

**Remedial Design Work Plan for
the Environmental Management Disposal Facility,
Oak Ridge, Tennessee**



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**Remedial Design Work Plan for
the Environmental Management Disposal Facility,
Oak Ridge, Tennessee**

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Oak Ridge Office of Environmental Management

United Cleanup Oak Ridge LLC
under contract 89303322DEM000067

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ACRONYMS

ACI	American Concrete Institute
ALR	Action Leakage Rate
API	American Petroleum Institute
ARAR	applicable or relevant and appropriate requirement
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
AWQC	ambient water quality criteria
CO	Contracting Officer
COC	Contaminants of Concern
CBCV	Central Bear Creek Valley
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
D	Drainage
DOE	U.S. Department of Energy
ELCR	excess lifetime cancer risk
EMDF	Environmental Management Disposal Facility
EMWMF	Environmental Management Waste Management Facility
ESP	Early Site Preparation
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
GWFD	groundwater field demonstration
HI	hazard index
IEEE	Institute of Electrical and Electronic Engineers
LWTS	Landfill Wastewater Treatment System
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NT	North Tributary
OREM	Oak Ridge Office of Environmental Management
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act of 1976
RDR	Remedial Design Report
RDWP/RAWP	Remedial Design Work Plan/Remedial Action Work Plan
ROD	Record of Decision
TDEC	Tennessee Department of Environment and Conservation
TSCA	Toxic Substance Control Act
UCOR	United Cleanup Oak Ridge LLC
UL	Underwriters Laboratories
W	West

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EXECUTIVE SUMMARY

The *Record of Decision for Comprehensive Environmental Response, Compensation, and Liability Act Oak Ridge Reservation Waste Disposal at the Environmental Management Disposal Facility, Oak Ridge, Tennessee* (Environmental Management Disposal Facility [EMDF] Record of Decision [ROD]) (DOE/OR/01-2794&D2/R2), presents the selected remedy for the construction and operation of an onsite waste disposal site for Oak Ridge Reservation (ORR) Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) waste. (Note that EMDF is also referred to as the Onsite Waste Disposal Facility.)

EMDF will support the U.S. Department of Energy Oak Ridge Office of Environmental Management's mission to decommission and demolish facilities and conduct remedial actions under CERCLA on the ORR in Oak Ridge, Tennessee. EMDF will be constructed in Central Bear Creek Valley and will provide an estimated 2.2 million cubic yards (cy) of additional landfill capacity for the disposal of wastes from CERCLA cleanup actions on the ORR.

This Remedial Design Work Plan (RDWP) presents the plan for the remedial design presented in Sect 2.12 of the EMDF ROD to protect public health and the environment from actual or threatened releases of hazardous substances through disposal of CERCLA waste generated during the cleanup of the Oak Ridge National Priorities List Site. A remedial design report (RDR)/remedial action work plan (RAWP) will be prepared for the design and construction of EMDF, and an RAWP will be prepared for EMDF operations and monitoring prior to startup. A phased construction completion report will be prepared to document construction and startup.

As described in the EMDF ROD (DOE/OR/01-2794&D2/R2), the design will meet the following Remedial Action Objectives:

- *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} ELCR or HI 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} ELCR or HI of 1*
- *Prevent unacceptable exposure to ecological receptors from CERCLA waste contaminants through meeting chemical-, location-, and action-specific ARARs*
- *Maintain a 15-ft separation between the bottom of emplaced waste and the seasonal high water table of the uppermost unconfined aquifer, which includes 5 ft of liner system and 10 ft of geologic buffer consistent with TDEC 0400-11-01-.04(4)(a)(2).*

The EMDF design will include the following scope:

- Landfill disposal cells with disposal capacity of up to 2.2 million cy
 - The results of the Groundwater Field Demonstration will determine the seasonal high water table that will control the final design elevation of the geologic buffer in the knoll area
- Upgradient stormwater diversion ditch
- Landfill Wastewater Treatment System (LWTS)
- Support facilities

- Performance monitoring network

This RDWP provides the applicable or relevant and appropriate requirements from the approved EMDF ROD for the landfill design, along with other design requirements for the balance of the landfill design (including the disposal cells, LWTS, and support facilities), identifies the RDR/RAWP that will be submitted for U.S. Environmental Protection Agency and Tennessee Department of Environment and Conservation review and approval, and provides a high-level schedule for this activity.

