Disposal Facility
EPA	U.S. Environmental Protection Agency
ES&H	Environment, Safety and Health
FDF	field data form
FFA	Federal Facility Agreement
FSP	Field Sampling Plan
LCOC	laboratory chain-of-custody
LOR	Letter of Receipt
NCR	nonconformance report
OREIS	Oak Ridge Environmental Information System
OREM	Oak Ridge Office of Environmental Management
ORR	Oak Ridge Reservation
PEMS	Project Environmental Measurements System
PM	Project Manager
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RADCON	Radiological Control
ROD	Record of Decision
S/CI	suspect/counterfeit items
SOP	standard operating procedure
SOW	Statement of Work
TDEC	Tennessee Department of Environment and Conservation
UCOR	URS | CH2M Oak Ridge LLC
USACE	U.S. Army Corps of Engineers

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A.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been developed to identify and implement quality assurance (QA) requirements for use in sample collection, laboratory analysis, and data management of groundwater assessments, surface water flow measurements, geotechnical exploration and testing, and geophysical studies needed to support the design of the proposed Environmental Management Disposal Facility (EMDF) on the U.S. Department of Energy (DOE) Oak Ridge Reservation (ORR) located in Oak Ridge, Tennessee. These requirements ensure that appropriate levels of QA and quality control (QC) are achieved and maintained. This plan identifies the procedures that will be followed in the collection, custody, and handling of samples, as well as environmental/laboratory data used in the Field Sampling Plans (FSPs) generated to support the EMDF project.

This QAPP provides the QA for collection of groundwater elevations, surface water flow measurements and geotechnical exploration in an uncontaminated setting for the Phase 1 and any follow-on design investigations. Samples will be collected for geotechnical laboratory analyses, not for chemical or radiological analyses. In addition, this QAPP establishes requirements and responsibilities applicable to project participants and establishes methods through which project personnel implement the requirements of the URS | CH2M Oak Ridge LLC (UCOR) QA programs. Any changes to this QAPP require completion of the EMDF QAPP Addendum form provided in Attachment 2.

This QAPP meets the requirements of the *EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5)* (U.S. Environmental Protection Agency [EPA] 2001); *URS | CH2M Oak Ridge LLC Quality Assurance Program Plan* (UCOR 2016a); and 10 *Code of Federal Regulations* (*CFR*) 830.122, *Quality Assurance Criteria*.

The stakeholders and data users in the performance of the environmental sampling and analysis effort are Oak Ridge Office of Environmental Management (OREM), the EPA Region 4 and the Tennessee Department of Environment and Conservation (TDEC). The selected characterization contractor is a prime contractor to OREM and has been tasked with implementation of the Phase 1 FSP using the QA requirements in this QAPP. UCOR will provide technical assistance and oversight of the Phase 1 sampling effort, and will be responsible for inputting data into Project Environmental Measurements System (PEMS).

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A.2 PROJECT ORGANIZATION

The organizational structure for this characterization project is presented in Fig. A.1.

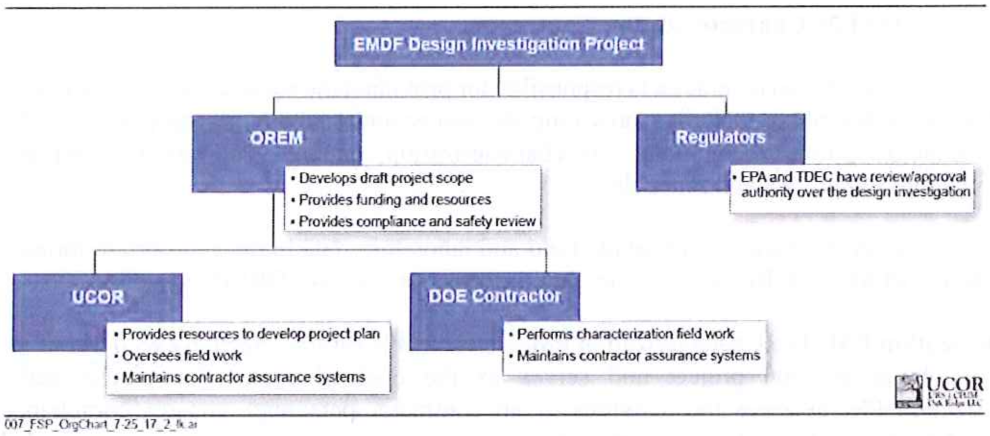

Fig. A.1. Project organization.

A.2.1 ROLES AND RESPONSIBILITIES

In accordance with DOE Order (O) 450.2, CHG 1 (MINCHG), *Integrated Safety Management*, and *Integrated Safety Management System Program Description* (DOE 2017), the authority and expectation to suspend work is extended to all employees of the Characterization Contractor and UCOR. All employees are empowered to refuse to perform work that is unsafe or may cause environmental impact, even if directed to do so by supervisors, customers, or other prime contractors on shared sites, without fear of reprisal. Work that is suspected or proven to place the workers, the public, or the environment at risk is to be stopped until it can be demonstrated that changes have been made and it is safe to proceed with the work.

Roles and responsibilities of the major EMDF Project administrative and functional interfaces are discussed below (see Fig. A.1). These positions may be combined and/or performed by one or more individuals.

The project contact list is provided in Attachment 1.

A.2.1.1 OREM

The OREM is responsible for developing the project scope of work, ensuring work scope is performed in a safe, compliant and effective manner, and maintaining the project scope, schedule and costs. OREM is responsible for approving deliverables and providing funding/resources to the project.

The DOE Oak Ridge Environmental Management Landfills Project Manager (PM), Contracting Officer (CO), and Contracting Officer Representative (COR) are solely responsible for the project scope and shall approve all changes to the scope baseline in advance of implementation.

OREM Landfills PM. Responsible for maintaining overall scope, schedule and costs for this characterization project.

OREM CO and COR. Manage compliance with contract requirements and determine if changes to contracts are necessary or required.

OREM Staff: Includes subject matter experts and facility representatives responsible for providing general oversight of the contractor's safety and compliance performance.

A.2.1.2 OREM Characterization Contractor

The OREM characterization contractor is responsible for providing the resources to complete the designated scope of work as described, including providing the geotechnical laboratory, geophysical subcontractor, and hydrogeologic testing subcontractor. The characterization contractor will report to OREM for overall project direction, scope, cost and schedules.

The characterization contractor will provide field and laboratory data in the appropriate format to support upload into the PEMS/Oak Ridge Environmental Information System (OREIS) systems.

Characterization PM. The Characterization PM is responsible for the effective execution of project tasks under this characterization project and serves as the point-of-contact for project activities. The Characterization PM oversees the activities of all contractor personnel, ensures compliance with the statement of work (SOW), and controls project consistency.

The Characterization PM supervises sampling activities and coordinates all planning, data collection, and reporting. The Characterization PM is responsible for ensuring work is performed in accordance with this FSP/QAPP and all applicable and appropriate procedures; coordinating activities of the field sampling personnel; ensuring all FSP/QAPP requirements are met and sampling procedures are followed by the samplers; directing planning and technical implementation of the FSP/QAPP and sampling procedures for all sampling activities; ensuring the proper collection, containerization, and storage/preservation of samples in accordance with the FSP/QAPP and applicable approved methods; ensuring delivery of samples to the laboratory as directed; confirming that training and certification requirements are met for each project; and ensuring adherence to QC requirements identified in this plan.

Contractor Environment, Safety, and Health Oversight. The assigned Environment, Safety, and Health (ES&H) Representative independently reports to the Characterization PM on matters concerning project safety and health. The ES&H Representative assists in addressing and resolving health and safety concerns involved in sampling events, provides oversight of controls required for protection from hazards associated with the sampling event, ensures all work is planned and conducted in a safe manner and in accordance with the five core functions of Integrated Safety Management, and reviews and approves applicable Job Hazard Analyses. The ES&H Representative also works with site Radiological Control (RADCON) to ensure safe operations. Work packages shall contain specific safety and health requirements for field activities and will be available to personnel in the field.

Contractor QA. The assigned QA Representative independently reports to the Characterization PM on matters concerning QA aspects of the project. The project QA Representative will perform the following functions:

- Review and approve the overall quality of project plans and reports.
- Ensure all measuring and testing equipment is properly maintained and calibrated.
- Coordinate with technical members of the project team to evaluate status, procedures, and nonconformances from a quality program standpoint.

- Coordinate the areas of records management, quality improvement, QA/QC, and quality assessments for the project.

- Compare collected data to the data quality objectives (DQOs) to assure project goals are met. Perform data quality assessments will include thorough reviews of the field and laboratory data for adherence to data collection procedures, protocols, and specifications in applicable SOWs.

The QA Representative is responsible for distributing and controlling procedures, overseeing the maintenance of training records, providing independent oversight for QA pertaining to work performed by the project, reviewing and providing concurrence for release of reports, ensuring data verification is performed, performing or overseeing performance of project file reviews, overseeing archival of critical records, ensuring required data entry to the audit and nonconformance data tracking systems, ensuring complete documentation of performance evaluation activities, and coordinating vendor/provider assessments as deemed necessary by the Characterization PM.

Contractor Sample Manager. The project Sample Manager supports planning and executing characterization field activities. The Sample Manager is responsible for maintaining chain-of-custody (COC) forms; field logbooks; coordinating with the Geotechnical Laboratory Manager to ensure sample technicians have the proper labels, containers, preservatives, etc., to satisfy DQOs; and coordinating with the project Transportation Specialist for sample shipment.

The contractor Sample Manager will interface with the project team personnel and provide the following services:

- Ensure planned project objectives are met and all on-site field activities are executed in a technically sound and responsible way with regard to health, safety and quality.
- Review field generated project documentation for completeness and accuracy and ensure field documents are appropriately field and stored.
- Participate in field decisions and prepare field change notices to document variances in the field.
- Ensures proper disposal of samples which includes receiving certificates of disposal.

Contractor Transportation Specialist. The project Transportation Specialist coordinates with the Sample Manager and is responsible for providing oversight and support necessary to ensure that sample shipments are conducted according to applicable U.S. Department of Transportation (DOT) procedures; determining the appropriate hazard classifications for sample shipments; directing sample shipments, including appropriate marking, labeling, and placarding in accordance with applicable standards; and ensuring sampling personnel are adequately trained in the applicable sample packaging.

Contractor Data Manager. The contractor Data Manager works with the project team and geotechnical laboratory to ensure the complete and accurate transfer of samples and information from the field to the laboratory. The Contractor data management function provides the following services:

- Assists field sampling teams in addressing identified data gaps, implementing DQO/data quality assessments processes, and determining data sufficiency.
- Verifies receipt of incoming field data and geotechnical data from the laboratory in both hard copy and electronic formats.
- Oversees and tracks the data review process and preparation and submittal of deliverables to the OREM CO/COR, OREM PM and UCOR Characterization Technical Lead.

- Identifies and resolves analysis issues and non-conformances.
- Ensures the laboratory is aware of the project DQOs, program goals, and QA/QC objectives.
- Monitors the QA/QC deliverables from the laboratory, ensures conformance with authorized procedures and sound practices, and assists in identifying and resolving non-conformances.
- Communicates the schedule of sample shipments and shipment contents to the laboratory, and provides status of sample shipments to the project team.

A.2.1.3 UCOR Project Team

The UCOR Project Team is responsible for providing technical assistance during the characterization process to support completion of the project scope as specified in the FSP.

UCOR EMDF PM. The UCOR EMDF PM is responsible for all aspects of the EMDF project and has overall responsibility for ensuring that the sampling effort results in information needed to support the future design of the EMDF.

UCOR Characterization Technical Lead. The UCOR Characterization Technical Lead serves as the primary interface between the OREM sampling contractor and UCOR as well as the subject matter expert for technical aspects of the FSP. As changes occur in the field, the UCOR Characterization Technical Lead will be informed by the UCOR representative in the field and then will communicate with the UCOR PM and the OREM PM for concurrence of said changes.

The UCOR Characterization Technical Lead is responsible for arranging inbound/outbound equipment and radiological surveys, and for ensuring radiological release surveys are performed for the samples prior to shipping offsite. The technical lead is also responsible for ensuring the applicable data are uploaded into PEMS and OREIS as needed.

UCOR Field Representative. The UCOR representative in the field is responsible for ensuring that the details of the sampling plan are implemented in the field as specified in the FSP/QAPP to ensure that data collected will support the future design efforts. There may be multiple representatives for the various elements of this scope. The UCOR representative will observe boring and other field activities, review field and lab results to verify the appropriate data are collected, and consult with the geotechnical lab on sample location selection and testing parameters. The UCOR field representative will consult with the UCOR Characterization Technical Lead and the OREM Landfills PM when there are or need to be field changes to the sampling design.

A.2.2 TRAINING AND QUALIFICATION OF PERSONNEL

DOE contractors, UCOR, and UCOR Subcontractors will provide trained and qualified personnel as governed by their contract and DOE O 426.2, *Personnel Selection, Training, Qualification and Certification Requirements for DOE Nuclear Facilities* (DOE 2013). Qualification of personnel is accomplished by consideration of experience, education, training, and by demonstration and testing to verify acquired skills.

The characterization contractor training program focuses on an approach to ensure that employees and subcontractors are trained and qualified commensurate with their responsibilities. Training includes mandatory company, access-specific, functional-specific, project-specific, facility-specific, job-specific, and professional qualification training.

All project personnel must be qualified and experienced in the project task(s) for which they are responsible. For those personnel actively involved in field work, training, at a minimum, will include 40-hour Occupational Safety and Health Administration training, general employee training, and site required orientation. All field personnel will be trained on the applicable work packages and this FSP/QAPP.

Additional training to standard operating procedures (SOPs) and other training that becomes identified as specific to the activities identified in this FSP/QAPP must also be completed before installing any borings or collecting any samples. In addition, site workers will receive training in personal protective equipment, daily tailgate safety meetings, and daily pre-job briefings. Data management personnel will also require training in the use of PEMS. Documentation of all training will be maintained in the contractor's corporate records.

Training may be performed during mobilization. Additional training that may be required for specific equipment or by ES&H, RADCON, and/or Transportation is not addressed in this QAPP, but will be addressed in the task-specific work control documents.

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A.3 DATA QUALITY OBJECTIVES

The EMDF FSP and this QAPP together describe the data collection and sample analyses requirements.

Quality objectives for data collection and analysis are developed as DQOs for this project in accordance with UCOR's prevailing revision of PROC-ES-1004, *Implementing and Documenting the Data Quality Objective Process* (UCOR 2014). The DQOs are provided in Sect. 4 of the FSP, however, the general quality objectives for the groundwater level, geotechnical, and geophysical data are as follows:

- Data generated will withstand scientific and technical scrutiny.
- Data will be generated using appropriate procedures for analysis, COC, data documentation, and reporting.
- Data will be of known representativeness, comparability, and sensitivity.

QC requirements will be communicated to the contracted laboratory accredited by the U.S. Army Corps of Engineers (USACE) or American Association of State Highway and Transportation Officials (AASHTO) for the specific American Society for Testing and Materials (ASTM) laboratory testing procedures called out in Appendix B of the FSP. Any necessary changes to these requirements will be documented, reviewed, and approved by the OREM CO/COR. Analyses will be scheduled according to program needs and will be consistent with ASTM/AASHTO standards. These requirements will be included in any contractual agreement between the Characterization Contractor and the USACE/AASHTO accredited lab.

Quality objectives for all field and laboratory data are to obtain reproducible, precise, and accurate measurements consistent with the intended use of the data and the limitations of the sampling and laboratory procedures. Project data requirements are identified in detail in the FSP. Geotechnical laboratory data will be provided in electronic and hard copy format as described in Sect. A.10. The data reported will comply with ASTM/AASHTO standards.

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A.4 PROCUREMENT, SUPPLIES, AND CONSUMABLES

All field instrumentation, sample containers, and other equipment or materials purchased for use in the FSP will be purchased in accordance with DOE G 414.1-3, *Suspect/Counterfeit Items Guide for Use with 10 CFR 830 Subpart A, Quality Assurance Requirements, and DOE O 414.1b, Quality Assurance* (DOE 2004) as implemented through the characterization contractor's QA Program Plan/Procurement Plan and applicable procedures. If applicable, all critical elements of the equipment or materials being purchased will be specified in the purchase order to the vendor.

Receipt, inspection, and acceptance of supplies and consumables will be in accordance with the characterization contractor's QA Program Plan/Procurement Plan/Inspection and Acceptance Testing requirements.

Characterization contractor personnel will implement the requirements in accordance with DOE Suspect/Counterfeit Items (S/CI). A standard S/CI clause is also required in procurement documents in accordance with characterization contractor's QA Program Plan/Procurement Plan.

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A.5 SAMPLE COLLECTION PROCEDURES

Sampling data generated during all phases of this project must be of acceptable quality. The Characterization PM is responsible for implementation and performance of sample collection, quality checks, and monitoring activities.

This section discusses field documentation, sample containers, sample packaging, decontamination of equipment and devices, sample identification and traceability, and field variance systems integral to the collection of samples. Related activities are performed in accordance with ASTM/AASHTO standards as described herein.

The measurement and testing locations are shown on Fig. 14, and a summary of field sampling activities is provided in Table 5 of the FSP. The FSP Appendix B contains the specific sampling approach for the field activities.

A.5.1 FIELD DOCUMENTATION

An integral part of field exploration and sampling activities will be to maintain current, accurate, and complete field records. Field records include COC forms, field logbooks, field testing reports, and drilling/boring logs. The COC (i.e., laboratory chain-of-custody [LCOC]) form, or equivalent, should document the transfer of sample custody from time of sample collection to laboratory receipt and will be in accordance with ASTM/AASHTO standards. The COC form will accompany the samples from the field to the USACE/AASHTO accredited laboratory. All applicable information on the COC will be filled out completely and legibly using indelible black ink. No blank spaces should appear on completed COC forms.

Field records will be reviewed by a characterization contractor member other than the person completing the record (e.g., boring/drilling logs), and the review will be documented by the reviewer's initials and the date. All field records and documentation will be maintained and controlled in accordance with ASTM/AASHTO standards.

A.5.1.1 Field Logbook and Field Data Forms

A bound logbook will be used to document all field activities. The logbook will include descriptions of daily progress of the fieldwork for the area of investigation. Field logbooks become part of the project record. Guidelines for the minimum entries to be made in field logbooks are provided in PROC-ES-2700, *Field Logbooks and Field Data Forms* (UCOR 2015a). The field logbooks are used to document a broad range of field activities, including, but not limited to, inspections, sampling, and testing and/or measurements. Field logbooks will be maintained by assigned personnel to document field activities, such as borehole drilling, geotechnical sampling, and geophysical logging/testing.

As electronic logbooks and/or electronic field data forms (FDF) and devices are developed and approved for use, the electronic logging devices may be utilized in lieu of a bound logbook and hard copy FDF. The e-logbook or e-forms and/or devices should be officially approved for use by the project and meet the specified quality requirements.

Borehole and test pit logs will document subsurface information (see Appendix B, Sect. B.2 of the FSP). Sample collection depths will be noted on the logs. Additional information provided in the field logbooks will include the following:

- Project name and location
- Dates and times
- General weather conditions
- Field observations
- Sampling performed, including locations, sample numbers, and analyses
- Deviations from the FSP
- Problems encountered and corrective actions taken
- QC activities

A.5.1.2 Field Documentation Checks

Documented quality check reviews of field logbooks are performed daily to ensure collection of the information as outlined in *Field Logbook and Field Data Forms* (UCOR 2015a) or Characterization Contractor equivalent. This review includes a quality check of field logbook entries of sample times and dates to the field logbook or other associated FDFs used for the day's activity (i.e., groundwater purge/sampling form). Field documentation reviews are conducted by a Quality Check Reviewer, or designee (i.e., peer). If deficiencies are encountered, the Quality Check Reviewer notifies the appropriate author to fully document (e.g., perform a Late Entry to the field logbook) or amend documentation, as appropriate and in accordance with *Field Logbooks and Field Data Forms* (UCOR 2015a).

A.5.1.3 Field Variances

Procedures cannot fully encompass all conditions encountered during field activities therefore variances from the field sampling procedures and/or ES&H Plan must be documented in the field logbook. Deviations from the approved scope of the project shall be approved in advance by the DOE PM, CO, and COR with consultation with UCOR. Variances from the characterization contractor ES&H Plan must be approved by the characterization contractor's ES&H representative.

Controlling and documenting field changes will be in accordance with the ASTM/AASHTO standards. Any deviations from procedural requirements and one-time difficulties will be reported to and authorized by the UCOR Characterization Technical Lead in consultation with the UCOR field representative and UCOR PM. Deviations from the requirement will be sufficiently documented in the field logbook.

If a variance is anticipated (e.g., because of a change in field instrumentation), the procedure will be modified in accordance with ASTM/AASHTO standards, and the changes will be documented in the field logbook or drilling/boring log.

A.5.2 SAMPLE CONTAINERS

The selection criteria for appropriate sample containers shall be in accordance with ASTM/AASHTO standards. The sample volume to be collected is dependent upon the methodology to be used. The USACE/AASHTO accredited laboratory shall provide this information prior to sample collection. Types of sample containers used will be documented in the drilling/boring log and/or on the COC. Sample containers will be provided or specified by the geotechnical lab in accordance with ASTM/AASHTO standards.

A.5.3 SAMPLE IDENTIFICATION AND TRACEABILITY

Sample numbers will be generated by the characterization contractor that will include the following information:

- EMDF Project
- Location identifier (e.g., GW-999)
- Depth

Sample containers will be labeled with a unique sample identification prior to sample collection. The sample labels will be completed with indelible black ink and in accordance with ASTM/AASHTO standards. Corrections should be made by drawing a single line through the erroneous information and initialing and dating the correction. Sample identification will be recorded in the drilling/boring log and COC form. Sample identification shall be associated with the sample type and location, thereby ensuring traceability of samples to the specific sample location.

A.5.4 TYPE AND FREQUENCY OF QC SAMPLES

No field QC samples will be required for this activity. Laboratory QC samples will be in accordance with the specified ASTM standard.

A.5.5 SAMPLE PACKAGING

Sample containers must comply with ASTM standards. Samples will be handled to avoid contamination from outside sources and to prevent sample moisture evaporation during and after collection. Sample preservation, storage, packaging, shipping, and handling will be in accordance with ASTM/AASHTO standards, the laboratory SOW, and DOT requirements.

After sample collection, the sampling team shall store samples in accordance with ASTM/AASHTO standards until packaging and shipment to an USACE/AASHTO accredited laboratory.

The Transportation Specialist or Sample Shipping Manager packages the samples, completes the required sections on the COC (i.e., records signature, time, date, air bill number), and seals the original COC in a watertight bag inside the shipping container.

A.5.6 STORAGE AND SHIPMENT OF SAMPLES

Samples will not be stored on site and shall be transported to controlled storage or the appropriate laboratory on the same day. Sample packaging for shipment to a laboratory will follow ASTM D4220/D4220M-14, *Standard Practices for Preserving and Transporting Soil Samples,* (ASTM 2014) to prevent physical damage. Samples collected, packaged, and shipped to the laboratory for analyses will be tracked using the carrier's tracking system (e.g., United Parcel Service, Federal Express), if not hand delivered.

Samples of material shipped from a site to a laboratory for analysis must be classified and prepared for the carrier in accordance with regulatory requirements found in the International Air Transport Association regulations and the U.S. DOT 49 *CFR*, Parts 100 through 177, *Transportation*, as outlined in PROC-TR-9503, *Shipping Samples from a Company Site* (UCOR 2012).

Samples are not expected to meet the definition of a hazardous material or dangerous goods.

A.6 SAMPLE CUSTODY

A sample is in custody if it is in the actual possession of a sample custodian, is in the view of a sample custodian after being in their physical possession, was in the physical possession of a sample custodian and then secured to prevent tampering (e.g., affixed with custody/tamper seals), and is placed in a secured area. Custody/tamper seals are placed on the container lid and side of the sample container to guard against and detect any sample tampering between the time of sample collection and receipt by the laboratory. Sample shipment containers (i.e., ice chest or coolers) will have custody/tamper seals placed across the hinge of the lid and opposite side (back and front) of the lid to also guard against or detect tampering.

A.6.1 CUSTODY SEALS

Custody/tamper seals are affixed to sample containers and sample shipment containers in accordance with the characterization contractor's COC Protocol for Environmental Sampling. The application of custody/tamper seals on shipping containers may be waived if the sample team maintains sample custody as defined in PROC-ES-2708, *Chain of Custody Protocol for Environmental Sampling,* Sect. 4[2] (UCOR 2016b) from the time of collection until the samples are relinquished to the Transportation Specialist. Certain sample containers may be placed in a resealable bag and have a custody seal affixed such that the seal must be broken when the bag is opened (i.e., over the bag opening).

A.6.2 SAMPLE TRACKING

The COC form documents the transfer of sample custody from the time of sample collection to laboratory receipt (Fig. A.2). The COC custody record will be initiated at the time of sample collection and remain with the sample from the field to storage, and sample shipment to the laboratory.

Upon laboratory receipt, the laboratory custodian will complete the required sections of the COC thereby accepting custody of the samples. Sample shipments will be examined immediately upon receipt by the laboratory to determine damage, loss, or inconsistencies. A Letter of Receipt (LOR) or equivalent will be completed by the laboratory that indicates sample condition, documentation inconsistency, and any problems discovered. If samples are damaged or the shipment has been otherwise compromised, the laboratory will immediately notify the characterization contractor.

Samples will be logged into the laboratory and will be tracked and maintained under conditions appropriate to the specific laboratory methods throughout the laboratory process as described in the laboratory QC manual. After appropriate information and required signatures have been added to the COC form and LOR, the laboratory will return signed copies to the characterization contractor as soon as practicable (e.g., usually within 24 hours). The LOR may be in the form of an electronic confirmation (e.g., email, pdf). The laboratory shall include a copy of the LOR and documentation of the analytical login (project sample number, laboratory sample number, analysis scheduled, etc.) in this sample receiving report.

CHAIN-OF-CUSTODY FORM

MACTEC Engineering & Consulting, Inc. - Knoxville Branch
1725 Louisville Drive - Knoxville, TN 37921-5904

Job Number:	Date:
Client Name:	of ___ Samples
Job Name:	Rush? Yes or No
Building:	
Inspectors:	

Sample I.D. Number	Location	Source Description	Lab I.D. Number	Comments

Friable Material:	Shipped Via: Ground unless other noted	Lab Shipped To: (If Required)
Non-Friable Material	(other: Airborne, Fed-Ex, UPS, US Mail, Etc.)	
Field Collection:	1st Transfer Facility:	2nd Transfer Facility: Disposal:
Name:	Name:	Name:
Signature:	Signature:	Signature:
Date:	Date:	Date:

Fig. A.2. LCOC example.

The original COC will be returned by the laboratory to the characterization contractor along with the data package. Original COC forms will be stored with the associated data deliverables or electronic data deliverables (EDDs), then provided as records at project completion.

A.6.3 SAMPLE DISPOSAL

Samples will be held for a minimum of 90 days following reporting. Samples will be stored by the laboratory in appropriate containers and under conditions appropriate to the specific laboratory methods.

The laboratory will be responsible for return of residual samples after the minimum retention period and upon approval by the project. Returns will be coordinated with the characterization contractor.

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A.7 DECONTAMINATION OF EQUIPMENT AND DEVICES

The Central Bear Creek Valley (CBCV) site is located in an uncontaminated area. All equipment and downhole tools will be steam cleaned prior to mobilization to the CBCV project site. Decontamination will consist of removing adhering soil and subsurface materials from the downhole tools prior to use and between sampling locations and intervals in accordance with the applicable standards. Field decontamination activities will be recorded in the applicable field notebook or on the drilling/boring log.

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A.8 CALIBRATION PROCEDURES AND FREQUENCY

A.8.1 FIELD INSTRUMENT CALIBRATION PROCEDURES AND FREQUENCY

Field instrumentation and measurement equipment will be calibrated by qualified individuals and maintained against certified equipment and/or standards having known valid traceability in accordance with ASTM/AASHTO standards. Field logbooks shall be used to record calibration, standardization, and field measurement data associated with field instruments and measurement equipment in accordance with ASTM/AASHTO standards.

Where radiological monitoring is required for samples, personnel, or certain activities, radiological protection personnel shall ensure radiological monitoring equipment is calibrated daily (e.g., daily source checks). Radiological monitoring instrument calibration records are established and maintained by UCOR radiological protection personnel.

If an instrument malfunctions prior to use, remove the device from service, tag the device so it is not inadvertently used, and notify the characterization contractor field personnel. If an instrument is discovered to be out of calibration while in the field, notify the Characterization PM or designee and discontinue related field work until a properly calibrated instrument is obtained. The characterization contractor field personnel will ensure that if an instrument is discovered to be out of calibration, the instrument will be tagged or segregated from other equipment (not to be used) and properly calibrated or disposed as appropriate.

If an instrument is found to be out of calibration and inadvertently used to obtain field measurement data, then a nonconformance report (NCR) will be completed and the sample will be considered null and void, resulting in a retest. The nonconformance will be documented by the appropriate project personnel in the field logbook along with the validity of the previous calibration or inspection with test results and the acceptability of similar equipment previously calibrated or inspected and tested. Any equipment that is consistently found to be out of calibration will be repaired or replaced. Such action(s) will be documented in the field logbook.

A.8.2 LABORATORY INSTRUMENT CALIBRATION PROCEDURES AND FREQUENCY

Laboratory equipment will be calibrated according to ASTM/AASHTO standards. Calibration frequency will be based on the standard employed, type of equipment, inherent stability, manufacturer's recommendations, values given in the USACE/AASHTO accredited laboratory QC manual, intended use, and experience. All standards used for equipment calibration will be traceable to ASTM/AASHTO standards. The source of the standard used must be documented in the lab records.

For volumetric laboratory measurements, ASTM/AASHTO approved volumetric equipment shall be used by trained and qualified technicians to prepare calibration standards, bench standards, samples for analysis, etc. For gravimetric measurements, calibration of analytical balances must be performed by trained and qualified instrument technicians using weights traceable to the National Institute of Standards and Technology.

It should be noted that other instrumentation (such as thermometers) must be properly maintained and calibrated to ASTM/AASHTO standards. The temperatures of ovens used in sample handling will be recorded, and the control limits shall be defined. When these limits are not met, the sample will be considered null and void, and a retest of the sample must occur.

A.8.3 CALIBRATION FAILURES

Laboratory equipment failures are addressed in the laboratory QC manual, which is audited by AASHTO. If a laboratory equipment failure occurs, the sample will be considered null and void, and a retest of the sample must occur once adequate equipment is acquired.

A.8.4 CALIBRATION RECORDS

Calibration data will be recorded in the laboratory records. The information will include the date, calibrator's initials, and standard used during the calibration process. Records that demonstrate traceability of all calibration standards used in calibrations to the certified source will be maintained in accordance with ASTM/AASHTO standards.

The appropriate project personnel will ensure that field calibration data records are kept current. Records for field instruments used will be maintained in the project files.

Records for laboratory equipment will be maintained as specified in the geotechnical laboratory QC manual in accordance with the laboratory's QC system.

A.9 PROJECT DATA QUALITY ASSESSMENT

The data assessment objectives for laboratory analysis will produce data of known and sufficient quality to support the project and resultant decisions. Appropriate procedures and QC checks will be employed to assess the level of acceptance of these parameters. Applicable QC data will be reported for the project along with the sample results. When the sample set is completed, QC data will be reviewed and evaluated to validate the information. Acceptance criteria and evaluation of laboratory results for the representativeness, comparability, and sensitivity parameters will be determined in compliance with ASTM/AASHTO standards.

The following quality parameters will be used to evaluate data quality:

- Representativeness
- Comparability
- Sensitivity

In determining data usability, especially in the decision-making process, the integrity and authenticity of the data must be evaluated and the measurement uncertainty must be determined. The laboratory analyzing the data must be accredited by the USACE or AASHTO through the certification program involving standard analysis in accordance with AASHTO procedures.

A.9.1 REPRESENTATIVENESS

Representativeness expresses the relative degree to which the data depict the characteristics of a population, parameter, sampling point, process condition, or environmental condition. The objective of this study is to accurately represent the material properties.

Representative samples for this investigation will be acquired through implementation of ASTM/AASHTO standards that will generate data representative of the sampling point location. Sampling procedures are designed to minimally impact the sample obtained, so that conditions representative of the sampling location will be maintained. Representativeness is also provided through the sample selection for geotechnical analysis by the UCOR field representative and geotechnical laboratory personnel. The combined consultation will ensure that the interval selected for analysis represents the site conditions and provides the most useful information for the future engineering design.

The goal for representative sample data will, therefore, be met through the proper documentation of field and standard protocols as well as through subject matter expert consultation and sample interval selection. Review of the data, documentation, and field information will also be implemented to identify sample population, parameter, or process characteristics relative to representativeness.

A.9.2 COMPARABILITY

Comparability expresses the confidence with which one data set can be compared with another. Comparability of the data generated in this investigation will be obtained through the implementation of the identified protocols for sampling and analysis of samples. Expression of results in standard units, and successful participation by the laboratories in external performance evaluation programs will enable the data produced through this investigation to be compared with future geotechnical data sets.

A.9.3 SENSITIVITY

Procedures to attain sensitivity objectives include the following:

- Uniform training and certification for staff
- Standard provisions for inspection, maintenance, and repair
- Provision of SOPs to technical staff
- Reference to SOPs in the field and laboratory QAPPs
- Field/laboratory QA inspections to determine compliance with the items specified in the support plans

A.10 DATA REPORTING

The results of the field investigation will be presented in a report as described in Sect. 9 of the FSP. Record copy and electronic data will be entered/presented into common, standardized formats. In addition to following field, sample management, data management, and laboratory QC manual specifications, verification of data may be made using a variety of computerized checks (i.e., record copy checked against EDD). These procedures will ensure that data are entered, encoded, processed in a consistent way, and available in a designated and usable format.

A.10.1 FIELD DATA REDUCTION AND EVALUATION

Data measurements collected during field activities will be evaluated by comparing the data to similar measurements, as applicable. Field measurements are collected in accordance with ASTM/AASHTO standards or procedures. The appropriate project personnel will be responsible for verifying that sampling protocols have been observed.

The COR/UCOR representative may perform a surveillance of the sampling protocols. These reviews may include checking the sample collection date and times, applicable procedures, calibration methods and frequency, COC, field logbook and/or drilling/boring logs, and other applicable information and documentation.

A.10.2 GEOTECHNICAL LABORATORY DATA REDUCTION AND EVALUATION

In general, the analyst will process the data either manually or by inputting the data into a relevant software program. For manually processed data, all the steps in the computation must be provided, including equations used and the source of input parameters such as response factors, dilution factors, and calibration constants. If calculations are not performed directly on the data sheet, the calculations must be provided on company letterhead paper and attached to the data sheets. All pages of the calculations must be signed and dated by the analyst performing the calculations as well as by the individual verifying the calculations.

For data input by an analyst and processed using a relevant software program, a copy of the input must be kept and uniquely identified with the project number and other pertinent information, as necessary. The samples to which the data processing refers must be clearly stated, and the input must be signed and dated by the analyst performing the input as well as the individual verifying the process. When processing data are acquired from instrumentation, the analyst and the oversight individual must verify that the correct project, sample numbers, calibration constants, response factors, units, equipment numbers, and numerical values used for detection limits are present.

A.10.2.1 Laboratory Data Review

The laboratory is responsible for ensuring that data reduction and calculations follow correct procedures, are documented, and are checked by qualified personnel, in accordance with the laboratories' internal QC manual. All information, including reduced and summarized data, will be retained with the raw data. Specific calculations used for data reduction will also be included. The laboratory is responsible for maintaining comprehensive documentation for all data produced, including the following:

- Appropriateness of equations employed
- Correctness of numerical input (both record copy and electronic)

- Numerical correctness of all calculations
- Interpretation of laboratory analysis output
- Comparability and correctness of initial and continuing calibration results
- Traceability of samples from receipt to data report by internal custody and tracking procedures
- Evaluation of data deliverable completeness and legibility
- Raw data from drilling/boring logs
- Geotechnical report

A.10.2.2 Data Reporting and Deliverables

Geotechnical reports and borehole logs will be loaded into OREIS while groundwater and surface water flow data will be uploaded into PEMS then transferred to OREIS.

A characterization contractor approved geotechnical data report, content and format, will be developed in accordance with the requirements ASTM/AASHTO standards. The geophysical data reports will also be loaded into OREIS.

A.11 RECORDS AND DOCUMENT CONTROL

A.11.1 RECORDS CONTROL

All QA records concerning the project (internal and external correspondence, FSP, QAPP, field logbooks, LCOC forms, data packages, audit reports, surveillance reports, NCRs, corrective action reports, management assessments, etc.) and other quality records are submitted to the DOE PM, CO, and COR at the end of each phase of the project. These records will be submitted to the UCOR Document Management Center (DMC) in accordance with PROC-OS-1001, *Records Management, Including Document Control* (UCOR 2017).

The DMC Controlled Document Worksheet, Form-1057 (Fig. A.3), is completed by the UCOR Characterization Technical Lead to identify all recipients of a controlled record copy of the FSP/QAPP. The DMC Supervisor, or designee, issues revised electronically controlled documents (or hard copy upon request) to those on the distribution list (see last page of this QAPP).

A.11.2 RECORDS RETENTION

Prior to the approval of the Record of Decision (ROD), all primary and secondary documents, decision relevant correspondence, and public notices/presentation materials are entered into the Administrative Record (AR). The AR is approved by the three Federal Facility Agreement (FFA) Parties prior to closing the AR. Post-ROD project/subproject FFA documents and correspondence are stored in post-decision record files maintained by the AR coordinator and are available to the public. All validated characterization sampling data supporting regulatory decisions shall be archived in OREIS and are available online to the FFA parties or in hardcopy upon request. Following receipt of information from external sources and issuance of reports, associated records, including those generated by subcontractors, shall be placed in the AR or the project post-decision record file, as required. Each contractor shall maintain project files as appropriate.

The AR Coordinator is responsible for maintaining evidence files to support the AR and maintaining post decision project files. All environmental characterization and post-remediation sampling and analysis generated, validated data used to support future decisions, decision changes, or used to determine the effectiveness of the remedy are archived in the OREIS database. Documents are initiated, compiled, and transmitted to the ORR AR Coordinator in accordance with PROC-OS-1003, *Administrative Record Program* (UCOR 2015b).

Records are retained and maintained in accordance with the length of time as specified in DOE records retention schedules (i.e., destroy 75 years after termination of the applicable FFA). The DMC obtains authorization for records turnover to the Federal Records Center or records destruction from the OREM contractor DMC Records Manager, Legal, and the originating organization, if different from the originator, during the 6 months before the record's scheduled destruction date. EPA and TDEC are made aware of planned destruction of FFA-related decision and completion materials and seek approval prior to any record destruction.

UCOR
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Oak Ridge LLC

DMC Controlled Document Worksheet

General Instructions: The following worksheet should be completed and attached to all Documents transmitted to the Document Management Center (DMC) for retention of the Record Copy and Controlled Copy distribution.

Document Number:	Revision Number:	Document Date:

Document Title:

Author/Contact

Applicable Project and Site:

Supersedes other Documents? Yes ☐ No ☐
If Yes, Indicate Document Numbers:

Should Previous Versions be Cancelled? Yes ☐ No ☐
If Yes, Indicate Document Number and Revision:

Indicate Recipients:

Notes or Special Instructions:

Submitted By **Date Submitted**

Attach the DMC Controlled Document Worksheet to the front of the document and forward to the Document Management Center Distribution.

NOTE: This worksheet is not for use with Facility Safety Documents – A Form 554 must be used for those documents.

Form-1057 (8/11) Rev. 0
PROC-OS-1001

Fig. A.3. UCOR Form-1057, DMC Controlled Document Distribution.

A.11.3 RECORDS STORAGE

Prior to the transmittal of documents to the DMC, Record Copy material will reside with the characterization contractor in suitable storage locations that will ensure the protection of Record Copy (hard copy and electronic) records. The protection includes, but is not limited to, reasonable safeguards against fire, theft, water damage, rodents, insect infiltration, or floods.

QA Records are a subcategory of Category I Records—records that require a rigorous level of protection because of their content or value. Non-lifetime QA records (non-permanent records) are Category II records, which have less stringent requirements. Records storage shall provide control and protection to records.

Category I and II records are maintained with the following storage requirements: (1) records are maintained in a lockable file cabinet or a lockable room that contains file cabinets, open shelving, or racks (in a lockable room, records may be boxed and stored on racks or other means to prevent boxes from residing directly on the floor); (2) access control is established to prevent unauthorized use, disclosure, theft, or destruction; (3) a posted list indicates designated personnel approved for unescorted access to records filing areas; and (4) an index system facilitates ease of records retrieval and accounts for records removed from the storage area.

Category I records include one of the following additional storage requirements: (1) records vault, one-hour fire-rated cabinet, plus smoke detection system; (2) fire suppression system and reasonable safeguards against theft, water damage, rodent or insect infiltration, or floods; (3) duplicate records in an identified duplicate storage area in a separate location (locations shall be sufficiently remote from each other to eliminate the chance of exposure to a single hazard); or (4) duplicate information on other record media stored in a separate location.

Electronic records and databases (i.e., OREIS, PEMS, and Tracker) are protected from damage and loss by full weekly and incremental nightly backups.

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A.12 REFERENCES

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UCOR 2015b. *Administrative Record Program*, PROC-OS-1003, URS | CH2M Oak Ridge LLC, Oak Ridge, TN, June 15.

UCOR 2016a. *URS | CH2M Oak Ridge LLC (UCOR) Quality Assurance Program Plan, Oak Ridge, Tennessee,* UCOR-4141/R4, URS | CH2M Oak Ridge LLC, Oak Ridge, TN, March.

UCOR 2016b. *Chain of Custody Protocol for Environmental Sampling*, PROC-ES-2708, URS | CH2M Oak Ridge LLC, Oak Ridge, TN, November 21.

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ATTACHMENT 1.
ENVIRONMENTAL MANAGEMENT DISPOSAL FACILITY QUALITY ASSURANCE PROGRAM PLAN (QAPP) CONTACT LIST

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EMDF Project Key Personnel Contact List

Role	Name	Organization	Telephone	Email
OREM Landfills Project Manager	Susan DePaoli	OREM/P2S	(865) 294-6065	depaolis@p2s.com
OREM Contracting Officer	Heather Cloar	OREM	(865) 576-1894	Heather.Cloar@orem.doe.gov
OREM Contracting Officer Representative	Brian DeMonia	OREM	(865) 241-6182	Brian.DeMonia@orem.doe.gov
Characterization Contractor Project Manager	Dirk Van Hoesen	Strata-G	(865) 705-8793	dvanhoesen@stratag.org
Characterization Contractor Health and Safety	David Bratley	CTI and Associates	(361) 548-9164	dbratley@cticompanies.com
Characterization Contractor Quality Assurance	Tammy Phillips	Strata-G	(865) 806-7188	tphillips@stratag.org
Characterization Contractor Sample Manager	Kevin Foye	CTI and Associates	248-459-4609	kfoye@cticompanies.com
Characterization Contractor Transportation Specialist.	Kevin Foye	CTI and Associates	248-459-4609	kfoye@cticompanies.com
Characterization Contractor Data Manager	Kevin Foye	CTI and Associates	248-459-4609	kfoye@cticompanies.com
UCOR EMDF Project Manager	Julie Pfeffer	UCOR	(865) 712-4172	julie.pfeffer@ettp.doe.gov
UCOR Characterization Technical Lead	Annette Primrose	UCOR	(865) 576-9170	annette.primrose@ettp.doe.gov
UCOR Field Representative(s)	Dick Ketelle/TBD	UCOR/RSI	(865) 574-5762	richard.ketelle@ettp.doe.gov

EMDF = Environmental Management Disposal Facility
OREM = Oak Ridge Office of Environmental Management
P2S = Professional Project Services, Inc.
RSI = Restoration Services, Inc.
TBD = to be determined
UCOR = URS | CH2M Oak Ridge LLC

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ATTACHMENT 2.
ENVIRONMENTAL MANAGEMENT DISPOSAL FACILITY QUALITY ASSURANCE PROGRAM PLAN ADDENDUM FORM

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ADDENDUM FORM
ENVIRONMENTAL MANAGEMENT DISPOSAL FACILITY
QUALITY ASSURANCE PROJECT PLAN

Addendum No.: __FY17-__________ **Effective Date:** ________________

Type of Change (check all that apply):

☐ Change in project organization

☐ Change in procedure or process for conducting an element of work

☐ Change in personnel listed in Appendix C – Contact List

☐ Other: ____

____

Attach copies of the pages affected by the change for insertion into the QAPP.

Change is: ☐ Permanent (i.e., >1 year) ☐ Temporary (i.e., <1 year)

Reason for Change(s):

Requester: ____ Date: ______________
(Person requesting revision to QAPP)

Approved by: ____ Date: ______________
(OREM Landfills Project Manager or authorized designee)

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APPENDIX B.
MEASUREMENT AND TESTING APPROACH AND METHODS

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CONTENTS

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TABLES

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ACRONYMS

ASTM	American Society for Testing and Materials
bgs	below ground surface
EMDF	Environmental Management Disposal Facility
NT	North Tributary
OREIS	Oak Ridge Environmental Information System
PEMS	Project Environmental Measurements System
P-wave	compression wave
S-wave	shear wave
SPT	standard penetration test
UCOR	URS | CH2M Oak Ridge LLC

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B.1 INTRODUCTION

The following procedures and American Society for Testing and Materials (ASTM) methods and guidelines will be used to ensure the appropriate quality of data are collected. The latest available version of these will be used.

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B.2 DRILLING FOR PIEZOMETERS, GEOTECHNICAL INVESTIGATION AND SEISMIC INVESTIGATION

Phase 1 boreholes as well as boreholes identified for a future investigation will be drilled as shown on Table B.1 and Fig. 14 in this Field Sampling Plan as specified in the latest version of SPG-00000-A005, *Standard Specification for Well Drilling, Installation and Abandonment* (URS | CH2M Oak Ridge LLC [UCOR] 2016). Note that planned future boreholes also are provided in Table B.1 for completeness.

Boreholes will be drilled by Tennessee-qualified monitoring well drillers. Core or representative samples will be collected from boreholes, but the method will vary depending on the material and tests performed as described below. A Boring Log Form or electronic logging device will be used to document soil and rock characteristics and pertinent field data during soil boring activities. Continuous bedrock core will be collected throughout the deepest boring at each paired piezometer location. A geologist or engineer will describe the material with sufficient detail to identify lithology, chert lenses, relic bedding, moisture, and other features that may bear or transmit water (e.g., areas of fracturing, bedding, dissolution).

The specific methods for data collection and logging are provided in Table B.2.

B.2.1 STANDARD PENETRATION TEST APPROACH

Standard penetration tests (SPTs) will be conducted using a qualified contractor with field oversight by a geotechnical engineer or geologist with geotechnical experience. These data will be collected and analyzed as described in Sect. B.5.

Borings will be installed at the approximate locations as presented in Fig. 14 in this Field Sampling Plan. For boreholes constructed while collecting SPT measurements, SPTs will begin at the ground surface, but beneath any drill pads that are present. This will allow measurement of the topsoil layer thickness. SPTs will be conducted at 2.5-ft intervals in the upper 10 ft of the borehole, then at 5-ft intervals until the top of competent rock is encountered and/or drilling refusal. While vertical variations are expected, testing on 5-ft intervals is adequate to describe this variation sufficiently for design purposes.

Measurements of the efficiency of the SPT hammer will be conducted in accordance with ASTM D4633, *Standard Test Method for Energy Measurement for Dynamic Penetrometers* (ASTM 2016).

All borings should be advanced to drilling refusal or a maximum of approximately 50 ft below ground surface. SPT data will be collected by driving a split-spoon sampler 18-24 in. and recording the blow counts every 6 in. Core will be collected between each SPT interval. Each boring will be cored an additional 10 ft below drilling refusal. The top of bedrock will be noted for each location.

A boring log will be maintained for each borehole that will include a brief description of the soil types encountered and the associated blow counts per depth intervals for SPTs.

Geotechnical samples will be collected from specified depths within offsets of selected boreholes following review of the SPT data and borehole logs by geotechnical engineers. These relatively undisturbed (Shelby tube) samples will target representative cohesive soils for permeability, laboratory shear strength, and consolidation tests.

Table B.1. Summary of subsurface sample collection locations

Location	Deep piezometer	Shallow piezometer	Residuum and bedrock core	Well point	Slug tests	FLUTe	GW levels	SPTs	Test pit	Potential geotechnical lab samples	Crosshole geophysics	Geophysical logging
GW-978	•		•			•	•	•		•		
GW-979		•			•		•					
GW-980	•		•			•	•	•		•		
GW-981		•			•		•					
GW-982	•		•			•	•	•		•		
GW-983		•			•		•					
GW-984	•		•			•	•	•		•		
GW-985		•			•		•					
GW-986	•		•			•	•	•		•		
GW-987		•			•		•					
GW-988	•		•			•	•	•		•		
GW-989		•			•		•					
GW-990	•		•			•	•	•		•		
GW-991		•			•		•					
GW-992	•		•			•	•	•		•		
GW-993		•			•		•					
GW-994	•		•			•	•	•		•		
GW-995		•			•		•					
GW-996	•		•			•	•	•		•		
GW-997		•			•		•					
GW-998	•		•			•	•	•		•		
GW-999		•			•		•					
GY-001	•		•			•	•	•		•		
GY-002		•			•		•			•		
GY-003		•	•		•		•	•		•		
GY-004		•	•		•		•	•		•		
GY-005	•						•					
GY-006				•			•					
GY-007				•			•					
GY-008				•			•					
GY-009				•			•					
EMDFBH-1 a-c			2					•		2 boreholes	•	•
EMDFBH-2			•					•		•		
EMDFBH-3 a-c			2					•		2 boreholes	•	•
EMDFBH-4			•					•		•		
EMDFBH-5			•					•		•		
EMDFBH-6			•					•		•		
EMDFBH-7			•					•		•		
EMDFPT-1									•	•		
EMDFPT-2									•	•		

FLUTe = Flexible Liner Underground Technologies, LLC
GW = groundwater
SPT = standard penetration test

Table B.2. Specific methods for data collection and logging

ASTM standard or UCOR procedure	Citation[a]
ASTM D1586	ASTM D1586-11, *Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils*, ASTM International, West Conshohocken, PA, 2011.
ASTM D2113	ASTM D2113-14, *Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration*, ASTM International, West Conshohocken, PA, 2014.
ASTM D2488	ASTM D2488-09a, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, ASTM International, West Conshohocken, PA, 2009.
ASTM D7012	ASTM D7012-14, *Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures*, ASTM International, West Conshohocken, PA, 2014.
ASTM D4220/ D4220M-14	ASTM D4220 / D4220M-14, *Standard Practices for Preserving and Transporting Soil Samples*, ASTM International, West Conshohocken, PA, 2014.
ASTM D4633	ASTM D4633-16, *Standard Test Method for Energy Measurement for Dynamic Penetrometers*, ASTM International, West Conshohocken, PA, 2016.
ASTM D5079	ASTM D5079-08, *Standard Practices for Preserving and Transporting Rock Core Samples (Withdrawn 2017)*, ASTM International, West Conshohocken, PA, 2008.
ASTM D6032/D6032M-17	ASTM D6032 / D6032M-17, *Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core*, ASTM International, West Conshohocken, PA, 2017.
PROC-ES-2303	*Borehole Logging*, PROC-ES-2303, latest revision, URS | CH2M Oak Ridge LLC, Oak Ridge, TN.

[a]The most current version of the procedure shall be used.

ASTM = American Society for Testing and Materials
UCOR = URS | CH2M Oak Ridge LLC

Boring logs will be provided to the laboratory with the collected samples for review by a geotechnical engineer to determine the number and types of tests. Sample packaging for shipment to the laboratory will prevent physical damage. The required tests and frequency are provided in Sect. B.5.2.

B.2.2 BOREHOLE AND TEST PIT ABANDONMENT

Boreholes that will not be converted to piezometers will be abandoned in accordance with *Standard Specification for Well Drilling, Installation, and Abandonment* (UCOR 2016) and the requirement listed in Table B.3.

Table B.3. Specific method for borehole abandonment

Reference	Citation[a]
PROC-ES-2106	*Well Plugging and Abandonment*, PROC-ES-2106, latest revision, URS | CH2M Oak Ridge LLC, Oak Ridge, TN.

[a]The most current version of the procedure shall be used.

Additional, follow-on seismic and geotechnical boreholes are expected to be plugged and abandoned:

- EMDFBH-1 a, b, and c (3 boreholes)
- EMDFBH-2
- EMDFBH-3 a, b, and c (3 boreholes)
- EMDFBH-4
- EMDFBH-5
- EMDFBH-6
- EMDFBH-7

Follow-on test pits also will be abandoned following data collection and photographic documentation. The excavated soil will be replaced in lifts not to exceed 3 ft and compacted by tamping with a bucket or tracking across the backfilled soil a minimum of three times. The test pits are expected to be included in a follow-on Field Sampling Plan to include the following:

- EMDFPT-1
- EMDFPT-2

B.3 HYDROGEOLOGIC INVESTIGATION

Piezometers are shown on Fig. 14. Piezometers, future well points, and the current and future planned tests are shown on Table B.4. Piezometers will be installed in designated boreholes by Tennessee-qualified monitoring well drillers in accordance with Oak Ridge Reservation requirements as specified in the latest version of *Standard Specification for Well Drilling, Installation, and Abandonment* (UCOR 2016). Well points will be installed according to manufacturer's instructions.

Each piezometer will be constructed with commercially fabricated 2-in.-diameter, flush-threaded, carbon steel or polyvinyl chloride conductor casings and well screens. Well screens will be slotted and will have an inside diameter equal to that of the piezometer casing. A minimum 1-ft sump will be installed below the well screens. No fitting (coupling) shall restrict the inside diameter of the jointed casing and/or screen. All screens, casings, and fittings shall be new.

Screen lengths will be a nominal 5 ft in length, where possible, for both the intermediate and shallow piezometers. The actual length of the screened interval and the screen setting shall be determined based on lithology, the interception of fractures (e.g., locations encountering groundwater) or lack of fractures, and the location of hydrogeological unit contacts. Screens will have 0.010-in. machine-cut slots. Screen bottoms shall be securely fitted with a threaded cap or plug of the same composition as the screen. A filter pack of silica sand will be placed around each screen such that no voids are created from the bottom of the borehole to approximately 0.6 m (2 ft) above the top of the screen. A minimum 2-ft seal of sodium bentonite pellets will be installed above the filter pack to ensure no void space and it will be hydrated with potable water for a minimum of 8 hours. Each piezometer will be secured at the surface with a locking, waterproof cap. Permanent surface completions of the piezometer will be decided by the project design team.

Table B.4. Hydrogeologic investigation current and future locations and planned tests

Location	Deep piezometer	Shallow piezometer	Well point	Slug tests	FLUTe	GW levels	Potential laboratory hydraulic conductivity
GW-978	•				•	•	•
GW-979		•		•		•	
GW-980	•				•	•	•
GW-981		•		•		•	
GW-982	•				•	•	•
GW-983		•		•		•	
GW-984	•				•	•	•
GW-985		•		•		•	
GW-986	•				•	•	•
GW-987		•		•		•	
GW-988	•				•	•	•
GW-989		•		•		•	
GW-990	•				•	•	•
GW-991		•		•		•	
GW-992	•				•	•	•
GW-993		•		•		•	
GW-994	•				•	•	•
GW-995		•		•		•	
GW-996	•				•	•	•
GW-997		•		•		•	
GW-998	•				•	•	•
GW-999		•		•		•	
GY-001	•				•	•	•
GY-002		•		•		•	•
GY-003		•		•		•	•
GY-004		•		•		•	•
GY-005	•					•	
GY-006			•			•	
GY-007			•			•	

Table B.4. Hydrogeologic investigation locations and planned tests (cont.)

Location	Deep piezometer	Shallow piezometer	Well point	Slug tests	FLUTe	GW levels	Potential laboratory hydraulic conductivity
GY-008			•			•	
GY-009			•			•	

FLUTe = Flexible Liner Underground Technology, LLC
GW = groundwater

Piezometer Development—Piezometers shall be developed no sooner than 24 hours after installation and shall continue until the piezometer responds to water-level changes and produces clear, sediment-free water to the extent possible. During development, water shall be removed throughout the entire column of water standing in the piezometer by periodically lowering and raising the pump intake or bailer. A minimum of three piezometer volumes will be evacuated, if possible. Temperature, pH, and specific conductivity of evacuated water will be monitored in accordance with PROC-ES-2101, *Groundwater Sampling Wells or Piezometers* (UCOR 2015), or equivalent during development and will be stable, if practical, before each piezometer shall be considered developed.

Hydraulic Conductivity—Both laboratory and field hydraulic conductivity measurements will be obtained as shown on Table B.4. The specific methods for hydraulic conductivity measurements are shown on Table B.5.

The total number of tests, specific locations, and depths of the laboratory samples will be determined in consultation with geotechnical engineers and the geotechnical laboratory following review of the borehole logs and collected samples. There is no specific criteria available in advance. The selection of samples for each test will be based on professional judgment by the design team and the laboratory based on the subsurface conditions encountered, sample quantity and quality, and budget.

Table B.5. Specific methods for hydraulic conductivity measurement

Reference	Citation[a]
ASTM D5084	ASTM D5084-16a, *Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter*. ASTM International, West Conshohocken, PA, 2016. (Provides additional information to correlate with field measurements, and recompacted bulk soil samples can be used to replicate as-placed values. Because of the small sample size, these samples may underestimate the permeability of the in situ materials. These sample results will be used in conjunction with the slug tests and FLUTe tests to develop a more complete picture of the hydraulic conductivity, including vertical conductivity values, present in situ.)
PROC-ES-2102	*Aquifer Testing*, PROC-ES-2102, latest revision, URS | CH2M Oak Ridge LLC, Oak Ridge, TN.
FLUTe Contractor Manual	Operating manual for specialty contractor performing FLUTe testing.

[a]The most current version of each standard, test method, or procedure shall be used.

ASTM = American Society for Testing and Materials
FLUTe = Flexible Liner Underground Technologies, LLC

Groundwater elevation measurements—Qualified field personnel will perform the measurements in accordance with the most recent version of the applicable operating procedure specified in Table B.6 (or a U.S. Environmental Protection Agency-approved technically equivalent procedure).

The procedures listed in Table B.6 will be used to determine groundwater elevations. Downhole monitors will be placed in each piezometer and will collect groundwater level, pH, conductivity, and temperature data every 30 minutes. Data will be downloaded every 2 weeks.

Table B.6. Specific methods for groundwater elevation measurements

Reference	Citation[a]
PROC-ES-2100	*Groundwater Level Measurement,* PROC-ES-2100, latest revision, URS | CH2M Oak Ridge LLC, Oak Ridge, TN.
PROC-ES-2101	*Groundwater Sampling Wells or Piezometers,* PROC-ES-2101, latest revision, URS | CH2M Oak Ridge LLC, Oak Ridge, TN.

[a]The most current version of each procedure shall be used.

Groundwater and surface water field data measurements collected by characterization contractor personnel will be manually entered into an electronic spreadsheet or provided in electronic format. These measurements will be provided to the UCOR characterization technical lead for electronic upload into the Project Environmental Measurements System (PEMS) by the UCOR characterization technical lead or designee. A PEMS report is printed or reviewed on screen and compared to the associated hard copy Field Data Form or the electronic raw data printout. The reviews are performed by sampling personnel or other pertinent personnel. Changes are provided to the characterization contractor to correct the database as appropriate. If data has been sent to Oak Ridge Environmental Information System (OREIS), then the UCOR characterization technical lead will submit a change request in accordance with PROC-ES-1002, *Submitting, Reviewing, and Dispositioning Changes to the Environmental Information Management (EIM) System (OREIS, PEMS, and TRACKER)* (UCOR 2014).

In addition and as possible and observed, groundwater levels will be noted and recorded for the seismic boreholes, SPT boreholes, and test pits.

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B.4 SURFACE WATER FLOW MEASUREMENT

Four surface water flumes will be placed along Drainage-10 West, North Tributary (NT)-10 and NT-11. The planned locations are shown on Fig. 14, however, field walkovers will be conducted to determine the specific locations for each flume based on the field conditions. Flumes will be installed per manufacturer's instructions. An additional two flumes will be located based on the field walkdown results. Flumes will be located where the streams enter and/or leave the estimated buffer zone or as appropriate.

The flumes will be monitored on an every 30 minute basis, with data downloaded every 2 weeks. The procedure listed in Table B.7 will be used to collect flow measurements.

Table B.7. Specific method for surface water flume installation

Reference	Citation[a]
PROC-ES-2200	*Surface Water Flow Measurements,* PROC-ES-2200, latest revision, URS | CH2M Oak Ridge LLC, Oak Ridge, TN.

[a]The most current version of the procedure shall be used.

Flow, temperature, pH, and conductivity measurements will be collected at the surface water flumes.

As noted in Sect. B.3, surface water flow data will be provided to the UCOR characterization technical lead for electronic upload into PEMS by the UCOR characterization technical lead or designee.

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B.5 GEOTECHNICAL AND GEOPHYSICAL DATA COLLECTION

Geophysical and geotechnical data acquisition are used together in the design stability analysis. The Phase 1 and anticipated future locations planned for collection of geotechnical and geophysical data are shown in Table B.8. The Phase 1 locations are shown on Fig. 14.

Table B.8. Geotechnical and geophysical collection current and future locations

Location	SPTs	Test pit	Potential geotechnical lab samples	Crosshole geophysics	Geophysical logging
GW-978	•		•		
GW-979					
GW-980	•		•		
GW-981					
GW-982	•		•		
GW-983					
GW-984	•		•		
GW-985					
GW-986	•		•		
GW-987					
GW-988	•		•		
GW-989					
GW-990	•		•		
GW-991					
GW-992	•		•		
GW-993					
GW-994	•		•		
GW-995					
GW-996	•		•		
GW-997					
GW-998	•		•		
GW-999					
GY-001	•		•		
GY-002			•		
GY-003	•		•		
GY-004	•		•		
EMDFBH-1 a-c	•		2 boreholes	•	•
EMDFBH-2	•		•		
EMDFBH-3 a-c	•		2 boreholes	•	•
EMDFBH-4	•		•		
EMDFBH-5	•		•		
EMDFBH-6	•		•		
EMDFBH-7	•		•		
EMDFPT-1		•	•		
EMDFPT-2		•	•		

SPT = standard penetration test

B.5.1 GEOPHYSICAL INVESTIGATION

Geophysical data acquisition in a future phase will be performed by a qualified subcontractor with experience in similar geologic conditions. A qualified geophysical subcontractor with at least 10 years of experience acquiring and interpreting geophysical data for geotechnical applications determinations, including foundation stability, will be used.

Tennessee-qualified monitoring well drillers will be used to construct the boreholes as described in Sect. B.2. Oversight will be provided by either a qualified field engineer or hydrogeologist with geophysical field experience to ensure the appropriate data are collected.

The principal failure areas for the Environmental Management Disposal Facility (EMDF) landfill during an earthquake are anticipated to be the southern earthen embankments and liner cover soils. The site-specific response analysis will provide seismic stability and deformation analysis of the landfill by performing the following in a follow-on investigation:

- Two borehole arrays will be placed to obtain cross-hole shear (S)-wave and compression (P)-wave velocity data. One array will be in the Maryville Limestone and one will be in the Nolichucky Shale, the major formations at the proposed EMDF site. Each array will consist of one source borehole and two data collection boreholes..
- Three boreholes will be drilled for each crosshole seismic testing array to a depth of at least 150 ft bgs, at least 50 ft into bedrock. The arrays will be positioned within the Maryville/Rogersville and Nolichucky formations. The EMDF site is underlain by Conasauga Group shale with similar seismic responses, and the collected data will be representative of the EMDF site area. Seismic borings will include performing SPTs in the soil/saprolite and rock coring below drilling refusal within bedrock.
- The three in-line boreholes in each array will be spaced approximately 10 ft apart from each other, center-to-center, at the ground surface (total spacing approximately 20 ft center-to-center from source borehole to farthest receiver borehole). Borings will be aligned approximately along strike. Actual seismic borehole locations will be adjusted, as required, based on field conditions.
- After rock coring and geophysical logging, boreholes will be enlarged (maximum borehole diameter of 6.5 in.) and 4-in. polyvinyl chloride casing will be installed to provide access for the crosshole seismic testing equipment. Vertical departure shall be maintained less than 1 percent out of plumb throughout the entire borehole depth.
- Boreholes and installed casings will be sized to allow acquisition of the required S-wave velocity and related values (approximately 4-in. inside diameter). Annular backfill grout will be designed to match density characteristics of the adjacent formation for compatibility of the installations for the required geophysical data acquisition.
- Crosshole seismic testing will be performed as per the guidance in Sect. B.5.2. Seismic velocities are to be measured within an accuracy of ± 10 m/s.
- Geophysical profiles will be developed from the bottom of the constructed boreholes to nominally 5 ft bgs.

SPT data (Sect. B.2.1) is used for liquefaction analyses. In addition, geophysical logs will be run in at least one of the uncased seismic boreholes in each array to further evaluate the stratigraphy and presence of higher conductivity zones to aid in geophysical data interpretation. These will include the following:

- Acoustic televiewer
- Natural gamma
- Spontaneous potential

Geophysical logs will be obtained by a specialty contractor in accordance with the contractor's operating instructions.

B.5.2 GEOTECHNICAL DATA

Table B.9 lists the tests to be performed; the number of tests are approximate. No specific criteria are available for sample selection. The total number of tests, specific locations, and depths will be determined in consultation with geotechnical engineers and the geotechnical laboratory following review of the borehole logs and collected samples. The selection of samples for each test will be based on professional judgment by the design team and the laboratory based on the subsurface conditions encountered and the engineering parameters needed for design, sample quantity and quality, and budget.

Table B.9. Geotechnical tests to be performed (current and future)

Residuum geotechnical tests	Total expected quantity	Applicable ASTM standards[a]	Comments
Thin-walled tube sampling/Shelby tube	51	ASTM D1587/D1587M-15, *Standard Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes*, ASTM International, West Conshohocken, PA, 2015.	Assume 3 per boring; will be taken in appropriate materials during drilling.
Moisture content	150	ASTM D2216-10, *Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass,* ASTM International, West Conshohocken, PA, 2010.	These lab tests will be performed separately and in conjunction with other laboratory tests (e.g., sieve analysis).
Unified soil classification	25	ASTM D2487-11, *Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)*, ASTM International, West Conshohocken, PA, 2011.	These lab tests will be performed in conjunction with other laboratory tests (e.g., sieve analysis).
Atterberg limits	12	ASTM D4318-17, *Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils,* ASTM International, West Conshohocken, PA, 2017.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.
Sieve analyses and P200 with Hydrometer	12	ASTM D422-63(2007)e2, *Standard Test Method for Particle-Size Analysis of Soils* (withdrawn in 2016 and no replacement, latest version will be used), ASTM International, West Conshohocken, PA, 2007.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.
Sieve analyses and P200 without Hydrometer	25	ASTM D422-63(2007)e2, *Standard Test Method for Particle-Size Analysis of Soils* (withdrawn in 2016 and no replacement, latest version will be used), ASTM International, West Conshohocken, PA, 2007.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.
Density of soil/unit weight	4	ASTM D7263-09, *Standard Test Methods for Laboratory Determination of Density (Unit Weight) of Soil Specimens,* ASTM International, West Conshohocken, PA, 2009.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.
Specific gravity	4	ASTM D854-14, *Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer,* ASTM International, West Conshohocken, PA, 2014.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.
Hydraulic conductivity (permeability) testing	12	ASTM D5084-16a, *Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter,* ASTM International, West Conshohocken, PA, 2016.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.

Table B.9. Geotechnical tests to be performed (cont.)

Residuum geotechnical tests	Total expected quantity	Applicable ASTM standards[a]	Comments
1-D consolidated tests	8	ASTM D2435/D2435M-11, *Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading*, ASTM International, West Conshohocken, PA, 2011.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.
Consolidated undrained triaxial test	4	ASTM D4767-11, *Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils,* ASTM International, West Conshohocken, PA, 2011.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.
Modified and/or standard proctor compaction test	12	ASTM D1557-12e1/D698-12e2, *Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)/ Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³),* ASTM International, West Conshohocken, PA, 2012.	Specific samples (test pit, boring and depth) will be assigned following review of borehole and test pit logs and collected samples.
Corrosion testing suite - chlorides	2	ASTM D512-12, *Standard Test Methods for Chloride Ion In Water*, ASTM International, West Conshohocken, PA, 2012, or ASSHTO T291, *Standard Method of Test for Determining Water-Soluble Chloride Ion Content in Soil,* American Association of State Highway and Transportation Officials, 1994.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.
Corrosion testing suite - sulfates	2	ASTM C1580-15, *Standard Test Method for Water-Soluble Sulfate in Soil,* ASTM International, West Conshohocken, PA, 2015.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.
Corrosion testing suite – sulfides	2	AWWA C105A.1.4 Qualitative Test, *Polyethylene Encasement for Ductile-Iron Pipe Systems*, American Water Works Association, 2010.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.
Corrosion testing suite - soil resistivity	2	G187-12a, *Standard Test Method for Measurement of Soil Resistivity Using the Two-Electrode Soil Box Method*, ASTM International, West Conshohocken, PA, 2012.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.
Corrosion testing suite - moisture content	2	Laboratory methods	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.
Corrosion testing suite - redox potential	2	ASTM G200-09(2014), *Standard Test Method for Measurement of Oxidation-Reduction Potential (ORP) of Soil*, ASTM International, West Conshohocken, PA, 2014.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.

Table B.9. Geotechnical tests to be performed (cont.)

Residuum geotechnical tests	Total expected quantity	Applicable ASTM standards[a]	Comments
Corrosion testing suite – pH	2	ASTM G51-95(2012), Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing, ASTM International, West Conshohocken, PA, 2012.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.
Bedrock Geotechnical/Geophysical Analysis			
Unconfined compression tests on rock with modulus measurements (rock only)	12	ASTM D7012-14, *Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures*, ASTM International, West Conshohocken, PA, 2014.	Specific samples (boring and depth) will be assigned following review of borehole logs and collected samples.
	2	ASTM D4428 / D4428M-14, *Standard Test Methods for Crosshole Seismic Testing*, ASTM International, West Conshohocken, PA, 2014.	

[a]The most current version of each procedure, standard, or test method shall be used.

AWWA = American Water Works Association

ASTM = American Society for Testing and Materials

B.5.3 GEOTECHNICAL LABORATORY

Geotechnical sample analysis will be performed by a geotechnical laboratory accredited by the U.S. Army Corps of Engineers or American Association of State Highway and Transportation Officials for the specific ASTM laboratory testing procedures called out in Sect. B.5.2.

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B.6 REFERENCES

ASTM 2016. ASTM D4633-16, *Standard Test Method for Energy Measurement for Dynamic Penetrometers*, ASTM International, West Conshohocken, PA, 2016.

UCOR 2014. *Submitting, Reviewing, and Dispositioning Changes to the Environmental Information Management (EIM) System (OREIS, PEMS, and TRACKER)*, PROC-ES-1002, latest revision, URS | CH2M Oak Ridge LLC, Oak Ridge, TN.

UCOR 2015. *Groundwater Sampling Wells or Piezometers,* PROC-ES-2101, latest revision, URS | CH2M Oak Ridge LLC, Oak Ridge, TN.

UCOR 2016. *Standard Specification for Well Drilling, Installation, and Abandonment*, SPG-00000-A005, latest revision, URS | CH2M Oak Ridge LLC, Oak Ridge, TN.

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DOE/OR/01-2739&D2

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Attachment B

TDEC Informal Dispute Letter (July 6, 2018)

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STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
Division of Remediation - Oak Ridge
761 Emory Valley Road
Oak Ridge, Tennessee 37830

July 6, 2018

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

Re: Proposed Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Waste (DOE/OR/01-2695&D2)

Dear Mr. Japp

The Tennessee Department of Environment and Conservation (TDEC) – Division of Remediation (DoR) received the D2 Proposed Plan (Plan) on June 7, 2018. TDEC reviewed the Plan pursuant to the Federal Facility Agreement (FFA) for the Oak Ridge Reservation (ORR). The Plan presents the Onsite Disposal Alternative located at Central Bear Creek Valley (CBCV) as the preferred remedy for disposal of waste from the U.S. Department of Energy (DOE) – Oak Ridge Office of Environmental Management (OREM) ORR CERCLA cleanup program.

TDEC cannot support issuing the Plan to the public as currently written and invokes informal dispute under Section XXVI of the FFA for the ORR. The Plan does not accurately reflect the State of Tennessee's position because it implies State approval of onsite disposal alternatives, including OREM's Preferred Alternative. It also fails to adequately communicate several key State concerns with the Preferred Alternative. TDEC proposes the following dates to meet and resolve this dispute: July 10, July 16 (morning), or July 20 (afternoon).

TDEC's objective for this dispute is to ensure the Plan is consistent with 40 CFR 300.430(e)(9)(iii)(H). In accordance with that federal regulation, TDEC seeks to resolve the dispute with a Plan that precisely represents the State's position regarding onsite disposal alternatives. The Plan must also communicate the State's key concerns in a complete and transparent manner.

Supporting issuance of the Plan for public comment would <u>not</u> be the same as State approval of the Plan or the onsite alternatives. The State cannot approve any of the onsite alternatives until OREM demonstrates the alternatives meet CERCLA requirements including Threshold Criteria.

The Plan relies on the fifth draft (D5) of 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&D5). Although neither TDEC nor the U.S. Environmental Protection Agency (EPA) could approve the RI/FS, the FFA parties agreed to resolve OREM's dispute over that report on December 7, 2017. The Dispute Resolution Agreement (DRA) documents that, subject to several terms and conditions, "The Proposed Plan will identify Central Bear Creek Valley (Site 7C) as the preferred location for onsite disposal of CERCLA mixed low level waste on the Oak Ridge Reservation."

Agreement to identify CBCV Site 7c as the preferred location, per the DRA, is not the same as agreeing to OREM's Preferred Alternative. In addition to the proposed landfill location, the Preferred Alternative includes OREM's proposed landfill size (23 acres of radioactive, hazardous, and toxic waste), waste types (including mercury waste from the Y-12 National Security Complex), and waste volume (2.2 to 2.8 million cubic yards).

The DRA allowed OREM to defer key elements for resolution before the Record of Decision (ROD). These key elements are required to determine whether the Preferred Alternative meets the CERCLA Threshold Criteria described in 40 CFR 300.430(f)(i)(A) and 40 CFR 300.430(e)(9)(iii). Threshold Criteria include overall protection of human health and the environment and compliance with Applicable or Relevant and Appropriate Requirements (ARARs). As currently written, the Plan is not clear that additional information identified in the enclosed State Acceptance language is still required.

Furthermore, OREM's Plan does not adequately address wastewater management. There is a fundamental disagreement between OREM and TDEC about discharge limits for wastewater from the proposed landfill. TDEC approval requires that OREM show that future wastewater discharges meet CERCLA Threshold Criteria and do not degrade waters of the State per Tennessee Rules 0400-40-05-.10(4) and 0400-40-03-.06. These requirements are necessary to protect receiving streams, as well as the people eating fish downstream. An attachment to the DRA lists these requirements, as does OREM's *Focused Feasibility Study [FFS] for Water Management for the Disposal of CERCLA Waste on the Oak Ridge Reservation, Oak Ridge, Tennessee* (DOE/OR/01-2664&D2). The FFS is a fundamental component of the RI/FS that serves as a basis for OREM's Plan. OREM has deferred components of the FFS and the RI/FS to be resolved prior to the ROD.

The DRA requires that OREM implement data collection identified in the Statement of Work provided by EPA and TDEC on August 8, 2017. In accordance with the DRA, the results and analyses thereof shall be included in the administrative record prior to the Proposed Plan public comment period. The DRA also says the field investigation and EPA/TDEC's review of the results shall be conducted prior to execution of the ROD and shall be used in selecting the remedy.

TDEC received a pre-publication draft report (Technical Memo 1 [TM-1]) yesterday (July 5). That report presents site characterization results from late winter and early spring of 2018. There was insufficient time for TDEC to review the results and evaluate their impact on the protectiveness and compliance of OREM's preferred alternative prior to submitting comments on the Proposed Plan within the timeframe required by the FFA.

Sincerely

Michael Higgins for

Randy Young,
FFA Manager

Enclosure: State Acceptance Language

xc: Dave Adler, DOE
Patricia Halsey, DOE
Rich Campbell, EPA
Carl Froede, EPA
Franklin Hill, EPA
Connie Jones, EPA
Don Rigger, EPA
Pete Osborne, SSAB
Amy Fitzgerald, ORRCA
Ron Woody, ORRCA
Traci Cofer, ORRCA

From:	Brad Stephenson
To:	John Blevins (john.blevins@orem.doe.gov); Henry, Brian; DePaoli, Susan (CONTR)
Cc:	Shari Meghreblian; Steve Goins (Steve.Goins@tn.gov); Chris P. Thompson; Andy Binford; Colby Morgan; Steven Stout; Michael D. Higgins; Kristof Czartoryski; Pat Flood; Randy Young (Randy.Young@tn.gov); Beth Rowan; Heather Lutz; Richard Campbell; Jones, Connie; froede.carl@epa.gov
Subject:	EMDF Proposed Plan State Acceptance
Date:	Thursday, May 3, 2018 5:21:00 PM
Attachments:	EMDF PP State Acceptance 2018-05-03.docx image001.png

John,

The attached file includes our text for the State Acceptance section of the Proposed Plan, as well as bullets for the summary table in Appendix A. We did not try to define every acronym because we understand DOE will do so while formatting the Proposed Plan.

Regards,

TN Department of Environment & Conservation

J. Brad Stephenson
Division of Remediation | Oak Ridge
761 Emory Valley Rd
Oak Ridge, TN 37830
p. 865-220-6587
f. 865-482-1835
Brad.Stephenson@tn.gov
tn.gov/environment

STATE ACCEPTANCE

The State of Tennessee recognizes the importance of selecting a waste disposal option to support environmental cleanup and building demolition on the Oak Ridge Reservation (ORR) by the U.S Department of Energy (DOE). The State also supports identification of the Central Bear Creek Valley (CBCV) site as the most promising disposal location on the ORR. A key reason the State supports evaluation of the CBCV site is its potential to meet DOE's estimated disposal capacity needs without relying on underdrains for collecting and discharging groundwater under the facility. The State anticipates that information DOE is collecting at the site may confirm these assumptions.

The State documented concerns about protecting human health and the environment throughout the CERCLA process leading to this Proposed Plan. On May 22, 2017, DOE initiated a formal dispute under the *Federal Facility Agreement for the Oak Ridge Reservation* to move the CERCLA process forward. The State, EPA and DOE signed a Dispute Resolution Agreement (DRA) on December 7, 2017. As part of the DRA, the three parties agreed to issue this Proposed Plan identifying CBCV as the preferred location for EMDF. The DRA outlines a general path for meeting CERCLA requirements.

The State has not approved the remedial investigation/feasibility study (RI/FS) report that serves as the primary basis for this Proposed Plan. Outstanding issues must be resolved before the State can approve a Record of Decision (ROD). The following discussion is meant to inform the public of the State's key concerns.

1) Site characterization (detailed description) – DOE must collect sufficient information about groundwater levels, springs and streams affecting the site's ability to contain the waste and protect the public and the environment. DOE must use this information to support an estimate of historical high groundwater levels at the CBCV site. The State supports DOE's commitment to share the data with the public and notes that the data must be in the administrative record before DOE asks the State to approve a ROD. The State expects DOE to use site-specific data to support ARAR waiver requests (see Item 2 below), develop waste acceptance criteria (WAC [see Item 3]), and assess long-term protectiveness per CERCLA. The Proposed Plan says DOE will justify requests for ARAR waivers or exemptions in the ROD. Therefore, the State suggests holding a public forum after DOE collects data from both wet and dry seasons to support such requests.

2) ARAR identification – The FFA parties must agree on the final ARARs as required by CERCLA. In addition, DOE requests an exemption under the State radioactive waste

disposal rules and waivers under the Toxic Substances Control Act (TSCA) for the following requirements, as allowed by the regulations.

- The site shall not discharge groundwater to the land surface (e.g., through springs) under natural conditions before a landfill is built.

- The site shall not be located on steep slopes to minimize erosion and landslides.

- The bottom of the liner system shall be at least 50 feet above the historical high water table, and there shall be no hydraulic connection between groundwater and streams at the site.

The rules containing these requirements allow DOE to demonstrate equal protection for any requirements that may be waived. All ARAR issues, including any requests for waivers or exemptions, must be resolved prior to ROD approval. Furthermore, regulatory review of site characterization data and projections of waste proposed for disposal (i.e., volumes, types, and characteristics) will inform final decisions on ARAR waivers, based on the conceptual dimensions for a waste disposal unit at CBCV. This includes a waiver for landfill stability after closure if an underdrain is used.

3) Waste acceptance criteria (WAC) – DOE must develop WAC based on realistic waste inventory assumptions and site-specific characterization data. For radioactive, hazardous, and toxic waste disposal facilities, computer modeling is used to develop protective WAC and limits on the amount of waste. The DRA provides for the State's independent verification of DOE modeling. State acceptance of the preferred alternative relies heavily on the State's ability to complete the independent verification. This will require DOE to provide the information we need to evaluate. Our evaluation will determine if we can assure the public that the WAC meet CERCLA requirements, including the Remedial Action Objectives presented in this Proposed Plan and performance objectives in Tennessee rule 0400-20-11-.16. The State must approve the WAC before approving the ROD.

4) DOE assessments - DOE intends to assess the performance of the proposed disposal facility as required by DOE Orders, through its authority under the Atomic Energy Act of 1954. DOE does not plan to complete a CERCLA risk assessment. The State intends to evaluate whether DOE's assessment meets the requirements of

CERCLA. This includes evaluating potential long-term risks associated with hazardous contaminants like mercury, as well as the toxic effects of uranium. The State's evaluation depends on DOE providing all documents that form the basis for the selected remedy. These documents include the Performance Assessment (PA), Composite Analysis (CA), and Preliminary Disposal Authorization Statement (PDAS). The State contends these DOE documents should be in the administrative record, because they will be relied upon to evaluate the protectiveness of the preferred alternative during remedy selection under CERCLA. For example, modeling to support the PA and CA should support the WAC, and the State will independently verify the modeling and WAC for protectiveness.

5) Mercury disposal - The State is particularly concerned about mercury disposal because of its potential release into Bear Creek and threat to people who eat fish downstream. Mercury contamination at the Y-12 National Security Complex (Y-12) is currently the greatest known environmental risk on the ORR[1]. DOE plans to demolish parts of Y-12, including the West End Mercury Area (WEMA) buildings. The State is concerned that disposal of mercury-contaminated waste in EMDF would further degrade Bear Creek, East Fork Poplar Creek, Poplar Creek and the Clinch River. The Antidegradation Statement of the Tennessee Water Quality Control Act (TWQCA) prohibits additional mercury discharges into Bear Creek. The State's position is that DOE must establish mercury inventory limits with consideration of mercury already present in the environment.

6) Use of underdrains - Tennessee regulations for siting and construction of solid waste disposal facilities do not allow for the use of underdrains to mitigate the presence of pre-existing creeks, springs or streams. Underdrains have been used occasionally to mitigate perched water that had the potential to impact construction. This position is reiterated in the State licensing rule for radioactive waste disposal [Tennessee 0400-20-11-.16(5)]. DOE intends for the landfill to contain radioactive, hazardous and toxic waste long into the future, but any drains below the landfill will degrade over time. As described in Item 1 above, DOE is collecting data at the CBCV site to determine if it would need an underdrain. Any State waivers or exemptions will be based on site-specific data.

---

[1] U.S. Department of Energy, 2017, Strategic Plan for Mercury Remediation at the Y-12 National Security Complex, Oak Ridge, Tennessee, Revision 1, DOE/OR/01-2605&D2/R1, September, p. ES-1.

7) Discharge limits - DOE must maintain a buffer between Bear Creek and the landfill, including wastewater management operations. Water in Bear Creek connects directly to groundwater that flows quickly through caves in the Maynardville Limestone rock layer. However, the Proposed Plan says DOE would discharge wastewater (water that contacts the waste) into Bear Creek without treatment if it complies with limits that have not been determined yet. DOE should not discharge untreated wastewater into Bear Creek without showing that 1) the discharged water will protect public health and the environment and achieve ARARs, such as anti-degradation requirements of the Clean Water Act, as required by CERCLA; and 2) will not result in the further degradation of the waters of the State.

CERCLA requires DOE to seek input from local governments and affected communities to help ensure selection of the most acceptable alternative. The State expects DOE to host a meeting to provide the public with an opportunity to ask questions and provide comments about the Proposed Plan including the administrative record. CERCLA also requires DOE to incorporate meaningful citizen input into making the decision. After DOE collects additional data, we may request another public meeting if our evaluation changes the State's understanding of conditions at the CBCV site.

BULLETS FOR TABLE: Proposed Plan Appendix A, Summary of CERCLA Evaluation Criteria for Disposal Alternatives

No Action Alternative

- The State recognizes DOE concerns that the no action alternative would require each cleanup project to select a disposal option for its waste.