Early Site Preparation activities, such as rerouting Bear Creek Road and Haul Road, were previously described in *Remedial Design Report/Remedial Action Work Plan for the Environmental Management Disposal Facility, Oak Ridge, Tennessee: Early Site Preparation Activities* (DOE/OR/01-2934&D2) and are not included in this document. Groundwater field demonstration activities, including the upgradient stormflow interceptor channel, are described in *RDWP/RAWP for the Groundwater Field Demonstration at the Environmental Management Disposal Facility, Oak Ridge, Tennessee* (DOE/OR/01-2948&D2) and are not included in this document.

1. INTRODUCTION AND PURPOSE

The *Record of Decision for Comprehensive Environmental Response, Compensation, and Liability Act Oak Ridge Reservation Waste Disposal at the Environmental Management Disposal Facility, Oak Ridge, Tennessee* (Environmental Management Disposal Facility [EMDF] Record of Decision [ROD]) (DOE/OR/01-2794&D2/R2), presents the selected remedy of construction and operation of an onsite waste disposal site for Oak Ridge Reservation (ORR) Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) waste. (Note that EMDF is also referred to as the Onsite Waste Disposal Facility.)

EMDF will support the U.S. Department of Energy (DOE) Oak Ridge Office of Environmental Management's (OREM's) mission to decommission and demolish facilities and conduct remedial actions under CERCLA on the ORR in Oak Ridge, Tennessee. Additional capacity is needed for the disposal of CERCLA waste beyond the currently approved CERCLA disposal facility known as the Environmental Management Waste Management Facility (EMWMF). EMDF will be constructed in Central Bear Creek Valley (CBCV) and will provide an estimated 2.2 million cubic yards (cy) of additional landfill capacity for the disposal of wastes from CERCLA cleanup actions on the ORR.

This Remedial Design Work Plan (RDWP) was prepared to present the plan for the remedial design presented in Sect 2.12 of the EMDF ROD to protect public health and the environment from actual or threatened releases of hazardous substances through disposal of CERCLA waste generated during the cleanup of the Oak Ridge National Priorities List Site. A remedial design report (RDR)/remedial action work plan (RAWP) will be prepared for the design and construction of EMDF, and an RAWP will be prepared for EMDF operations that will include details regarding the design of the Resource Conservation and Recovery Act of 1976 (RCRA)-required monitoring well network prior to startup. A phased construction completion report will be prepared to document construction and startup.

1.1 PURPOSE

This RDWP provides the applicable and relevant and appropriate requirements (ARARs) from the approved EMDF ROD for the landfill design, along with other design requirements for the balance of the landfill design (including the disposal cells, Landfill Wastewater Treatment System [LWTS], and support facilities), identifies the RDR/RAWP that will be submitted for U.S. Environmental Protection Agency (EPA) and Tennessee Department of Environment and Conservation (TDEC) approval, and provides a high-level schedule for this activity.

Early Site Preparation (ESP) activities, such as rerouting Bear Creek Road and Haul Road, were previously described in *Remedial Design Report/Remedial Action Work Plan for the Environmental Management Disposal Facility, Oak Ridge, Tennessee: Early Site Preparation Activities* (DOE/OR/01-2934&D2) and are not included in this document. Groundwater field demonstration (GWFD) activities, including the upgradient stormflow interceptor channel, are described in RDWP/RAWP for the *Groundwater Field Demonstration at the Environmental Management Disposal Facility, Oak Ridge, Tennessee* (GWFD RDWP/RAWP) (DOE/OR/01-2948&D2) and are not included in this document.