Onsite Disposal Alternatives

- State acceptance of the onsite disposal alternatives depends on the following:
    - Evaluation of information DOE is collecting on streams, springs and groundwater (e.g., depth of the historical high water table) that would affect the ability to contain the waste and protect humans and the environment (including the degree and duration of reliance on underdrains to discharge groundwater or surface water during facility operation or after closure);

- Agreement on a final list of protective requirements (ARARs), including how site characterization data and projections of waste to be disposed will inform how DOE justifies any ARAR waiver or exemption requests;

- Evaluation of realistic information on the amounts and types of waste to be disposed, including WAC;

- Independent verification that the proposed WAC comply with the law and protect human health and the environment over the long term;

- Agreement on limits for the amount of hazardous and radioactive wastewater that DOE may discharge into Bear Creek;

- Evaluation of the degree to which the PA and CA help show the preferred alternative would meet CERCLA requirements, including evaluation of potential long-term risks associated with hazardous contaminants like mercury and the toxic effects of uranium;

- Preventing additional mercury releases into Bear Creek through protective limits on the amount of mercury to be disposed and discharged;

- Timely inclusion in the administrative record of all documents that form the basis for remedy selection, including the PA, CA and PDAS; and

- Community feedback and DOE's evaluation and inclusion of public input.

East Bear Creek Valley

- The EBCV alternative is not acceptable to the State because meeting DOE's capacity needs would require building the facility over existing streams and springs that would require underdrains.

- Long-term protectiveness and justifications for ARAR waivers and exemptions have not been established.

Central Bear Creek Valley

- The State supports identification of the CBCV site as the most promising disposal location on the ORR. DOE must collect and evaluate additional information about the site to determine long-term protectiveness and provide justification for waivers and exemptions.

- An important reason the State supports this site is its potential to meet DOE's estimated disposal capacity needs without relying on underdrains to discharge groundwater or surface water during operation of the facility or after closure.

West Bear Creek Valley

- The WBCV alternative is not acceptable to the State, because meeting DOE's capacity needs would require building the facility over existing streams and springs that would require underdrains.

- Long-term protectiveness and justifications for ARAR waivers and exemptions have not been established.

Dual Site

- The State could support the dual-site alternative as a promising disposal option on the ORR, although DOE would need to collect and provide additional information about the sites.

- An important reason the State could support this alternative is its potential to meet DOE's estimated disposal capacity needs without relying on underdrains to discharge groundwater or surface water during operation of the facility or after closure.

Offsite Disposal Alternative

- The State could support the offsite disposal alternative, because the offsite facilities have approved permits that comply with applicable regulations and are located in relatively flat, dry, unpopulated locations with deep water tables—factors that make them more protective over the long term than sites on the ORR.

- Offsite disposal of mercury-contaminated waste would also remove large amounts of mercury from the Clinch River watershed, reducing potential future mercury releases to streams where people fish.

Hybrid Disposal Alternative

- The State could support the hybrid disposal alternative because the offsite facilities have already been permitted in relatively flat, dry, unpopulated locations with deep water tables—factors that make them more protective over the long term than sites on the ORR. However, DOE would need to provide additional information about the onsite location(s).

- A hybrid alternative that uses offsite disposal of mercury would remove large amounts of mercury from the Clinch River watershed, reducing potential future mercury releases to streams where people fish.

- An important reason the State could support this alternative is its potential to meet DOE's estimated disposal capacity needs with a combination of onsite and offsite disposal without relying on underdrains to discharge groundwater or surface water during operation of the onsite facility or after closure.

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Attachment C

TDEC State Acceptance Language (Submitted to DOE May 3, 2018)

STATE ACCEPTANCE

The State of Tennessee recognizes the importance of selecting a waste disposal option to support environmental cleanup and building demolition on the Oak Ridge Reservation (ORR) by the U.S Department of Energy (DOE). The State also supports identification of the Central Bear Creek Valley (CBCV) site as the most promising disposal location on the ORR. A key reason the State supports evaluation of the CBCV site is its potential to meet DOE's estimated disposal capacity needs without relying on underdrains for collecting and discharging groundwater under the facility. The State anticipates that information DOE is collecting at the site may confirm these assumptions.

The State documented concerns about protecting human health and the environment throughout the CERCLA process leading to this Proposed Plan. On May 22, 2017, DOE initiated a formal dispute under the *Federal Facility Agreement for the Oak Ridge Reservation* to move the CERCLA process forward. The State, EPA and DOE signed a Dispute Resolution Agreement (DRA) on December 7, 2017. As part of the DRA, the three parties agreed to issue this Proposed Plan identifying CBCV as the preferred location for EMDF. The DRA outlines a general path for meeting CERCLA requirements.

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2) ARAR identification – The FFA parties must agree on the final ARARs as required by CERCLA. In addition, DOE requests an exemption under the State radioactive waste

disposal rules and waivers under the Toxic Substances Control Act (TSCA) for the following requirements, as allowed by the regulations.

- The site shall not discharge groundwater to the land surface (e.g., through springs) under natural conditions before a landfill is built.

- The site shall not be located on steep slopes to minimize erosion and landslides.

- The bottom of the liner system shall be at least 50 feet above the historical high water table, and there shall be no hydraulic connection between groundwater and streams at the site.

The rules containing these requirements allow DOE to demonstrate equal protection for any requirements that may be waived. All ARAR issues, including any requests for waivers or exemptions, must be resolved prior to ROD approval. Furthermore, regulatory review of site characterization data and projections of waste proposed for disposal (i.e., volumes, types, and characteristics) will inform final decisions on ARAR waivers, based on the conceptual dimensions for a waste disposal unit at CBCV. This includes a waiver for landfill stability after closure if an underdrain is used.

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CERCLA. This includes evaluating potential long-term risks associated with hazardous contaminants like mercury, as well as the toxic effects of uranium. The State's evaluation depends on DOE providing all documents that form the basis for the selected remedy. These documents include the Performance Assessment (PA), Composite Analysis (CA), and Preliminary Disposal Authorization Statement (PDAS). The State contends these DOE documents should be in the administrative record, because they will be relied upon to evaluate the protectiveness of the preferred alternative during remedy selection under CERCLA. For example, modeling to support the PA and CA should support the WAC, and the State will independently verify the modeling and WAC for protectiveness.

5) Mercury disposal - The State is particularly concerned about mercury disposal because of its potential release into Bear Creek and threat to people who eat fish downstream. Mercury contamination at the Y-12 National Security Complex (Y-12) is currently the greatest known environmental risk on the ORR[1]. DOE plans to demolish parts of Y-12, including the West End Mercury Area (WEMA) buildings. The State is concerned that disposal of mercury-contaminated waste in EMDF would further degrade Bear Creek, East Fork Poplar Creek, Poplar Creek and the Clinch River. The Antidegradation Statement of the Tennessee Water Quality Control Act (TWQCA) prohibits additional mercury discharges into Bear Creek. The State's position is that DOE must establish mercury inventory limits with consideration of mercury already present in the environment.

6) Use of underdrains – Tennessee regulations for siting and construction of solid waste disposal facilities do not allow for the use of underdrains to mitigate the presence of pre-existing creeks, springs or streams. Underdrains have been used occasionally to mitigate perched water that had the potential to impact construction. This position is reiterated in the State licensing rule for radioactive waste disposal [Tennessee 0400-20-11-.16(5)]. DOE intends for the landfill to contain radioactive, hazardous and toxic waste long into the future, but any drains below the landfill will degrade over time. As described in Item 1 above, DOE is collecting data at the CBCV site to determine if it would need an underdrain. Any State waivers or exemptions will be based on site-specific data.

[1] U.S. Department of Energy, 2017, Strategic Plan for Mercury Remediation at the Y-12 National Security Complex, Oak Ridge, Tennessee, Revision 1, DOE/OR/01-2605&D2/R1, September, p. ES-1.

7) Discharge limits – DOE must maintain a buffer between Bear Creek and the landfill, including wastewater management operations. Water in Bear Creek connects directly to groundwater that flows quickly through caves in the Maynardville Limestone rock layer. However, the Proposed Plan says DOE would discharge wastewater (water that contacts the waste) into Bear Creek without treatment if it complies with limits that have not been determined yet. DOE should not discharge untreated wastewater into Bear Creek without showing that 1) the discharged water will protect public health and the environment and achieve ARARs, such as anti-degradation requirements of the Clean Water Act, as required by CERCLA; and 2) will not result in the further degradation of the waters of the State.

CERCLA requires DOE to seek input from local governments and affected communities to help ensure selection of the most acceptable alternative. The State expects DOE to host a meeting to provide the public with an opportunity to ask questions and provide comments about the Proposed Plan including the administrative record. CERCLA also requires DOE to incorporate meaningful citizen input into making the decision. After DOE collects additional data, we may request another public meeting if our evaluation changes the State's understanding of conditions at the CBCV site.

BULLETS FOR TABLE: Proposed Plan Appendix A, Summary of CERCLA Evaluation Criteria for Disposal Alternatives

No Action Alternative

- The State recognizes DOE concerns that the no action alternative would require each cleanup project to select a disposal option for its waste.

Onsite Disposal Alternatives

- State acceptance of the onsite disposal alternatives depends on the following:
    - Evaluation of information DOE is collecting on streams, springs and groundwater (e.g., depth of the historical high water table) that would affect the ability to contain the waste and protect humans and the environment (including the degree and duration of reliance on underdrains to discharge groundwater or surface water during facility operation or after closure);

- Agreement on a final list of protective requirements (ARARs), including how site characterization data and projections of waste to be disposed will inform how DOE justifies any ARAR waiver or exemption requests;

- Evaluation of realistic information on the amounts and types of waste to be disposed, including WAC;

- Independent verification that the proposed WAC comply with the law and protect human health and the environment over the long term;

- Agreement on limits for the amount of hazardous and radioactive wastewater that DOE may discharge into Bear Creek;

- Evaluation of the degree to which the PA and CA help show the preferred alternative would meet CERCLA requirements, including evaluation of potential long-term risks associated with hazardous contaminants like mercury and the toxic effects of uranium;

- Preventing additional mercury releases into Bear Creek through protective limits on the amount of mercury to be disposed and discharged;

- Timely inclusion in the administrative record of all documents that form the basis for remedy selection, including the PA, CA and PDAS; and

- Community feedback and DOE's evaluation and inclusion of public input.

East Bear Creek Valley

- The EBCV alternative is not acceptable to the State because meeting DOE's capacity needs would require building the facility over existing streams and springs that would require underdrains.

- Long-term protectiveness and justifications for ARAR waivers and exemptions have not been established.

Central Bear Creek Valley

- The State supports identification of the CBCV site as the most promising disposal location on the ORR. DOE must collect and evaluate additional information about the site to determine long-term protectiveness and provide justification for waivers and exemptions.

- An important reason the State supports this site is its potential to meet DOE's estimated disposal capacity needs without relying on underdrains to discharge groundwater or surface water during operation of the facility or after closure.

West Bear Creek Valley

- The WBCV alternative is not acceptable to the State, because meeting DOE's capacity needs would require building the facility over existing streams and springs that would require underdrains.

- Long-term protectiveness and justifications for ARAR waivers and exemptions have not been established.

Dual Site

- The State could support the dual-site alternative as a promising disposal option on the ORR, although DOE would need to collect and provide additional information about the sites.

- An important reason the State could support this alternative is its potential to meet DOE's estimated disposal capacity needs without relying on underdrains to discharge groundwater or surface water during operation of the facility or after closure.

Offsite Disposal Alternative

- The State could support the offsite disposal alternative, because the offsite facilities have approved permits that comply with applicable regulations and are located in relatively flat, dry, unpopulated locations with deep water tables—factors that make them more protective over the long term than sites on the ORR.

- Offsite disposal of mercury-contaminated waste would also remove large amounts of mercury from the Clinch River watershed, reducing potential future mercury releases to streams where people fish.

Hybrid Disposal Alternative

- The State could support the hybrid disposal alternative because the offsite facilities have already been permitted in relatively flat, dry, unpopulated locations with deep water tables—factors that make them more protective over the long term than sites on the ORR. However, DOE would need to provide additional information about the onsite location(s).

- A hybrid alternative that uses offsite disposal of mercury would remove large amounts of mercury from the Clinch River watershed, reducing potential future mercury releases to streams where people fish.

- An important reason the State could support this alternative is its potential to meet DOE's estimated disposal capacity needs with a combination of onsite and offsite disposal without relying on underdrains to discharge groundwater or surface water during operation of the onsite facility or after closure.

Attachment D

EPA Informal Dispute Letter (July 10, 2018)

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

July 10, 2018

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. John M. Japp,
Federal Facility Agreement Manager
Oak Ridge Office of Environmental Management
Post Office Box 2001
Oak Ridge, Tennessee 37831

Dear Mr. Japp:

The Environmental Protection Agency has received the document titled Proposed Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Waste, Oak Ridge, Tennessee (DOE/OR/1-2695&D2). The document was transmitted by the Department of Energy (DOE) on June 5, 2018 and received by the EPA on June 12, 2018.

As provided by Section XXVI of the Oak Ridge Reservation Federal Facility Agreement, the EPA finds that the DOE did not satisfactorily resolve its comments on the D1 Proposed Plan document referenced above and issues raised during the development of the D2 Proposed Plan, as further described below. The EPA hereby invokes dispute resolution.

The EPA is invoking dispute because the Proposed Plan fails to inform the public that the Administrative Record for the management and discharge of landfill wastewater is not yet complete because it does not provide a basis for ensuring that the discharge of landfill wastewater will be protective of human health and the environment and will comply with all applicable or relevant and appropriate legal requirements (ARARs). The Administrative Record is incomplete because the DOE has not completed the "Focused Feasibility Study (FFS) for Water Management for the Disposal of CERCLA Waste on the Oak Ridge Reservation" as noted in the D5 RI/FS. In order to resolve the dispute, the Proposed Plan should be revised to inform the public that while the agencies have not yet completed the evaluation to ensure that the discharge of landfill wastewater will be protective and ARAR-compliant, the FFS will complete that evaluation prior to the Record of Decision, and the Record of Decision will establish CERCLA and NCP-compliant discharge requirements.

In addition, please note that because the proposed remedy is greater than $50 million, the Record of Decision must be signed by the EPA Administrator. The Region is required to brief the Administrator before the Proposed Plan is released for public comment. The briefing of Acting Administrator Wheeler will occur once the Region has determined that the EMDF Proposed Plan can be approved. The Region, therefore, requests that DOE not publish the Proposed Plan until DOE is notified that the EPA Administrator will support the proposed remedy.

The EPA looks forward to working with DOE ORR and the Tennessee Department of Environment and Conservation to expeditiously resolve these issues utilizing the Section XXVI informal dispute process for this primary document. The EPA recommends that the Project Managers, their immediate supervisors and all necessary support (e.g., attorneys and key contractors) work together to resolve these significant issues.

If you have any questions regarding this matter, please call Carl Froede at (404) 562-8550 or me at (404) 562-8551.

Sincerely,

Constance A. Jones

Constance A. Jones
Federal Facility Agreement Project Manager
Restoration & DOE Coordination Section
Restoration and Site Evaluation Branch
Superfund Division

cc: Randy Young, TDEC
Brian Henry, DOE
John Blevins, DOE
Brad Stephenson, TDEC
Patricia Halsey, DOE

Attachment E

Dispute Resolution Agreement (DRA)
with Appendix G Draft ARAR List (December 7, 2017)

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Dispute Resolution Agreement

This Formal Dispute Resolution Agreement memorializes the Federal Facility Agreement (FFA) parties' agreement regarding the *Remedial Investigation/Feasibility Study (RI/FS) for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Waste Disposal for Oak Ridge Reservation Waste Disposal Oak Ridge, Tennessee (DOE/OR/01-2535).* The US Department of Energy initiated a formal FFA dispute with the objective of moving the CERCLA process forward. The Senior Executive Committee has agreed to resolve this dispute as stated below.

Issues Discussed:

The US Department of Energy (DOE), the US Environmental Protection Agency (EPA), and the State of Tennessee's Department of Environment and Conservation (TDEC) dispute discussions eventually focused on:

- Site Characterization
- Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBCs).
- Modeling used to develop preliminary Waste Acceptance Criteria (WAC).

Resolution:

The Parties agree that:

1. Subject to the terms and conditions of this agreement, the Parties agree to give their best efforts to work jointly to issue a Proposed Plan within approximately 60 days of executing this agreement.

2. The Proposed Plan will identify Central Bear Creek Valley (Site 7C) as the preferred location for onsite disposal of CERCLA mixed low level waste on the Oak Ridge Reservation.

3. The Proposed Plan will include a TDEC/EPA approved Field Sampling Plan (FSP) as an appendix. The FSP shall reflect mutual agreement of the parties to implement data collection identified in the "Statement of Work" provided by EPA and TDEC for Site 7C. The results and analysis of the field investigation in accordance with the FSP shall be included in the administrative record and the Proposed Plan public comment period shall be provided thereafter. This field investigation, and EPA/TDEC's review of the results thereof, shall be conducted prior to execution of the Record of Decision (ROD) and shall be used in selecting the remedy.

4. Per DOE Order 435.1, DOE will issue a preliminary Disposal Authorization Statement for onsite disposal of CERCLA mixed low level waste on the Oak Ridge Reservation prior to signing the ROD. DOE issued a letter to EPA and TDEC dated July 7, 2016 concerning "Response to Action from Environmental Program Council Meeting on May 24, 2016, Regarding Compliance with U.S. Department of Energy Order 435.1 for a New Onsite Disposal Facility." That letter stands and is incorporated by reference into this dispute resolution agreement.

5. DOE shall provide funding to TDEC for FFA related oversight activities such as independent verification of modeling through a $250,000 grant.

6. The attached RI/FS Appendix G preliminarily reflects the ARARs and TBCs. The ROD will determine the final version of Appendix G (and waivers with justification, if necessary) considering new information gathered after the Proposed Plan and all public comment received. Appendix G does not currently reflect agreement regarding DOE Order and Manual TBCs as citations, however the parties will resolve this issue prior to signature of the ROD

John A. Mullis II
Manager
Oak Ridge Office of Environmental Management

12/07/2017
Date

Onis "Trey" Glenn, III
Regional Administrator
U.S. Environmental Protection Agency, Region 4

12/7/17
Date

Robert J. Martineau, Jr.
Commissioner
Tennessee Department of Environment and Conservation

Dec. 7, 2017
Date

APPENDIX G:
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

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CONTENTS

TABLES

FIGURES

ACRONYMS

ACM	asbestos-containing material
AEA	Atomic Energy Act of 1954
ALARA	as low as reasonably achievable
ANOVA	analysis of variance
ARAP	Aquatic Resource Alteration Permit
ARAR	applicable or relevant and appropriate requirement
ARPA	Archaeological Resources Protection Act of 1979
AWQC	ambient water quality criteria
BCV	Bear Creek Valley
BMP	best management practice
CAA	Clean Air Act of 1970
CCC	criterion continuous concentration
CFR	*Code of Federal Regulations*
CMBST	combustion
CMC	criterion maximum concentration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	contaminant of concern
CWA	Clean Water Act of 1972
DEACT	deactivation
DOE	U.S. Department of Energy
DOE M	DOE Manual
DOE O	DOE Order
DOT	U.S. Department of Transportation
EBCV	East Bear Creek Valley
EIS	Environmental Impact Statement
EMDF	Environmental Management Disposal Facility
EMWMF	Environmental Management Waste Management Facility
EP	extraction procedure
EPA	U.S. Environmental Protection Agency
F&AL	fish and aquatic life
FEMA	U.S. Federal Emergency Management Agency
FFA	Federal Facility Agreement
FFCA	Federal Facility Compliance Agreement
FFS	Focused Feasibility Study
FR	Federal Register
FML	flexible membrane liner
GCL	geosynthetic clay liner
HMR	Hazardous Materials Regulations
HMTA	Hazardous Materials Transportation Act of 1975

ID	identification number
IRR	irrigation
LDR	land disposal restriction
LDS	leak detection system
LLW	low-level [radioactive] waste
LWTS	landfill wastewater treatment system
LWW	livestock watering and wildlife
MCL	maximum contaminant level
MOU	memorandum of understanding
NAAQS	National Ambient Air Quality Standard
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NESHAP	National Emission Standards for Hazardous Air Pollutants
NRC	Nuclear Regulatory Commission
NT	Northern Tributary (to Bear Creek)
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
POLYM	polymerization
PPE	personal protective equipment
PQL	practical quantitation limit
RCRA	Resource Conservation and Recovery Act of 1976
REC	recreation
RORG	recovery of organics
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RRL	required reporting limit
SDWA	Safe Drinking Water Act of 1974
SHPO	State Historic Preservation Officer
SLB	shallow land burial
TBC	to be considered [guidance]
TC	toxicity characteristic
TCA	*Tennessee Code Annotated*
TDEC	Tennessee Department of Environment and Conservation
THPO	Tennessee Historic Preservation Officer
TSCA	Toxic Substances Control Act of 1976
TSD	treatment, storage and disposal
TWRA	Tennessee Wildlife Resources Agency
TWRCP	Tennessee Wildlife Resources Council Proclamation
U.S.	United States
USC	*United States Code*
USGS	U.S. Geological Service

UTS	universal treatment standards
WAC	waste acceptance criteria
WWTU	wastewater treatment unit

1. INTRODUCTION

The purpose of this Appendix is to identify and describe applicable or relevant and appropriate requirements (ARARs) for the disposal alternatives considered in this Remedial Investigation/Feasibility Study (RI/FS). Development of ARARs is an iterative process. This list of ARARs and to be considered (TBC) guidance will be further evaluated and refined as more information becomes known about proposed remedies, and a detailed design is developed for a preferred remedy concurrent with the Proposed Plan stage. The final list of enforceable ARARs and TBCs will be set when the Record of Decision (ROD) is finalized.

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Section 121(d) (see United States [U.S.] Code Title 42, Chapter 103, Section 9621{d}), as amended, specifies that remedial actions for cleanup of hazardous substances must comply with requirements and standards under federal or more stringent state environmental laws and regulations that are applicable or relevant and appropriate to the hazardous substances or particular circumstances at a site, or obtain a waiver under 40 *Code of Federal Regulations* (CFR) 300.430 (f)(1)(i)(B) and (C). Inherent in the interpretation of ARARs is the assurance that protection of human health and the environment is ensured. This RI/FS evaluates waste disposition for the volume of CERCLA waste generated from cleanup actions on the U.S. Department of Energy (DOE) Oak Ridge Reservation (ORR) that exceeds the available capacity of the existing Environmental Management Waste Management Facility (EMWMF) in Bear Creek Valley on the ORR. The purpose of this appendix is to specify federal and state chemical-, location-, and action-specific ARARs for the On-site Disposal Alternatives (all sites)[1] for construction and operation of an additional CERCLA waste disposal facility referred to as the Environmental Management Disposal Facility (EMDF), the Off-site Disposal Alternative for transport of CERCLA waste to an approved off-site facility, and the Hybrid Disposal Alternative (a combination of on-site and off-site disposal). For the Hybrid Disposal Alternative, ARARs include all ARARs for each of the other two alternatives.

ARARs include federal and state environmental or facility siting laws/regulations designed to protect the environment and the public; they do not include occupational safety or worker radiation protection requirements. The U.S. Environmental Protection Agency (EPA) requires compliance with the Occupational Safety and Health Administration (OSHA) standards under Section 300.150 of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) regulations at 40 CFR 300.150, independent of the ARARs process; therefore, the regulations promulgated by OSHA related to occupational safety are not addressed as ARARs. These regulations would appear in and be implemented by the appropriate health and safety plans for this action.

The following terms are used throughout this appendix:

- Applicable requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable." (40 CFR 300.5).
- Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not ''applicable'' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems

[1] Several sites are proposed as locations to be considered for an on-site disposal facility in the Remedial Investigation/Feasibility Study. They are considered as distinct and individual Alternatives; however, as ARARs apply equally to all Site Options regardless of the location, the singular "Alternative" may be used throughout this appendix, as opposed to the plural "Alternatives".

or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate." (40 CFR 300.5).

- To be considered guidance is non-promulgated advisories or guidance issued by Federal or State governments, are not legally binding, and do not have the status of potential ARARs. The TBC category consists of advisories, criteria, or guidance developed by federal and state agencies that may be useful in developing CERCLA remedies per 40 CFR 300.400(g)(3). TBCs may be considered along with ARARs as part of the site risk assessment and may be used in determining the necessary level of cleanup for protection of health or the environment.

CERCLA on-site remedial response actions must comply only with the substantive requirements of a regulation related to federal, state, or local permits (CERCLA Section 121[e]). To ensure that CERCLA response actions proceed as rapidly as possible, EPA re-affirmed in the final NCP (59 Federal Register [FR] 47416, September 15, 1994) that on-site remedial response actions need only comply with substantive requirements. The term on-site means the real extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action. Substantive requirements pertain directly to actions or conditions at a site, while administrative requirements facilitate their implementation. EPA recognizes that certain of the administrative requirements (i.e., consultation with state agencies, reporting, etc.) are accomplished through the state involvement and public participation. These administrative requirements should also be observed if they are useful in determining cleanup standards at the site (59 FR 47416).

Federal Facility Agreement (FFA) (DOE 1992) participants have agreed that the DOE ORR CERCLA actions generating wastes and the disposal facility evaluated in that alternative are considered to be on the same site, with respect to addressing regulations that relate to transport of waste within a site or between sites. The basis for this determination is described in Chapter 2 of this Appendix.

In accordance with 40 CFR 300.400(g), ARARs and TBC guidance have been identified for the disposal alternatives evaluated in this RI/FS. In accordance with EPA guidance (EPA 1991), there are no ARARs/TBCs for the No Action Alternative. For the On-site Disposal Alternatives (all sites) and Hybrid Disposal Alternative, Tables G-1 and G-2 list the chemical-specific ARARs/TBCs; Table G-3 lists the location-specific ARARs/TBCs; and Tables G-4 through G-10 list the action-specific ARARs/TBCs.

Table G-11 provides the action-specific ARARs/TBCs for the Off-Site Disposal Alternative; these ARARs would also apply to the Hybrid Disposal Alternative. Chemical-specific and location-specific requirements may apply at the generator site or at the off-site disposal facility, but they are not ARARs for this alternative. See Chapter 8 for a discussion of ARARs given for the Off-site Disposal Alternative.

The On-site Disposal Alternatives (all sites) would comply with all ARARs with the exceptions as described below. DOE is requesting, for all proposed sites, that the FFA parties determine that a Toxic Substances Control Act of 1976 (TSCA) requirement may be waived as provided in 40 CFR 761.75(c)(4). The evidence for requesting this waiver is given in Chapter 4 of this Appendix. Under TSCA 40 CFR 761.75(c)(4) *Waivers*, evidence may be submitted to the Regional Administrator that operation of the landfill will not present an unreasonable risk of injury to health or the environment from polychlorinated biphenyls (PCBs) when one or more of the requirements of paragraph (b) *Technical Requirements* of 40 CFR 761.75 are not met. On the basis of such evidence and any other available information, the Regional Administrator may in his discretion find that one or more of the requirements of paragraph (b) of 40 CFR 761.75 is not necessary to protect against such a risk and may waive the requirements in any approval for that landfill. Execution of a final Record of Decision for the proposed remedial action will constitute the sole mechanism for a Regional Administrator finding that one or more of the requirements of paragraph (b) of 40 C.F.R. 761.75 is not necessary to protect against such risk and provides justification for a waiver.

Further, an exemption will be requested for the Tennessee Department of Radiation Health requirement, at TDEC 0400-20-11-17(1)(h), which states that the hydrogeologic unit used for disposal shall not discharge ground water to the surface within the disposal site. The exemption, also called a variance or exception, is located at DRH rule, TDEC 0400-20-04-.08, which provides that the Department may, upon application by any person or upon its own initiative, grant exemptions, variances, or exceptions from the requirements of these regulations which are not prohibited by statute and which will not result in undue hazard to public health and safety or property. Execution of a final Record of Decision for the proposed remedial action will constitute the sole mechanism for a Departmental grant of exemption, variance or exception from the requirements of these regulations which will not result in undue hazard to public health and safety or property.

Evidence to support granting a waiver is given in Chapter 4 of this Appendix, along with evidence supporting the attainment of several other requirements. The grounds for invoking any proposed waivers is provided for in the RI/FS; any waiver/exemption request from ARARs will be provided in and granted through approval of the ROD.

2. CERCLA ON-SITE CONSIDERATIONS

CERCLA Section 121(e) exempts on-site CERCLA activities from administrative permitting requirements. The NCP, at 40 CFR 300.5, defines "on-site" as *"the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for the implementation of the response action."* Disposal of waste in a newly constructed on-site disposal facility, proposed in the On-site Disposal Alternatives in this RI/FS, would consolidate wastes from cleanup of the ORR into a new disposal facility on the ORR. CERCLA Section 104(d)(4), discretionary authority to treat noncontiguous facilities as one site, also supports considering consolidation of waste between the individual sites as an on-site action and allows the EPA to consider multiple facilities as one for the purpose of conducting response actions where two or more noncontiguous facilities are reasonably related on the basis of geography, or on the basis of the threat or potential threat to the public health or welfare or the environment. The preamble to the NCP (at 55 FR 8690 [March 8, 1990]) clarifies that Section 104(d)(4) can be used when noncontiguous facilities are reasonably close to one another and wastes at the sites are compatible for a selected treatment or disposal approach. For purposes of not requiring a permit for the EMDF and the identification of ARARs, it is assumed that consolidation of wastes into a centralized disposal cell would be considered an on-site action under the CERCLA definition of "on site" and CERCLA Section 104(d)(4), as well as within the context of the FFA (see FFA Section IV, paragraph A).

Treating all areas of contamination within ORR as "on-site" for the purposes of waste disposal determinations is consistent both with the statute and EPA policy and was acknowledged and documented in the signed EMWMF ROD (DOE, 1999) and reaffirmed in the East Tennessee Technology Park Zone 2 ROD (DOE, 2005). An August 3, 1995, EPA memorandum from Stephen D. Luftig, Acting Director, EPA Office of Emergency and Remedial Response (EPA 1995) provides that, where federal facilities are listed on the National Priorities List, *"the CERCLA site consists of all contaminated areas within the area used to define the site."*

By virtue of its location within the contiguous geographical boundaries of ORR, a single disposal facility would constitute a "suitable area in very close proximity to the contamination" in the case of areas of contamination on the ORR. Accordingly, it would be appropriate to consider such a disposal facility as "on-site" for the purposes of evaluating potential on-site disposal alternatives. The disposal facility analyzed in the On-site Disposal Alternatives would accept CERCLA wastes meeting the facility-specific waste acceptance criteria (WAC) from ORR sites and associated sites outside the ORR boundary but within the state of Tennessee that have been contaminated by the receipt or transport of material from past ORR operations conducted by DOE and its predecessors. No out-of-state waste would be accepted at the proposed disposal facility.

3. ROLE OF NUCLEAR REGULATORY COMMISSION REGULATIONS AND DOE ORDERS

Under the Atomic Energy Act of 1954 (AEA), the Atomic Energy Commission, had responsibility for the development and production of nuclear weapons and for both the development and the safe regulation of the civilian uses of nuclear materials. Under the Energy Reorganization Act of 1974, this function was split between two separate and unique agencies (NRC and DOE). DOE has responsibility for the development and production of nuclear weapons, promotion of nuclear power, and other energy-related work, as well as the regulation of defense nuclear facilities, and NRC has responsibility for the development and the safe regulation of civilian/commercial uses of nuclear materials. Unless a particular DOE facility is also a Nuclear Regulatory Commission-licensed facility, NRC low-level radioactive waste regulations [generally] are not considered legally applicable requirements at its environmental restoration sites.

NRC has promulgated regulations governing the facilities and activities it oversees and licenses. The regulations in 10 CFR 61 establish, for land disposal of radioactive waste, the procedures, criteria, and terms and conditions upon which the NRC issues licenses for the disposal of radioactive wastes containing byproduct, source and special nuclear material received from other persons. The regulations in 10 CFR 20 establish standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the NRC. Note that both sets of regulations are legally applicable only to NRC-licensed facilities or activities.

Under its Agreement State program, NRC often relinquishes its regulatory authority over source, byproduct and special nuclear material to agreement states, authorizing them to administer NRC's regulatory authority program in their state over licensed facilities. Tennessee is an "NRC Agreement" state.

Similarly, DOE is legally responsible for the management of nuclear materials at its facilities and has developed its own set of orders to carry out its statutory responsibilities under the AEA. DOE orders are not promulgated because they apply only to DOE facilities and operations, and do not apply to non-governmental entities, as NRC regulations do. Tennessee specifically exempts DOE and its contractors or subcontractors from its NRC-equivalent regulations in Tennessee Department of Environment and Conservation (TDEC) 0400-20-10-.06 and NRC exempts DOE from its definition of a "person" subject to its regulations in 10 CFR 20.1003. EPA's ARARs guidance (EPA 1989a) recognizes DOE's unique role, stating that *"most of DOE's operations are exempt from NRC's licensing and regulatory requirements"* and DOE's requirements for *"radioactive waste management are spelled out in a series of internal DOE Orders...issued under the Atomic Energy Act [that] have the same force for DOE facilities or 'within DOE' as does a regulation."* The manual further states that, *"Because DOE's Orders typically incorporate requirements promulgated by other Federal agencies, they should be consistent with existing regulations."* (pp. 5–17 to 5–18). DOE Manual (M) 435.1-1, *Radioactive Waste Management Manual*, is generally consistent with and typically includes equivalent 10 CFR 61 requirements that are appropriate or "well-suited" to DOE sites and waste management operations.

After a lengthy review and discussion by the FFA parties, all agreed that certain of these NRC standards and DOE order requirements would be considered relevant and appropriate requirements and TBC guidance, respectively, for this CERCLA response action. These agreed-upon requirements are included in the ARARs tables.

4. TECHNICAL ARARS AND ARAR WAIVER REQUESTS

As a result of the engineering construction, site conditions, and anticipated type of waste planned for disposal in a proposed EMDF, DOE is seeking a waiver for two TSCA technical requirements. The request for a waiver is being sought under TSCA, at 40 CFR 761.75(c)(4)(Sections 4.1 and 4.2). An exemption will also be sought for the requirement at TDEC 0400-20-11-.17(1)(h) under the state DRH rule (TDEC 0400-20-04-.08) (Section 4.3) Justification as to the ability of the proposed remedies to meet those ARARs is discussed in detail in those sections. Because the standards of protectiveness for waivers in other regulatory regimes may be different than "protectiveness" under CERCLA, the CERCLA protectiveness standard will apply. Lastly, several technical requirements in the ARAR tables require specific additional information. Section 4.4 addresses those ARARs.

4.1 TSCA 40 CFR 761.75(b)(3)

Technical TSCA requirements for chemical waste landfills used for the disposal of PCBs and PCB items include 40 CFR 761.75(b)(3) relating to hydrologic conditions that states "*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.*"

As none of the proposed disposal sites in Bear Creek Valley (BCV) meet two parts of this requirement (those two parts are underlined), and because the facilities can be designed without meeting these requirements and still be protective of human health and the environment, a waiver is being requested. Under 40 CFR 761.75(c)(4) *Waivers*. "*An owner or operator of a chemical waste landfill may submit evidence to the Regional Administrator that operation of the landfill will not present an unreasonable risk of injury to health or the environment from PCBs when one or more of the requirements of paragraph (b) of this section are not met. On the basis of such evidence and any other available information, the Regional Administrator may in his discretion find that one or more of the requirements of paragraph (b) of this section is not necessary to protect against such a risk and may waive the requirements in any approval for that landfill.* The waiver of the TSCA requirement shall be made as part of the CERCLA Record of Decision process. The CERCLA remedy protectiveness standard will apply in addition to the TSCA standard. Evidence and rationale in the following three categories is presented to support this waiver request:

PCB management and disposal practices on the ORR

Equivalent or superior effectiveness of site soils and engineered features of the EMDF

Results of risk assessment and related fate and transport modeling for PCBs

4.1.1 PCB Management and Disposal Practices on the ORR

ORR facilities [East Tennessee Technology Park (ETTP), Y-12, and Oak Ridge National Laboratory) manage TSCA-regulated materials, including PCBs. Because of the age of many ORR facilities and the varied uses for PCBs in gaskets, grease, building materials, and equipment, DOE self-disclosed unauthorized use of PCBs to EPA in the late 1980s. As a result, DOE Oak Ridge Environmental Management and EPA Region 4 consummated a major compliance agreement known as the "Oak Ridge Reservation Polychlorinated Biphenyl Federal Facilities Compliance Agreement" (DOE 2012) (ORR PCB FFCA), which became effective December 16, 1996, and was last revised on May 23, 2012. The modification in 2012 incorporated institutional controls at the closed Toxic Substances Control Act Incinerator at the ETTP where limited areas of contamination remain in place at the facility after the facility closure actions were completed. The institutional controls will remain in place until future PCB cleanup actions, which will be addressed during CERCLA demolition actions, are complete.

The ORR PCB FFCA provides a mechanism to address legacy PCB-use issues across the ORR. The agreement specifically addresses the unauthorized use of PCBs [e.g. - in ventilation ducts and gaskets, lubricants, hydraulic systems, heat transfer systems (electrical equipment such as transformers and capacitors)], and other unauthorized uses; storage and disposal of PCB waste; cleanup and/or decontamination of PCBs and PCB items including PCBs mixed with radioactive materials; PCB research and development; and ORR records and reporting requirements. A major focus of the agreement is the disposal of PCB waste. The ORR PCB FFCA established specific requirements related to PCB disposal including a compliance strategy with four sequential, interdependent phases: 1) preparation of a PCB/radioactive waste inventory; 2) identification of treatment/disposal options for PCB wastes; 3) evaluation and selection of of preferred options for wastes; and 4) a PCB waste management plan and schedules (Attachment I to DOE 2012).

As a result of the compliance agreement, DOE and its contractor continue to notify EPA when additional unauthorized uses of PCBs, such as PCBs in paint, adhesives, electrical wiring, or floor tile, are identified. This notification process is routinely incorporated into the CERCLA documentation for demolition and remedial actions. EPA is updated annually on the status of DOE actions with regard to management and disposition of PCBs covered under the ORR PCB FFCA.

PCB waste generation, transportation, disposal, and storage at ETTP are regulated under EPA Identification Number (ID) TN0890090004. The removal of legacy PCB waste at Y-12 was completed in 2011 in accordance with the terms of the ORR PCB FFCA. PCB waste generation, transportation, and storage at ORNL are regulated under EPA ID TN1890090003.

The WAC for the EMWMF and proposed for EMDF do not (will not) allow for disposal of any liquids. ORR waste management practices dictate that inactive electrical equipment such as transformers and capacitors containing PCBs that are taken out of use are drained of PCB liquids and the drained liquids and carcasses are disposed of off-site through commercial vendors authorized by EPA for PCB disposal. Neither the liquids nor the electrical equipment are allowed for disposal in the EMWMF or proposed EMDF. In addition, other PCB containing equipment such as fluorescent light ballasts are systematically removed from buildings prior to demolition and disposed of through off-site commercial vendors. The ORR PCB FFCA addresses the requirements for management, removal, and disposal of PCB impregnated gaskets and ductwork contaminated with PCBs. The majority of PCB sources are systematically removed from buildings during pre-demolition decommissioning work when friable asbestos-containing materials (ACM) and universal wastes such as batteries and mercury-containing equipment and bulbs/lamps are removed. Project-specific waste management plans developed for building D&D and remedial actions under CERCLA include requirements to address PCB management and disposal that undergo review and approval by EPA and TDEC under the FFA for the ORR.

As a result of these in-place procedures on the ORR, disposal of PCB waste in the existing EMWMF has been limited to bulk PCB waste disposal (< 50 ppm), and has been confirmed in Waste Lot acceptance documents to date. It is expected that these procedures will continue in effect throughout operation of a future on-site disposal facility as well, thereby limiting all on-site disposal of PCB waste to < 50 ppm. This information is given as evidence that the proposed facility will not present an unreasonable risk of injury to health or the environment from PCBs when the requirements of 40 CFR 761.75(b)(3) are not met.

4.1.2 Equivalent or Superior Effectiveness of Site Soils and Engineered Features of the EMDF

The technical requirements for engineered features of chemical waste landfills defined in 40 CFR 761.75 (b) include two main components: 1) 4 ft of in place silt/clay soils or 3ft of compacted silt/clay soil liner thickness with a permeability ≤ 1x10-7 cm/sec, and 2) a leachate collection system that can be a simple (single), compound (double), or suction lysimeter system. A synthetic membrane liner is used "if in the judgment of the Regional Administrator", the hydrologic or geologic conditions require such a liner to provide a permeability equivalent to the soils noted above (i.e. ≤ 1x10-7 cm/sec).

The engineered features proposed for the EMDF include RCRA and state solid waste required elements that exceed the 40 CFR 761.75 (b) requirements. These features are described and illustrated in detail in Section 6 of the RI/FS Report and in summary include: 1) a 5 ft thick liner system that includes two impermeable high density polyethylene (HDPE) liners that are (each) specified as 60 mil thickness for a total 120 mil thickness (TSCA requires only a single 30 mil liner), a geosynthetic clay liner, and two leachate collection drainage layers with a lower leak detection layer, 2) 10 ft of low permeability vadose zone geologic buffer material [per TDEC solid waste requirement 0400-11-01-.04(4)(a)(2)], and 3) a variable thickness of low permeability structural fill material and relatively low permeability in-situ silty clay residuum/saprolite material within low areas of topography. The entire top to bottom vertical sequence below the waste layer includes (layers with greater thickness and low permeability are noted in parentheses):

- Protective material layer (1ft)
- Geotextile separator layer
- Leachate collection drainage layer (1ft)
- Geotextile cushion layer
- Primary geomembrane liner (Liner #1 – 60mil HDPE)
- Geosynthetic clay liner (≤ $1x10^{-9}$ cm/sec)
- Geocomposite drainage layer/leak detection layer
- Secondary geomembrane liner (Liner #2 – 60mil HDPE)
- Compacted clay liner (3 ft ≤ $1x10^{-7}$ cm/sec)
- Geologic buffer layer (10 ft ≤ $1x10^{-5}$ cm/sec)
- Structural fill layer (variable thickness ≤ $1x10^{-5}$ cm/sec)
- In-situ silty clay residuum soils and saprolite (variable thickness with relatively low permeability (10^{-4} to 10^{-7} cm/sec)
- Underdrain network designed to maintain the water table at depths ranging from 30-95 ft below the bottom of the waste

Application of these more stringent requirements under RCRA results in a facility which meets or exceeds the standards of performance provided by TSCA. The language of the TSCA requirement does not provide a true performance standard that can be evaluated. For example, gravel and highly fractured rock can have a hydraulic conductivity of as low as 1×10^{-1} cm/second, compared to a conductivity of up to 1×10^{-7} cm/second for clay. For a continuous 50 ft layer, the range of time for permeation could be anywhere from 4.2 hours (gravel) to 482 years (clay). The engineered cell will use a multiple liner system that will incorporate flexible geomembranes, geosynthetic clay liners (GCLs) and low permeability clay. The range of hydraulic conductivities for these materials range from < 1×10^{-7} cm/second for low permeability clay; 5×10^{-9} cm/second for GCLs; and between 1×10^{-11} and 1×10^{-13} cm/second for geomembranes depending on the type of materials used. In addition to a leachate collection/detection system overlying a 3-ft thick clay foundation layer, a 10-ft geologic buffer composed of clay will be used to isolate the disposal cell from the groundwater table.

The final landfill cover (an 11 ft thick multilayer system with lateral drainage and low permeability layers) significantly reduces infiltration of water through the waste and along with the liner/geobuffer materials limits the potential for mobilization and exposure of PCBs and other waste constituents to the public and the environment. The sequence of engineered and in-situ materials proposed for the EMDF provides protection and redundancy well beyond the basic requirements for liners, leachate collection, and the 3-4 ft thick soil liner specifications defined for PCB disposal in chemical waste landfills stipulated in 40 CFR 761.75 (b). In addition, the underdrain networks provide a viable system for lowering the pre-existing water table and maintaining a significant thickness of unsaturated zone below the waste, liner, and geobuffer materials for those sites (Sites 5 and 14) where underdrains are incorporated in the facility concepts.

These engineered features (liner components; geologic buffer; and for some sites, underdrains) demonstrate equivalent or superior protectiveness to that provided under the TSCA hydrogeologic requirement, and limit the possibility of PCB releases that would present an "unreasonable risk of injury to health or the environment from PCBs".

4.1.3 Results of Risk Assessment and Related Fate and Transport Modeling for PCBs

Additional evidence supporting the TSCA waiver comes from fate and transport modeling of contaminants of concern (including PCBs and other organic compounds). Model simulations of potential PCB migration and exposure via ground water migration have been completed to estimate risk over longer timeframes assuming that current and future planned land use controls no longer exist. The modeling simulates contaminant migration via ground water pathways from the waste cells through the unsaturated zone below the site and then laterally downgradient through the saturated zone to a domestic well supplying drinking water to a hypothetical family of four. The simulations and risk assessment also calculate risks to a maximally exposed individual associated with contaminated surface water that is used for crop irrigation and livestock watering. The modeling and risk assessment employ two particular representative PCB Aroclors (Aroclor-1221 and -1232) to evaluate potential PCB migration and risks. Hazardous, non-radiological organic contaminants such as PCBs were not modeled past 1,000 years due to their expected natural degradation in the environment well within the 1,000 year timeframe. The modeling results indicated that these PCBs would not peak until well after the 1,000 year timeframe at the proposed receptor locations. Thus PCBs would not pose a risk to human health.

Consumption of PCB-contaminated foods is the most significant route of exposure to PCBs for the general human population (National Academy Press 2001). This exposure typically occurs as a result of bioaccumulation of PCBs through the food chain from contaminated sediments and accumulations of PCBs in macroinvertebrates that are carried up through the food chain through fish to humans and wildlife. The streams at and near the EMDF site are quite small and have intermittent and relatively low base flow characteristics, limiting the potential for PCBs to enter the food chain via surface water/sediment pathways and human exposure through fish consumption. The streams within an approximately 2000 ft radius of the site do not include water of sufficient size or volume to sustain any fish populations that could yield fish for human consumption. PCB dissolved phase aqueous migration from the waste cells (where PCBs occur in solid phase only and with relatively low bulk concentrations of PCBs) through extensive layers of underlying fine grained low permeability soils with high sorptive capacity would inherently limit the potential for PCB migration to the nearest stream channels where flood plain sediments are limited in length and areal extent.

PCBs have relatively low water solubility and low vapor pressures and tend to readily partition to organic matter in soils and sediments. The relatively low mobility of PCBs in the subsurface environment and high adsorption of PCBs to soil particles and organic compounds in combination with significantly reduced infiltrations rates within the landfill footprint suggest that PCB migration in the subsurface would be limited. The risk of exposure to human health and the environment would therefore be limited.

4.2 TSCA 40 CFR 761.75(b)(5)

Technical requirements for chemical waste landfills used for the disposal of PCBs and PCB items include this siting requirement regarding 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.*" [40 CFR 761.75(b)(5) – TSCA regulations]. The proposed disposal sites in BCV are situated abutting the slopes of Pine Ridge, but the question has been raised regarding whether the slopes of the East (EBCV) and Central (CBCV) (Figure G.1) Sites meet the requirement as stated. The landfill in EBCV and CBCV can be engineered to remain protective of human health and the environment, and will minimize erosion and help prevent landslides/slumping, thus a waiver is being requested. Under 40 CFR 761.75(c)(4) *Waivers.* "*An owner or operator of a chemical waste landfill may submit evidence to the Regional Administrator that operation of the landfill will not present an unreasonable risk of injury to health or the environment from PCBs when one or more of the requirements of paragraph (b) of this section are not met. On the basis of such evidence and any other available information, the Regional Administrator may in his discretion find that one or more of the requirements of paragraph (b) of this section is not necessary to protect against such a risk and may waive the requirements in any approval for that landfill.* The waiver of the TSCA requirement shall be made as part of the CERCLA Record of Decision process. The CERCLA remedy protectiveness standard will apply in addition to the TSCA standard. Evidence regarding the low levels of PCBs expected to be disposed in this landfill (as with the technical requirement above) and equivalent or superior effectiveness of engineered features of the EMDF are presented to support the waiver request.

4.2.1 PCB Management and Disposal Practices on the ORR

As a result of these in-place procedures on the ORR, as given in the previous waiver discussion and evidence section, disposal of PCB waste in the existing EMWMF has been limited to bulk PCB waste disposal (< 50 ppm), and has been confirmed in Waste Lot acceptance documents to date. It is expected that these procedures will continue in effect throughout operation of a future on-site disposal facility as well, thereby limiting all on-site disposal of PCB waste to < 50 ppm. This information is given as evidence that the proposed facility will not present an unreasonable risk of injury to health or the environment from PCBs when the requirements 40 CFR 761.75(b)(5) of this section is not met.

4.2.2 Equivalent or Superior Effectiveness of Engineered Features of the EMDF

The intent of the siting criterion is to ensure long-term stability of the landfill by avoiding terrain that is prone to slope failure and intense runoff that could cause damaging erosion, landslides, or slumping. What exactly constitutes low, moderate, and high relief is not explicitly stated in the regulation and additional research did not provide a standard definition. Some slopes in the vicinity of the proposed landfills are steep. The EMDF footprint in EBCV is proposed for an area of moderate to steep existing slopes within the BCV along the southern flank of Pine Ridge. Existing grades range from less than 25%, flatter than 4 horizontal (H) to 1 vertical (V) over the majority of the footprint, to approximately 50%, 2H to 1V for only a small portion of the footprint (see Figure G-1) on the north side of the footprint. As such, the landfill footprint is braced against Pine Ridge at the localized steep slope locations. Based on the general site descriptions within the RI/FS, there are no unstable ground areas subject to previous sliding that were identified. Stability is not only a function of slope angles, but also the materials in place and their properties. Should on-site disposal be selected for implementation, additional field investigations would be planned to support the design phase that would verify existing observations and further evaluate historic slope stability. Extensive geotechnical characterization studies will be performed to provide data for final design and the calculations required to analyze static slope stability for the proposed EBCV facility.

The existing natural slopes of Pine Ridge along Bear Creek Valley have not shown any indications of past or future landslides or slumping. Characterization efforts such as test pits, boreholes, well drilling logs, and corresponding laboratory testing have occurred at various locations down the valley and demonstrate the stability of the existing terrain. Problems could arise if the existing slopes of Pine Ridge were excavated incorrectly, but this has been a design consideration in the conceptual designs of the RI/FS. Avoiding undercutting along Pine Ridge was a primary driver in the conceptual designs for two reasons: 1) to avoid creating potentially unstable slopes above excavated areas and 2) to avoid intercepting any potentially shallow groundwater traveling down the ridge.

The relatively impermeable landfill features (cover system) will promote stability by reducing recharge in the area, as saturated soils are a primary cause of landslides and slumping. The landfill has been configured to improve overall landfill stability and associated existing slope stability through buttressing effects, control of groundwater beneath the landfill, and reducing erosional flow paths for surface water. The majority of the footprint (about three-fourths of the footprint area) lies on existing slopes of about 30% steepness or less, while only about one-fourth of the footprint is developed on the steeper slopes of Pine Ridge. Based on cross-sections presented within the RI/FS, the landfills creates a buttress against the ridge for creation of the geologic buffer and bottom liner systems which are sloped at a proposed slope of 3H to 1V – flatter than some existing grades on the ridge. When filled, the completed landfill creates a buttress fill that flattens sections of the ridge and puts a large stabilizing mass at the toe of the steepest slopes above the proposed site area. Further, the EMDF configuration controls surface water and groundwater through collection and rerouting drainage features that improve the overall stability of the landfill and associated existing slopes. Riprap armor and buttressing have been incorporated into the conceptual designs to further mitigate the potential for erosion and promote long-term stability. Diversion of upgradient surface water runoff is incorporated in the conceptual site design, to further reduce erosion at the site. As a final note, the EBCV Site upgradient north-side drainage area is a relatively small area totally only ten acres, with a quite narrow swath representing the path of storm water flow directed toward the landfill and requiring diversion (see Figure G-1), thus runoff that will be directed around the landfill using French and trench drains is limited in volume and velocity.

Any new slopes constructed as part of any landfill will use standard allowable (constructed) slopes which will then be validated through modeling and calculations. All of the landfills considered in the RI/FS use similar proposed slopes for the various phases of landfill construction. Slope failure is always a key issue in the design of any large earth structure, regardless of existing terrain. Landfill design involves rigorous seismic analysis and slope stability calculations. Volume 3 of the Remedial Design Report for EMWMF provides examples of the types of slope stability modeling and calculations that will be performed to ensure long-term stability, while Volume 1 of the report provides the quality assurance plans that are used to ensure that the landfill is constructed to the standards required to ensure long-term stability. The new facility will undergo this process as well as considering new seismic standards that have been implemented in recent years.

TSCA regulations do not explicitly identify seismic requirements; instead the siting requirement is given to promote the use of stable sites. However, explicit seismic requirements for the proposed landfill are derived from RCRA requirements (40 CFR 264.18(a)(1)) and NRC siting requirements (TDEC 0400-20-11-.17(1)(i)), and are included in the ARARs for this landfill; they will be met. Meeting these requirements further demonstrates the ability of this site to fulfill the intent of the TSCA regulation at 40 CFR 761.75(b)(5).

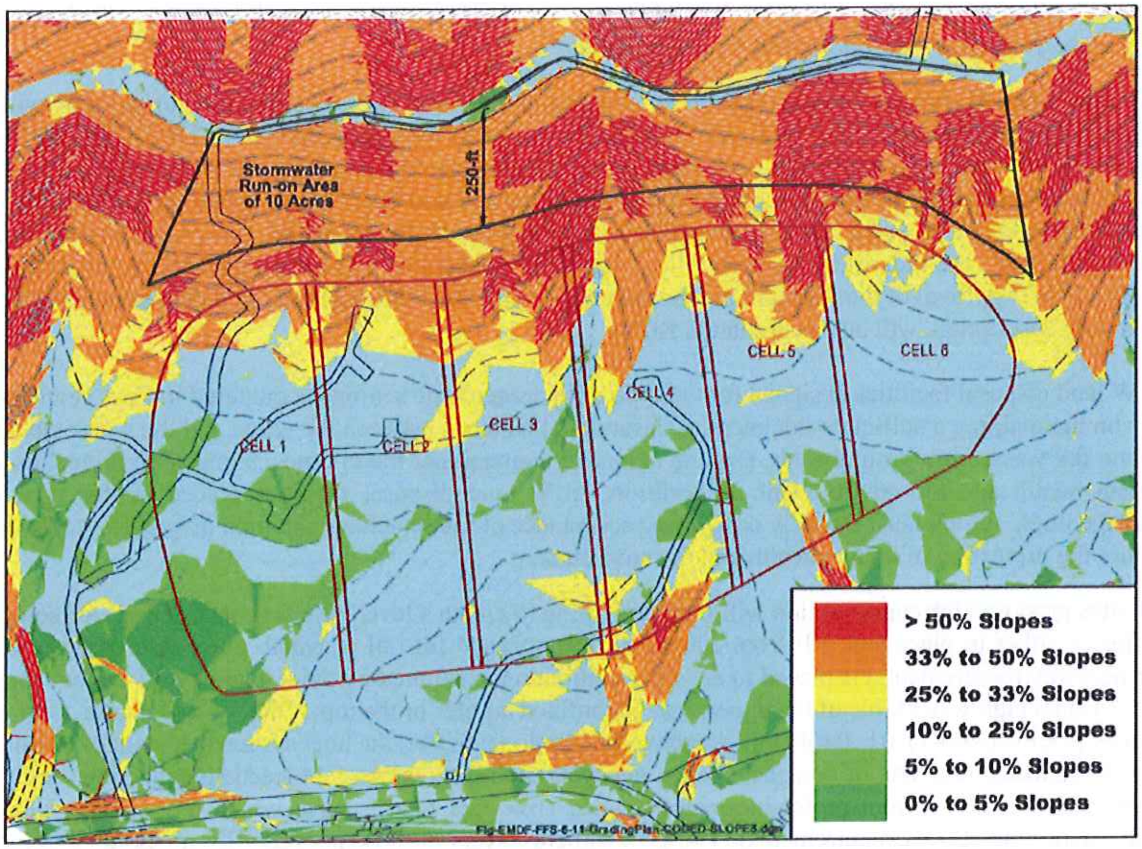

Figure G-1. EBCV Site Slopes

Slopes rated at 50% equates to 2H:1V slopes, 33% equates to 3H:1V, 25% equates to 4H:1V, and 10% equates to 10H:1V.

4.3 TDEC 0400-20-11-.17(1)(h)

This TDEC requirement, an NRC-based low level waste (LLW) disposal siting criterion, states "*The hydrogeologic unit used for disposal shall not discharge groundwater to the surface within the disposal site.*" The following definitions are given in TDEC 0400-20-11-.03:

- Hydrogeologic unit – *any soil or rock unit or zone which by virtue of its porosity or permeability, or lack thereof, has a distinct influence on the storage or movement of groundwater.*
- Disposal site – *portion of a land disposal facility which is used for disposal of waste. It consists of disposal units and a buffer zone.*
  - Disposal unit – *discrete portion of the disposal site into which waste is placed for disposal.*
  - Buffer zone – *portion of the disposal site that is controlled by the licensee and that lies under the disposal units and between the disposal units and the boundary of the site.*

NRC guidance (NUREG 0902) states the rationale of this criterion: "*This requirement will result in a travel time for most dissolved radionuclides at least equal to the travel time of the groundwater from the disposal area to the site boundary. In addition, this requirement should provide sufficient space within the buffer* *zone to implement remedial measures, if needed, to control releases of radionuclides before discharge to the ground surface or migration from the disposal site."*

All of the alternatives have some indication of springs and seeps and stream tributaries and, as such, will not meet this requirement. DOE will seek an exemption from this requirement under TDEC 0400-20-04-.08, which provides that exemptions, variances, or exceptions from the requirements of these regulations may be granted so long as they are not prohibited by statute and will not result in undue hazard to public health and safety or property. On the basis of information presented in the RI/FS, this exemption appears to be warranted. The request for the exemption, variance or exception will be included and demonstrated in the ROD. Approval of the exemption, assuming that none of the characterization data contradicts the following description, will also occur in the ROD.

LLW land disposal facilities designed for the type of hydrogeologic setting encountered in East Tennessee rely on maintaining a sufficient thickness of unsaturated material between the waste and the water table to isolate the waste from groundwater, provide extended contaminant travel times, and ensure protection of human health and the environment. In addition, LLW land disposal facilities placed in this type of hydrogeologic setting must also rely on limiting acceptance of radionuclides and final inventories to further ensure the protection of human health and the environment.

All sites proposed for consideration will require grading to create a level base for construction. A geologic buffer of either in place soil, fill from cut areas, or purchased fill (all of which must meet specific low permeability requirements) is placed to ensure a minimum unsaturated material thickness of 10 feet above the seasonal high water table of the uppermost unconfined aquifer or the top of the formation of a confined aquifer [TDEC 0400-11-01-.04(4)(a)(2)]. Above this geologic buffer, the liner system is installed. The liner system includes three feet of compacted clay, geosynthetic layers, a one foot leachate collection drainage layer, and a final one foot protective material layer (five feet total), above which the waste is placed (consistent with RCRA requirements). The geosynthetic layers are low permeability materials that have been simulated in multiple independent tests to function for many centuries. These features will isolate the short-lived radionuclides so that decay occurs in place; therefore, they will minimize risk to human health or the environment (see discussion in main document Section 6.2.2.4.8). The geosynthetic materials ensure that leachate does not contaminate the underlying groundwater during the service life of the synthetic liner components. These three features (geologic buffer, liner, and geosynthetics within the liner) along with the material specifications they must meet (e.g., per RCRA) exceed design requirements specified in the TDEC NRC-based *Licensing Requirements for Land Disposal of Radioactive Waste* (TDEC 0400-20-11), which does not require any material, liner, or other engineered feature between the waste and the hydrogeologic unit used for disposal.

The conceptual design for the EMDF at all BCV candidate sites incorporates a minimum 15 ft vadose (unsaturated) zone, comprised of the liner and geobuffer between the waste and high water table. Conceptual designs of several sites proposed for consideration include engineered underdrain systems installed beneath the geobuffer to capture and divert groundwater discharge and maintain the minimum thickness of the vadose interval. In addition, in-situ and structural fill materials incorporated to level the footprint provide additional vadose zone thickness beneath portions of the waste for all sites, greatly increasing depths to groundwater in those limited areas. Minimally, vadose zone depths are thus 15 ft, with maximum depths in isolated areas at some sites reaching 90 ft. In the event that contaminants are released from the waste, this underlying vadose zone depth (minimum of 15 ft which includes 3 ft of low hydraulic conductivity clay) provides an extended travel time that would increase the travel time of groundwater from the disposal area to the site boundary as targeted by the siting criterion.

After closure of the landfill facility, the 11 foot final cover system, which also includes geosynthetic layers, ensures that recharge to the footprint is limited for hundreds and up to thousands of years, minimizing release of contaminants and further ensuring that groundwater tables remain lowered. In addition, maintenance and monitoring of the leachate collection and leak detection systems along with required groundwater monitoring (e.g., RCRA Subpart F) will provide indications of potential releases of radionuclides to groundwater and permit the implementation of remedial measures prior to discharge to the ground surface or migration from the disposal site.

Limiting the acceptance of radionuclides during operations and limiting the final inventory of those contaminants allowed at closure of the facility will also provide a significant measure of protectiveness. Determination of these limits for a proposed site will take into account site-specific conditions and consider failure scenarios and their outcomes, to ultimately set limits that ensure human and environmental protectiveness are met per Remedial Action Objectives given in this RI/FS.

In totality, the facility conceptual designs' engineered features for all sites, and radionuclide contaminant limits that will be enforced, ensure protection of groundwater above and beyond the NRC requirement's intended outcome. The above information is provided in support of an exemption, variance or exception of TDEC 0400-20-11-.17(1)(h), by demonstrating the substantive means by which the NRC-derived requirements are met or exceeded. On the basis of information presented in the RI/FS, this exemption appears to be warranted. The exemption to the DRH requirement shall be made as part of the CERCLA Record of Decision process. The CERCLA remedy protectiveness standard will apply in addition to the DRH standard.

4.4 TECHNICAL ARARS WITH ADDITIONAL NOTES

A limited number of ARARs provided in Tables G-2 through G-8 require notes to provide some clarification. The following list addresses those ARARs, and the notes that apply.

- **Table G-2, 40 CFR 61.93(b)(4)(i) and TDEC 1200-03-11-.08(6),** [*Note: DOE has an ORR-wide radionuclide emissions monitoring program in place to comply with these requirements under 40 CFR 61, Subpart H. Adherence to the ORR-wide National Emission Standards for Hazardous Air Pollutants (NESHAPs) monitoring program will constitute compliance with this ARAR requirement.*]
- **Table G-4, TDEC 0400-12-02-.03(2)(e)(1)(i)(III),** *[Note: The demonstration referred to here will be a description of how corrective action would be implemented.]*
- **Table G-4, 40 CFR 761.75(b)(3),** *[Note: A waiver under TSCA will be requested for certain of these requirements.]*
- **Table G-4, 40 CFR 761.75(b)(5),** *[Note: A waiver under TSCA will be requested for this requirement.]*
- **Table G-4, 40 CFR 761.75(c)(4),** [*Note: Waiver of any technical requirement shall be made as part of the CERCLA Record of Decision process. The CERCLA remedy protectiveness standard will apply in additional to the TSCA standard.*]
- **Table G-4, TDEC 0400-20-11-.17(h),** *[Note: The exemption, variance or exception from the requirement shall be made as part of the CERCLA Record of Decision process. The CERCLA remedy protectiveness standard will apply in addition to the DRH standard.]*
- **Table G-4, TDEC 0400-20-11-.16(1); TDEC 0400-20-11-.17(1)(c, d, g, h, 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).]*

5. CHEMICAL-SPECIFIC ARARs/TBCs

Chemical-specific ARARs and TBC guidance provide health- or risk-based concentration or discharge limitations in various environmental media (i.e., surface water, groundwater, soil, and air) for specific hazardous substances, pollutants, or contaminants. 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 and listed in Tables G-1 and G-2 for the On-site Disposal Alternative. There are also chemical-specific ARARs limiting exposure to radioactivity identified for the On-site Disposal Alternatives (see Table G-2) that are discussed below.

5.1 SURFACE WATER QUALITY STANDARDS

Surface water bodies in Tennessee are assigned use classifications by the Tennessee Water Quality Control Board. Those use classifications are not assigned based on surrounding land uses, and may have no relationship to how the surface water is currently being used. Tennessee surface water use classifications are listed in TDEC 0400-40-04. Bear Creek, near the EMWMF and the proposed EMDF, is classified by the state for Fish and Aquatic Life (FAL), Recreation (REC), Irrigation (IRR), and Livestock Watering and Wildlife (LWW) uses. All other named and unnamed surface waters in the Clinch River Basin, with the exception of wet weather conveyances, which have not been specifically named in the regulations, are classified for FAL, REC, LWW, and IRR uses per TDEC 0400-40-04-.09. Each of the use classifications has water quality standards set under TDEC 0400-40-03, although only the FAL and REC uses have specific numeric ambient water quality criteria (AWQC) set for particular compounds. The REC AWQC are human health criteria and the FAL criteria are set for the protection of aquatic life. All of these criteria, both numeric and narrative, are all potential ARARs for any effluent discharges to Bear Creek. How and where the specific effluent limits would be applied and enforced should the selected remedy include an on-site water treatment facility at the EMWMF/EMDF, would be specified in the final decision document for this action under full oversight and approval by the regulatory authorities and as agreed to by the FFA parties.

A preliminary subset of key contaminants of concern in the leachate/contact water has been identified and agreed to by the FFA parties; this subset has been used during the development and screening of remedial alternatives in the FFS. AWQC for this subset of contaminants of concern are listed in Table G-1. Other narrative water quality standards are included in Table G-2 as potential chemical-specific ARARs.

Per TDEC 0400-40-05-.10(4), effluent discharges are required to meet the anti-degradation requirements of TDEC 0400-40-03-.06 to ensure that new or increased discharges do not cause measurable degradation of any parameter that is "unavailable." Unavailable parameters exist where water quality is at, or fails to meet, the levels specified as water quality criteria in TDEC 0400-40-03-.03.

5.2 RADIATION PROTECTION

TDEC 0400-20-11-.16(2) contains a numeric performance objective for all LLW land disposal facilities that states "Concentrations of radioactive material which may be released to the general environment in groundwater, surface water, air, soil, plants or animals must not result in an annual dose exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid and 25 millirems to any organ of any member of the public. Reasonable effort shall be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable (ALARA)." This objective will be met for all radioactive material releases to the environment from the disposal cell and from any accompanying on-site landfill wastewater treatment system that may be constructed under the on-site disposal alternative. Landfill wastewater treatment is discussed in Section 7.4.

EPA Guidance Office of Solid Waste and Emergency Response Directive 9200.4-18 (EPA 1997) establishes cleanup levels for CERCLA sites with radioactive contamination. Responses to radionuclide releases will be consistent with this guidance, which establishes cleanup levels based on the NCP range of an excess upper bound lifetime cancer risk to an individual of between 10^{-4} to 10^{-6} (40 CFR 300.430[e][2)(i][A][2]. The guidance states that analysis indicates that if sites were cleaned up under a 25/75/25 mrem/yr dose limit, the residual contamination would correspond to approximately 10 mrem/yr EDE.

6. LOCATION-SPECIFIC ARARS/TBCS

Location-specific requirements (see Table G-3) establish restrictions on siting or requirements for how activities will be conducted solely because they will take place in special locations (e.g., wetlands, floodplains, critical habitats, historic districts, streams, presence of threatened or endangered species). Additional location-specific ARARs place restrictions on certain site attributes, such as hydrogeology or seismicity that could affect the performance of a remedy. The location-specific ARARs discussed here are based on the siting of the proposed EMDF in East Bear Creek Valley immediately east of EMWMF. The Off-site Disposal and No-Action Alternatives would not impact any special locations.

6.1 FLOODPLAINS/WETLANDS

Activities that affect wetlands are regulated under federal and state law. Impacts to wetlands from siting a new disposal facility would be avoided whenever possible. If impacts were unavoidable, they would be minimized through steps such as project design changes or the implementation of best management practices (BMPs), erosion and sedimentation controls, and site restoration.

As described in Appendix E of this RI/FS, several wetlands have been identified within or near the EMDF site. If an On-site Disposal Alternative is the selected remedy in the ROD, certain wetlands would be destroyed or adversely impacted and compensatory mitigation in the form of wetland restoration, creation, or enhancement would be carried out as required.

The conceptual design footprint of the EMDF, leachate storage tanks, contact water basins, access roads, and sediment basins are not within the 100-year or 500-year floodplain of Bear Creek for any of the proposed sites. However, if the final EMDF, including the wastewater treatment facility, is sited in an area away from the EMWMF requiring piping of wastewater to the water treatment facility, piping may need to be laid in a floodplain. Therefore, regulations regarding potential impacts on floodplains are included in Table G-3 for the On-site Disposal Alternative. Construction activities at the EMDF site would involve some disturbance of wetlands and aquatic resources and ARARs regarding those activities are included in Table G-3; mitigation activities are therefore assumed in the on-site cost estimate.

6.2 AQUATIC RESOURCES

The Fish and Wildlife Coordination Act of 1958 requires federal agencies to consider the effect of water-related projects on fish and wildlife resources and take action to prevent loss or damage to these resources. The provisions of the Act are not applicable to those projects or activities carried out in connection with land use and management programs carried out by federal agencies on federal lands under their jurisdiction; however, the provisions may be relevant and appropriate for such activities.

The TDEC Division of Water Pollution Control requires Aquatic Resource Alteration Permits (ARAPs) for alterations of waters of the state, including wetlands. Typical actions that trigger these requirements include the impoundment, diversion, stream location, or other control or modifications of any body of water or wetland. General permits are available for alteration of wet-weather conveyances, minor wetland alterations, minor road crossings, utility line crossings of streams, bank stabilization, sand and gravel dredging, debris removal, construction of a new intake and outfall structure, and stream and restoration habitat removal. Since this project would be implemented under CERCLA, proposed activities for development of an on-site disposal facility would be required to meet only the substantive requirements under the applicable General permit or individual ARAP process, including such elements as BMPs and erosion and sedimentation controls.

Implementation of the on-site EMDF would require substantial modification of NT-3 (i.e., construction over a portion of NT-3), site improvements, and potential construction of new bridges or culverts that would impact existing wetlands. Other direct impacts to aquatic resources are not expected to be required, based on the conceptual design. Actual design considerations will determine whether and to what extent aquatic impacts will occur.

6.3 ENDANGERED, THREATENED, OR RARE SPECIES

Tennessee lists state-specific threatened, endangered, and in-need-of-management animal species in Tennessee Wildlife Resource Conservation Proclamations (TWRCPs) 00-14 and 00-15, which supersede TWCRPs 94-16 and 94-17. The TDEC Division of Natural Areas Natural Heritage Program Rare Animal List (2009) was also consulted. The Tennessee endangered plant species are listed in Rule 0400-06-02-.04. The TDEC Division of Natural Areas Tennessee Natural Heritage Program Rare Plant List (2012) was also consulted for threatened and special status species.

As described in Appendix E, the East Bear Creek Valley (EBCV) site is not known to contain plants that are threatened or endangered, in need of management, or species of concern (Collins, et al, 2015; Baranski

2009). A biologic and wetlands survey was conducted of the EBCV site, and no rare or status plants or habitats were identified within the area. If such plants were later discovered in the area, they would be protected and preserved per the Tennessee Rare Plant Protection and Conservation Act of 1985. The Tennessee dace (*Phoxinus tennesseensis*), which is listed as a "species in need of management" by the state of Tennessee and known to occur in Bear Creek and several of its tributaries, was not found in NT-3 upstream of the Haul Road. Should any actions associated with the selected remedy impact any state-listed threatened or rare animal species or habitat, impacts would be considered and mitigated as appropriate in accordance with the Tennessee Nongame and Endangered or Threatened Wildlife Species Conservation Act.

Bald eagles, as well as the gray bat, the Indiana bat and the northern long-eared bat are known to inhabit the ORR. Although a biologic survey did not identify any in the EMWMF and the proposed EMDF project areas, there are trees in the area that could be potential nesting habitat for these species. The U.S. Fish and Wildlife Service (FWS) has established restrictions and guidance on tree cutting and felling which are designed to protect endangered and threatened animal species and their habitat. ORR land managers are required to comply with these restrictions, either by limiting tree removal to designated times of the year or by having the ORR Natural Resources Manager inspect and clear the trees for removal. Tree cutting should be carried out from November 15 to March 31 where possible to meet FWS bat conservation guidelines. Other tree cutting guidelines specific to the ORR are available from the ORR Natural Resources Manager.

DOE has signed a Memorandum of Understanding (MOU) with the FWS regarding implementation of Executive Order 13186 "Responsibilities of Federal Agencies to Protect Migratory Birds" (September 12, 2013). The MOU requires DOE to coordinate with the FWS prior to DOE operations and activities with significant adverse effects on migratory birds and their habitats, and to initiate appropriate actions to avoid or minimize the take of migratory birds. Although the MOU and the consultation it requires might be considered an administrative requirement under CERCLA, DOE will take appropriate actions, as necessary, to avoid or minimize the take of migratory birds as required by Executive Order 13186, which is listed as a TBC in Table G.3, should any migratory birds or their habitats be identified in the project area during implementation of the remedy.

6.4 CULTURAL RESOURCES

There are no known significant historical or archaeological resources within the EMDF proposed footprints, support facilities, or roadways (see Appendix E). No prehistoric sites are known to exist at the EMDF site and adjacent areas to be impacted by the proposed construction of support facilities and roadways. If such resources (e.g., Native American remains) are discovered during site grading and excavation activities, work will be suspended until applicable requirements are met. Several statutes and regulations protect cultural resources, such as Native American artifacts, that may be discovered. For the On-site Disposal Alternative, if such a discovery is made at any time during the project, it must be reasonably protected from disturbance and all activity in the discovery area must cease until the site and artifacts are properly evaluated.

7. ON-SITE DISPOSAL ALTERNATIVES – ACTION-SPECIFIC ARARs/TBCs

Under the On-site Disposal Alternatives, most future-generated CERCLA waste in excess of the EMWMF capacity would be disposed of in a centralized, newly constructed engineered disposal facility on the ORR. This facility would be designed to manage radioactive low-level waste (LLW), RCRA characteristic waste, polychlorinated biphenyl (PCBs), and mixed waste consisting of combinations of these waste types. The anticipated small portion of CERCLA waste that does not meet the disposal facility WAC (see Chapter 2, Section 2.1.3 of the main RI/FS document), including a minimal volume of disposal facility operations waste, would be shipped to an off-site commercial facility for disposal by the generating project and is not considered part of this analysis nor part of the On-site Disposal Alternative.

Performance, design, or other action-specific requirements set controls or restrictions on particular kinds of activities related to the management of hazardous waste under the selected remedy (55 FR 8741, March 8, 1990). No one set of regulations is tailored to the combination of wastes which will be disposed. Selection of action-specific ARARs for the On-site, Hybrid, and Off-site Disposal Alternatives is based on the overriding priority to manage wastes in a manner protective of human health and the environment over both the short-term and long-term. As previously stated, there are no ARARs for the No Action Alternative.

Action-specific ARARs for the On-site and Hybrid Disposal Alternatives (see Tables G-4 through G-10) address:

- Siting requirements (Table G-4)
- Design requirements (Table G-5)
  - General landfill design
  - Landfill liner system
  - Storm water control for landfill
  - RCRA tanks system and
- Construction requirements (Table G-6)
- Operations requirements (Table G-7)
  - Emissions and effluents (note that most ARARs under this subheading are currently incorporated in the FFS (see Section 7.4)
  - Secondary waste and waste acceptance criteria attainment
  - Construction and operation of an on-site volume reduction facility
  - Transportation
  - General operations
- Environmental monitoring requirements (Table G-8)
  - Pre-operations monitoring
  - Operations and closure/postclosure monitoring
- Closure and post-closure requirements (Table G-9)
- Operation of an on-site wastewater management facility (Table G-10)

A key assumption is that requirements for storage before transport, transportation requirements for moving wastes from individual response sites to the on-site disposal facility, and requirements for treatment of these wastes are not ARARs for the On-site or Hybrid Disposal Alternatives because these requirements will be met by the individual waste generators prior to placement in the on-site facility. Some wastes (e.g., decontamination and decommissioning waste that exceeds WAC for the on-site disposal facility) may be managed at the generator site pending shipment to an off-site facility for treatment or disposal. In the event waste is determined to exceed WAC after receipt at the on-site disposal facility, the waste would be returned to the generator.

7.1 GENERAL CONSTRUCTION STANDARDS – SITE PREPARATION, EXCAVATION ACTIVITIES, AND CONSTRUCTION

Site preparation activities, such as excavation, earth-moving operations, and construction of support buildings would trigger requirements to prevent and minimize emission of radioactivity, fugitive dust, and storm-water runoff. These requirements, as listed in Table G-6, are ARARs for general construction activities under the On-site and Hybrid Disposal Alternatives. Reasonable precautions include the use of BMPs for erosion prevention and sediment control to prevent runoff and application of water on denuded surfaces to prevent particulate matter from becoming airborne.

7.2 WASTE MANAGEMENT

Table G-7 lists ARARs and TBC guidance for characterization and management of different types of waste streams.

7.2.1 Characterization

All primary wastes (e.g., soil, scrap metal, and debris) delivered to the On-site EMDF and secondary wastes (e.g., contaminated personal protective equipment, dewatering fluids, decontamination wastewaters) generated during facility construction, operations, or closure will be appropriately characterized as either solid, hazardous, PCB-contaminated, radioactive, and/or mixed wastes and managed in accordance with appropriate RCRA, Clean Air Act of 1970 (CAA), TSCA, or DOE requirements for each waste stream. Requirements for characterization and management of waste are triggered in all phases of implementation of the On-site and Hybrid Disposal Alternatives. Other projects generating waste to be disposed of at an on-site (or off-site) facility are responsible for characterizing waste per these requirements and to confirm that that the waste meets the disposal facility's WAC. These waste streams must be characterized and managed as RCRA waste, TSCA waste, LLW, or mixed waste as appropriate.

7.2.2 Storage

RCRA-hazardous waste may be accumulated and temporarily stored in containers on-site provided that the containers meet substantive RCRA requirements and are properly marked as hazardous waste. Containers may be stored on-site provided that container integrity is ensured and precautions to prevent release of the waste are taken.

Storage areas must be properly designed and operated such that containers are not in prolonged contact with liquid from precipitation, and the area will contain any spilled materials. PCBs and PCB items must be properly marked and stored in containers per TSCA requirements. PCB and PCB radioactive waste may be stored in a PCB storage facility, or in a RCRA compliant storage facility.

7.2.3 Waste Segregation

TSCA waste must be segregated from incompatible wastes during management and storage. LLW should be segregated from mixed waste. ARARs addressing this segregation [for example 40 CFR 761.75(b)(8)] would be implemented through operations plans and procedures for an on-site facility.

7.2.4 Waste Treatment and Disposal

RCRA waste may be land disposed only if it meets treatment standards or alternative treatment standards for hazardous waste (40 CFR 268) and requirements for ignitable, reactive, and incompatible waste. Hazardous waste may not be disposed of as free liquids and empty containers should be reduced in volume (e.g., shredded, compacted) prior to disposal. Treatment to meet LDRs will be accomplished.

Bulk PCB remediation waste, other PCB cleanup wastes, and PCB bulk product waste may be disposed of in a RCRA-compliant land disposal facility or a chemical waste landfill or by performance or risk-based options per 40 CFR 761.61(b)(2).

Potentially biodegradable LLW bearing uranium and thorium shall be conditioned to minimize the generation and escape of biogenic gases. LLW must have structural stability by processing or packaging of the waste; void spaces must be reduced to the extent practicable.

Secondary waste generation (e.g., landfill wastewaters) will be managed per requirements under RCRA and TSCA, which would be implemented through operations plans and procedures for an on-site facility.

7.2.5 Construction and Operation of an On-site Volume Reduction Facility

A separate facility dedicated to mechanical size reduction of waste debris will be constructed and operated on site in the Hybrid Disposal Alternative and the Option 1 Off-site Disposal Alternative. The facility will provide staging areas and equipment to conduct mechanical size reduction of debris. Because this facility will be handling debris likely contaminated with radioactive and possibly hazardous contaminants, the facility will be constructed and operated in accordance with RCRA requirements for a miscellaneous treatment facility. It is possible that there may be air pollutant emissions from this facility, although the amounts are not expected to be large enough to be considered a "major source" or to exceed emission thresholds and offset ratios allowed under CAA regulations. The air regulations and available exemptions will be reexamined as ARARs as facility design is further developed and refined.

7.3 DISPOSAL SITE SUITABILITY REQUIREMENTS

Siting and design requirements for land disposal facilities for RCRA-hazardous waste and LLW stipulate that facilities not be located in a 100-year floodplain or areas subject to seismic activity that could adversely affect the facility's stability or ability to meet performance standards. Performance standards for the facility include the requirement to achieve long-term stability of the disposal site.

Location requirements for a chemical-waste landfill under TSCA are very similar to RCRA requirements for a hazardous waste landfill. However, the hydrologic requirements of TSCA specify that the bottom of the landfill liner system or natural in-place soil barrier must be located at least 50 ft above the historical high water table and prohibit any hydrologic connection between the site and any surface water. This depth requirement applies to all sites, regardless of underlying geology and soil type. The proposed EMDF locations will not meet the TSCA hydrologic requirement. As noted in Chapter 4 of this Appendix, two TSCA waivers to TSCA hydrologic and topographic requirements will be requested in the final Record of Decision on the basis that the proposed facility at the locations examined will not present an unreasonable risk of injury to health or the environment from PCBs if the requirements at 40 CFR 761.75(b)(3) and 40 CFR 761.75(b)(5) cannot be met.

With the exceptions as noted above, implementation of the On-site Disposal Alternatives (all sites) would meet all CERCLA ARARs. .

7.4 WASTEWATER COLLECTION AND DISCHARGE

Non-contact storm water generated during construction, operations, closure and post-closure will be collected in sedimentation basins to allow solids to settle out, and then will be released to surface streams.

At the request of TDEC and the EPA, a separate FFS that addresses landfill wastewater management for both the EMWMF and the EMDF has been prepared in parallel with this RI/FS. The FFS identifies several landfill wastewater management alternatives and provides appropriate ARARs. The preferred alternative and ARARs from this RI/FS and the FFS will be merged into a selected remedy and ARARs in the ROD.

7.5 DESIGN, CONSTRUCTION, AND OPERATION OF A MIXED (RCRA HAZARDOUS, TSCA CHEMICAL AND LOW-LEVEL RADIOACTIVE) WASTE LANDFILL

Tables G-4 through G-9 list RCRA and TSCA ARARs regarding design, construction and operation of a mixed waste landfill. RCRA and TSCA requirements regarding design and maintenance of a security system and access roads are applicable. TSCA requires pre-construction baseline sampling and sampling during operations of groundwater and surface water. TSCA specifies leachate collection and liner design requirements for the landfill. If a synthetic liner is used, it must have a minimum thickness of 30 mils.

CERCLA differentiates between substantive and administrative requirements. Some requirements that would be considered administrative for most CERCLA response actions (and therefore would not be identified as ARARs) have nevertheless been identified as ARARs for the On-site and Hybrid Disposal Alternatives because they are necessary to meet substantive requirements for an operating disposal facility. Operation of the on-site disposal facility will be in compliance with general facility requirements for security, inspection, training, construction quality assurance, contingency planning, preparedness and prevention, and inventory as identified in Table G-7.

RCRA regulations require that the landfill design must prevent leachate generation and release of hazardous constituents to groundwater. Requirements stipulate that a disposal facility needs two or more liners, including a top liner and a bottom liner each with a leachate collection and removal system. The bottom liner will include a leak detection system. Facility design must also provide for run-on/runoff control systems and wind dispersion control systems. Construction and operation requirements include construction and post-construction inspections.

Mercury-contaminated wastes (i.e., those that fail the Toxicity Characteristic Leaching Procedure because of mercury) will be treated to meet land disposal restrictions (LDRs) as required in 40 CFR 268.

7.6 CLOSURE

After a disposal cell is filled to capacity, pursuant to RCRA, it must be covered with a final cover designed and constructed to provide long-term minimization of liquid migration through the capped area; function with minimum maintenance; promote drainage and minimize erosion or abrasion of the cover; and accommodate settling and subsidence so that the cover's integrity is maintained. Additionally, the cap must have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present to keep water and leachate from collecting in the waste.

Groundwater detection monitoring will continue throughout closure and for the compliance period agreed upon by the FFA parties. Wells that are no longer needed for compliance monitoring must be permanently plugged and abandoned.

TSCA regulations do not specifically address capping individual cells of the chemical waste landfill; however, EPA guidance indicates that closure of a TSCA landfill should parallel closure requirements under RCRA.

7.7 POST-CLOSURE CARE

The owner of a RCRA landfill must have a post-closure plan and provide appropriate post-closure notices and surveys to the appropriate local authorities. Post-closure care must begin after closure. Under CERCLA, five-year reviews are performed where hazardous substances remain on-site, to determine if remedy protectiveness is being maintained. Reviews continue, per 40 CFR 300.430(f)(4)(ii), as long as the hazardous substances remain above levels that would allow unlimited use and unrestricted exposure.