1.2 REMEDIAL ACTION OBJECTIVES

As described in the EMDF ROD (DOE/OR/01-2794&D2/R2), the following remedial action objectives (RAOs) will guide the development of the design for the waste disposal remedy:

- *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} ELCR or HI 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} ELCR or HI of 1*
- *Prevent unacceptable exposure to ecological receptors from CERCLA waste contaminants through meeting chemical-, location-, and action-specific ARARs*
- *Maintain a 15-ft separation between the bottom of emplaced waste and the seasonal high water table of the uppermost unconfined aquifer, which includes 5 ft of liner system and 10 ft of geologic buffer consistent with TDEC 0400-11-01-.04(4)(a)(2).*

2. PROJECT ORGANIZATION

2.1 PROJECT ORGANIZATION

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

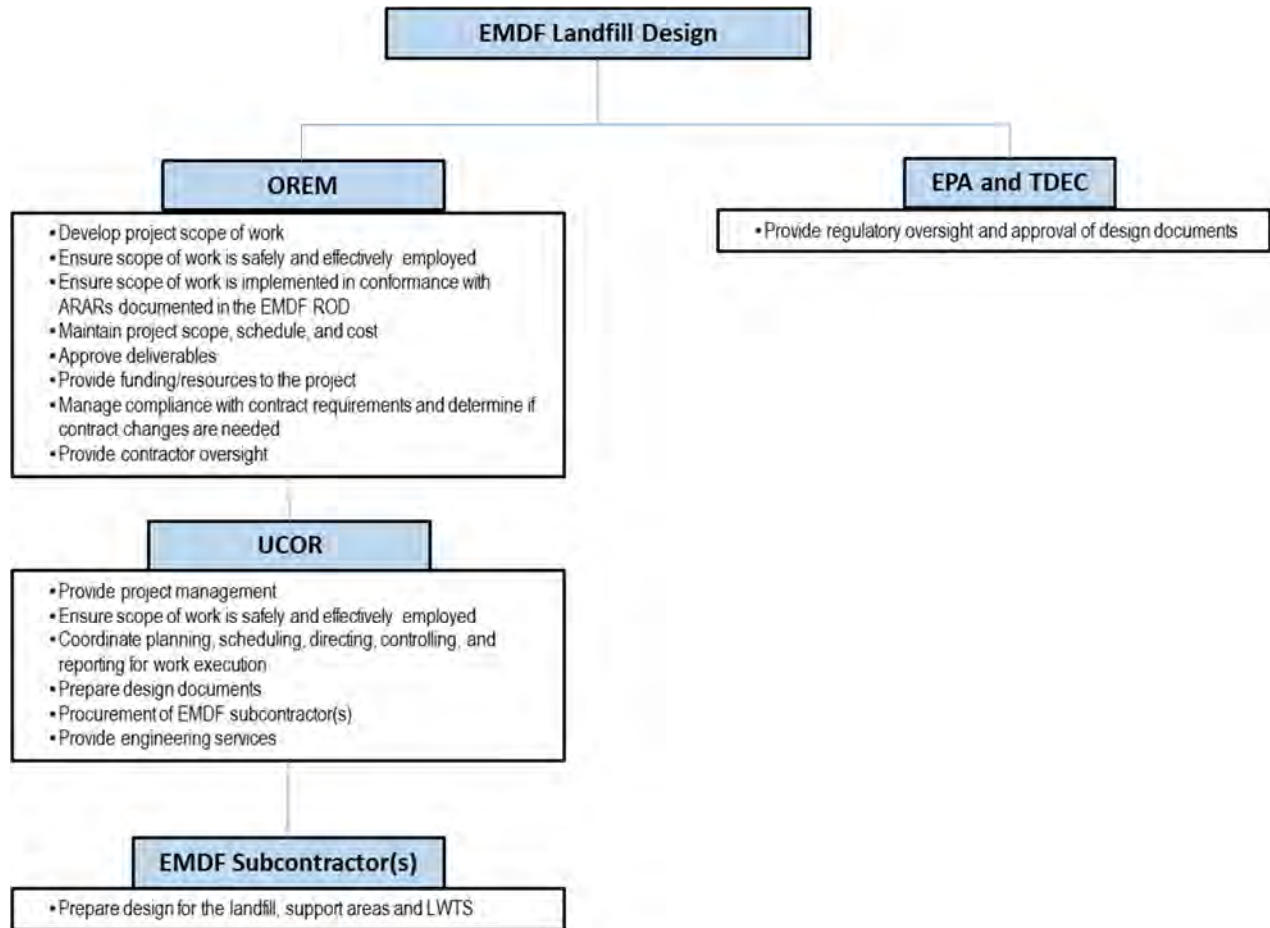


Fig. 1. EMDF Landfill Design Project organization.

2.1.1 OREM

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

The OREM Federal Project Director (or Deputy) is responsible for maintaining the overall scope, schedule, and costs. The OREM Contracting Officer (CO) and CO Representative are responsible for managing compliance with contract requirements and determining if changes to contracts are necessary or required. OREM staff, including subject matter experts and facility representatives, are responsible for providing general oversight of the contractor's safety and compliance performance.

2.1.2 Regulators

TDEC and EPA have review/approval authority over this scope through reviewing and approving this RDWP under *Federal Facility Agreement for the Oak Ridge Reservation* (DOE/OR-1014) (FFA) protocols. TDEC and EPA will also provide regulatory oversight of activities, and may also provide independent oversight and monitoring of associated activities and independent evaluation of results.

2.1.3 UCOR

United Cleanup Oak Ridge LLC (UCOR) is responsible for working with OREM to develop the project scope of work; ensuring the work scope is performed in a safe, compliant, and effective manner; and maintaining the project scope, schedule, and costs.

UCOR will provide additional project management and support oversight for the project, which includes coordination of overall planning, scheduling, directing, controlling, and reporting for the execution of the work. UCOR will prepare the design documents for the disposal cells, LWTS, and support facilities and areas.

UCOR will procure services of design subcontractor(s) for the activities by preparing statements of work, technically reviewing proposals, answering questions, supplying design and site information, and supporting pre-bid meetings, tours, and site access.

UCOR will provide design oversight for OREM. Oversight will include reviewing submittals and providing design oversight.

UCOR will provide regulatory support for the project, including development of the RDR/RAWP.

2.1.4 Subcontractors

Design subcontractor(s) will develop the engineering design documents for the disposal cells, LWTS, and support facilities and areas.

3. PROJECT DESCRIPTION

3.1 SITE DESCRIPTION

The EMDF site is located in CBCV within an upland area located between north-south trending valleys of North Tributary (NT)-10 and NT-11 (Fig. 2). The site and surrounding areas are forested, except for areas along the south side between 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 engineered wetland basins completed in 2015 for the Y-12 National Security Complex compensatory wetland mitigation. Haul Road and Bear Creek Road are located in the southern part of the site and were relocated to the south prior to EMDF construction as part of the ESP activities.

3.1.1 Geology

The EMDF site is located in CBCV within an upland area located between north-south trending valleys of NT-10 and NT-11. The EMDF disposal site predominantly overlies bedrock of the Conasauga Group, including the Maryville Formation and Nolichucky Shale (Fig. 2). These formations are predominantly shales, siltstones, and mudstones with little limestone present in the bedrock underlying the proposed disposal cells.

The typical weathering profile consists of topsoil, silty/clayey soil residuum, saprolite, and fractured bedrock. Recent stream deposits are present along the streams and tributaries throughout the EMDF site (DOE/OR/01-2819&D1, *Technical Memorandum #2, Environmental Management Disposal Facility, Phase 1 Monitoring, Oak Ridge, Tennessee*).

Karst features, such as sinkholes, sinking streams, and resurgent springs, have not been documented within the formations underlying the proposed footprint of EMDF, but are documented within the Maynardville outcrop belt south of EMDF.

3.1.2 Groundwater

Groundwater migrates from the upland areas along Pine Ridge and discharges to stream channels, supporting base flow within the NT streams and Bear Creek. There is also a component of groundwater flow along strike, most notably in the Maynardville Limestone to the south of the EMDF site.