Property use must be restricted and the facility must be maintained to protect the integrity of the landfill cover and other components. General post-closure care includes site surveillance and maintenance, maintenance and operation of the leachate collection system as long as leachate is being generated, and environmental monitoring, including groundwater detection monitoring.

7.8 ENVIRONMENTAL MONITORING DURING OPERATION, CLOSURE, AND POST-CLOSURE CARE

The owner of a RCRA landfill must conduct monitoring of leachate, surface water, and groundwater during landfill operations, closure, and the post-closure care period. RCRA and TSCA provide requirements for construction of groundwater monitoring wells, and RCRA further specifies groundwater monitoring program, sample collection, and detection monitoring requirements.

The substantive requirements of RCRA detection and compliance monitoring at 40 CFR 264, Subpart F will be carried out, as applicable, during landfill operation, closure, and post-closure. An appropriate point of compliance and compliance period will be determined after discussions with regulators and recorded in appropriate FFA documents such as the Remedial Action Work Plan. Certain Subpart F ARARs relating to monitoring will be tailored to the specific wastes accepted by EMDF; tailoring of these ARARs are discussed further below and within Table G-8. Groundwater detection monitoring is designed to detect a potential release from the landfill, and compliance monitoring is intended to be used to confirm a release and to assist with corrective actions in the event a leak is confirmed. In the event of a release, remedial actions would be planned and implemented under CERCLA, as applied by the FFA, and not RCRA.

RCRA and TSCA provide requirements for locating and constructing groundwater monitoring wells which will be met. Newly constructed monitoring wells will be developed to remove any particulate matter and to ensure adequate flow of groundwater into the borehole. RCRA specifies groundwater monitoring program requirements, sample collection, and analyses to be conducted at 40 CFR 264, Subpart F. DOE proposes to comply with substantive Subpart F requirements within the context of the CERCLA FFA process. Further, in recognition of the fact that the proposed EMDF is primarily a low-level radioactive waste landfill, DOE proposes certain modifications to Subpart F requirements that will make these requirements more suitable to a LLW landfill than a commercial hazardous waste landfill. Proposed modifications include:

- Subpart F requires that analyses conducted on groundwater during detection and compliance monitoring are to include the constituents listed in 40 CFR 264, Appendix IX. This list is relevant but not appropriate since it (a) does not address radioactivity or radionuclides (primary contaminants of concern), and (b) includes a long list of organic compounds that are prohibited from disposal by the EMDF WAC. An appropriate analyte list will be provided in a monitoring plan to be prepared and approved by the FFA parties prior to waste receipt. It is noted that a constituent list that is appropriate for the EMDF should contain some radioactive parameters (alpha, beta) and certain radionuclides. These constituents are not subject to RCRA, but may be included as part of the expected CERCLA environmental monitoring program at the EMDF.
- The NCP (40 CFR 300.430[e][5][B] and [C]), requires that remedial actions conducted in surface or groundwater that are or may be used for drinking water must meet the Safe Drinking Water Act of 1974 (SDWA) maximum contaminant level goal, or if that is set to zero, the maximum contaminant level (MCL) will apply. However, this remedial action is not being conducted in or on surface or groundwater; therefore, the MCLs are not ARARs for this action. Tennessee classifies all groundwater as potable water, unless otherwise classified. Although EPA has not approved Tennessee's groundwater classification scheme, the SDWA limits are used as screening criteria for groundwater contaminants that may originate from the EMDF and, as such, the concentration limits set forth in 40 CFR 264.94 may change, per approval of the FFA parties and as allowed by 40 CFR 264.94(b), to the SDWA limits. Likewise, MCLs will be used as screening criteria for radionuclides in groundwater. The SDWA limits are not applicable or relevant and appropriate for surface waters, which are not classified for Domestic Water Supply. The MCLs are listed in Appendix H for informational purposes.

- Detection monitoring required by 40 CFR 264.98 will use indicator parameters and a short list of laboratory analytes to statistically determine if a release to groundwater is indicated. Detection monitoring will either follow the statistical procedures defined in the regulation, or will develop an alternative procedure for approval by the FFA parties.

- Compliance monitoring will be carried out in the event that a leak is thought to have been detected. If a leak is confirmed, compliance monitoring plans will be approved by the FFA parties. It is anticipated that compliance monitoring would incorporate certain 40 CFR 264.99 requirements.

- The corrective action requirements of 40 CFR 264.100, triggered by exceedances confirmed during compliance monitoring, will be met entirely through the CERCLA FFA process that is currently in place or as may be modified by future agreement among the FFA parties.

Reporting requirements of 40 CFR 264 Subpart F are administrative, and the FFA reporting requirements will be followed. The EMDF ROD, when approved, constitutes the necessary "permit" to operate a CERCLA landfill.

7.9 CONSTRUCTION AND OPERATION OF AN ON-SITE LANDFILL WASTEWATER TREATMENT SYSTEM

Proposed onsite alternatives in the FFS include construction and operation of a landfill wastewater treatment system (LWTS). ARARs specific to the construction and operation of an on-site LWTS are listed in Table G-10.

Although the EMWMF and the proposed EMDF are designed to accept RCRA Subtitle C hazardous waste, no RCRA listed hazardous waste has been disposed at EMWMF and all RCRA characteristic waste sent to the EMWMF has been treated to meet RCRA LDRs prior to transfer. Years of leachate and contact water sampling data indicate none of the water contains RCRA characteristic waste. RCRA listed waste will be prohibited from disposal at the proposed EMDF per the ROD. Estimates of future waste streams at the EMDF, however, indicate there may be enough mercury to cause leachate or contact waters to fail TCLP for hazardous characteristics, which would cause the wastewater stream to be characteristically hazardous.

On-site wastewater treatment units that are part of a wastewater treatment facility subject to regulation under Section 402 or Section 307(b) of the Clean Water Act of 1972 (CWA) are exempt from the requirements of RCRA Subtitle C for all tank systems, conveyance systems (whether piped or trucked), and ancillary equipment used to store or transport RCRA contaminated water so long as the definitions for "tank system" are met [40 CFR 264.1(g)(6); 40 CFR 260.10; 40 CFR 270.1(c)(2)(v); TDEC 0400-12-01-.07(1)(b)(4)(iv); 53 FR 34079, September 2, 1988]. Therefore, RCRA requirements are not legally applicable to the wastewater treatment facility(ies), including any tanks, containers, trucks, pipelines, or surface impoundments. However, because the EMWMF and the proposed EMDF are designed to meet RCRA hazardous waste facility standards and the EMDF water may be characteristically hazardous, the situation is considered sufficiently similar and "well suited" to a RCRA site to consider certain of the RCRA standards "relevant and appropriate" requirements under the CERCLA ARARs process for this action [see 40 CFR 300.430(g)(2) for a discussion of the "relevant and appropriate" analysis process]. These include the design, construction, operation, and closure/post-closure standards for tanks and surface impoundments. Although effluent from RCRA Subtitle C hazardous waste landfills is regulated under the CWA and subject to effluent limits set under 40 CFR 445.11, CERCLA actions are exempt from the need to obtain permits (see Chapter 1 of this Appendix). Such effluent limitations would, in this case, be specified in the final decision document for this action under full oversight and approval by the regulatory authorities and as agreed to by the FFA parties, as discussed in Sect. 5.1 of this Appendix.

The surface water quality standards discussed as chemical-specific ARARs in Chapter 5 of this Appendix and listed as chemical-specific ARARs in Tables G-1 and G-2 will be implemented through the state's action-specific effluent discharge requirements under the CWA. The state requires that point source discharges of wastewaters receive the degree of treatment or effluent reduction necessary to comply with water quality standards and, where appropriate, that such discharges comply with the "Standard of Performance" as required by TN Water Quality Control Act at TCA §§69-3-101, et seq. For industrial discharges without applicable National Pollutant Discharge Elimination System federal effluent guidelines for its particular category of industry, best professional judgment must be employed to determine appropriate effluent limitations and standards. As discussed in Section G.5.1, the specific effluent criteria and how and where they would be applied and enforced as final limits, should the selected remedy include an on-site LWTS, would be negotiated and set in the final decision document for this action and could include any subset of these criteria, as determined by the regulatory authorities.

It is possible that there may be air pollutant emissions from a constructed LWTS, although the amounts are not expected to be large enough to be considered a "major source" or to exceed emission thresholds and offset ratios allowed under CAA regulations. The National Ambient Air Quality Standards (NAAQS) are established as the criteria state and local governments must plan to achieve and thus are not directly enforceable in and of themselves. Under the CAA §110, states are required to promulgate regulations to achieve the NAAQS and these state regulations are then the potential ARARs. The CAA NESHAPs for various industrial sources that emit one of several pollutants are established in 40 CFR 61. Most of the NESHAPs are neither applicable nor relevant and appropriate to cleanup at CERCLA sites because they regulate particular types of sources that would not be expected to be found at a CERCLA site (EPA, 1989; EPA, 1990; EPA, 1992a). The 40 CFR 61.92 radionuclide NESHAP, however, is applicable to DOE facilities and is included as a chemical-specific ARAR in Table G-2. The RCRA air emission control requirements of 40 CFR 264 Subpart CC [air emission standards for tanks] do not apply to a waste management unit(s) that is used solely for on-site treatment or storage of hazardous waste that is generated as the result of implementing remedial activities required under CERCLA authorities [40 CFR 264.1080(b)(5); TDEC 0400-12-01-.32(a)(2)(v)]. On-site remediation and treatment of contaminated water using air strippers is also an exempted air contaminant source under TDEC regulations provided the emissions are no more than 5 tons per year of any regulated pollutant that is not a hazardous air pollutant and less than 1000 pounds per year of each hazardous air pollutant [TDEC 1200-03-09-.04(4)(d)(24)]. If on-site water treatment is selected as part of an alternative, the air regulations and available exemptions will be reexamined as ARARs as facility design is further developed and refined.

Per EPA regulation and guidance, reporting and recordkeeping requirements, as well as requirements related to test procedures and sampling methods are considered administrative requirements, not substantive environmental protection standards, therefore are not ARARs [40 CFR 300.5; EPA, 1992b, pg. 2; Preamble to the Final NCP, 55 *FR* 8756, March 8, 1990; EPA, 1988, pg. 1-11]. Although these requirements will be met as mandated by internal DOE and company policy and procedures, and will be completed in accordance with those procedures and CERCLA requirements and guidance and documented in project files, they are not listed as ARARs in the ARAR tables.

7.10 OFF-SITE TRANSPORTATION AND DISPOSAL

ARARs for off-site transportation and disposal of hazardous waste, mixed radioactive waste, LLW, and PCB waste are listed in Table G-11 and discussed below in Chapter 8. ARARs given for the off-site alternative apply to the on-site elements of the alternative only (e.g., those ARARs discussing placarding are provided to address the actions that are carried out at an on-site loading station).

8. OFF-SITE DISPOSAL ALTERNATIVE ACTION-SPECIFIC ARARs/TBCs

Table G-11 lists action-specific ARARs for the Off-site and Hybrid Disposal Alternatives and for off-site transportation and disposal of waste under the On-site Disposal Alternative. Prior to sending the wastes off-site, debris will be size reduced at an on-site volume reduction facility at ETTP under Option 1. Under the Hybrid Disposal Alternative debris may be size reduced as well. ARARs for a size reduction facility are discussed in Section 7.2.5 and included in Table G-11. Any wastes that are transferred off-site or transported in commerce along public rights-of-way must meet the U.S. Department of Transportation (DOT) requirements summarized in Table G-11 for hazardous materials, as well as the specific requirements for the type of waste (e.g., RCRA, TSCA, LLW, or mixed).

The DOT regulations for hazardous materials include requirements for marking labeling, placarding, and packaging. RCRA requires generators to ensure and document that the hazardous waste they generate is properly identified and transported to a treatment, storage, and disposal facility. Specific requirements are given for manifesting, packaging, labeling, marking, and placarding. In addition, there are record-keeping and reporting requirements. Pre-transport requirements reference the DOT regulations under 49 CFR 172, 173, 178, and 179.

CERCLA Section 121(d)(3) requires that permitted facilities in receipt of any hazardous substance, pollutant, or contaminant generated during CERCLA response actions be in compliance with RCRA and applicable state laws. EPA has established the procedures and criteria for determining whether facilities are acceptable for the receipt of such waste at 40 CFR 300.440. A regulatory determination pursuant to 40 CFR 300.440 will be obtained for any permitted facility to which remediation waste, including landfill wastewater, may be transferred for treatment.

Any generator who relinquishes control of PCB wastes by transporting them to an off-site disposal facility must comply with the applicable provisions of TSCA (40 CFR 761.207 et seq.). Once wastes generated from a CERCLA response action are transferred off site, all administrative as well as substantive provisions of all applicable requirements must be met.

DOE's policy is to treat, store, and in the case of LLW, dispose of waste at the site where it is generated, if practical, or at another DOE facility if on-site capabilities are not practical and cost effective. The use of non-DOE facilities for storage, treatment, and disposal of LLW may be approved by ensuring, at a minimum, that the facility complies with applicable federal, state, and local requirements and has the necessary permit(s), license(s), and approval(s) to accept the specific waste.

Table G-1. Numeric Ambient Water Quality Criteria (AWQC) that are Potential Chemical-Specific ARARs/TBCs for Key COCs in EMWMF/EMDF Landfill Wastewater[a]

Chemical	Fish and Aquatic Life [TDEC 0400-40-03-.03(3)]		Recreation[b] [TDEC 0400-40-03-.03(4)]	Required reporting level[c] [TDEC 0400-40-03-.05(8)]
	Criterion maximum concentration (CMC) (µg/L or ppb)	Criterion continuous concentration (CCC) (µg/L or ppb)	Organisms only (µg/L or ppb)	(RRL) (µg/L or ppb)
Aldrin (c)	3.0		0.00050	0.5
Arsenic (c)			10.0	1.0
Arsenic (III)	340[d]	150[d]		1.0
b-BHC (c)			0.17	
Cadmium	2.0[e]	0.25[e]		1.0
Chromium (III)	570[e]	74[e]		1.0
Chromium (VI)	16[d]	11[d]		10.0
Copper	13[e]	9.0[e]		1.0
Cyanide	22	5.2	140	5.0
4,4'-DDT (b)(c)	1.1	0.001	0.0022	0.1
4,4'-DDE (b)(c)			0.0022	0.1
4,4'-DDD (b)(c)			0.0031	0.1
Dieldrin (b)(c)	0.24	0.056	0.00054	0.05
Lead	65[e]	2.5[e]		1.0
Mercury (b)	1.4[d]	0.77[d]	0.051	0.2
Nickel	470[e]	52[e]	4600	10.0

(b) = bioaccumulative parameter
(c) = carcinogenic parameter

[a] http://www.tn.gov/sos/rules/0400/0400-40/0400-40-03.
[b] A 10^{-5} risk level is used for setting TDEC recreational criteria for all carcinogenic pollutants. Recreational criteria for noncarcinogenic chemicals are set using a 10^{-6} risk level. [*Note*: All federal recreational criteria are set at a 10^{-6} risk level].
[c] In cases in which the in-stream AWQC or effluent limits established for an outfall are less than current chemical technological capabilities for analytical detection, compliance with the AWQC or limits will be determined using the higher RRLs, as allowed pursuant to TDEC 0400-40-03-.05(8).
[d] Criteria are expressed as dissolved.
[e] Criteria are expressed as dissolved and are a function of total hardness (mg/L). Criteria displayed correspond to a total hardness of 100 mg/L.

ARARs = applicable or relevant and appropriate requirements
AWQC = ambient water quality criteria
CCC = criterion continuous concentration
CMC = criterion maximum concentration
COCs = contaminants of concern
EMDF = Environmental Management Disposal Facility
EMWMF = Environmental Management Waste Management Facility
RRL = required reporting level
TBC = to-be-considered [guidance]
TDEC = Tennessee Department of Environment and Conservation

Table G-2. Chemical-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives

Media/Chemical	Requirements	Prerequisite	Citation
Radionuclide emissions	Emissions of radionuclides (other than radon) to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/year.	Radionuclide emissions from point sources at a DOE facility—**applicable**	40 CFR 61.92 TDEC 1200-03-11-.08(6)
	Radionuclide emission measurements shall be made at all release points which have a potential to discharge radionuclides into the air in quantities which could cause an effective does equivalent in excess of 1 percent of the standard. All radionuclides which could contribute greater than 10 percent of the potential effective dose equivalent for a release point shall be measured.		40 CFR 61.93(b)(4)(i) TDEC 1200-03-11-.08(6)
Releases of radionuclides to the environment	Shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve doses to members of the public that are ALARA.	Releases of radionuclides into the environment from an active NRC licensed operation—**relevant and appropriate**	TDEC 0400-20-05-.40(2)
Radon releases to environment	No source at a Department of Energy facility shall emit more than 20 picocuries per square meter per second (pCi/[m^2-sec]) (1.9 pCi/[ft^2-sec]) of radon-222 as an average for the entire source, into the air. This requirement will be part of any Federal Facilities Agreement reached between Environmental Protection Agency and DOE.	Radon releases to the environment at a DOE facility—**applicable**	40 CFR 61.192 TDEC 1200-03-11-.17
Performance objectives for LLW disposal facility	Concentrations of radioactive material which may be released to the general environment in groundwater, surface water, air, soil, plants or animals must not result in an annual dose exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid and 25 millirems to any organ of any member of the publicReasonable effort shall be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable (ALARA).	Construction of a LLW disposal facility—**relevant and appropriate**	TDEC 0400-20-11-.16(2)
Instream water quality criteria for release of landfill wastewater into Bear Creek tributary	Dissolved oxygen shall not be less than 5.0 mg/l. Substantial or frequent variations in dissolved oxygen levels, including diurnal fluctuations, are undesirable if caused by man-induced conditions. Diurnal fluctuations shall not be substantially different than the fluctuations noted in reference streams in the region. There shall always be sufficient dissolved oxygen present to prevent odors of decomposition and other offensive conditions.	Release of wastewater or effluents into surface water—**applicable** as instream criteria beyond the mixing zone	TDEC 0400-40-03-.03(3)(a) TDEC 0400-40-03-.03(4)(a) TDEC 0400-40-03-.03(5)(a) TDEC 0400-40-03-.03(6)(a)
	The pH value shall not fluctuate more than 1.0 unit over a period of 24 hours and shall not be outside the following ranges: 6.0-9.0.		TDEC 0400-40-03-.03(3)(b) TDEC 0400-40-03-.03(4)(b) TDEC 0400-40-03-.03(5)(b) TDEC 0400-40-03-.03(6)(b)

Table G-2. Chemical-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Media/Chemical	Requirements	Prerequisite	Citation
	The hardness of or the mineral compounds contained in the water shall not impair its use for irrigation or livestock watering and wildlife.		TDEC 0400-40-03-.03(5)(c) TDEC 0400-40-03-.03(6)(c)
	There shall be no distinctly visible solids, scum, foam, oily slick, or the formation of slimes, bottom deposits or sludge banks of such size or character that may be detrimental to fish and aquatic life or recreation or impair its use for irrigation or livestock watering and wildlife.		TDEC 0400-40-03-.03(3)(c) TDEC 0400-40-03-.03(4)(c) TDEC 0400-40-03-.03(5)(d) TDEC 0400-40-03-.03(6)(d)
	There shall be no turbidity, total suspended solids, or color in such amounts or of such character that will materially affect fish and aquatic life or result in any objectionable appearance to the water, considering the nature and location of the water.		TDEC 0400-40-03-.03(3)(d) TDEC 0400-40-03-.03(4)(d)
	The maximum water temperature shall not exceed 3 degrees C relative to an upstream control point. The temperature of the water shall not exceed 30.5 degrees C and the maximum rate of change shall be 2 degrees C per hour. There shall be no abnormal water temperature changes that may affect aquatic life unless caused by natural conditions. The temperature in flowing streams shall be measured at mid-depth. Temperature shall not interfere with its use for irrigation or livestock watering and wildlife purposes.		TDEC 0400-40-03-.03(3)(e) TDEC 0400-40-03-.03(4)(e) TDEC 0400-40-03-.03(5)(e) TDEC 0400-40-03-.03(6)(e)
	Waters shall not contain substances that will impart unpalatable flavor to fish or result in noticeable offensive odors in the vicinity of the water or otherwise interfere with fish or aquatic life.		TDEC 0400-40-03-.03(3)(f) TDEC 0400-40-03-.03(4)(g)
	Waters shall not contain substances or combination of substances including disease-causing agents which, by way of either direct exposure or indirect exposure through food chains, may cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction), physical deformations, or restrict or impair growth in fish or aquatic life or their offspring. See Table G.1 for list of criteria for key contaminants of concern.		TDEC 0400-40-03-.03(3)(g)
	Water shall not contain toxic substances that will render the water unsafe or unsuitable for water contact activities including the capture and subsequent consumption of fish and shellfish, or will propose toxic conditions that will adversely affect man, animal, aquatic life, or wildlife. See Table G.1 for list of criteria for key contaminants of concern.		TDEC 0400-40-03-.03(4)(j)
	Water shall not contain other pollutants that will be detrimental to fish or aquatic life, or adversely affect the quality of the waters for recreation, irrigation, or livestock watering and wildlife.		TDEC 0400-40-03-.03(3)(h) TDEC 0400-40-03-.03(4)(k) TDEC 0400-40-03-.03(5)(f) and (g)

Table G-2. Chemical-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Media/Chemical	Requirements	Prerequisite	Citation
			TDEC 0400-40-03-.03(6)(f) and (g)
	Water shall not contain iron at concentrations that cause toxicity or in such amounts that interfere with habitat due to precipitation or bacteria growth.		TDEC 0400-40-03-.03(3)(i)
	The one-hour and thirty-day average concentrations of ammonia shall not exceed the acute criterion and chronic criteria calculated using the equations given in TDEC 0400-40-03-.03(3)(j).		TDEC 0400-40-03-.03(3)(j)
	Water shall not contain nutrients in concentrations that stimulate aquatic plant and/or algae growth to the extent that aquatic habitat is substantially reduced and/or biological integrity fails to meet regional goals or that the public's recreational uses of the water body or downstream waters are affected. Quality of downstream waters shall not be detrimentally affected. Interpretation of this provision may be made using the document Development of Regionally-based Interpretations of Tennessee's Narrative Nutrient Criterion and/or other scientifically defensible methods.		TDEC 0400-40-03-.03(3)(k) TDEC 0400-40-03-.03(4)(h)
	The concentration of the *e. coli* group shall not exceed 126 per 100 ml as a geometric mean based on a minimum of 5 samples collected as specified in the regulation. The concentration of *e. coli* group in any individual sample shall not exceed 1 per 100 ml.		TDEC 0400-40-03-.03(3)(l) TDEC 0400-40-03-.03(4)(f)
	Waters shall not be modified through the addition of pollutants or through physical alteration to the extent that diversity and/or productivity of aquatic biota within the receiving waters are substantially decreased or, in the case of wadeable streams, substantially different from conditions in reference streams in the same ecoregion. The parameters associated with this criterion are the aquatic biota measured. These are response variables.		TDEC 0400-40-03-.03(3)(m)
	Quality of stream habitat shall provide for development of a diverse aquatic community that meets regionally-based biological integrity goals. Types of habitat loss include channel and substrate alterations, rock and gravel removal, stream flow changes, silt accumulation, precipitation of metals, and removal of riparian vegetation. For wadeable streams, instream habitat within each sub ecoregion shall be generally similar to that found at reference streams. However, streams shall not be assessed as impacted by habitat loss if it has been demonstrated that the biological integrity goal has been met.		TDEC 0400-40-03-.03(3)(n)

Table G-2. Chemical-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Media/Chemical	Requirements	Prerequisite	Citation
	Stream flow shall support fish and aquatic life criteria and recreational use.		TDEC 0400-40-03-.03(3)(o) TDEC 0400-40-03-.03(4)(m)
Antidegradation requirements	Effluent limitations may be required to insure [sic] compliance with the Antidegradation Statement in TDEC 0400-40-03-.06.	Point source discharge(s) of pollutants into waters of the U.S. —**applicable**	TDEC 0400-40-05-.10(4)
	New or increased discharges that would cause measurable degradation of the parameter that is unavailable shall not be authorized. Nor will discharges be authorized if they cause additional loadings of unavailable parameters that are bioaccumulative or that have criteria below current method detection levels.	Waters with "unavailable"[as defined in TDEC 0400-40-03-.06(2)] parameters—**applicable**	TDEC 0400-40-03-.06(2)(a)
	No new or expanded water withdrawals that will cause additional measurable degradation of the unavailable parameter shall be authorized.		TDEC 0400-40-03-.06(2)(b)
	Where one or more of the parameters comprising the habitat criterion are unavailable, activities that cause additional degradation of the unavailable parameter or parameters above the level of de minimis shall not be authorized.		TDEC 0400-40-03-.06(2)(c)

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives

Location Resource	Requirements	Prerequisite	Citation
	Wetlands		
Presence of wetlands as defined in 10 CFR 1022.4	Incorporate wetland protection considerations into its planning, regulatory, and decision-making processes, and, to the extent practicable, minimize the destruction, loss, or degradation of wetlands; and; preserve and enhance the natural and beneficial values of wetlands.	DOE actions that involve potential impacts to, or take place within wetlands—**applicable**	10 CFR 1022.3(a)(7) and (8)
	Undertake a careful evaluation of the potential effects of any proposed wetland action. Avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction of and occupancy and modification of wetlands. Avoid direct and indirect development in a wetland wherever there is a practicable alternative. Identify, evaluate, and, as appropriate, implement alternative actions that may avoid or mitigate adverse wetland impacts.		10 CFR 1022.3(b), (c), (d)
	Project Description. This section shall describe the proposed action and shall include a map showing its location with respect to the floodplain and/or wetland. For actions located in a floodplain, the nature and extent of the flood hazard shall be described, including the nature and extent of hazards associated with any high-hazard areas.		10 CFR 1022.13(a)(1)
	Floodplain or Wetland Impacts. This section shall discuss the positive and negative, direct and indirect, and long- and short-term effects of the proposed action on the floodplain and/or wetland. This section shall include impacts on the natural and beneficial floodplain and wetland values (§ 1022.4) appropriate to the location under evaluation. In addition, the effects of a proposed floodplain action on lives and property shall be evaluated. For an action proposed in a wetland, the effects on the survival, quality, and function of the wetland shall be evaluated.		10 CFR 1022.13(a)(2)
	Alternatives. Consider alternatives to the proposed action that avoid adverse impacts and incompatible development in a wetland area, including alternate sites, alternate actions, and no action. DOE shall evaluate measures that mitigate the adverse effects of actions in a wetland including, but not limited to, minimum grading requirements, runoff controls, design and construction constraints, and protection of ecologically-sensitive areas.		10 CFR 1022.13(a)(3)

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Location Resource	Requirements	Prerequisite	Citation
	If no practicable alternative to locating or conducting the action in the wetland is available, then before taking action design or modify the action in order to minimize potential harm to or within the wetland, consistent with the policies set forth in Executive Order 11990.		10 CFR 1022.14(a)
Presence of jurisdictional wetlands as defined in 40 CFR 230.3; 33 CFR 328.3(a), and 33 CFR 328.4	The discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands, is prohibited if there is a practical alternative that would have less adverse impact. No discharge shall be permitted that results in violation of state water quality standards, violates any toxic effluent standard, and/or jeopardizes an endangered species or its critical habitat. No discharge will be permitted that will cause significant degradation of waters of the United States. No discharge is permitted unless mitigation measures have been taken in accordance with 40 CFR 230, Subpart H.	Actions that involve discharge of dredged or fill material into waters of United States, including jurisdictional wetlands—**applicable**	40 CFR 230.10(a), (b), (c) and (d) 40 CFR 230, Subpart H
Mitigation of state wetlands as defined under TDEC 0400-40-07-.03	If an applicant proposes an activity that would result in appreciable permanent loss of resource value of wetlands, the applicant must provide mitigation, which results in no overall net loss of resource value. Compensatory measures must be at a ratio of 2:1 for restoration, 4:1 for creation and enhancement, and 10:1 for preservation, or at a best professional judgment ratio agreed to by the state. For any mitigation involving the enhancement or preservation of existing wetlands, to the extent practicable, the applicant shall complete the mitigation before any impact occurs to the existing state waters. For any mitigation involving restoration or creation of a wetland, to the extent practicable, the mitigation shall occur either before or simultaneously with impacts to the existing state waters. Mitigation actions for impacts to wetlands are prioritized as listed in TDEC 0400-40-07-.04 (7)(b)(1)(i) – (viii).	Activity that would cause loss of wetlands as defined in TDEC 0400-40-07-.03—**applicable**	TDEC 0400-40-07-.04 (7)(b)
Presence of minor isolated wetlands of less than 0.25 acres – Minor alterations to wetlands	Authorizes minor temporary or permanent alterations of wetlands, where avoidance is not possible. Alterations of up to 0.10 acres of moderate resource value wetlands and up to 0.25 acre of wetlands that are degraded or of low functional capacity must meet certain requirements as follows: _Special Conditions_ • Activities where all practicable measures to avoid and minimize adverse impacts to the wetlands and other waters of the state have not been employed are not covered by this permit.	Alteration of minor isolated wetlands of less than 0.25 acres—**applicable**	*TCA* 69-3-108(l) TDEC 0400-40-07-.01 TDEC ARAP General Permit for Minor Alterations to Wetlands (effective April 7, 2015) (**TBC**)
	• Excavation and fill activities associated with the wetlands alteration shall be kept to a minimum.		

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Location Resource	Requirements	Prerequisite	Citation
	• Wetlands outside of the permitted impact areas shall be clearly marked so that all work performed is solely within the permitted impact area.		
	• Authorized wetland alterations shall not cause measureable degradation to resource values and classified uses of hydrologically connected wetlands or other waters of the state, including disruption of sustaining surface or groundwater hydrology. Adjacent wetlands or streams determined likely to be measurably degraded by such hydrologic alteration, or by partial fill, must be included in the cumulative impact calculation, even if not filled or otherwise directly altered physically.		
	• Temporary impacts to wetlands shall be mitigated by the removal and stockpiling of the first 12 inches of topsoil, prior to construction. Upon completion of construction activities, all temporary wetland impact areas are to be restored to pre-construction contours, and the stockpiled topsoil spread to restore these areas to pre-construction elevation. Other side-cast material shall not be placed within the temporary impact locations. Permanent vegetation stabilization using native species of all disturbed areas in or near the wetland must be initiated within 14 days of project completion. Non-native non-invasive annuals may be used as cover crops until native species can be established.		
	General Conditions • Activities, either individually or cumulatively, that may result in greater than *de minimis* degradation to waters of the state are not covered.		
	• Clearing, grubbing, or other disturbance of areas to wetland vegetation shall be kept at a minimum. Unnecessary wetland vegetation removal, including trees, and soil disturbance is prohibited. Native wetland vegetation must be reestablished after work is completed. Coverage under this permit does not serve to waive any local wetland buffer protection requirement.		
	• Activity may not result in a disruption or barrier to the movement of fish or other aquatic life and wetland dependent species.		
	• Activities occurring in known or likely habitat of state or federally listed threatened, endangered, deemed in need of management, or species of special concern may not be authorized without prior coordination with the TWRA and TDEC Division of Natural Areas to determine if any special conditions are required to avoid and/or minimize harm to the listed species or their habitat. Adverse effects to federally listed threatened and		

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Location Resource	Requirements	Prerequisite	Citation
	endangered species are not permitted without prior authorization from the U.S. FWS.		
	• This permit does not authorize impacts to cultural, historic or archaeological features or sites.		
	• This permit does not authorize access to private property. Arrangements concerning the use of private property shall be made with the landowner.		
	• Where practicable, all activities shall be accomplished in the dry. All surface water flowing towards this work shall be diverted using cofferdams and/or berms constructed of sandbags, clean rock (containing no fines or soils), steel sheeting, or other non-erodible, non-toxic material. All such diversion materials shall be removed upon completion of work.		
	• All activities must be carried out in such a manner as will prevent violations of water quality criteria as stated in TDEC Rule 0400-40-03. This includes, but is not limited to, prevention of any discharge or use of materials that may be harmful to humans, terrestrial or aquatic life, or causes a condition in which visible solids, bottom deposits or turbidity impairs the designated uses of waters of the state.		
	• Erosion and sediment controls must be in place and functional before any earth moving operations begin, and shall be designed according to the department's *Erosion and Sediment Control Handbook*. Permanent vegetative stabilization using native species of all disturbed areas in or near the stream channel must be initiated within 15 days of project completion. Non-native non-invasive annuals may be used as cover crops until native species can be established.		
	• The use of monofilament-type erosion control netting or blanket is prohibited.		
	Floodplains		
Presence of floodplain as defined in 10 CFR 1022.4	Incorporate floodplain management goals into planning, regulatory, and decision-making processes, and, to the extent practicable, reduce the risk of flood loss; minimize the impact of floods on human safety, health, and welfare; restore and preserve natural and beneficial values served by floodplains; require the construction of DOE structures and facilities to be, at a minimum, in accordance with FEMA National Flood Insurance Program building standards; and promote public awareness of flood hazards by providing conspicuous delineations of past and probable flood heights on DOE property that is in an identified floodplain.	DOE actions that involve potential impacts to, or take place within, floodplains—**applicable**	10 CFR 1022.3(a)(1) through (6)

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Location Resource	Requirements	Prerequisite	Citation
	Undertake a careful evaluation of the potential effects of any proposed floodplain action. Identify, evaluate, and, as appropriate, implement alternative actions that may avoid or mitigate adverse floodplain impacts.		10 CFR 1022.3(b) and (d)
	Avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. Avoid direct and indirect development in a floodplain wherever there is a practicable alternative.		10 CFR 1022.3(c)
	Consider alternatives to the proposed action that avoid adverse impacts and incompatible development in the floodplain, including alternate sites, alternate actions, and no action. DOE shall evaluate measures that mitigate the adverse effects of actions in a floodplain including, but not limited to, minimum grading requirements, runoff controls, design and construction constraints, and protection of ecologically-sensitive areas.		10 CFR 1022.13(a)(3)
	If no practicable alternative to locating or conducting the action in the floodplain is available, then before taking action design or modify the action in order to minimize potential harm to or within the floodplain, consistent with the policies set forth in Executive Order 11988.		10 CFR 1022.14(a)
	Aquatic Resources		
Within an area potentially impacting "waters of the State" as defined in TCA 69-3-103(42)	• Must comply with the [substantive] requirements of the ARAP for erosion and sediment control to prevent pollution of waters of the state. Pollution control requirements are detailed in each particular General Permit.	Action potentially altering the properties of any "waters of the State"—**applicable**	TCA 69-3-108(1) TDEC 0400-40-07-.01
Waters of the state as defined in TCA 69-3-103(42) – Bank stabilization	Bank stabilization activities along state waters must be conducted in accordance with the requirements of the ARAP Program (Rules of the TDEC, Chap. 0400-40-07). The general permit requirements for stream bank stabilization include the following: *Special Conditions* 1. Hand armoring bank stabilization treatment is limited to 300 linear ft. for the treatment of one bank and 200 linear ft. if treatment includes both banks. • Use of grout, concrete or other barrier that prevents the establishment of rooted vegetation may be authorized on a limited basis. These treatments may only be permitted in areas where critical public infrastructure would prohibit other, less severe treatments from use.	Bank-stabilization activities affecting waters of the state—**applicable**	TCA 69-3-108(l) TDEC 0400-40-07-.01 TDEC ARAP General Permit for Bank Stabilization Activities (effective July 23, 2015) (**TBC**)

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Location Resource	Requirements	Prerequisite	Citation
	2. Soil bioengineering techniques used to stabilize streambanks are limited to 1000 linear ft. • Hard armoring used in conjunction with these techniques is subject to the same limitations described in Special Condition #1 above. • Stone toe protection in connection with, and directly below, soil bioengineering treatment is allowable, but must be limited to the minimum height necessary to stabilize the immediate bed-bank interface. It may not exceed 1/5 the bank height or one row of "class c" rock, whichever is greater.		
	3. Instream structures may be used in conjunction with bank treatments, subject to the same limitations on streambank hard armoring and total project lengths. These structures may include rock vanes, weirs, jetties, wing deflectors, or similar techniques, subject to the following conditions: • Placement of liners, matting or hard armor in other locations along the stream bottom is not covered. • Projects must be limited to a maximum of five instream structures. • Structures keyed into both banks that span the channel may not impede the movement of fish and aquatic life. • Instream structures keyed into one bank must not extend past 1/3 the width of the stream channel. • Use of instream structures in any waterway which is identified by TDEC as having contaminated sediments, and the activity will likely mobilize the contaminated sediments are not covered.		
	4. Work performed by vehicles and other related heavy equipment may not be staged within the stream channel.		
	5. Work performed by hand and related hand-operated equipment may not be staged within the stream channel.		
	6. Permit does not authorize projects for which the primary purpose is stream relocation, compensatory mitigation, flood control or drainage improvement.		
	General Conditions • Activities, either individually or cumulatively, that may result in greater than *de minimis* degradation to waters of the state are not covered.		

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Location Resource	Requirements	Prerequisite	Citation
	• Clearing, grubbing, or other disturbance to riparian vegetation shall be kept at the minimum necessary for slope construction and equipment operations. Unnecessary riparian vegetation removal, including trees, is prohibited. Native riparian vegetation must be reestablished after work is completed. Coverage under this permit does not serve to waive any local riparian buffer protection requirement.		
	• Activity may not result in the permanent disruption to the movement of fish or other aquatic life upon project completion.		
	• Activities that directly impact wetlands, or impair surface water flow into or out of any wetland areas are not covered.		
	• Activities occurring in known or likely habitat of state or federally listed threatened, endangered, deemed in need of management, or species of special concern may not be authorized without prior coordination with the TWRA and TDEC Division of Natural Areas to determine if any special conditions are required to avoid and/or minimize harm to the listed species or their habitat. Adverse effects to federally listed threatened and endangered species are not permitted without prior authorization from the U.S. FWS.		
	• Backfill activities must be accomplished in a manner that stabilizes the streambed and banks to prevent erosion. The completed activities may not disrupt or impound stream flow.		
	• The use of monofilament-type erosion control netting or blanket is prohibited in the stream channel and along the riparian corridor.		
	• This permit does not authorize impacts to cultural, historic or archaeological features or sites.		
	• This permit does not authorize access to private property. Arrangements concerning the use of private property shall be made with the landowner.		
	• Where practicable, all activities shall be accomplished in the dry. All surface water flowing towards this work shall be diverted using cofferdams and/or berms constructed of sandbags, clean rock (containing no fines or soils), steel sheeting, or other non-erodible, non-toxic material. All such diversion materials shall be removed upon completion of work. Activities may be conducted in the flowing water if working in the dry will likely cause additional degradation. If work is conducted in the flowing water, it must be of short duration and with minimal impact.		
	• All activities must be carried out in such a manner as will prevent violations of water quality criteria as stated in TDEC Rule 0400-40-03. This includes, but is not limited to, prevention of any discharge or use of		

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Location Resource	Requirements	Prerequisite	Citation
	materials that may be harmful to humans, terrestrial or aquatic life, or causes a condition in which visible solids, bottom deposits or turbidity impairs the designated uses of waters of the state.		
	• Erosion and sediment controls must be in place and functional before any earth moving operations begin, and shall be designed according to the department's *Erosion and Sediment Control Handbook*. Permanent vegetative stabilization using native species of all disturbed areas in or near the stream channel must be initiated within 15 days of project completion. Non-native non-invasive annuals may be used as cover crops until native species can be established.		
	• Temporary stream crossings shall be limited to one point in the construction area and erosion control measures shall be utilized where stream bank vegetation is disturbed. Stream beds shall not be used as linear transportation routes for construction equipment, rather, the stream channel may be crossed perpendicularly with equipment provided no additional fill or excavation is necessary.		
Waters of the state as defined in TCA 69-3-103(33) – Culvert maintenance activities	The maintenance of existing, currently serviceable structures or fills, such as dams, intake and outfall structures, utilities, culverts, and bridges in waters of the state must be conducted in accordance with the requirements of the ARAP Program (Rules of the TDEC, Chap. 0400-40-07). "Currently serviceable" means not so degraded as to essentially require reconstruction. In addition, this permit also authorizes: • Replacement of pipes and culverts where they are no longer currently serviceable. • Excavation of accumulated sediments and debris obstructing or impeding the function of existing structures, for a cumulative maximum of 100 linear ft. above and/or below the structure. • Placement of clean rock fill material within 25 ft. upstream and 25 ft. downstream of existing structures, where the erosive action of flowing water has undermined structural integrity. • Minor deviations in the structure's configuration or filled area including those due to changes in materials, construction techniques, current construction codes or safety standards which are required as part of repair or rehabilitation.	Maintenance activities affecting waters of the state—**applicable**	TCA 69-3-108(l) TDEC 0400-40-07-.01 TDEC ARAP General Permit for Maintenance Activities (effective April 7, 2015) (**TBC**)
	<u>*Special Conditions*</u> • The length of the pipe or culvert structure may not be increased.		

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Location Resource	Requirements	Prerequisite	Citation
	• The capacity or diameter of the pipe or culvert may be increased during replacement, providing it does not result in channel widening or other channel destabilization.		
	• Increasing dam height, resulting in increased impoundment footprint or change in downstream water quality is not covered.		
	• Dewatering of impoundments to conduct dam maintenance must be performed in a controlled manner designed to minimize the release of accumulated sediments into downstream waters.		
	General Conditions • Activities, either individually or cumulatively, that may result in greater than *de minimis* degradation to waters of the state are not covered.		
	• Clearing, grubbing, or other disturbance to riparian vegetation shall be kept at the minimum necessary for slope construction and equipment operations. Unnecessary riparian vegetation removal, including trees, is prohibited. Native riparian vegetation must be reestablished after work is completed. Non-native, non-invasive annuals may be used as cover crops until native species are established. Coverage under this permit does not serve to waive any local riparian buffer protection requirement.		
	• Widening of the stream channel as a result of this activity is prohibited.		
	• Activity may not result in the permanent disruption to the movement of fish or other aquatic life.		
	• Activities that directly impact wetlands, or impair surface water flow into or out of any wetland areas are not covered.		
	• Activities occurring in known or likely habitat of state or federally listed threatened, endangered, deemed in need of management, or species of special concern may not be authorized without prior coordination with the TWRA and TDEC Division of Natural Areas to determine if any special conditions are required to avoid and/or minimize harm to the listed species or their habitat. Adverse effects to federally listed threatened and endangered species are not permitted without prior authorization from the U.S. FWS.		
	• Backfill activities must be accomplished in a manner that stabilizes the streambed and banks to prevent erosion. All contours must be returned to pre-project conditions to the extent practicable and the completed activities may not disrupt or impound stream flow.		

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Location Resource	Requirements	Prerequisite	Citation
	• The use of monofilament-type erosion control netting or blanket is prohibited.		
	• This permit does not authorize impacts to cultural, historic or archaeological features or sites.		
	• This permit does not authorize access to private property. Arrangements concerning the use of private property shall be made with the landowner. Maintenance activities also require approval from any easement holders.		
	• Where practicable, all activities shall be accomplished in the dry. All surface water flowing towards this work shall be diverted using cofferdams and/or berms constructed of sandbags, clean rock (containing no fines or soils), steel sheeting, or other non-erodible, non-toxic material. All such diversion materials shall be removed upon completion of work.		
	• All activities must be carried out in such a manner as will prevent violations of water quality criteria as stated in TDEC Rule 0400-40-03. This includes, but is not limited to, prevention of any discharge or use of materials that may be harmful to humans, terrestrial or aquatic life, or causes a condition in which visible solids, bottom deposits or turbidity impairs the designated uses of waters of the state.		
	• Erosion and sediment controls must be in place and functional before any earth moving operations begin, and shall be designed according to the department's *Erosion and Sediment Control Handbook*. Permanent vegetative stabilization using native species of all disturbed areas in or near the stream channel must be initiated within 15 days of project completion. Non-native non-invasive annuals may be used as cover crops until native species can be established.		
	• Stream beds shall not be used as linear transportation routes for construction equipment. Temporary stream crossings shall be limited to one point in the construction area and erosion control measures shall be utilized where streambank vegetation is disturbed. The crossing area shall be constructed so that stream or wetland flow is not obstructed. Following construction, all materials used for the temporary crossing shall be removed and disturbed streambanks shall be restored and stabilized if needed.		
	• Maintenance activities related to the excavation of accumulated sediments and debris obstructing or impeding the function of an existing structure, for a cumulative maximum of 100 linear ft. immediately above and/or below the structure, and/or the placement of clean rock fill material within 25 ft. upstream and 25 ft. downstream of existing structures may be done without authorization from TDEC prior to the commencement of work provided		

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Location Resource	Requirements	Prerequisite	Citation
	the work is performed in accordance with these permit terms and conditions.		
Waters of the state as defined in TCA 69-3-103 (42) – Wet weather conveyances	Wet weather conveyance activities conducted in accordance with the following conditions are considered de minimis: *General Conditions* • The activity may not result in the discharge of waste or other substances that may be harmful to humans or wildlife. • Material may not be placed in a location or manner so as to impair surface water flow into or out of any wetland area.	Activities that alter wet-weather conveyances—**applicable**	TDEC 0400-40-07-.04(10)(a) TDEC ARAP General Permit for Alteration of Wet Weather Conveyances (effective April 7, 2015) (**TBC**)
	• Sediment shall be prevented from entering other waters of the state. • Erosion/sediment controls shall be designed according to size and slope of disturbed or drainage areas to detain runoff and trap sediment and shall be properly selected, installed, and maintained in accordance with manufacturer's specifications and good engineering practices.		
	• Erosion and sediment control measures must be in place and functional before earthmoving operations begin, and must be constructed and maintained throughout the construction period. Temporary measures may be removed at the beginning of the work day, but shall be replaced at the end of the work day.		
	• Check dams must be utilized where runoff is concentrated. Clean rock, log, or sandbag check dams shall be properly constructed to detain runoff and trap sediment. Check dams or other erosion control devices are not to be constructed in jurisdictional streams. Clean rock can be of various type and size depending on the application and must not contain fines, soils or other wastes or contaminants.		
	• Appropriate steps must be taken to ensure that petroleum products or other chemical pollutants are prevented from entering waters of the state. All spills must be reported to the appropriate emergency management agency and TDEC. In the event of a spill, measures shall be taken immediately to prevent pollution of waters of the state, including groundwater.		
	• This permit does not authorize impacts to cultural, historic or archaeological features or sites.		
	• This permit does not authorize access to private property. Arrangements concerning the use of private property shall be made with the landowner.		

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Location Resource	Requirements	Prerequisite	Citation
	• This permit does not authorize adverse impact to formally listed state or federal threatened or endangered species or their critical habitat.		
Within area impacting stream or any other body of water - *and*- presence of wildlife resources (e.g., fish)	The effects of water-related projects on fish and wildlife resources and their habitat should be considered with a view to the conservation of fish and wildlife resources by preventing loss of and damage to such resources.	Action that impounds, modifies, diverts, or controls waters, including navigation and drainage activities—**relevant and appropriate**	Fish and Wildlife Coordination Act (16 *USC* 662(a))
Location encompassing aquatic ecosystem as defined as 40 CFR 230.3(c)	The discharge of dredged or fill material into waters of the United States is prohibited if there is a practical alternative that would have less adverse impact. No discharge shall be permitted that results in violation of state water quality standards, violates any toxic effluent standard, and/or jeopardizes an endangered species or its critical habitat. No discharge will be permitted that will cause significant degradation of waters of the United States. No discharge of dredged or fill material shall be permitted unless appropriate and practicable steps in accordance with 40 CFR 230.70 et seq. are taken that will minimize potential adverse impacts of the discharge on the aquatic ecosystem.	Action that involves the discharge of dredged or fill material into "waters of the U.S.", including jurisdictional wetlands—**applicable**	40 CFR 230.10(a), (b), (c) and (d) 40 CFR 230, Subpart H
Mitigation of state waters other than wetlands	Must provide mitigation that results in no overall net loss of resource values for any activity that would result in appreciable permanent loss of resource value of a state water. For any mitigation involving relocation or re-creation of a stream segment, to extent practicable must complete mitigation before any impact occurs to existing state waters. Mitigation measures include but are not limited to: restoration of degraded stream reaches and/or riparian zones; new (relocated) stream channels; removal of pollutants from and hydrologic buffering of stormwater runoff; and other measures which have a reasonable likelihood of increasing the resource value of a state water. Mitigation measures or actions should be prioritized in the following order: restoration, enhancement, re-creation, and protection.	Activity that would result in an appreciable permanent loss of resource value of a state water —**applicable**	TDEC 0400-40-07-.04(7)(a)
	Cultural Resources		
Presence of historical resources on public land	Federal agencies must take into account the effects of their undertakings on historic properties.	Federal agency undertaking that may impact historical properties listed or eligible for inclusion on the National Register of Historic Places—**applicable**	36 CFR 800.1(a)
	Determine whether the proposed Federal action is an undertaking as defined in § 800.16(y) and, if so, whether it is a type of activity that has the potential to cause effects on historic properties.		36 CFR 800.3(a)
	Determine and document the area of potential effects, as defined in §800.16(d).		36 CFR 800.4(a)(1) – (2)

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Location Resource	Requirements	Prerequisite	Citation
	Review existing information on historic properties within the area of potential effects, including any data concerning possible historic properties not yet identified.		
	Take the steps necessary to identify historic properties within the area of potential effects.		36 CFR 800.4(b)
	Apply the National Register criteria (36 CFR 63) to properties identified within the area of potential effects that have not been previously evaluated for National Register eligibility. If the agency official determines any of the National Register criteria are met and the SHPO/THPO agrees, the property shall be considered eligible for the National Register for section 106 purposes.		36 CFR 800.4(c)(1) – (2)
	Shall apply the criteria of adverse effect to historic properties within the area of potential effects.		36 CFR 800.5(a)
	Shall ensure that a determination, finding, or agreement under the procedures in this subpart is supported by sufficient documentation to enable any reviewing parties to understand its basis.		36 CFR 800.11(a)
Presence of archaeological resources on public land	No person may excavate, remove, damage, or otherwise alter or deface, or attempt to excavate, remove, damage, or otherwise alter or deface any archaeological resource located on public lands or Indian lands unless such activity is pursuant to a permit issued under §7.8 or exempted by §7.5(b) of this part.	Action that would cause the irreparable loss or destruction of significant historic or archaeological resources or data on public land—**applicable**	43 CFR 7.4(a)
Presence of human remains, funerary objects, sacred objects, or objects of cultural patrimony	Intentional excavation of human remains, funerary objects, sacred objects, or objects of cultural patrimony from Federal or tribal lands may be conducted only if: • The objects are excavated or removed following the requirements of the Archaeological Resources Protection Act (ARPA) (16 *USC* 470aa et seq.) and its implementing regulations and • The disposition of the objects is consistent with their custody as described in §10.6.	Action involving alteration of terrain that might cause irreparable loss or destruction of any discovered significant scientific, prehistoric, historic, or archaeological resources—**applicable**	43 CFR 10.3(b)(1) and (3)
	Must take reasonable steps to determine whether a planned activity may result in the excavation of human remains, funerary objects, sacred objects, or objects of cultural patrimony from Federal lands.		43 CFR 10.3(c)

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Location Resource	Requirements	Prerequisite	Citation
	If inadvertent discovery occurred in connection with an on-going activity on Federal or tribal lands, in addition to providing the notice described above, must stop activities in the area of the inadvertent discovery and make a reasonable effort to protect the human remains, funerary objects, sacred objects, or objects of cultural patrimony discovered inadvertently.	Excavation activities that inadvertently discover such resources on federal lands or under federal control—**applicable**	43 CFR 10.4(c)
	Must take immediate steps, if necessary, to further secure and protect inadvertently discovered human remains, funerary objects, sacred objects, or objects of cultural patrimony, including, as appropriate, stabilization or covering.		43 CFR 10.4(d)(ii)
Presence of a cemetery	Intentional desecration of a place of burial without legal privilege or authority to do so is prohibited.	Action that would alter or destroy property in a cemetery—**applicable**	*TCA* 39-17-311(a)(1)
	Disinterment of a corpse that has been buried or otherwise interred, without legal privilege or authority to do so, is prohibited.		*TCA* 39-17-312(a)(2)
	Endangered, Threatened or Rare Species		
Presence of Tennessee nongame species as defined in TCA 70-8-103 and listed in TWRA Proclamations 00-14 and 00-15	May not take (i.e., harass, hunt, capture, kill or attempt to kill), possess, transport, export, or process wildlife species. May not knowingly destroy the habitat of such species. Certain exceptions may be allowed for reasons such as education, science, etc., or where necessary to alleviate property damage or protect human health or safety. Upon good cause shown and where necessary to protect human health or safety, endangered or threatened species or "in need of management" species may be removed, captured, or destroyed.	Action impacting Tennessee nongame species, including wildlife species which are "in need of management" (as listed in TWRA Proclamations 00-14 and 00-15 as amended by 00-21) —**applicable**	TCA 70-8-104(b) and (c) TCA 70-8-106(e) TWRA Proclamations 00-14, Section II and 00-15, Section II, as amended by Proclamation 00-21 (**TBC**) See also the TN Natural Heritage Program Rare Animal List (2009)
Presence of Tennessee-listed endangered or rare plant species as listed in TDEC 0400-06-02-.04	May not knowingly uproot, dig, take, remove, damage or destroy, possess or otherwise disturb for any purposes any endangered species.	Action impacting rare plant species including but not limited to federally listed endangered species—**relevant and appropriate**	TCA 70-8-309(a) 16 USC 1531 et seq. TDEC 0400-06-02-.04 and Tennessee Natural Heritage Program Rare Plant List (2012)
Presence of federally endangered or threatened species, as designated in 50 CFR 17.11 and 17.12 or critical habitat of such species	Actions that jeopardize the existence of a listed species or results in the destruction or adverse modification of critical habitat must be avoided or reasonable and prudent mitigation measures taken.	Action that is likely to jeopardize fish, wildlife, or plant species or destroy or adversely modify critical habitat—**applicable**	16 U.S.C. 1531 et seq., Sect. 7(a)(2)
	Unlawful killing, possession, and sale of migratory bird species, as defined in 50 CFR 10.13, native to the U.S. or its territories is prohibited.	Action that is likely to impact migratory birds—**applicable**	16 USC 703-704

Table G-3. Location-specific ARARs and TBC Guidance for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Location Resource	Requirements	Prerequisite	Citation
Presence of migratory birds as defined in 50 CFR 10.13, and their habitats	Requirements are as follows: • avoid or minimize, to the extent practicable, adverse impacts on migratory bird resources when conducting agency action; • restore and enhance the habitats of migratory birds, as practicable; and • prevent or abate the pollution or detrimental alteration of the environment for the benefit of migratory birds, as practicable.	Federal agency action that is likely to impact migratory birds—**TBC**	Executive Order 13186

Table G-4. Action-specific ARARs and TBC Guidance (Siting Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives

Action	Requirements	Prerequisite	Citation
Siting of a RCRA landfill	A new facility where treatment, storage, or disposal of hazardous waste will be conducted must not be located within 200 ft of a fault which has had displacement in Holocene time.	Construction of a RCRA hazardous waste landfill—**applicable**	40 CFR 264.18(a)(1)
	A facility located in a 100 year floodplain (as defined in 40 CFR 264.18[b][2]) must be designed, constructed, operated and maintained to prevent washout of any hazardous waste, unless it can be demonstrated that procedures are in effect which will cause the waste to be removed safely, before flood waters can reach the facility.		40 CFR 264.18(b)(1) TDEC 0400-12-01-.06(2)(i)
Siting of new commercial hazardous waste management facility	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 groundwater remediation. The demonstration shall specify how a corrective action response will be effectively implemented to remediate a release to groundwater within the facility property boundary and shall illustrate all the factors that are necessary to be in compliance with Rule 0400-12-01-.06(6)	Construction of a new commercial hazardous waste management facility – **relevant and appropriate**	TDEC 0400-12-02-.03(2)(e)(1)(i)(III)
Siting requirements for a TSCA Landfill	Shall be located in thick, relatively impermeable formations such as large area clay pans. Where this is not possible, the soil shall have a high clay and silt content with the following parameters: (i) In place soil thickness, 4-ft or compacted soil liner thickness, 3 ft; (ii) Permeability (cm/sec), equal to or less than 1 x 10-7; (iii) Percent soil passing No. 200 Sieve, >30; (iv) Liquid Limit, >30; and (v) Plasticity Index > 15.	Construction of a TSCA landfill—**applicable**	40 CFR 761.75(b)(1)
	The landfill must be located above the historical high groundwater table. Floodplains, shorelands and groundwater recharge areas shall be avoided. The site shall have monitoring wells and leachate collection. There shall be no hydraulic connection between the site and standing or flowing surface water. *[Note: A waiver under TSCA 40 CFR 761.75(c)(4) will be requested for this requirement.]* The bottom of the landfill liner system or natural in-place soil barrier shall be at least 50 ft from the historical high water table. *[Note: A waiver under TSCA 40 CFR 761.75(c)(4) will be requested for this requirement.]*	Construction of a TSCA chemical waste landfill—**applicable**	40 CFR 761.75(b)(3)

Table G-4. Action-specific ARARs and TBC Guidance (Siting Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	The landfill site shall be located in an area of low to moderate relief to minimize erosion and to help prevent landslides or slumping. *[Note: A waiver under TSCA 40 CFR 761.75(c)(4) will be requested for this requirement.]*		40 CFR 761.75(b)(5)
Waiver of a TSCA chemical waste landfill technical requirement	An owner or operator of a chemical waste landfill may submit evidence to the Regional Administrator that operation of the landfill not present an unreasonable risk of injury to health or the environment from PCBs when one or more of the requirements of paragraph (b) of this section are not met. On the basis of such evidence and any other available information, the Regional Administrator may in his discretion find that one or more of the requirements of paragraph (b) of this section is not necessary to protect against such a risk and may waive the requirements in any approval for that landfill. *Note: Waiver of any technical requirement shall be made as part of the CERCLA Record of Decision process. The CERCLA remedy protectiveness standard will apply in addition to the TSCA standard.*		40 CFR 761.75(c)(4)
Siting requirements and performance objectives for LLW disposal facility	Land disposal facilities must be sited, designed, operated, closed and controlled after closure so that reasonable assurance exists that exposures to humans are within the limits established in the performance objectives. *[Note: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), and (5).*	Construction of a LLW disposal facility—**relevant and appropriate**	TDEC 0400-20-11-.16(1)
	Stability of the site after closure. 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.		TDEC 0400-20-11-.16(5)
	Disposal site shall be capable of being characterized, modeled, analyzed and monitored.		TDEC 0400-20-11-.17(1)(b)
	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 performance objectives. *[Note: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), and (5).]*		TDEC 0400-20-11-.17(1)(c)
	Areas must be avoided having known natural resources which, if exploited, would result in failure of the cell to meet performance objectives. *[Note: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), and (5).]*		TDEC 0400-20-11-.17(1)(d)

Table G-4. Action-specific ARARs and TBC Guidance (Siting Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	Disposal site must be generally well drained and free of areas of flooding and frequent ponding, and waste disposal shall not take place in a 100- year floodplain or wetland.		TDEC 0400-20-11-.17(1)(e)
	Upstream drainage area must be minimized to decrease the amount of runoff which could erode or inundate the disposal unit.		TDEC 0400-20-11-.17(1)(f)
	The disposal site must provide sufficient depth to the water table that groundwater intrusion, perennial or otherwise, into the waste will not occur. 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 Rules of the TDEC 0400-20-11-.16 being met, wastes may be disposed below the water table. In no case will waste disposal be permitted in the zone of fluctuation of the water table. *[Note: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), and (5).]*		TDEC 0400-20-11-.17(1)(g)
	The hydrogeologic unit used for disposal shall not discharge groundwater to the surface within the disposal site. *Note: An exception, variance or exemption to this requirement will be requested under TDEC 0400-20-04-.08.*		TDEC 0400-20-11-.17(1)(h)
Exemption of TDEC 0400-20-11-17(h) requirement	The Department may, upon application by any person or upon its own initiative, grant exemptions, variance, or exceptions from the requirements of these regulations which are not prohibited by statute and which will not result in undue hazard to public health and safety or property. *Note: The exemption, variance or exception from the requirement shall be made as part of the CERCLA Record of Decision process. The CERCLA remedy protectiveness standard will apply in addition to the DRH standard.*		TDEC 0400-20-04-.08
	Areas must be avoided where tectonic processes such as faulting, folding, seismic activity may occur with such frequency to affect the ability of the site to meet the performance objectives. *[Note: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), and (5).]*		TDEC 0400-20-11-.17(1)(i)
	Areas must be avoided where surface geologic processes such as mass wasting, erosion, slumping, landsliding or weathering may occur with such frequency and extent to affect		TDEC 0400-20-11-.17(1)(j)

Table G-4. Action-specific ARARs and TBC Guidance (Siting Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	the ability of the disposal site to meet performance objectives or preclude defensible modeling and prediction of long-term impacts. *[Note: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), and (5).]*		
	The disposal site must not be located where nearby activities or facilities could impact the site's ability to meet performance objectives or mask environmental monitoring. *[Note: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), and (5).]*		TDEC 0400-20-11-.17(1)(k)

Table G-5. Action-specific ARARs and TBC Guidance (Design Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives

Action	Requirements	Prerequisite	Citation
	General Landfill Design		
Preparedness and prevention	Facilities must be designed, constructed, maintained, and operated to prevent any unplanned release of hazardous waste or hazardous waste constituents into the environment and minimize the possibility of fire or explosion. All facilities must be equipped with communication and fire suppression equipment and undertake additional measures as specified in 40 CFR 264.30 *et seq.*	Operation of a RCRA hazardous waste facility—**applicable**	40 CFR 264.30-264.37 TDEC 0400-12-01-.06(3)
Site design for a LLW disposal facility	Site design features must be directed toward long-term isolation and avoidance of the need for continuing active maintenance after site closure.	Design of a LLW disposal facility—**relevant and appropriate**	TDEC 0400-20-11-.17(2)(a)
	Disposal site design and operation must be compatible with the disposal site closure and stabilization plan and lead to disposal site closure that provides assurance that the performance objectives will be met. *[Note: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), and (5).]*		TDEC 0400-20-11-.17(2)(b)
	Disposal site must be designed to complement and improve, where appropriate, the ability of the disposal site's natural characteristics to assure that the performance objectives will be met. *[Note: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), and (5).]*		TDEC 0400-20-11-.17(2)(c)
	Covers must be designed to minimize to the extent practicable water infiltration, to direct percolating or surface water away from the disposed waste and to resist degradation by surface geologic processes and biotic activity.		TDEC 0400-20-11-.17(2)(d)
	Surface features must direct surface water drainage away from disposal units at velocities and gradients which will not result in erosion that will require ongoing active maintenance in the future.		TDEC 0400-20-11-.17(2)(e)
	Disposal site must be designed to minimize to the extent practicable the contact of water with waste during storage, the contact of standing water with waste during disposal and the contact of percolating or standing water with wastes after disposal.		TDEC 0400-20-11-.17(2)(f)
	A buffer zone of land must be maintained between any disposal unit and the disposal boundary and beneath the disposed waste. The buffer zone shall be of adequate dimensions to carry out environmental monitoring activities specified in paragraph (4) of this rule and take mitigative measures if needed.		TDEC 0400-20-11-.17(3)(h)

Table G-5. Action-specific ARARs and TBC Guidance (Design Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	Landfill Liner System		
Liner design requirements for a TSCA landfill	Synthetic membrane liners shall be used when the hydrologic or geologic conditions at the landfill require such in order to achieve the permeability equivalent to the soils in paragraph (b)(1) of this section. Whenever a synthetic liner is used at a landfill site, special precautions shall be taken to insure that its integrity is maintained and that it is chemically compatible with PCBs. Adequate soil underlining and cover shall be provided to prevent excessive stress or rupture of the liner. The liner must have a minimum thickness of 30 mils.	Design of a TSCA chemical waste landfill—**applicable**	40 CFR 761.75(b)(2)
Liner and leachate collection design for a RCRA landfill	The owner or operator of a landfill unit on which construction commences after January 29, 1992 must install two or more liners and a leachate collection and removal system above and between such liners.	Design of a RCRA landfill—**applicable**	40 CFR 264.301(c) TDEC 0400-12-01-.06(14)(b)(3)
Liner system for RCRA landfill	(i) The liner system must include: A. A top liner, designed and constructed of materials (e.g., geomembrane) to prevent the migration of hazardous constituents into the liner during active life and the post closure period; and B. A composite bottom liner, consisting of at least two components. The upper component must be designed and constructed of materials (e.g., a geomembrane) to prevent the migration of hazardous constituents into this component during the active life and post-closure care period. The lower component must be designed and constructed of materials to minimize the migration of hazardous constituents if a breach in the upper component were to occur. The lower component must be constructed of at least 3 feet (91 cm) of compacted soil material with a hydraulic conductivity of no more than 1×10^{-7} cm/sec. (ii) Liners must comply with paragraphs (a)(1)(i), (ii), and (iii) of this section.		40 CFR 264.301(c)(1) TDEC 0400-12-01-.06(14)(b)(3)(i)(I)

Table G-5. Action-specific ARARs and TBC Guidance (Design Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
Liner for a RCRA landfill	A liner that is designed, constructed, and installed to prevent any migration of wastes out of the landfill to the adjacent subsurface soil or groundwater or surface water at any time during the active life (including the closure period) of the landfill. The liner must be constructed of materials that prevent wastes from passing into the liner during the active life of the facility. The liner must be: (i) Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients, physical contact with the waste or leachate to which they are exposed, climatic conditions, or stress from installation or daily operation; (ii) Placed on a foundation or base capable of supporting the liner and resistance to the pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression or uplift; and (iii) Installed to cover all surrounding earth likely to be in contact with waste or leachate.		40 CFR 264.301(a)(1) TDEC 0400-12-01-.06(14)(b)1(i)
Facility design, construction	Underlying the liners shall be a geologic buffer which shall have: (i) A maximum hydraulic conductivity of 1.0×10^{-5} cm/s and measures at least ten (10) feet from the bottom of the liner to the seasonal high water table of the uppermost unconfined aquifer or top of the formation of a confined aquifer, or (ii) Have a maximum hydraulic conductivity of 1.0×10^{-6} cm/s and measure not less than five (5) feet from the bottom of liner to the seasonal high water table of the uppermost unconfined aquifer or the top of the formation of a confined aquifer, or (iii) Other equivalent or superior protection as defined in subpart (ii) of this part.	Design and construction of a solid waste landfill— **relevant and appropriate**	TDEC 0400-11-01-.04(4)(a)(2)
Leachate collection and removal system	Must be designed, constructed, operated, and maintained to collect and remove leachate from the landfill during the active life and post closure period and ensure that the leachate depth over the liner does not exceed 30 cm. The leachate collection and removal system must comply with paragraphs (c)(3)(iii) and (iv) of this section.	Design of a RCRA landfill— **applicable**	40 CFR 264.301(c)(2) TDEC 0400-12-01-.06(14)(b)1(ii)
Leak detection system	The leachate collection and removal system between the liners, and immediately above the bottom composite liner in the case of multiple leachate collection and removal systems, is also a leak detection system. This leak detection system must be capable of detecting, collecting, and removing leaks of hazardous constituents at the earliest practicable time through all areas of the top liner likely to be exposed to waste or leachate during the active life and post-closure care period. The requirements for a leak detection system in this paragraph are satisfied by installation of a system that is, at a minimum: (i) Constructed with a bottom slope of one percent or more;		40 CFR 264.301(c)(3) TDEC 0400-12-01-.06(14)(b)3(iii)

Table G-5. Action-specific ARARs and TBC Guidance (Design Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	(ii) Constructed of granular drainage materials with a hydraulic conductivity of $1 \times 10{-}2$ cm/sec or more and a thickness of 12 inches (30.5 cm) or more; or constructed of synthetic or geonet drainage materials with a transmissivity of $3 \times 10{-}5$ m2/sec or more; (iii) Constructed of materials that are chemically resistant to the waste managed in the landfill and the leachate expected to be generated, and of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying wastes, waste cover materials, and equipment used at the landfill; (iv) Designed and operated to minimize clogging during the active life and post-closure care period; and (v) Constructed with sumps and liquid removal methods (e.g., pumps) of sufficient size to collect and remove liquids from the sump and prevent liquids from backing up into the drainage layer. Each unit must have its own sump(s). The design of each sump and removal system must provide a method for measuring and recording the volume of liquids present in sump and of liquids removed.		
Leak detection system action leakage rate	(a) The action leakage rate is the maximum design flow rate that the leak detection system (LDS) can remove without the fluid head on the bottom liner exceeding 1 foot. The action leakage rate must include an adequate safety margin to allow for uncertainties in the design (e.g., slope, hydraulic conductivity, thickness of drainage material), construction, operation, and location of the LDS, waste and leachate characteristics, likelihood and amounts of other sources of liquids in the LDS, and proposed response actions. (b) To determine if the action leakage rate has been exceeded, the owner or operator must convert the weekly or monthly flow rate from the monitoring data obtained under part 264.303(c) of this paragraph to an average daily flow rate (gallons per acre per day) for each sump.		40 CFR 264.302 TDEC 0400-12-01-.06(c)
	Storm Water Control for Landfill		
Run-on/runoff control systems	Run-on control system must be capable of preventing flow onto the active portion of the landfill during peak discharge from a 25-year storm event.	Design of a RCRA landfill—**applicable**	40 CFR 264.301(g) TDEC 0400-12-01-.06(14)(b)(7)
	Run-off management system must be able to collect and control the water volume from a runoff resulting from a 24-hour, 25-year storm event.		40 CFR 264.301(h) TDEC 0400-12-01-.06(14)(b)(8)
	If the landfill site is below the 100-year floodwater elevation, the operator shall provide surface water diversion dikes around the perimeter of the landfill site with a minimum height equal to two feet above the 100-year floodwater elevation.	Design of a TSCA landfill—**applicable**	40 CFR 761.75(b)(4)(i) and (ii)

Table G-5. Action-specific ARARs and TBC Guidance (Design Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	If the landfill site is above the 100-year floodwater elevation, the operators shall provide diversion structures capable of diverting all of the surface water runoff from a 24-hour, 25-year storm.		
	RCRA Tank System and Impoundment Designs		
Design of a RCRA Tank System	Must prepare an assessment attesting that the tank system design has sufficient structural integrity and is acceptable for the storing/treating of hazardous waste. The assessment must include the information specified in 40 CFR 264.192(a)(1)-(5) [TDEC 0400-12-01-.06(10)(c)(1)-(5)].	Storage of RCRA hazardous waste in a new tank system—**relevant and appropriate**	40 CFR 264.192(a) TDEC 0400-12-01-.06(10)(c)(1)
	Ancillary equipment (i.e., piping) must be supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction.		40 CFR 264.192(e) TDEC 0400-12-01-.06(10)(c)(5)
	Must provide the degree of corrosion protection based upon the information in 40 CFR 264.192(a)(3) (TDEC 0400-12-01-.06[10][c][1][iii]) to ensure the integrity of the tank system during use. Installation of field fabricated corrosion protection system must be supervised by an independent corrosion expert.		40 CFR 264.192(f) TDEC 0400-12-01-.06(10)(c)(6)
	Must provide secondary containment in order to prevent release of hazardous waste or constituents into the environment.		40 CFR 264.193(a)(1) TDEC 0400-12-01-.06(10)(d)(1)
	Secondary containment systems must be: • Designed, installed, and operated to prevent any migration of wastes or accumulated liquid out of the system to the soil, groundwater, or surface water at any time during the use of the tank system; and • Capable of detecting and collecting releases and accumulated liquids until the collected material is removed.		40 CFR 264.193(b) TDEC 0400-12-01-.06(10)(d)(2)

Table G-5. Action-specific ARARs and TBC Guidance (Design Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	Secondary containment systems must be at a minimum: • Constructed of or lined with materials that are compatible with the wastes(s) to be placed in the tank system and must have sufficient strength and thickness to prevent failure owing to pressure gradients (including static head and external hydrological forces), physical contact with the waste to which it is exposed, climatic conditions, and the stress of daily operation (including stresses from nearby vehicular traffic). • Placed on a foundation or base capable of providing support to the secondary containment system, resistance to pressure gradients above and below the system, and capable of preventing failure due to settlement, compression, or uplift; • Provided with a leak-detection system that is designed and operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of hazardous waste or accumulated liquid in the secondary containment system within 24 hours, or at the earliest practicable time if the owner or operator can demonstrate to the Regional Administrator that existing detection technologies or site conditions will not allow detection of a release within 24 hours; and • Sloped or otherwise designed or operated to drain and remove liquids resulting from leaks, spills, or precipitation. Spilled or leaked waste and accumulated precipitation must be removed from the secondary containment system within 24 hours, or in as timely a manner as is possible to prevent harm to human health and environment, if the owner or operator can demonstrate to the Regional Administrator that removal of released waste or accumulated precipitation cannot be accomplished within 24 hours.		40 CFR 264.193(c) TDEC 0400-12-01-.06(10)(d)(3)
	Secondary containment for tanks must include one or more of the following devices: • a liner (external to the tank); • a vault; • a double-walled tank; or • an equivalent device as approved by the EPA.		40 CFR 264.193(d) TDEC 0400-12-01-.06(10)(d)(4)

Table G-5. Action-specific ARARs and TBC Guidance (Design Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	External liner systems must be: • designed and operated to contain 100 percent of the capacity of the largest tank within its boundary; • designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration. (Such additional capacity must be sufficient to contain precipitation from a 25 year, 24-hour rainfall event); • free of cracks or gaps; and • designed and installed to surround the tank completely and to cover all surrounding earth likely to come into contact with the waste if the waste is released from the tank(s) (i.e., capable of preventing lateral as well as vertical migration of the waste).		40 CFR 264.193(e)(1) TDEC 0400-12-01-.06(10)(d)(5)(i)
	Vault system must be: • designed or operated to contain 100 percent of the capacity of the largest tank within its boundary; • designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration. (Such additional capacity must be sufficient to contain precipitation from a 25 year, 24-hour rainfall event); • constructed of chemical-resistant water stops in all joints (if any); • provided with an impermeable interior coating or lining that is compatible with the stored waste and that will prevent migration of the waste into the concrete; • provided with a means to protect against formation of and ignition of vapors within the vault if the waste being stored or treated meets the definition of ignitable or reactive waste under 40 CFR 261.21 or 261.23; and • provided with an exterior moisture barrier or otherwise designed or operated to prevent migration of moisture into the vault if the vault is subject to hydraulic pressure.		40 CFR 264.193(e)(2) TDEC 0400-12-01-.06(10)(d)(5)(ii)

Table G-5. Action-specific ARARs and TBC Guidance (Design Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	Double-walled tanks must be: • designed as an integral structure (i.e., an inner tank completely enveloped within and outer shell) so that any release from the inner tank is contained by the outer shell; • protected, if constructed of metal, from both corrosion of the primary tank interior and of the external surface of the outer shell; and • provided with a built-in continuous leak detection system capable of detecting a release within 24 hours, or at the earliest practicable time.		40 CFR 264.193(e)(3) TDEC 0400-12-01-.06(10)(d)(5)(iii)
	Ancillary equipment must be provided with secondary containment (e.g., trench, jacketing, double-walled piping) that meets the requirements of 40 CFR 264.193(b) and (c) (TDEC 0400-12-01-.06[10][d][2] and [3]) except for: • aboveground piping (exclusive of flanges, joints, valves, and other connections) that are visually inspected for leaks on a daily basis; • welded flanges, welded joints and welded connections, that are visually inspected for leaks on a daily basis; • seamless or magnetic coupling pumps and seal-less valves, that are visually inspected for leaks on a daily basis; and • pressurized aboveground piping systems with automatic shut-off devices (e.g., excess flow check valves, flow metering shutdown devices, loss of pressure actuated shut-off devices) that are visually inspected for leaks on a daily basis.		40 CFR 264.193(f) TDEC 0400-12-01-.06(10)(d)(6)
Design and installation of a RCRA surface impoundment	Must install a liner system consisting of two or more liners and a leachate collection and removal system, constructed in accordance with 40 CFR 264.221(c)(1)-(4) (TDEC 0400-12-01-.06[11][b][3][i]-[iv]).	Storage of RCRA hazardous waste in a new surface impoundment—**relevant and appropriate**	40 CFR 264.221(c) TDEC 0400-12-01-.06(11)(b)(3)
	Must implement a leak detection system capable of detecting, collecting and removing leaks of hazardous constituents from all areas of the top liner during the active life and post-closure care period.		40 CFR 264.221(c)(2) TDEC 0400-12-01-.06(11)(b)(3)(ii)
	Must design, construct and maintain dikes with sufficient structural integrity to prevent massive failure.		40 CFR 264.221(h) TDEC 0400-12-01-.06(11)(b)(8)
	Alternative design practices to those in 40 CFR 264.221(c) (TDEC 0400-12-01-.06[11][b][3]) may be approved by the Regional Administrator.		40 CFR 264.221(d) TDEC 0400-12-01-.06(11)(b)(4)

Table G-5. Action-specific ARARs and TBC Guidance (Design Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
Design and operation of a RCRA container storage area	Storage areas that store containers holding only wastes that do not contain free liquids need not have a containment system defined by paragraph (b) of this section, except as provided by paragraph (d) of this section or provided that: (1) Area must be sloped or otherwise designed and operated to drain liquid from precipitation, or (2) The containers must be elevated or otherwise protected from contact with accumulated liquid.	Storage of RCRA hazardous waste in containers that do not contain free liquids—**applicable**	40 CFR 264.175(c) TDEC 0400-12-01-.06(9)(f)(3)
	Area must have a containment system designed and operated in accordance with 40 CFR 264.175(b) as follows: • a base must underlie the containers which is free of cracks or gaps and is sufficiently impervious to contain leaks, spills and accumulated precipitation until the collected material is detected and removed; • base must be sloped or the containment system must be otherwise designed and operated to drain and remove liquids resulting from leaks, spills or precipitation, unless the containers are elevated or are otherwise protected from contact with accumulated liquids; • must have sufficient capacity to contain 10 percent of the volume of containers or volume of largest container, whichever is greater; • run-on into the system must be prevented unless the collection system has sufficient capacity to contain any run-on which might enter the system along with volume required for containers immediately above; and • spilled or leaked waste and accumulated precipitation must be removed from the sump or collection area in a timely manner as or necessary to prevent overflow of the collection system.	Storage in Containers: Storage of RCRA hazardous waste with free liquids or F020, F021, F022, F023, F026 and F027 in containers—**applicable**	40 CFR 264.175(a), (b), and (d) TDEC 0400-12-01-.06(9)(f)

Table G-6. Action-specific ARARs and TBC Guidance (Construction Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives

Action	Requirements	Prerequisite	Citation
Pre-construction activities	Prior to excavation, all bore holes drilled or dug during subsurface investigation of the site, piezometers, and abandoned wells which are either in or within 100 feet of the areas to be filled must be backfilled with a bentonite slurry or other sealant approved by the Commissioner to an elevation at least ten feet greater than the elevation of the lowest point of the landfill base (including any liner), or to the ground surface if the site will be excavated less than ten feet below grade.	Construction of a solid waste disposal facility—**relevant and appropriate**	TDEC 0400-11-01-.04(2)(l)
Activities causing fugitive dust emissions	Shall take reasonable precautions to prevent particulate matter from becoming airborne. Reasonable precautions shall include, but are not limited to the following:	Use, construction, alteration, repair or demolition of a building, or appurtenances or a road or the handling, transport or storage of material—**applicable**	TDEC 1200-3-8-.01(1)
	Use, where possible, of water or chemicals for control of dust in demolition of existing buildings or structures, construction operations, grading of roads, or the clearing of land;		TDEC 1200-3-8-.01(1)(a)
	Application of asphalt, oil, water, or suitable chemicals on dirt roads, materials stock piles, and other surfaces which can create airborne dusts;		TDEC 1200-3-8-.01(1)(b)
	Shall not cause or allow fugitive dust to be emitted in such a manner to exceed 5 minute/hour or 20 minute/day beyond property boundary lines on which emission originates.		TDEC 1200-3-8-.01(2)

Table G-6. Action-specific ARARs and TBC Guidance (Construction Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
Activities causing stormwater runoff (e.g., clearing, grading, excavation)	Implement good construction management techniques (including sediment and erosion, vegetative controls, and structural controls) in accordance with the substantive requirements of General Permit No. TNR10-0000 and TNR05-0000, to ensure stormwater discharge is properly managed and: • does not violate water quality criteria as stated in TDEC 0400-40-03-.03, including, but not limited to, prevention of discharge that cause a condition in which visible solids, bottom deposits, or turbidity impairs the usefulness of waters of the state for any designated uses for that water body by TDEC 0400-40-04; • does not contain distinctly visible floating scum, oil, or other matter; • does not cause an objectionable color contrast in the receiving stream; and • results in no materials in concentrations sufficient to be hazardous or otherwise detrimental to humans, livestock, wildlife, plant life, or fish and aquatic life in the receiving stream. • Discharges that would cause measurable degradation of waters with unavailable parameters are not authorized. To be eligible to obtain and maintain coverage, must satisfy, at a minimum, the following additional requirements for discharges into waters with unavailable parameters for siltation and habitat alterations due to in-channel erosion: ○ Measures used at the site must be designed to control stormwater runoff generated by a 5-year, 24-hour storm event at a minimum. ○ Additional physical or chemical treatment of stormwater runoff, such as use of treatment chemicals, may be necessary to minimize the amount of sediment being discharged when clay and other fine particle soils are found on sites.	Stormwater discharges associated with construction activities that disturb ≥ 1 acre total—**relevant and appropriate**	TCA 69-3-108(1) Tennessee General Permit No. TNR10-0000 (effective October 1, 2016) (**TBC**) Tennessee General Permit No. TNR10-0000, Sections 5.3.2 and 5.4.1
Activities causing storm water runoff	Shall develop and implement storm water management controls to insure compliance with the terms and conditions of *General Permit No. TNR050000* ("Stormwater Multi-Sector General Permit for Industrial Activities") or any applicable site-specific permit.	Existing and new stormwater discharges associated with industrial activity—**applicable**	*TCA* 69-3-108(e) through (j) TDEC 0400-40-10-.03(2)(a) *General Permit No. TNR05-0000,* Sector K (effective April 15, 2015) (**TBC**)
	Shall develop and maintain a storm water pollution prevention/control plan prepared in accordance with good engineering practices and with the factors outlined in 40 CFR 125.3(d)(2) or (3) as appropriate and any additional requirements listed in Part XI for the particular sector of industrial activity. The plan shall identify potential sources of pollution that may reasonably be expected to affect the quality of storm water discharges associated with industrial activity.		*General Permit No. TNR050000,* Section 4 (**TBC**)

Table G-6. Action-specific ARARs and TBC Guidance (Construction Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	Storm water pollution prevention plans shall include, at a minimum, the items identified in *General Permit No. TNR050000 Sector K.3*, including a description of potential pollution sources, storm water management measures and controls, preventive maintenance, spill prevention and response procedures, and sediment and erosion controls.	Storm water discharges associated with industrial activity at hazardous waste treatment, storage or disposal facilities—**TBC**	*General Permit No. TNR050000 Sector K.3* (**TBC**)
	Shall monitor at least annually the identified storm water outfalls in accordance with the monitoring requirements specified in *General Permit No. TNR050000 Sector K.5* and the parameters listed in Table K-1 (effluent limitations in 40 CFR 445, Subpart A) of *General Permit No. TNR050000 Sector K*, as appropriate [except for landfills operated in conjunction with other industrial or commercial operations when landfill only receives wastes generated by industrial or commercial operation directly associated with the landfill (i.e., "captive landfills")]. Sampling waivers are available under the conditions specified in *General Permit No. TNR050000 Sector K.5.1.3*.		*General Permit No. TNR050000 Sector K.5* (**TBC**)
Construction quality assurance	During construction or installation, liners and cover systems must be inspected for uniformity, damage and imperfections (e.g., holes, cracks, thin spots, etc.). Immediately after construction or installation: (1) Synthetic liners and covers must be inspected to ensure tight seams and joints and the absence of tears, punctures, or blisters; and (2) Soil-based and admixed liners and covers must be inspected for imperfections including lenses, cracks, channels, root holes, or other structural non-uniformities that may cause an increase in the permeability of the liner or cover.	Construction of a RCRA landfill—**applicable**	40 CFR 264.303(a) TDEC 0400-12-01-.06(14)(d)(1)
Construction of new outfall structure for discharge of wastewater	Construction, maintenance, repair, rehabilitation or replacement of intake and outfall structures shall be carried out in such a way that work: <u>*Special Conditions*</u> • Shall be located and oriented such as to avoid permanent alteration or damage to the integrity of the stream channel including the opposite stream bank. Alignment of the outfall structure (except for diffusers) should be as parallel to the stream flow as is practicable, with the discharge pointed downstream. Diffusers may be placed perpendicular to stream flow for more complex mixing. • Intake and outfall structures shall be designed to minimize harm and prevent impoundment of normal or base flows. • Velocity dissipation devices shall be placed as needed at discharge locations to provide a non-erosive velocity from the structure.	Construction of intake and outfall structures in waters of the state—**applicable**	TCA 69-3-108(l) TDEC 0400-40-07-.01 TDEC General Permit for Construction of Intake and Outfall Structures (effective April 7, 2015) (TBC)

Table G-6. Action-specific ARARs and TBC Guidance (Construction Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	• Headwalls, bank stabilization materials, and any other hard armoring associated with the installation of each structure shall be limited to a total of 25 ft. along the receiving stream's bank.		
	General Conditions • Activities, either individually or cumulatively, that result in greater than *de minimis* degradation to waters of the state are not covered under this permit. • Clearing, grubbing and other disturbances to riparian vegetation shall be kept at the minimum necessary for slope construction and equipment operations. Unnecessary riparian vegetation removal, including trees, is prohibited. Native riparian vegetation must be reestablished after work is completed. Non-native, non-invasive annuals may be used as cover crops until native species are established. Coverage under this permit does not serve to waive any local riparian buffer protection requirement, and permittees are responsible for obtaining any necessary local approval.		
	• Widening of the stream channel as a result of this activity is prohibited. • Activity may not result in a disruption or barrier to the movement of fish and aquatic life. • Activities that directly impact wetlands, or impair surface water flow into or out of any wetland area are not covered under this permit.		
	• Activities occurring in known or likely habitat of state or federally listed threatened, endangered, deemed in need of management, or species of special concern may not be authorized without prior coordination with the TWRA and TDEC Division of Natural Areas to determine if any special conditions are required to avoid and/or minimize harm to the listed species or their habitat. Adverse effects to federally listed threatened and endangered species are not permitted without prior authorization from the U.S. FWS.		
	• Backfill activities must be accomplished in a manner that stabilizes the streambed and banks to prevent erosion. All contours must be returned to pre-project conditions to the extent practicable and completed activities may not disrupt or impound stream flow.		