Thirty-two piezometers were installed across the EMDF site between February 2018 and January 2019, to better understand the geology and groundwater elevations at EMDF (Fig. 2). Downhole monitors were installed in each piezometer to collect continuous depth to groundwater, pH, and water temperature data. These have been monitored since installation (excluding periods when individual downhole monitors were not functioning). Note, GW-991 is always dry and no downhole monitor was installed. Additional information, including issues related to the initial downhole monitors, can be found in *Technical Memorandum #2, Environmental Management Disposal Facility Phase 1 Monitoring, Oak Ridge, Tennessee* (DOE/OR/01-2819&D1).

In general, the vertical hydraulic gradients between the shallow and deeper bedrock zones are mostly small (less than 0.03 ft/ft vertical gradient). Three well pairs consistently have a slight downward gradient (GW-978/GW-979, GW-980R/GW-981, and GW-988/GW-989). They are located on the knoll. Slight upward vertical hydraulic gradients have only been observed at well pairs GW-992R/GW-993 and GW-994/GW-995 at the base of the knoll, with a maximum upward gradient of 0.07 ft/ft in the southern part of the proposed EMDF footprint near the existing Haul Road (Fig. 2).

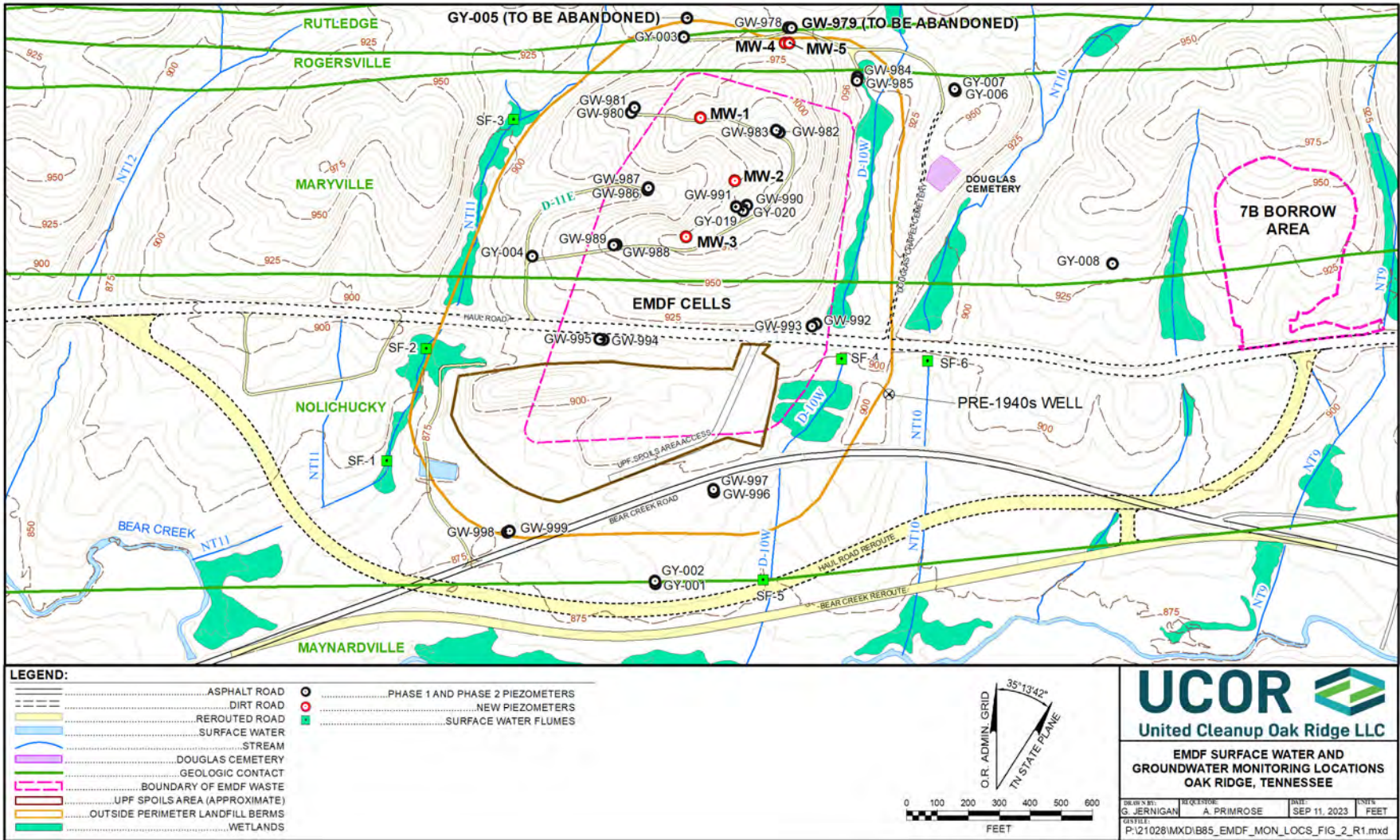


Fig. 2. Geology and piezometers at the EMDF site.

Groundwater/piezometric surface elevations confirmed that the piezometric surface generally mirrors topography (i.e., is higher elevations beneath knolls/ridges and lower near the tributaries). The piezometric surface responds to rainfall events, indicating recharge is occurring on the site. Seasonal variation is also observed, with higher piezometric surfaces observed during the winter/spring wet season (typically November to March) than in the summer/fall dry season. The GWFD results will be used to determine the seasonal high water table to establish the design elevation of the geologic buffer in the knoll area, as described in the approved GWFD RDWP/RAWP.

The gradients and piezometric surface confirm that shallow groundwater at the site receives localized recharge in the higher elevations of the site during precipitation events. The tributaries are groundwater discharge locations and influence the groundwater flow in their immediate areas (DOE/OR/01-2819&D1, *Technical Memorandum #2, Environmental Management Disposal Facility, Phase 1 Monitoring, Oak Ridge, Tennessee*).