Table G-6. Action-specific ARARs and TBC Guidance (Construction Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	• Use of monofilament-type erosion control netting or blanket is prohibited. • This permit does not authorize impacts to cultural, historic or archaeological features or site. • This permit does not authorize access to private property. Arrangements concerning the use of private property shall be made with the landowner.		
	• Where practicable, all activities shall be conducted in the dry. All surface water flowing towards this work shall be diverted using cofferdams and/or berms constructed of sandbags, clean rock (containing no fines or soils), steel sheeting, or other non-erodible, non-toxic material. All such diversion materials shall be removed upon completion of work.		
	• All activities must be carried out in such a manner as will prevent violations of water quality criteria as stated in TDEC 0400-40-03-.03. This includes, but is not limited to, the prevention of any discharge or use of materials that may be harmful to humans, terrestrial or aquatic life, or causes a condition in which visible solids, bottom deposits, or turbidity impairs the designated uses of waters of the state.		
	• Erosion prevention and sediment control measures must be in place and functional before earth moving operations begin, and shall be designed according to TDEC's *Erosion and Sediment Control Handbook*. Permanent vegetative stabilization using native species of all disturbed areas in or near the stream channel must be initiated within 15 days of project completion. Non-native, non-invasive annuals may be used as cover crops until native species can be established.		
	• Stream beds must not be used as linear transportation routes for construction equipment. Temporary stream crossings shall be limited to one point in the construction area and erosion control measures shall be utilized where stream bank vegetation is disturbed. The crossing shall be constructed so that stream or wetland flow is not obstructed. Following construction, all materials used for the temporary crossing shall be removed and disturbed streambanks shall be restored and stabilized if needed.		
Pre-operation/operation of a RCRA tank system (tanks and piping)	Prior to use, must ensure that proper handling procedures are adhered to in order to prevent damage to the system during installation.		40 CFR 264.192(b) TDEC 0400-12-01-.06(10)(c)(2)
	Prior to use, must inspect the system for the presence of weld breaks, punctures, scrapes of protective coatings, cracks, corrosion, other structural damage, or inadequate construction/installation. All discrepancies must be remedied before the system is covered, enclosed or placed in use.		40 CFR 264.192(b)(1)-(6) TDEC 0400-12-01-.06(10)(c)(2)(i)-(vi)

Table G-6. Action-specific ARARs and TBC Guidance (Construction Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	Prior to use, tanks and ancillary equipment must be tested for tightness. If a tank system is found not to be tight, all repairs necessary to remedy the leak(s) must be performed prior to the system being placed into use.		40 CFR 264.192(d) TDEC 0400-12-01-.06(10)(c)(4)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives

Action	Requirements	Prerequisite	Citation
	Emissions and Effluents		
Control of air emissions from an above-grade RCRA tank system	The requirements of 40 CFR 264 Subpart CC do not apply to a waste management unit that is used solely for on-site treatment or storage of hazardous waste that is generated as a result of implementing remedial activities required under CERCLA authorities.	Storage of RCRA hazardous waste in a new tank system—**relevant and appropriate**	40 CFR 264.1080(b)(5) TDEC 0400-12-01-.32(a)(2)(v)
Control of emissions from a WWTU treatment system	On-site remediation and treatment of contaminated water using air strippers is an exempted air contaminant source provided the emissions are no more than 5 tons per year of any regulated pollutant that is not a hazardous air pollutant and less than 1,000 pounds per year of each hazardous air pollutant.	Emissions of air pollutants from new air contaminant sources—**applicable**	TDEC 1200-03-09-.04(4)(d)(24)
Activities causing stormwater runoff (e.g., during operations)	Shall develop and implement storm water management controls to insure compliance with the terms and conditions of *General Permit No. TNR050000* ("Stormwater Multi-Sector General Permit for Industrial Activities") or any applicable site-specific permit and with TDEC 0400-40-10.03(2)(c).	Storm water discharges associated with industrial activity—**applicable**	TCA 69-3-108(l) General Permit No. TNR05-0000, Sector K (effective June 1, 2009) (**TBC** guidance)
	Shall develop and maintain a storm water pollution prevention/control plan prepared in accordance with good engineering practices and with the factors outlined in 40 CFR 125.3(d)(2) or (3) as appropriate and any additional requirements listed in Part XI for the particular sector of industrial activity. The plan shall identify potential sources of pollution that may reasonably be expected to affect the quality of storm water discharges associated with industrial activity.		General Permit No. TNR050000, Section 4
	Storm water pollution prevention plans shall include, at a minimum, the items identified in *General Permit No. TNR050000 Sector K.3*, including a description of potential pollution sources, storm water management measures and controls, preventive maintenance, spill prevention and response procedures, and sediment and erosion controls.	Storm water discharges associated with industrial activity at hazardous waste treatment, storage or disposal facilities—**TBC**	General Permit No. TNR050000 Sector K.3
	Shall monitor at least annually the identified storm water outfalls in accordance with the monitoring requirements specified in General Permit No. TNR050000 Sector K.5 and the parameters listed in Table K-1 of General Permit No. TNR050000 Sector K, as appropriate. Sampling waivers are available under the conditions specified in General Permit No. TNR050000 Sector K.5.1.3.		General Permit No. TNR050000 Sector K.5
	Secondary Waste and Waste Acceptance Criteria Attainment		
Characterization of solid waste (e.g., contaminated PPE, equipment, spent filters)	Must determine if waste is hazardous waste or if waste is excluded under 40 CFR 261.4; and	Generation of solid waste as defined in 40 CFR 261.2, and which is not excluded under 40 CFR 261.4(a) —**applicable**	40 CFR 262.11(a) TDEC 0400-12-01-.03(1)(b)(1)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	Must determine if waste is listed under Subpart D of 40 CFR Part 261; or		40 CFR 262.11(b) TDEC 0400-12-01-.03(1)(b)(2)
	Must characterize waste by using prescribed testing methods or applying generator knowledge based on information regarding material or processes used.		40 CFR 262.11(c) TDEC 0400-12-01-.03(1)(b)(3)
Characterization of hazardous waste	If waste is determined to be hazardous, must refer to Parts 261, 262, 264, 266, 268, and 273 of Title 40 for possible exclusions or restrictions pertaining to management of the specific waste.	Generation of RCRA hazardous waste for storage, treatment or disposal—**applicable**	40 CFR 262.11(d) TDEC 0400-12-01-.03(1)(b)(4)
	Must obtain a detailed chemical and physical analysis of a representative sample of the waste(s) which at a minimum contains all the information which must be known to treat, store, or dispose of the waste in accordance with 40 CFR 264 and 268.		40 CFR 264.13(a)(1) TDEC 0400-12-01-.06(2)(d)(1)
	Must determine if the waste meets the treatment standards in 40 CFR 268.40, 268.45, or 268.49 by testing in accordance with prescribed methods or use of generator knowledge of waste.		40 CFR 268.7(a) TDEC 0400-12-01-.10(1)(g)(1)
	Must determine each EPA Hazardous Waste Number (Waste Code) to determine the applicable treatment standards under 40 CFR 268.40 et seq.		40 CFR 268.9(a) TDEC 0400-12-01-.10(1)(i)(1)
	Must determine the underlying hazardous constituents (as defined in 40 CFR 268.2[i]) in the waste.	Generation of RCRA characteristically hazardous waste (and is not D001 non-wastewaters treated by CMBST, RORGS, or POLYM of Section 268.42 Table 1) for storage, treatment or disposal—**applicable**	40 CFR 268.9(a); TDEC 0400-12-01-.10(1)(i)(1)
Management of hazardous waste on site	A generator who treats, stores, or disposes of hazardous waste on-site must comply with the applicable [substantive] standards and requirements set forth in 40 CFR parts 264, 265, 266, 268, and 270.	Generation of RCRA hazardous waste for storage, treatment or disposal on-site—**applicable** if secondary wastes are determined to be hazardous	40 CFR 262.10, Note 2 TDEC 0400-12-01-.03(1)(a)(3)
Temporary storage of hazardous waste in containers on-site – "Satellite Accumulation Area"	A generator may accumulate as much as 55 gal. of hazardous waste at or near any point of generation where wastes initially accumulate which is under the control of the operator of the process generating the waste provided that he: • complies with 40 CFR 265.171, 265.172 and 265.173(a); and	Accumulation of 55 gal. or less of RCRA hazardous waste at or near any point of generation—**applicable**	40 CFR 262.34(c)(1)(i) TDEC 0400-12-01-.03(4)(e)(5)(i)(I)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	• container is be marked with the words "Hazardous Waste" or with other words that identify contents.		40 CFR 262.34(c)(1)(ii) TDEC 0400-12-01-.03(4)(e)(5)(i)(II)
Temporary storage of hazardous waste in containers on-site – "90-Day Storage Area"	A generator may accumulate hazardous waste at the facility provided that: • the waste is placed in containers that comply with Subparts I, AA, BB, and CC of 40 CFR 265; and	Accumulation of RCRA hazardous waste on-site as defined in 40 CFR 260.10—**applicable**	40 CFR 262.34(a)(1)(i) TDEC 0400-12-01-.03(4)(e)(2)(i)(I)
	• container is marked with the date upon which each period of accumulation begins and is visible for inspection; and		40 CFR 262.34(a)(2) TDEC 0400-12-01-.03(4)(e)(2)(ii)
	• container is marked with the words "Hazardous Waste"		40 CFR 262.34(a)(3) TDEC 0400-12-01-.03(4)(e)(2)(iii)
Use and management of hazardous waste in containers	If container is not in good condition (e.g., severe rusting, structural defects) or if it begins to leak, must transfer waste into container in good condition.	Storage of RCRA hazardous waste in containers—**applicable**	40 CFR 264.171 TDEC 0400-12-01-.06(9)(b)
	Use container made or lined with materials compatible with waste to be stored so that the ability of the container is not impaired.		40 CFR 264.172 TDEC 0400-12-01-.06(9)(c)
	Container holding hazardous waste must always be kept closed during storage, except to add/remove waste.		40 CFR 264.173(a) TDEC 0400-12-01-.06(9)(d)
	Container holding hazardous waste must not be opened, handled, or stored in a manner which may rupture the container or cause it to leak.		40 CFR 264.173(b) TDEC 0400-12-01-.06(9)(d)
Operation of a RCRA container area	Area must be sloped or otherwise designed and operated to drain liquid from precipitation, or containers must be elevated or otherwise protected from contact with accumulated liquid.	Storage in containers of RCRA hazardous waste that do not contain free liquids—**applicable**	40 CFR 264.175(c) TDEC 0400-12-01-.06(9)(f)(3)
Storage of RCRA hazardous waste with free liquids in containers	Area must have a containment system designed and operated in accordance with 40 CFR 264.175(b) as follows:	Storage of RCRA hazardous waste with free liquids or storage of waste codes F020, F021, F022, F023, F026 and F027 that do not contain free liquids in containers—**applicable**	40 CFR 264.175(a) and (d) TDEC 0400-12-01-.06(9)(f)(1) – (2)
	• a base must underlie the containers which is free of cracks or gaps and is sufficiently impervious to contain leaks, spills and accumulated precipitation until the collected material is detected and removed;		40 CFR 264.175(b)(1) TDEC 0400-12-01-.06(9)(f)(2)(i)
	• base must be sloped or the containment system must be otherwise designed and operated to drain and remove liquids resulting from leaks, spills or precipitation,		40 CFR 264.175(b)(2) TDEC 0400-12-01-.06(9)(f)(2)(ii)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	unless the containers are elevated or are otherwise protected from contact with accumulated liquids;		
	• must have sufficient capacity to contain 10 percent of the volume of containers or volume of largest container, whichever is greater;		40 CFR 264.175(b)(3) TDEC 0400-12-01-.06(9)(f)(2)(iii)
	• run-on into the system must be prevented unless the collection system has sufficient capacity to contain any run-on which might enter the system, along with the volume required for containers as listed immediately above; and		40 CFR 264.175(b)(4) TDEC 0400-12-01-.06(9)(f)(2)(iv)
	• spilled or leaked waste and accumulated precipitation must be removed from the sump or collection area in as timely a manner as is necessary to prevent overflow of the collection system.		40 CFR 264.175(b)(5) TDEC 0400-12-01-.06(9)(f)(2)(v)
Characterization and management of universal waste	A large quantity handler of universal waste must manage universal waste in accordance with [substantive requirements of] 40 CFR 273 in a way that prevents releases of any universal waste or component of a universal waste to the environment.	Generation of universal waste [as defined in 40 CFR 273] for disposal—**applicable**	40 CFR 273 TDEC 0400-12-01-.12
	Must label or mark the universal waste to identify the type of universal waste.		40 CFR 273.34 TDEC 0400-12-01-.12(3)(e)
	A large quantity handler of universal waste must immediately contain all releases of universal wastes and other residues from universal wastes, and must determine whether any material resulting from the release is hazardous waste, and if so, must manage the hazardous waste in compliance with all applicable requirements.		40 CFR 273.37 TDEC 0400-12-01-.12(3)(h)
Disposal of universal waste	The generator of the universal waste must determine whether the waste exhibits a characteristic of hazardous waste. If it is determined to exhibit such a characteristic, it must be managed in accordance with 40 CFR 260 through 272 [TDEC 0400-1-11-.01 through .10]. If the waste is not hazardous, the generator may manage and dispose of it in any way that is in compliance with applicable federal, state, and local solid waste regulations.	Generation of universal waste [as defined in 40 CFR 273] for disposal—**applicable**	40 CFR 273.33 TDEC 0400-12-01-.12(3)(d)
Operation of a Subtitle D solid waste landfill	A facility must be operated and maintained in a manner to minimize litter. Fencing, diking and/or other practices shall be provided as necessary to confine solid wastes subject to dispersal. All litter must be collected for disposal in a timely manner.	Operation of a Subtitle D solid waste landfill—**relevant and appropriate**	TDEC 0400-11-01-.04(2)(d)
	There must be maintained on-site operating equipment capable of spreading and properly compacting the volume of solid wastes received, and capable of handling the earthwork required. Back-up equipment must be available within 24 hours of primary equipment breakdown.		TDEC 0400-11-01-.04(2)(g)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	Cover material sufficient to meet the initial and intermediate cover requirements of this rule must be available at the facility. If such material must be hauled in from off-site *[i.e., off of ORR]*, at least a 30-day supply must be maintained on site at all times. *[Note: Off-site, as referred to here, is assumed to mean off of the ORR.]*		TDEC 0400-11-01-.04(2)(h)
	Collection and holding facilities associated with run-on and run-off control systems must be emptied or otherwise managed expeditiously after storms to maintain design capacity of the system. Run-on and run-off must be managed separately from leachate. Other control measures (e.g. temporary mulching or seeding, silt barriers) must be taken as necessary to control erosion of the site.		TDEC 0400-11-01.04(2)(i)
	The operator must take dust control measures as necessary to prevent dust from creating a nuisance or safety hazard to adjacent landowners or to persons engaged in supervising, operating, and using the site. The use of any dust suppressants (other than water) must be approved prior to use.		TDEC 0400-11-01.04(2)(j)
	There must be installed on-site a permanent benchmark (e.g., concrete marker) of known elevation.		TDEC 0400-11-01.04(2)(o)
Waste handling activities at a solid waste landfill	Solid waste disposal activities shall be confined to the smallest practicable area. Compaction will be performed as necessary to ensure a stable fill..	Land disposal of solid waste—**relevant and appropriate**	TDEC 0400-11-01-.04(6)(b)(1)
	Emplaced solid wastes shall be covered with soil or other material of such depths and at such intervals as is necessary to prevent fire hazards, promote a stable fill, minimize potential harmful releases of solid wastes or solid waste constituents.		TDEC 0400-11-01-.04(6)(b)(2)
Management and storage of used oil	Used oil generators shall not store used oil in units other than tanks, containers, or units subject to regulation under parts 264 or 265 of this chapter.	Generation and storage of used oil, (as defined in 40 CFR 279.1) and possible release—**applicable**	40 CFR 279.22(a) TDEC 0400-12-01-.11(3)(c)(1)
	Containers and aboveground tanks used to store used oil at generator facilities must be in good condition (no severe rusting, apparent structural defects or deterioration); and not leaking (no visible leaks).		40 CFR 279.22(b)(1) and (2) TDEC 0400-12-01-.11(3)(c)(2)(i) and (ii)
	Containers and aboveground tanks used to store used oil at generator facilities must be labeled or marked clearly with the words "Used Oil."		40 CFR 279.22(c)(1) and (2) TDEC 0400-12-01-.11(3)(c)(3)(i) and (ii)
	Upon detection of a release of used oil to the environment, a generator must stop the release; contain, clean up, and properly manage the released used oil; and, if		40 CFR 279.22(d) TDEC 0400-12-01-.11(3)(c)(4)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	necessary, repair or replace any leaking used oil storage containers or tanks prior to returning them to service.		
Management of PCB waste (e.g., contaminated PPE, equipment, wastewater)	Any person storing or disposing of PCB waste must do so in accordance with 40 CFR 761, Subpart D	Generation of waste containing PCBs at concentrations ≥ 50 ppm—**applicable**	40 CFR 761.50(a)
	Any person cleaning up and disposing of PCBs shall do so based on the concentration at which the PCBs are found.	Generation of PCB remediation waste as defined in 40 CFR 761.3—**applicable**	40 CFR 761.61
Temporary storage of PCB waste (e.g., PPE, rags) in a container(s)	Storage area must be clearly marked as required by 40 CFR 761.40(a)(10). Any leaking PCB items and their contents shall be transferred immediately to a properly marked non-leaking container(s). Container(s) shall be in accordance with requirements set forth in DOT HMR at 49 *CFR* 171-180.	Storage of PCBs and PCB items at concentration ≥ 50 ppm for disposal—**applicable**	40 CFR 761.65(c)(3) 40 CFR 761.65(c)(5) 40 CFR 761.65(c)(6)
Disposal of containers of TSCA PCB wastes	Container(s) shall be marked as illustrated in 40 *CFR* 761.45(a).	Disposal of PCBs or PCB items in chemical waste landfill—**applicable**	40 CFR 761.40(a)(1)
Disposal of PCB cleaning solvents, abrasives, and equipment	May be reused after decontamination in accordance with 761.79.	Generation of PCB wastes from the cleanup of PCB remediation wastes—**applicable**	40 *CFR* 761.61(a)(5)(v)(B)
Risk-based disposal of PCB remediation waste or bulk product waste	May dispose of in a manner other than prescribed in 40 CFR 761.61(a) or (b) if approved in writing by EPA and method will not pose an unreasonable risk of injury to health or the environment.	Disposal of PCB remediation waste—**applicable**	40 CFR 761.61(c) 40 CFR 761.62(c)
Performance-based disposal of PCB remediation waste	Shall be disposed according to 40 CFR 761.60(a) or (e), or decontaminate in accordance with 40 CFR 761.79.	Disposal of liquid PCB remediation waste—**applicable**	40 CFR 761.61(b)(1)
	May dispose by one of the following methods: • in a high-temperature incinerator approved under 40 CFR 761.70(b); • by an alternate disposal method approved under 40 CFR 761.60(e); • in a chemical waste landfill approved under 40 CFR 761.75;	Disposal of nonliquid PCB remediation waste (as defined in 40 CFR 761.3)—**applicable**	40 CFR 761.61(b)(2) 40 CFR 761.61(b)(2)(i)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	• in a facility with a coordinated approval issued under 40 CFR 761.77; or		
	• through decontamination in accordance with 40 CFR 761.79.		40 CFR 761.61(b)(2)(ii)
Performance-based disposal of PCB bulk product waste	PCB bulk product waste may disposed of by one of the following: • in a chemical waste landfill approved under Section 761.75; • in a hazardous waste landfill permitted by EPA under §3004 of RCRA or by authorized state under §3006 of RCRA;	Disposal of PCB bulk product waste as defined in 40 CFR 761.3—**applicable**	40 CFR 761.62(a)(2) and (3)
Disposal of PCB decontamination waste and residues	Such waste shall be disposed of at their existing PCB concentration unless otherwise specified in 40 CFR 761.79(g)(1-6).	Generation of PCB decontamination waste and residues—**applicable**	40 CFR 761.79(g)
Disposal of decontaminated PCB wastes as non-TSCA wastes	Materials from which PCBs have been removed in accordance with the standards under 40 CFR 761.79(b) or to an alternate risk-based decontamination standard approved by EPA under 40 CFR 761.79(h)(5) are considered unregulated for disposal under Subpart D of TSCA.	Generation of PCB wastes, including water, organic liquids—**applicable**	40 CFR 761.79(a)(4)
Disposal of TSCA PCB wastes	PCBs and PCB items shall be placed in a manner that will prevent damage to containers or articles.	Disposal of PCBs or PCB items in chemical waste landfill—**applicable**	40 CFR 761.75(b)(8)(i)
Disposal of TSCA PCB wastes (e.g., from drained electrical equipment)	Bulk liquids not exceeding 500 ppm PCBs may be disposed of provided such waste is pretreated and/or stabilized (e.g., chemically fixed, evaporated, mixed with dry inert absorbent) to reduce its liquid content or increase its solid content so that a non-flowing consistency is achieved to eliminate the presence of free liquids prior to final disposal. PCB Container of liquid PCBs with a concentration between 50 and 500 ppm PCB may be disposed of if each container is surrounded by an amount of inert sorbent material capable of absorbing all of the liquid contents of the container.	Disposal of PCB container with liquid PCB between 50 ppm and 500 ppm into a TSCA chemical waste landfill—**applicable**	40 CFR 761.75(b)(8)(ii)
Placement of untreated waste in a land disposal facility	This part identifies hazardous wastes that are restricted from land disposal and defines those limited circumstances under which an otherwise prohibited waste may continue to be land disposed.	Treatment of characteristic hazardous waste—**applicable**	40 CFR 268.1 (a)
Disposal of RCRA hazardous waste in a land-based unit	May be land disposed only if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 CFR 268.40 before land disposal. The table lists either "total waste" standards, "waste-extract" standards, or "technology-specific" standards (as detailed further in 40 CFR 268.42).	Land disposal, as defined in 40 CFR 268.2, of RCRA restricted waste—**applicable**	40 CFR 268.40(a) TDEC 0400-12-01-.10(3)(a)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	For characteristic wastes (D001 – D043) that are subject to the treatment standards, all underlying hazardous constituents must meet the UTSs specified in 40 CFR 268.48.	Land disposal of restricted RCRA characteristic wastes (D001-D043) that are not managed in a wastewater treatment unit that is regulated under the CWA, that is CWA equivalent, or that is injected into a Class I nonhazardous injection well—**applicable**	40 CFR 268.40(e) TDEC 0400-12-01-.10(3)(a)(5)
	Are not prohibited if the wastes no longer exhibit a characteristic at the point of land disposal, unless the wastes are subject to a specified method of treatment other than DEACT in 40 CFR 628.40, or are D003 reactive cyanide.	Land disposal of RCRA-restricted characteristic wastes—**applicable**	40 CFR 268.1(c)(4)(iv) TDEC 0400-12-01-.10(1)(a)(3)(iv)
	Prior to land disposal, soil contaminated with hazardous waste must be treated to meet the applicable alternative treatment standards of 40 CFR 268.49(c) or according to the applicable Universal Treatment Standards in 40 CFR 268.48 applicable to the listed hazardous waste and/or applicable characteristic of hazardous waste if the soil is characteristic.	Land disposal, as defined in 40 CFR 268.2, of RCRA-restricted hazardous soils — **applicable**	40 CFR 268.49(b) TDEC 0400-12-01-.10(3)(j)(2)
Variance from a treatment standard for RCRA restricted hazardous wastes	A variance from a treatment standard may be approved if it is: • not physically possible to treat the waste to the level specified in the treatment standard, or by the method specified as the standard; or • inappropriate to require the waste to be treated to the level specified in the treatment standard or by the method specified as the treatment standard even though such treatment is technically possible.	Generation of a RCRA hazardous waste requiring treatment prior to land disposal—**applicable**	40 CFR 268.44 TDEC 0400-12-01-.10(3)(e)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
Treatment and disposal of hazardous debris in a land disposal unit	(a) *Treatment standards.* Hazardous debris must be treated prior to land disposal as follows unless EPA determines under §261.3(f)(2) of this chapter that the debris is no longer contaminated with hazardous waste or the debris is treated to the waste-specific treatment standard in this subpart for the waste contaminating the debris: (1) *General.* Hazardous debris must be treated for each "contaminant subject to treatment" defined by paragraph (b) of this section using the technology or technologies identified in Table 1 of this section. (2) *Characteristic debris.* Hazardous debris that exhibits the characteristic of ignitability, corrosivity, or reactivity identified under §261.21, 261.22, and 261.23 of this chapter, respectively, must be deactivated by treatment using one of the technologies identified in Table 1 of this section. (3) *Mixtures of debris types.* The treatment standards of Table 1 in this section must be achieved for each type of debris contained in a mixture of debris types. If an immobilization technology is used in a treatment train, it must be the last treatment technology used. (4) *Mixtures of contaminant types.* Debris that is contaminated with two or more contaminants subject to treatment identified under paragraph (b) of this section must be treated for each contaminant using one or more treatment technologies identified in Table 1 of this section. If an immobilization technology is used in a treatment train, it must be the last treatment technology used. (5) *Waste PCBs.* Hazardous debris that is also a waste PCB under 40 CFR part 761 is subject to the requirements of either 40 CFR part 761 or the requirements of this section, whichever are more stringent.	Treatment of characteristic hazardous debris—**applicable**	40 CFR 268.45(a)
	(b) *Contaminants subject to treatment.* Hazardous debris must be treated for each "contaminant subject to treatment." The contaminants subject to treatment must be determined as follows: (1) *Toxicity characteristic debris.* The contaminants subject to treatment for debris that exhibits the Toxicity Characteristic (TC) by §261.24 of this chapter are those EP constituents for which the debris exhibits the TC toxicity characteristic.		40 CFR 268.45(b)(1)
	(c) *Conditioned exclusion of treated debris.* Hazardous debris that has been treated using one of the specified extraction or destruction technologies in Table 1 of this section and that does not exhibit a characteristic of hazardous waste identified under subpart C, part 261, of this chapter after treatment is not a hazardous waste and need not be managed in a subtitle C facility. Hazardous debris contaminated with a listed waste that is treated by an immobilization		40 CFR 268.45(c)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	technology specified in Table 1 is a hazardous waste and must be managed in a subtitle C facility.		
Disposal requirements for particular RCRA waste forms and types	Except as provided in paragraph (b) of this section, and in §264.316, ignitable or reactive RCRA waste must not be placed in a landfill unless the waste and the landfill meet all applicable provisions of 40 CFR Part 268; and (1) the resulting waste, mixture or dissolution of material no longer meets the definition of ignitable or reactive waste under §261.21 or §261.23 of this chapter; and (2) 40 CFR 264.17(b) is complied with.	Disposal of ignitable or reactive RCRA waste—**applicable**	40 CFR 264.312(a) TDEC 0400-12-01-.06(14)(m)(1)
	Must not be placed into a cell unless 40 CFR 264.17(b) is compiled with (see below).	Disposal of incompatible wastes in a RCRA landfill—**applicable**	40 CFR 264.313 TDEC 0400-12-01-.06(14)(n)
Treatment and disposal of ignitable, reactive, or incompatible RCRA wastes	Must take precautions to prevent reactions which: • generate extreme heat, pressure, fire or explosion, or produce uncontrolled fumes or gases which pose a risk of fire or explosion; • produce uncontrolled toxic fumes or gases which threaten human health or the environment; • damage the structural integrity of the device or facility	Operation of a RCRA facility that treats, stores, or disposes of ignitable, reactive, or incompatible wastes—**applicable**	40 CFR 264.17(b) TDEC 0400-12-01-.06(2)(h)(2)
Disposal of bulk or containerized liquids in a RCRA landfill	May not dispose of bulk or non-containerized liquid hazardous waste or hazardous waste containing free liquids (whether or not sorbents have been added) in any landfill.	Placement of bulk or non-containerized RCRA hazardous waste—**applicable**	40 CFR 264.314(a) TDEC 0400-12-01-.06(14)(o)(1)
Disposal of containers in RCRA landfill	May not place containers holding free liquid in a landfill unless the liquid is mixed with an absorbent, solidified, removed, or otherwise eliminated.	Placement of containers containing RCRA hazardous waste in a landfill—**applicable**	40 CFR 264.314(c) TDEC 0400-12-01-.06(14)(o)(3)
	Sorbents used to treat free liquids to be disposed of in landfills must be non-biodegradable as described in 264.314(d)(1).		40 CFR 264.314(d) TDEC 0400-12-01-.06(14)(o)(5)
	Unless they are very small, containers must be either at least 90% full when placed in the landfill, or crushed, shredded, or similarly reduced in volume to the maximum practical extent before burial in the landfill.		40 CFR 264.315 TDEC 0400-12-01-.06(14)(p)
Construction and operation of a volume reduction facility (miscellaneous treatment facility)	Follow design and operating standards that ensure protection of human health and the environment for units in which hazardous waste is treated.	Processes involving treatment of RCRA hazardous waste in a miscellaneous unit as defined in 40 CFR 260.10—**applicable** to volume reduction facility	40 CFR 264.601 TDEC 0400-12-01-.06(27)(b)
	Prevent any releases that may have adverse effects on human health or the environment due to migration of waste constituents, specifically preventing adverse effects in: • the groundwater or subsurface environment		40 CFR 264.601(a) through (c) TDEC 0400-12-01-.06(27)(b)(1) through (3)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	• surface water, or wetlands, or the soil surface; • the air		
	A miscellaneous unit that is a disposal unit must be maintained in a manner that complies with §264.601 during the post-closure care period. In addition, if a treatment or storage unit has contaminated soils or groundwater that cannot be completely removed or decontaminated during closure, then that unit must also meet the requirements of §264.601 during post-closure care. The post-closure plan under §264.118 must specify the procedures that will be used to satisfy this requirement.		40 CFR 264.603 TDEC 0400-12-01-.06(27)(d)
Characterization of LLW (e.g., wastewater, contaminated PPE)	Shall be characterized using direct or indirect methods and the characterization documented in sufficient detail to ensure safe management and compliance with the WAC of the receiving facility.	Generation of LLW for storage and disposal at a DOE facility—**TBC**	DOE M 435.1-1(IV)(I)
	Characterization data shall, at a minimum, include the following information relevant to the management of the waste: • physical and chemical characteristics; • volume, including the waste and any stabilization or absorbent media; • weight of the container and contents; • identities, activities, and concentrations of major radionuclides; • characterization date; • generating source.		DOE M 435.1-1(IV)(I)(2)
Packaging of LLW for disposal	Must not be packaged for disposal in cardboard or fiberboard boxes.	Generation of LLW for disposal at a LLW disposal facility—**relevant and appropriate**	TDEC 0400-20-11-.17(7)(a)(1)
	Must be solidified or packaged in sufficient absorbent material to absorb twice the volume of liquid.	Generation of liquid LLW for disposal at a LLW disposal facility—**relevant and appropriate**	TDEC 0400-20-11-.17(7)(a)(2)
	Shall contain as little free standing and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1 percent of the volume.	Generation of solid LLW containing liquid for disposal at a LLW disposal facility—**relevant and appropriate**	TDEC 0400-20-11-.17(7)(a)(3)
	Must not be capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures or of explosive reaction with water.	Generation of LLW for disposal at a LLW disposal	TDEC 0400-20-11-.17(7)(a)(4)
	Must not contain, or be capable of, generating quantities of toxic gases, vapor, or fumes.		TDEC 0400-20-11-.17(7)(a)(5)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	Must not be pyrophoric.	facility—**relevant and appropriate**	TDEC 0400-20-11-.17(7)(a)(6)
	Must have structural stability either by processing the waste or placing the waste in a container or structure that provides stability after disposal.		TDEC 0400-20-11-.17(7)(b)(1)
	Must be converted into a form that contains as little free standing and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1 percent of the volume of the waste when the waste is in a disposal container designed to ensure stability, or 0.5 percent of the volume of the waste for waste processed to a stable form.	Generation of liquid LLW or LLW containing liquids for disposal at a LLW disposal facility—**relevant and appropriate**	TDEC 0400-20-11-.17(7)(b)(2)
	Void spaces within the waste and between the waste and its package must be reduced to the extent practicable.	Generation of LLW for disposal at a LLW disposal facility—**relevant and appropriate**	TDEC 0400-20-11-.17(7)(b)(3)
Temporary storage of LLW	Shall not be readily capable of detonation, explosive decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water.	Management of LLW at a DOE facility—**TBC**	DOE M 435.1-1(IV)(N)(1)
	Shall be stored in a location and manner that protects the integrity of waste for the expected time of storage and minimizes worker exposure.		DOE M 435.1-1(IV)(N)(3)
	Shall be managed to identify and segregate LLW from mixed waste.		DOE M 435.1-1(IV)(N)(6)
	Shall be packaged in a manner that provides containment and protection for the duration of the anticipated storage period and until disposal is achieved or until the waste has been removed from the container.	Storage of LLW in containers at a DOE facility—**TBC**	DOE M 435.1-1(IV)(L)(1)(a)
	Vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container.		DOE M 435.1-1(IV)(L)(1)(b)
	Containers shall be marked such that their contents can be identified.		DOE M 435.1-1(IV)(L)(1)(c)
Treatment of LLW	Treatment to provide more stable waste forms and to improve the long-term performance of a LLW disposal facility shall be implemented as necessary.	Generation for disposal of LLW at a DOE facility—**TBC**	DOE M 435.1-1(IV)(O)
Disposal of LLW at an off-site disposal facility or in the EMWMF	LLW shall be certified as meeting waste acceptance requirements before it is transferred to the receiving facility.		DOE M 435.1-1(IV)(J)(2)
	Transportation		
Transportation of hazardous waste on-site	The generator manifesting requirements of 40 CFR 262.20-262.32(b) do not apply. Generator or transporter must comply with the requirements set forth in 40 CFR	Transportation of hazardous wastes on a public or private right-of-way within or along	40 CFR 262.20(f) TDEC 0400-12-01-.03(3)(a)(6)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	263.30 and 263.31 in the event of a discharge of hazardous waste on a private or public right-of-way.	the border of contiguous property under the control of the same person, even if such contiguous property is divided by a public or private right-of-way—**applicable**	
Transportation of universal waste off-site	Off-site shipments of universal waste by a large quantity handler of universal waste shall be made in accordance with 40 CFR 273-38 (TDEC 0400-1-11-.12[3][i]).	Preparation of off-site shipments of universal waste by a large quantity generator of universal waste—**applicable**	40 CFR 273.38 TDEC 0400-1-11-.12(3)(i)
Transportation of used oil off-site	Except as provided in paragraphs (a) to (c) of this rule, generators must ensure that their used oil is transported by transporters who have obtained U.S. EPA ID numbers.	Preparation of off-site shipment of used oil by generators of used oil—**applicable**	40 CFR 279.24 TDEC 0400-1-11-.11(3)(e)
Transportation of LLW off-site	LLW waste shall be packaged and transported in accordance with DOE O 1460.1A and DOE O 460.2.	Preparation of off-site shipment of LLW—**TBC**	DOE M 435.1-1(I)(1)(E)(11)
	To the extent practicable, the volume of waste and number of shipments shall be minimized.		DOE M 435.1-1(IV)(L)(2)
	General Operations		
Incompatible wastes	Incompatible wastes must not be placed in the same landfill cell unless 40 CFR 264.17(b) is complied with.	Disposal of incompatible wastes in a RCRA landfill—**applicable**	40 CFR 264.313 TDEC 0400-12-01-.06(14)(n)
Waste placement	Wastes must be emplaced in a manner that maintain the package integrity during emplacement, minimizes the void spaces between packages and permit the void spaces to be filled.	Disposal of LLW on land—**relevant and appropriate**	TDEC 0400-20-11-.17(3)(d)
	Void spaces between packages must be filled with earth or other material to reduce future subsidence within the disposal unit.		TDEC 0400-20-11-.17(3)(e)
	Closure and stabilization measures as set forth in the closure plan must be carried out as each disposal unit is filled and covered.		TDEC 0400-20-11-.17(3)(i)
	Active waste disposal operations must not have an adverse effect on completed closure and stabilization measures.		TDEC 0400-20-11-.17(3)(j)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
Security system	Must prevent the unknowing entry and minimize the possibility for unauthorized entry of persons or livestock onto active portion of the facility or comply with provisions of 40 CFR 264.14(b) and (c).	Operation of a RCRA landfill—**applicable**	40 CFR 264.14 TDEC 0400-12-01-.06(2)(e)
	Unless a natural barrier adequately deters access by the general public, either warning signs and fencing must be installed and maintained as follows, or the requirements of paragraph (c)(1) of this section must be met. (1) Warning signs must be displayed at all entrances and at intervals of 100 m (330 ft) or less along the property line of site or along the perimeter of the sections of site where asbestos-containing waste material is deposited. The warning signs must: (i) Be posted in such a manner and location that a person can easily read the legend; and (ii) Conform to the requirements of 51 cm × 36 cm (20"×14") upright format signs specified in 29 CFR 1910.145(d)(4) and this paragraph; and (iii) Display the legend, as listed in 40 CFR 61.154(b)(1)(iii), in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this paragraph.	Operation of an active waste disposal site that receives asbestos-containing material from a source covered under 40 CFR 61.145—**applicable**	40 CFR 61.154(b)(1)
	The perimeter of the disposal site must be fenced in a manner adequately to deter access by the general public.		40 CFR 61.154(b)(2)
	Supporting facilities: (i) A 6-ft woven mesh fence, wall or similar device shall be placed around the site to prevent unauthorized access. (ii) Roads shall be maintained to and within the site which are adequate to support the operation and maintenance of the site without causing safety or nuisance problems or hazardous conditions. (iii) Site shall be operated and maintained to prevent hazardous conditions resulting from spilled liquids and windblown materials.	Construction of a TSCA chemical waste landfill—**applicable**	40 CFR 761.75(b)(9)
General inspections	Operators must inspect facility for malfunctions and deterioration, operator errors, and discharges, often enough to identify and correct any problems.	Operation of a RCRA hazardous waste landfill—**applicable**	40 CFR 264.15(a) TDEC 0400-12-01-.06(2)(f)(1)
	Operators must remedy any deterioration or malfunction of equipment or structures on a schedule that ensures that the problem does not lead to an environmental or human health hazard.		40 CFR 264.15(c) TDEC 0400-12-01-.06(2)(f)(3)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
Inspection of landfill following storms	Must inspect landfill weekly and after storm events to ensure proper functioning of: (i) Deterioration, malfunctions, or improper operation of run-on and run-off control systems; (ii) Proper functioning of wind dispersal control systems, where present; and (iii) The presence of leachate in and proper functioning of leachate collection and removal systems, where present.	Operation of a RCRA hazardous waste landfill—**applicable**	40 CFR 264.303(b) TDEC 0400-12-01-.06(14)(d)(2)
Inspection of landfill	Must record the amount of liquids removed from the leak detection system sumps at least weekly during the active life and closure period.		40 CFR 264.303(c)(1) TDEC 0400-12-01-.06(14)(d)(3)(i)
Personnel training	Operators must ensure personnel adequately trained in hazardous waste, emergency response, monitoring equipment maintenance, alarm system procedures, etc.		40 CFR 264.16 TDEC 0400-12-01-.06(2)(g)
Construction quality assurance program	Operators must develop and implement a Construction Quality Assurance Program to ensure that the unit meets or exceeds all design criteria and specifications for all physical components including: foundations, dikes, liners, geomembranes, leachate collection and removal systems, leak detection systems and final covers in accordance with remaining provisions of 40 CFR 264.19.		40 CFR 264.19 TDEC 0400-12-01-.06(2)(j)
Contingency plan	Operators must have a contingency plan, designed to minimize hazards to human health and the environment from fires, explosions or other unplanned sudden releases of hazardous waste to air, soil, or surface water in accordance with 40 CFR 264.52.		40 CFR 264.51 TDEC 0400-12-01-.06(4)(b)
	Operators must have at least one emergency coordinator on the facility premises responsible for coordinating emergency response measures in accordance with 40 CFR 264.56.		40 CFR 264.55 TDEC 0400-12-01-.06(4)(f)
Inventory requirements	The owner or operator of a landfill must maintain the following items in the operating record required under §264.73: (a) On a map, the exact location and dimensions, including depth, of each cell with respect to permanently surveyed benchmarks; and (b) The contents of each cell and the approximate location of each hazardous waste type within each cell.	Operation of a RCRA hazardous waste landfill—**applicable**	40 CFR 264.309 TDEC 0400-12-01-.06(14)(j)
	Maintain, until closure, records of the location, depth and area, and quantity in cubic yards of asbestos containing material within the disposal site on a map or diagram.	Operation of an active waste disposal site that receives ACM from a source covered under 40 CFR 61.145—**applicable**	40 CFR 61.154(f)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	Disposal records shall include information on the PCB concentration in the liquid wastes and the three dimensional burial coordinates for PCBs and PCB items.	Operation of a TSCA chemical waste landfill—**applicable**	40 CFR 761.75(b)(8)(iv)
	Boundaries and locations of each disposal unit must be accurately located and mapped by means of a land survey. Units must be marked in such a way that the boundaries of each unit can be easily defined. Three permanent survey marker control points, referenced to USGS or NGS survey control stations, must be established on site to facilitate surveys. The USGS or NGS control states must provide horizontal and vertical controls as checked against USGS or NGS record files.	Land disposal of LLW—**relevant and appropriate**	TDEC 0400-20-11-.17(3)(g)
Leak detection system operation	Must collect and remove liquids in the leak detection system sumps to minimize the head on the bottom liner.	Operation of a RCRA landfill—**applicable**	40 CFR 264.301(c)(4) TDEC 0400-12-01-.06(14)(b)3(iv)
Run-on/runoff control systems	Collection and holding facilities must be emptied or otherwise expeditiously managed after storm events to maintain design capacity of the system		40 CFR 264.301(i) TDEC 0400-12-01-.06(14)(b)(9)
Wind dispersal control system	Must cover or manage the landfill to control wind dispersal of particulate matter		40 CFR 264.301(j) TDEC 0400-12-01-.06(14)(b)(10)
Control wind dispersal of asbestos wastes	Must be no visible emissions to the outside air; or	Operation of an active waste disposal site that receives ACM from a source covered under 40 CFR 61.145—**applicable**	40 CFR 61.154(a)
	Rather than meet the no visible emission requirement of paragraph (a) of this section, at the end of each operating day, or at least once every 24-hour period while the site is in continuous operation, the asbestos-containing waste material that has been deposited at the site during the operating day or previous 24-hour period shall: (1) Be covered with at least 15 centimeters (6 inches) of compacted non-asbestos-containing material, or (2) Be covered with a resinous or petroleum-based dust suppression agent that effectively binds dust and controls wind erosion. Such an agent shall be used in the manner and frequency recommended for the particular dust by the dust suppression agent manufacturer to achieve and maintain dust control.		40 CFR 61.154(c)
Response actions for leak detection system	Must have a response action plan which sets forth the actions to be taken if action leakage rate has been exceeded.	Operation of a RCRA landfill leak detection system—**applicable**	40 CFR 264.304(a) TDEC 0400-12-01-.06(14)(e)(1)
	Must determine to the extent practicable the location, size and cause of any leak.	Flow rate into the leak detection system exceeds action leakage rate for any sump—**applicable**	40 CFR 264.304(b)(3) TDEC 0400-12-01-.06(14)(e)(2)(iii)
	Must determine whether waste receipt should cease or be curtailed; whether any waste should be removed from the unit for inspection, repairs, or controls, and whether or not the unit should be closed.		40 CFR 264.304(b)(4) TDEC 0400-12-01-.06(14)(e)(2)(iv)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	Must determine any other short or long-term actions to be taken to mitigate or stop leaks.		40 CFR 264.304(b)(5) TDEC 0400-12-01-.06(14)(e)(2)(v)
	To make the leak and/or remediation determinations, must: (i)(I) Assess the source and amounts of the liquids by source; (i)(II) Conduct a hazardous constituent or other analyses of the liquids in the leak detection system to identify sources and possible location of leaks, and the hazard and mobility of the liquid; and (i)(III) Assess the seriousness of leaks in terms of potential for escaping into the environment; or (ii) Document why such assessments are not needed.	Operation of a RCRA landfill leak detection system—**applicable**	40 CFR 264.304(c) TDEC 0400-12-01-.06(14)(e)(3)
Operation of a RCRA tank system	Hazardous wastes or treatment reagents must not be placed in the tank system if they could cause the tank, its ancillary equipment or the containment system to rupture, leak, corrode, or otherwise fail.	Storage of RCRA hazardous waste in a new tank system—**relevant and appropriate**	40 CFR 264.194(a) TDEC 0400-12-01-.06(10)(e)(1)
	Must use appropriate controls and practices to prevent spills an overflows from the tank or containment system. These include at a minimum: • spill prevention controls (e.g., check valves, dry disconnect couplings); • overfill prevention controls (e.g., level sensing devices, high level alarms, automatic feed cutoff, or bypass to a standby tank; and • maintenance of sufficient freeboard in uncovered tanks to prevent overtopping by wave or wind action or by precipitation.		40 CFR 264.194(b) TDEC 0400-12-01-.06(10)(e)(2)
	Must comply with the requirements of 40 CFR 264.196 (TDEC 0400-12-01-.06[10][g]) if a leak or a spill occurs in the tank system.		40 CFR 264.194(c) TDEC 0400-12-01-.06(10)(e)(3)
Operation of a RCRA surface impoundment	Design and operate facility to prevent overtopping resulting from normal or abnormal operations; overfilling; wind and wave action; rainfall; run-on; malfunctions of level controllers, alarms and other equipment; and human error.	Storage of RCRA hazardous waste in a surface impoundment—**relevant and appropriate**	40 CFR 264.221(g) TDEC 0400-12-01-.06(11)(b)(7)
	Remove surface impoundment from operation if the dike leaks or if there is a sudden drop in liquid level.		40 CFR 264.227 TDEC 0400-12-01-.06(11)(h)
Operation of a landfill accepting asbestos waste	Either discharge no visible emissions to the outside air; or	Disposal of asbestos-containing material—**applicable**	40 CFR 61.154(a)(1)
	Rather than meet the no visible emission requirement of paragraph (a) of this section, at the end of each operating day, or at least once every 24-hour period while the site is in continuous operation, the asbestos-containing waste material that has been deposited at the site during the operating day or previous 24-hour period shall:		40 CFR 61.154(c)(1)

Table G-7. Action-specific ARARs and TBC Guidance (Operations Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	(1) Be covered with at least 15 centimeters (6 inches) of compacted non-asbestos-containing material, or (2) Be covered with a resinous or petroleum-based dust suppression agent that effectively binds dust and controls wind erosion. Such an agent shall be used in the manner and frequency recommended for the particular dust by the dust suppression agent manufacturer to achieve and maintain dust control.		
	Unless a natural barrier adequately deters access by the general public, either warning signs and fencing must be installed and maintained as follows, or the requirements of paragraph (c)(1) of this section must be met. (1) Warning signs must be displayed at all entrances and at intervals of 100 m (330 ft) or less along the property line of the site or along the perimeter of the sections of the site where asbestos-containing waste material is deposited. The warning signs must: (i) Be posted in such a manner and location that a person can easily read the legend; and (ii) Conform to the requirements of 51 cm × 36 cm (20″×14″) upright format signs specified in 29 CFR 1910.145(d)(4) and this paragraph; and (iii) Display the legend, as listed in 40 CFR 61.154(b)(1)(iii), in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this paragraph.	Operation of an active waste disposal site that receives asbestos-containing material from a source covered under 40 CFR 61.145—**applicable**	40 CFR § 61.154(b)(1)
	The perimeter of the disposal site must be fenced in a manner adequately to deter access by the general public.		40 CFR § 61.154(b)(2)

Table G-8. Action-specific ARARs and TBC Guidance (Environmental Monitoring Requirements – All Phases) for CERCLA Waste Disposal, On-site Disposal Alternatives

Action	Requirements	Prerequisite	Citation
Pre-operations monitoring	A preoperational monitoring program must be conducted to provide basic environmental data on the disposal site characteristics including information about the ecology, meteorology, climate, hydrology, geology, geochemistry and seismology of the disposal site. For those characteristics that are subject to seasonal variation, data must cover at least a 12-month period.	Land disposal of LLW—**relevant and appropriate**	TDEC 0400-20-11-.17(4)(a)
Corrective measures based on monitoring	Must have plans for taking corrective measures if migration of radionuclides would indicate that the performance objectives may not be met. *[Note: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), and (5).]*	Land disposal of LLW—**relevant and appropriate**	TDEC 0400-20-11-.17(4)(b)
Construction and operations monitoring	During site construction and operation, shall maintain a monitoring program, including a monitoring system. The monitoring system must be capable of providing early warning of releases of radionuclides from the disposal unit before they leave the site boundary.	Land disposal of LLW—**relevant and appropriate**	TDEC 0400-20-11-.17(4)(c)
Post-operations monitoring	After the disposal site is closed, post-operational surveillance of the disposal site shall be maintained by a monitoring system based on the operating history and the closure and stabilization of the disposal site.	Land disposal of LLW—**relevant and appropriate**	TDEC 0400-20-11-.17(4)(d)
Groundwater and surface water monitoring	The groundwater and surface water from the disposal site area must be sampled prior to commencing operation for use as baseline data	Construction of TSCA chemical waste landfill—**applicable**	40 CFR § 761.75(b)(6)(i)(A)
Surface water monitoring	Designated surface water course shall be sampled at least monthly when the landfill is being used for disposal.	Operation of a TSCA chemical waste landfill—**applicable**	40 CFR § 761.75(b)(6)(i)(B)
Leachate collection system	Leachate collection systems shall be monitored monthly for quantity and physicochemical characteristics of leachate produced. The leachate should be either treated to acceptable limits for discharge in accordance with a State or Federal permit or disposed of by another State or Federally approved method. Water analysis shall be conducted as provided in paragraph (b)(6)(iii) of this section.	Operation of a TSCA chemical waste landfill—**applicable**	40 CFR § 761.75(b)(7)

Table G-8. Action-specific ARARs and TBC Guidance (Environmental Monitoring Requirements – All Phases) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
Monitoring well construction and operation	All monitoring wells shall be cased and the annular space between the monitor zone (zone of saturation) and the surface shall be completely backfilled with Portland cement or an equivalent material and plugged with Portland cement to effectively prevent percolation of surface water into the well bore. The well opening at the surface shall have a removable cap to provide access and to prevent entrance of rainfall or stormwater runoff. The groundwater monitoring well shall be pumped to remove the volume of liquid initially contained in the well before obtaining a sample for analysis. The discharge shall be treated to meet applicable State or Federal standards or recycled to the chemical waste landfill.	Construction and operation of a TSCA groundwater monitoring well—**applicable**	40 CFR § 761.75(b)(6)(ii)(B)
Operation of leachate collection system	After the cover is installed, must record the amount of liquids removed from the leak detection system at least monthly. If the liquid level in the sump stays below the pump operating level for two consecutive months, the amount of liquids in the sumps must be recorded at least quarterly. If the liquid level in the sump stays below the pump operating level for two consecutive quarters, the amount of liquids in the sumps must be recorded at least semi-annually. If at any time during the post-closure care period the pump operating level is exceeded at units on quarterly or semi-annual recording schedules, the owner or operator must return to monthly recording of amounts of liquids removed from each sump until the liquid level again stays below the pump operating level for two consecutive months.	Closure of a RCRA landfill—**applicable**	40 CFR § 264.303(c)(2) TDEC 0400-12-01-.06(14)(d)(3)(ii)
General post-closure care	Must maintain and monitor a groundwater monitoring system and comply with all other applicable provisions of 40 CFR 264, Subpart F.		40 CFR § 264.310(b)(4) TDEC 0400-12-01-.06(14)(k)(2)(iv)
Determining RCRA Concentration Limits	Concentration limits shall be determined taking into account those constituents that are reasonably expected to be contained in or derived from waste present in the landfill. These limits must not exceed those listed in TDEC 0400-12-.06(6)(f)(1), Table 1.	RCRA hazardous constituents detected in groundwater in the uppermost aquifer underlying a hazardous waste landfill—**applicable**	40 *CFR* § 264.94(a) TDEC 0400-12-.06(6)(f)(1)
Groundwater monitoring well construction	All monitoring wells must be cased in a manner that maintains the integrity of the monitoring well bore hole. This casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of ground-water samples. The annular space (i.e., the space between the bore hole and well casing) above the sampling depth must be sealed to prevent contamination of samples and the groundwater.	Construction of RCRA groundwater monitoring well—**applicable**	40 *CFR* § 264.97(c) TDEC 0400-12-01-.06(6)(h)(3)

Table G-8. Action-specific ARARs and TBC Guidance (Environmental Monitoring Requirements – All Phases) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
Groundwater monitoring requirements for RCRA hazardous waste landfills	The groundwater monitoring system must consist of a sufficient number of wells, installed at appropriate locations and depths to yield samples from the uppermost aquifer that: • Represent the quality of background groundwater; • Represent the quality of groundwater passing the point of compliance; and • Allow for the detection of contamination when the hazardous waste or constituents have migrated from the waste management area to the uppermost aquifer.	Operation of a detection monitoring program under 40 *CFR* § 264.98—**applicable**	40 *CFR* § 264.97(a) TDEC 0400-12-01-.06(6)(h)(1)
	Groundwater monitoring program must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide a reliable indication of groundwater quality below the waste management area.		40 *CFR* § 264.97(d) TDEC 0400-12-01-.06(6)(h)(4)
	Groundwater monitoring program must include sampling and analytical methods that are appropriate and accurately measure hazardous constituents in groundwater samples.		40 *CFR* § 264.97(e) TDEC 0400-12-01-.06(6)(h)(5)
	Groundwater monitoring program must include a determination of the groundwater surface elevation each time groundwater is sampled.		40 *CFR* § 264.97(f) TDEC 0400-12-01-.06(6)(h)(6)
	The number and size of samples collected to establish background and measure groundwater quality at the point of compliance shall be appropriate for the form of statistical test employed following generally accepted statistical principles.		40 *CFR* § 264.97(g) TDEC 0400-12-01-.06(6)(h)(7)
	The owner or operator will specify one of the following statistical methods to be used in evaluating groundwater monitoring data for each hazardous constituent. The statistical test chosen shall be conducted separately for each hazardous constituent in each well. Where PQLs are used in any of the following statistical procedures to comply with §264.97(i)(5), the PQL must be proposed by the owner or operator and approved by Tennessee and EPA through the CERCLA process. Use of any of the following statistical methods must be protective of human health and the environment and must comply with the performance standards outlined in 40 *CFR* § 264.97(i).	Operation of a detection monitoring program under 40 *CFR* § 264.98—**applicable**	40 *CFR* § 264.97(h) TDEC 0400-12-01-.06(6)(h)(8)
	• A parametric analysis of variance (ANOVA) followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's mean and the background mean levels for each constituent.		40 *CFR* § 264.97(h)(1) TDEC 0400-12-01-.06(6)(h)(8)(i)
	• An analysis of variance (ANOVA) based on ranks followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's median and the background median levels for each constituent.		40 *CFR* § 264.97(h)(2) TDEC 0400-12-01-.06(6)(h)(8)(ii)

Table G-8. Action-specific ARARs and TBC Guidance (Environmental Monitoring Requirements – All Phases) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	• A tolerance or prediction interval procedure in which an interval for each constituent is established from the distribution of background data and level of each constituent in each compliance well is compared to the upper tolerance or prediction limit.		40 *CFR* § 264.97(h)(3) TDEC 0400-12-01-.06(6)(h)(8)(iii)
	• A control chart approach that gives control limits for each constituent.		40 *CFR* § 264.97(h)(4) TDEC 0400-12-01-.06(6)(h)(8)(iv)
	• Another statistical test method submitted by the owner or operator and approved by Tennessee and EPA through the CERCLA process.		40 *CFR* § 264.97(h)(5) TDEC 0400-12-01-.06(6)(h)(8)(iv)
	Any statistical method chosen under § 264.97(h) shall comply with the following performance standards, as appropriate:	Operation of a detection monitoring program under 40 *CFR* § 264.98—**applicable**	40 *CFR* § 264.97(i) TDEC 0400-12-01-.06(6)(h)(9)
	• The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of chemical parameters or hazardous constituents. If the distribution of the chemical parameters or hazardous constituents is shown by the owner or operator to be inappropriate for a normal theory test, then the data should be transformed or a distribution-free theory test should be used. If the distributions for the constituents differ, more than one statistical method may be needed.		40 *CFR* § 264.97(i)(1) TDEC 0400-12-01-.06(6)(h)(9)(i)
	• If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a ground-water protection standard, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple comparisons procedure is used, the Type I experiment wise error rate for each testing period shall be no less than 0.05; however, the Type I error of no less than 0.01 for individual well comparisons must be maintained. This performance standard does not apply to tolerance intervals, prediction intervals, or control charts.		40 *CFR* § 264.97(i)(2) TDEC 0400-12-01-.06(6)(h)(9)(ii)
	• If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be proposed by the owner or operator and approved by Tennessee and EPA through the CERCLA process.		40 *CFR* § 264.97(i)(3) TDEC 0400-12-01-.06(6)(h)(9)(iii)
	• If a tolerance interval or a prediction interval is used to evaluate groundwater monitoring data, the levels of confidence, and, for tolerance intervals, the percentage of the population that the interval must contain, shall be proposed by the owner or operator and approved by Tennessee and EPA through the CERCLA process. These parameters will be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.		40 *CFR* § 264.97(i)(4) TDEC 0400-12-01-.06(6)(h)(9)(iv)

Table G-8. Action-specific ARARs and TBC Guidance (Environmental Monitoring Requirements – All Phases) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	• The statistical method shall account for data below the limit of detection with one or more statistical procedures that are protective of human health and the environment. Any PQL approved by Tennessee and EPA through the CERCLA process under § 264.97(h) that is used in the statistical method shall be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility.		40 *CFR* § 264.97(i)(5) TDEC 0400-12-01-.06(6)(h)(9)(v)
	• If necessary, the statistical method shall include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.		40 *CFR* § 264.97(i)(6) TDEC 0400-12-01-.06(6)(h)(9)(vi)
Detection monitoring	Must monitor for specified indicator parameters, waste constituents or reaction products that provide a reliable indication of the presence of hazardous constituents in groundwater.	Operation of a detection monitoring program under 40 *CFR* § 264.98—**applicable**	40 *CFR* § 264.98(a) TDEC 0400-12-01-.06(6)(i)(1)
	Must install a groundwater monitoring system at the compliance point as specified under 40 *CFR* § 264.95 that complies with 40 *CFR* § 264.97(a)(2) and (c).		40 *CFR* § 264.98(b) TDEC 0400-12-01-.06(6)(i)(2)
	Must conduct a monitoring program for each specified chemical parameter and hazardous constituent.		40 *CFR* § 264.98(c) TDEC 0400-12-01-.06(6)(i)(3)
	Sampling frequency shall be sufficient to determine whether there is statistically significant evidence of contamination.		40 *CFR* § 264.98(d) TDEC 0400-12-01-.06(6)(i)(4)
	Must determine the groundwater flow rate and direction in the uppermost aquifer annually at a minimum.		40 *CFR* § 264.98(e) TDEC 0400-12-01-.06(6)(i)(5)
	Must determine whether there is statistically significant evidence of contamination of any specified chemical parameter or hazardous constituent at a specified frequency.		40 *CFR* § 264.98(f) TDEC 0400-12-01-.06(6)(i)(6)
	If there is statistically significant evidence of contamination at any monitoring well at the compliance point, must follow the substantive provisions of this subsection [§264.98(g)].		40 *CFR* § 264.98(g) TDEC 0400-12-01-.06(6)(i)(7)
Surface water monitoring post-closure	Designated surface water course shall be sampled on a frequency of no less than once every six months after final closure of the disposal area.	Closure of a TSCA chemical waste landfill—**applicable**	40 CFR 761.75(b)(6)(i)(C)

Table G-9. Action-specific ARARs and TBC Guidance (Closure and Post-closure Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives

Action	Requirements	Prerequisite	Citation
Decontamination/disposal of equipment	During the partial and final closure periods, all equipment, structures, etc. must be properly disposed of or decontaminated unless otherwise specified in §§ 264.197, 264.228, 264.258, 264.280 or § 264.310.	Closure of a RCRA landfill—**applicable**	40 CFR 264.114 TDEC 0400-12-01-.06(7)(e)
Closure of RCRA landfill and other RCRA hazardous waste management units	Must close the unit in a manner that: (a) Minimizes the need for further maintenance; and (b) Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere; and (c) Complies with the closure requirements of this part, including, but not limited to, the requirements of §§264.178, 264.197, 264.228, 264.258, 264.280, 264.310, 264.351, 264.601 through 264.603, and 264.1102.	Closure of a RCRA hazardous waste management facility—**applicable**	40 CFR 264.111 TDEC 0400-12-01-.06(7)(b)
Closure of RCRA landfill	Must cover the landfill or cell with a final cover designed and constructed to: (1) Provide long-term minimization of migration of liquids through the closed landfill; (2) Function with minimum maintenance; (3) Promote drainage and minimize erosion or abrasion of the cover; (4) Accommodate settling and subsidence so that the cover's integrity is maintained; and (5) Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.	Closure of a RCRA hazardous waste management landfill—**applicable**	40 CFR 264.310(a) TDEC 0400-12-01-.05(14)(k)
Clean closure of a RCRA container storage area	Must remove all hazardous waste and residues from containment system. Remaining containers, liners, bases and soil containing or contaminated with hazardous waste or residues must be decontaminated or removed.	Management of RCRA hazardous waste in a container storage area—**applicable**	40 CFR 264.178 TDEC 0400-12-01-.06(9)(i)
Clean closure of TSCA storage facility	A TSCA/RCRA storage facility closed under RCRA is exempt from the TSCA closure requirements of 40 CFR 761.65(e).	Closure of TSCA/RCRA storage facility—**applicable**	40 CFR 761.65(e)(3)
Closure of groundwater monitoring well(s)	Shall be accomplished by a licensed driller.	Permanent plugging and abandonment of a well—**relevant and appropriate**	TDEC 0400-45-09-.16(2)
	Shall be completely filled and sealed in such a manner that vertical movement of fluid either into or between formation(s) containing groundwater classified pursuant to rule 0400-45-06-.05(1) through the bore hole is not allowed.		TDEC 0400-45-06-.09(6)(d)

G-9. Action-specific ARARs and TBC Guidance (Closure and Post-closure Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	Shall be performed in accordance with the provisions for Seals at 0400-45-06-(6)(e), (f), and (g); for Fill Materials at 0400-45-06-.09(6)(h) and (i); for Temporary Bridges at 0400-45-06-.09(6)(j); for Placement of Sealing Materials at 0400-45-06-.09(7)(a) and (b); and Special Conditions at 0400-45-06-09(8)(a) and (b), as appropriate.		TDEC 0400-45-06-.09(6)(e) through (j) TDEC 0400-45-06.09(7) TDEC 0400-45-06.09(8)(a) TDEC 0400-45-06.09(8)(b)
Closure of a RCRA tank system	Must remove or decontaminate all waste residues, contaminated containment system components (liners, etc.) contaminated soils, and structures and equipment contaminated with waste, and manage them as hazardous waste, unless 40 CFR 261.3(d) (TDEC 0400-12-01-.02[1][c][4]) applies. If all contents cannot be practicably removed or decontaminated, consider the tank system a landfill and close in accordance with the landfill closure requirements of 40 CFR 264.310 (TDEC 0400-12-01-.06[14][k]).	Closure of a RCRA hazardous tank system—**relevant and appropriate** if wastewater is determined to be hazardous	40 CFR 264.197(a) and (b)TDEC 0400-12-01-.06(10)(h)(1) and (2)
Closure and post-closure care of a surface impoundment	Must remove or decontaminate all waste residues and contaminated materials; otherwise free liquids must be removed, the remaining wastes stabilized to a bearing capacity sufficient to support final cover, and the facility closed and covered with a final cover designed in accordance with 40 CFR 264.228(a)(2)(iii)(A)-(E) (TDEC 0400-12-01-.06[11][i][1][ii][III]). If some waste residues or contaminated materials are left in place at final closure, must comply with all postclosure requirements contained in §§264.117 through 264.120 (TDEC 0400-12-01-.06[7][h] through [k]), including maintenance and monitoring throughout the postclosure period. Must also: • maintain integrity and effectiveness of final cover, making repairs to the cap as necessary; • maintain and monitor leak detection system; • maintain and monitor groundwater monitoring system; • prevent run-on and runoff from eroding or otherwise damaging final cover.	Closure of a hazardous waste surface impoundment—**relevant and appropriate** if wastewater is determined to be hazardous	40 CFR 264.228(a) and (b) TDEC 0400-12-01-.06(11)(i)(1) and (2)

G-9. Action-specific ARARs and TBC Guidance (Closure and Post-closure Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
Survey plat	Must submit to the local zoning authority or the authority with jurisdiction over local land use, a survey plat indicating the location and dimensions of landfill cells, with respect to permanently surveyed benchmarks. The plat must contain a note, prominently displayed which states the owner/operator obligation to restrict disturbance of the landfill.	Closure of a RCRA landfill—**applicable**	40 CFR 264.116 TDEC 0400-12-01-.06(7)(g)
	Within 60 days of a site becoming inactive and after the effective date of this subpart, record, in accordance with State law, a notation on the deed to the facility property and on any other instrument that would normally be examined during a title search; this notation will in perpetuity notify any potential purchaser of the property that: (1) The land has been used for the disposal of asbestos-containing waste material; (2) The survey plot and record of the location and quantity of asbestos-containing waste disposed of within the disposal site required in §61.154(f) have been filed with the Administrator; and (3) The site is subject to 40 CFR part 61, subpart M.	Closure of an asbestos-containing waste disposal site—**applicable**	40 CFR 61.151(e)
Duration	Post closure care must begin after closure and continue for at least 30 years after that date.	Closure of a RCRA landfill—**applicable**	40 CFR 264.117(a) TDEC 0400-12-01-.06(7)(h)
Protection of facility	Post-closure use of property must never be allowed to disturb the integrity of the final cover, liners, or any other components of the containment system or the facility's monitoring system unless necessary to reduce a threat to human health or the environment.		40 CFR 264.117(c) TDEC 0400-12-01-.06(7)(h)(3)
Post-closure plan	Must have a written post-closure plan which identifies planned monitoring activities and frequency at which they will be performed for groundwater monitoring, containment systems and cap maintenance.		40 CFR 264.118 TDEC 0400-12-01-.06(7)(i)
Post-closure notices	Must submit to the local zoning authority a record of the type, location, and quantity of hazardous wastes disposed of within each cell of the unit.		40 CFR 264.119(a) TDEC 0400-12-01-.06(7)(j)(1)
Survey plat	Must record, in accordance with State law, a notation on the deed to the facility property - or on some other instrument which is normally examined during a title search - that will in perpetuity notify any potential purchaser of the property that the land has been used to manage hazardous wastes, and its use is restricted.		40 CFR 264.119(b) TDEC 0400-12-01-.06(7)(j)(2)

G-9. Action-specific ARARs and TBC Guidance (Closure and Post-closure Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
General post-closure care	After final closure, owner or operator must: (i) Maintain the effectiveness and integrity of the final cover including making repairs to the cap as necessary to correct effects of settling, erosion, etc.; (ii) Continue to operate the leachate collection and removal system until leachate is no longer detected; (iii) Maintain and monitor the leachate detection system in accordance with 40 CFR 264.301(a)(3)(iv) and (4) and 40 CFR 264.303(c); (iv) Maintain and monitor a groundwater monitoring system and comply with all other applicable provisions of 40 CFR 264, Subpart F; (v) Prevent run-on and run-off from eroding or otherwise damaging final cover; and (vi) Protect and maintain surveyed benchmarks used to locate waste cells.		40 CFR 264.310(b) TDEC 0400-12-01-.06(14)(k)(2)
LLW disposal facility pre-closure activities	Prior to closure of the disposal site, the following information will be obtained: • Any additional geologic, hydrologic, or other disposal site data pertinent to the long-term containment of emplaced radioactive wastes obtained during the operation period. • The result of tests, experiments or other analyses relating to backfill of excavated areas, closure and sealing, waste migration and interaction with emplacement media, or any other test, experiments or analysis pertinent to the long-term containment of emplaced waste within the disposal site. • Any proposed revision of plans for decontamination and/or dismantlement of surface operational facilities, backfilling of excavated areas, or stabilization of the disposal site for postclosure care. • Any significant new information regarding the environmental impact of closure activities and long-term performance of the disposal site.	Closure of a LLW disposal facility—**relevant and appropriate**	TDEC 0400-20-11-.12(1)
Closure of a LLW landfill	Covers must be designed to minimize to the extent practicable water infiltration, to direct percolating or surface water away from the disposed waste and to resist degradation by surface geologic processes and biotic activity.	Closure of a LLW disposal landfill—**relevant and appropriate**	TDEC 0400-20-11-.17(2)(d)
Closure of an asbestos-containing waste disposal area	Upon closure, comply with the provisions of 40 CFR 61.151(a) – (c)[TDEC 1200-3-11-.02(2)(l)(1) – (3)]:	Closure/capping of a permitted asbestos disposal site—**relevant and appropriate**	40 CFR 61.154(g) TDEC 1200-3-11-.02(5)(g)
	Must either discharge no visible emissions to the outside air; <u>or</u>		40 CFR 61.151(a)(1) TDEC 1200-3-11-.02(2)(l)(1)(i)
	Cover the ACM with at least 6 in. of compacted non-asbestos-containing material and grow and maintain a cover of vegetation on the area adequate to prevent exposure of the asbestos-containing waste; <u>or</u>		40 CFR 61.151(a)(2) TDEC 1200-3-11-.02(2)(l)(1)(ii)

G-9. Action-specific ARARs and TBC Guidance (Closure and Post-closure Requirements) for CERCLA Waste Disposal, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
	Cover the asbestos-containing waste with at least 2 ft of compacted non-asbestos-containing material and maintain it to prevent exposure of the waste.		40 CFR 61.151(a)(3) TDEC 1200-3-11-.02(2)(l)(1)(iii)
	Unless a natural barrier adequately deters access by the general public, install and maintain warning signs and fencing as detailed in 40 CFR 61.151(b)(1) – (3) <u>or</u> comply with 40 CFR 61.151(a)(2) or (a)(3).		40 CFR 61.151(b) TDEC 1200-3-11-.02(2)(l)(2)
	Owner may use an alternative control method that has received prior approval of the Administrator rather than comply with the requirements of 40 CFR 61.151(a) or (b).		40 CFR 61.151(c) TDEC 1200-3-11-.02(2)(l)(3)

Table G-10. Action-specific ARARs and TBC Guidance for Operation of an On-site Landfill Wastewater Treatment System, On-site Disposal Alternatives

Action	Requirements	Prerequisite	Citation
Release of landfill wastewater into Bear Creek tributary	Shall receive the degree of treatment or effluent reduction necessary to comply with water quality standards and, where appropriate, will comply with the "Standard of Performance" as required by TN Water Quality Control Act at TCA §§69-3-101, et seq. For industrial discharges without applicable federal effluent guidelines, best professional judgment should be employed to determine appropriate effluent limitations and standards.	Point source discharge(s) of pollutants into waters of the U.S. —**applicable**	TCA §§69-3-101 *et seq.* TDEC 0400-40-03-.05(6) TDEC 0400-40-05-.09(1)(b)
Non-continuous batch discharges (those discharges which are not continuous as defined in 40 CFR 122.2) of landfill wastewater	Non-continuous discharges shall be particularly described and limited, considering the following factors, as appropriate: • Frequency • Total mass • Maximum rate of discharge of pollutants during the discharge; and • Mass or concentration of specified pollutants	Non-continuous discharge of pollutants to surface waters—**applicable** if water is released on a non-continuous batch basis rather than continuously	40 CFR 122.45(e) TDEC 0400-40-05-.08(1)(n)
Exclusion from 40 CFR 445 effluent discharge standards for RCRA Subtitle C landfills point source category	Pursuant to 40 CFR 445.1(e), RCRA Subtitle C landfills that only receive wastes generated by the industrial operations directly associated with the landfill are exempt from the CWA effluent standards under 40 CFR 445.11.	Point source discharge of wastewater from RCRA Subtitle C landfills [as defined in 40 CFR 445.2(f)] into waters of the U.S.— **applicable**	40 CFR 445.1(e)

<table>
<tr>
<td>Effluent discharge standards for RCRA Subtitle C landfills point source category</td>
<td>Any <u>new source</u> subject to this subpart must achieve the following <u>effluent limitations</u> which represent the application of best practicable control technology currently available (BPT):

Effluent Limitations
<table>
<tr><th>Regulated parameter</th><th>Maximum daily [1]</th><th>Maximum monthly avg. [1]</th></tr>
<tr><td>BOD5</td><td>220</td><td>56</td></tr>
<tr><td>TSS</td><td>88</td><td>27</td></tr>
<tr><td>Ammonia (as N)</td><td>10</td><td>4.9</td></tr>
<tr><td>α-Terpineol</td><td>0.042</td><td>0.019</td></tr>
<tr><td>Aniline</td><td>0.024</td><td>0.015</td></tr>
<tr><td>Benzoic acid</td><td>0.119</td><td>0.073</td></tr>
<tr><td>Naphthalene</td><td>0.059</td><td>0.022</td></tr>
<tr><td>p-Cresol</td><td>0.024</td><td>0.015</td></tr>
<tr><td>Phenol</td><td>0.048</td><td>0.029</td></tr>
<tr><td>Pyridine</td><td>0.072</td><td>0.025</td></tr>
</table>
</td>
<td>Point source discharge of wastewater from RCRA Subtitle C landfills [as defined in 40 CFR 445.2(f)] into waters of the U.S.— applicable</td>
<td>40 CFR 445.14</td>
</tr>
</table>

Action	Requirements	Prerequisite	Citation
	Arsenic 1.1 0.54 Chromium 1.1 0.46 Zinc 0.535 0.296 pH (2) (2) 1 Milligrams per liter (mg/L. ppm). 2 Within the range 6 to 9. [65 FR 3048. Jan. 19. 2000: 65 FR 14344. Mar. 16. 2000] [2]		
Temporary bypass of waste stream	Bypass is prohibited unless: • Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage; • There were no feasible alternatives to bypass; condition not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance	Bypass, as defined in TDEC 0400-40-05-.02(15), of waste stream—**applicable**	TDEC 0400-40-05-.07(2)(l)
	A bypass that doesn't cause effluent limitations to be exceeded may be allowed only if bypass is necessary for essential maintenance to assure efficient operation		TDEC 0400-40-05-.07(2)(m)
Wastewater transferred by truck or pipeline to on-site on-ORR CWA-authorized WWTU	A user may not introduce into a wastewater facility any pollutant(s) which causes pass through or interference, and wastewater must meet the pretreatment standards and prohibitions [waste acceptance criteria and limits] set by the wastewater facility prior to transfer.	Transfer of contaminated wastewater to a CWA-authorized wastewater facility for treatment—**applicable**	TDEC 0400-40-14-.05(1) – (2) and (4)

[2] The 40 CFR Part 445 requirements will be addressed in an FFA dispute currently underway in the water management FFS. Resolution of how this ARAR is addressed will occur prior to the Record of Decision and any ARAR s will be included in the final Record of Decision.

Table G-10. Action-specific ARARs and TBC Guidance for Operation of an On-site Landfill Wastewater Treatment System, On-site Disposal Alternatives (Continued)

Action	Requirements	Prerequisite	Citation
Management of water generated from EMDF landfill	On-site wastewater treatment units that are part of a wastewater treatment facility subject to regulation under Section 402 or Section 307(b) of the CWA are exempt from the requirements of RCRA Subtitle C for all tank systems, conveyance systems (whether piped or trucked), and ancillary equipment used to store or transport RCRA contaminated water.	On-site wastewater treatment units subject to regulation under §402 or §307(b) of the CWA – **applicable** if water is determined to be hazardous	40 CFR 264.1(g)(6) 40 CFR 260.10 40 CFR 270.1(c)(2)(v) TDEC 0400-12-01-.07(1)(b)(4)(iv) 53 FR 34079, September 2, 1988
Disposal of wastewaters containing RCRA hazardous constituents	Disposal is not prohibited if the wastes are managed in a treatment system which subsequently discharges to waters of the U.S. under the CWA unless the wastes are subject to a specified method of treatment other than DEACT in 40 CFR 268.40 or are D003 reactive cyanide.	Disposal of RCRA restricted hazardous wastes that are hazardous only because they exhibit a hazardous characteristic and are not otherwise prohibited under 40 CFR 268 - **applicable** if water is determined to be hazardous	40 CFR 268.1(c)(4)(i) TDEC 0400-12-01-.10(1)(a)(3)(iv)(I)

Table G-11. Action-specific ARARs and TBC Guidance for CERCLA Waste Disposal, Off-site Disposal Alternative

Action	Requirements	Prerequisite	Citation
Construction and operation of a volume reduction facility (miscellaneous treatment facility)	Follow design and operating standards that ensure protection of human health and the environment for units in which hazardous waste is treated.	Processes involving treatment of RCRA hazardous waste in a miscellaneous unit as defined in 40 CFR 260.10—**applicable** to volume reduction facility	40 CFR 264.601 TDEC 0400-12-01-.06(27)(b)
	Prevent any releases that may have adverse effects on human health or the environment due to migration of waste constituents, specifically preventing adverse effects in: • the groundwater or subsurface environment • surface water, or wetlands, or the soil surface; • the air		40 CFR 264.601(a) through (c) TDEC 0400-12-01-.06(27)(b)(1) through (3)
	A miscellaneous unit that is a disposal unit must be maintained in a manner that complies with §264.601 during the post-closure care period. In addition, if a treatment or storage unit has contaminated soils or groundwater that cannot be completely removed or decontaminated during closure, then that unit must also meet the requirements of §264.601 during post-closure care. The post-closure plan under §264.118 must specify the procedures that will be used to satisfy this requirement.		40 CFR 264.603 TDEC 0400-12-01-.06(27)(d)
Transportation of hazardous materials	Shall be subject to and must comply with all applicable provisions of the HMTA and HMR at 49 CFR 171-180.	Any person who, under contract with a department or agency of the federal government, transports "in commerce", or causes to be transported or shipped, a hazardous material—**applicable**	49 CFR 171.1(c)
Transportation of hazardous and radioactive materials off-site	The waste must meet packaging, labeling, marking, placarding and pre-transport requirements in accordance with DOT regulations.	Transportation of hazardous and radioactive materials above exempt quantities—**applicable**	49 CFR 171, 172, 173, 174, 177, 178, and 179
	Must meet packaging requirements based on the maximum activity of radioactive material in a package.	Packaging of radioactive materials above exempt quantities for public transport—**applicable**	49 CFR 173.431 49 CFR 173.433 49 CFR 173.435 49 CFR 173.411
Transportation of LLW off-site	LLW waste shall be packaged and transported in accordance with DOE O 1460.1D and DOE O 460.2A.	Preparation of off-site shipment of LLW—**TBC**	DOE M 435.1-1(I)(1)(E)(11)
	To the extent practicable, the volume of waste and number of shipments shall be minimized.		DOE M 435.1-1(IV)(L)(2)
Transportation of PCB wastes off-site	Must comply with the manifesting provisions at 40 CFR 761.207 through 218.	Relinquishment of control over PCB wastes by transporting, or offering for transport—**applicable**	40 CFR 761.207(a)

Table G-11. Action-specific ARARs and TBC Guidance for CERCLA Waste Disposal, Off-site Disposal Alternative (Continued)

Action	Requirements	Prerequisite	Citation
Transportation of hazardous waste off-site	Must comply with the generator requirements of 40 CFR 262.20-23 for manifesting, Sect. 262.30 for packaging, Sect. 262.31 for labeling, Sect. 262.32 for marking, Sect. 262.33 for placarding, Sect. 262.41(a) for record keeping requirements, and Sect. 262.12 to obtain EPA ID number.	Off site transportation of RCRA hazardous waste—**applicable**	40 CFR 262.10(h) TDEC 0400-12-01-.03(1)(a)(8)
	Must comply with the requirements of 40 CFR 263.11-263.31. (Standards applicable to transporters of hazardous waste.)	Transportation of hazardous waste within the United States requiring a manifest—**applicable**	40 CFR 263.11 - 263.31
	A transporter who meets all applicable requirements of 49 CFR 171-179 and the requirements of 40 CFR 263.11 and 263.31 will be deemed in compliance with 40 CFR 263.	Transportation of hazardous waste within the United States requiring a manifest—**applicable**	40 CFR 263.10(a)
Transportation of hazardous waste on-site	The generator manifesting requirements of 40 CFR 262.20-262.32(b) do not apply. Generator or transporter must comply with the requirements set forth in 40 CFR 263.30 and 263.31 in the event of a discharge of hazardous waste on a private or public right-of-way.	Transportation of hazardous wastes on a public or private right-of-way within or along the border of contiguous property under the control of the same person, even if such contiguous property is divided by a public or private right-of-way—**applicable**	40 CFR 262.20(f)
Transportation of universal waste off-site	Off-site shipments of universal waste by a large quantity handler of universal waste shall be made in accordance with 40 CFR 273.38 (TDEC 0400-1-11-.12[3][i]).	Preparation of off-site shipments of universal waste by a large quantity generator of universal waste—**applicable**	40 CFR 273.38 TDEC 0400-1-11-.12(3)(i)
Transportation of used oil off-site	Except as provided in paragraphs (a) to (c) of this rule, generators must ensure that their used oil is transported by transporters who have obtained U.S. EPA ID numbers.	Preparation of off-site shipment of used oil by generators of used oil—**applicable**	40 CFR 279.24 TDEC 0400-1-11-.11(3)(e)

Tables G-2 through G-11 Acronyms

ACM = asbestos-containing material
ALARA = as low as reasonably achievable
ANOVA = analysis of variance
ARAP = aquatic resource alteration permit
ARAR = applicable or relevant and appropriate requirement
ARPA = Archaeological Resources Protection Act of 1979
CERCLA = Comprehensive Environmental Response, Compensation and Liability Act of 1980
CFR = *Code of Federal Regulations*
CMBST = combustion
CWA = Clean Water Act of 1972
DEACT = deactivation
DOE = U.S. Department of Energy
DOE M = Radioactive Waste Management Manual
DOE O = U.S. Department of Energy Order
DOT = U.S. Department of Transportation
EMWMF = Environmental Management Waste Management Facility
EP = extraction procedure
EPA = U.S. Environmental Protection Agency
FEMA = U.S. Federal Emergency Management Agency
HMR = Hazardous Materials Regulations
HMTA = Hazardous Materials Transportation Act of 1975 (Amendments of 1976)
ID = identification number
LDS = leak detection system
LLW = low-level (radioactive) waste

NGS = National Geodetic Society
NRC = Nuclear Regulatory Commission
ORR = Oak Ridge Reservation
PCB = polychlorinated biphenyl
POLYM = polymerization
PPE = personal protective equipment
PQL = practical quantitation limit
RCRA = Resource Conservation and Recovery Act of 1976
RORGS = recovery of organics
SHPO = State Historic Preservation Officer
TBC = to be considered
TC = toxicity characteristic
TCA = *Tennessee Code Annotated*
TDEC = Tennessee Department of Environment and Conservation
T&E = threatened and endangered (species)
THPO = Tennessee Historic Preservation Officer
TN = Tennessee
TSCA = Toxic Substances Control Act of 1976
TWRA = Tennessee Wildlife Resources Agency
U.S. = United States
USC = *United States Code*
USGS = U.S. Geological Service
UTS = universal treatment standards
WWTU = wastewater treatment unit

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