3.1.3 Surface Water

Surface water drainages near the site include NT-10, NT-11, Drainage (D)-10 West (W), and D-11 East, an east–west trending feature that drains westward into NT-11 near the center of the site (Fig. 2). Surface water flow in these drainage channels flows from Pine Ridge to Bear Creek located on the valley floor. The surface water systems are fed by precipitation, surface runoff and shallow stormflow, and groundwater that discharges via springs and seeps.

Stream flow is primarily a result of runoff during precipitation events and from subsequent shallow seeps with limited flow or dry stream conditions during the summer months. Shallow soil can act as a stormflow layer when flow is present, with surface water transport through macropores that result from decaying vegetation such as fallen branches or tree roots (Fig. 3). Stormflow emerges as visible flow further downstream (DOE/OR/01-2819&D1, *Technical Memorandum #2, Environmental Management Disposal Facility, Phase 1 Monitoring, Oak Ridge, Tennessee*). Meandering stream channels filled with sediments are present upstream of the Haul Road culverts, and are not typical of other higher gradient streams found across the ORR.



Fig. 3. Macropores examples in the EMDF area.

Continuous flow monitoring data for NT-10, NT-11, and D-10W were collected for one year as part of Phase 1 site characterization (see flume locations on Fig. 2). The available U.S. Geological Survey base flow data indicate that base flow is continuous along the D-10W, NT-10, and NT-11 stream channels during the winter/spring non-growing wet season (Robinson and Johnson 1995, *Results of a Seepage Investigation at Bear Creek Valley, Oak Ridge, Tennessee, January – September 1994*). Several seeps are located adjacent to the drainages and tributaries, indicating localized shallow groundwater discharge occurs there at least seasonally.

During the summer/fall growing season with warm and often dry conditions, base flow is negligible and streamflow is often limited to pulsed flow associated with significant storm events (Robinson and Johnson 1995). Flow monitoring for Bear Creek downstream of the EMDF site indicates continuous flow in Bear Creek (DOE/OR/01-2695&D2/R1, *Proposed Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Waste*).

3.1.4 Ecological Resources

A detailed natural resource evaluation and wetland delineation study was performed over most of the EMDF footprint. The evaluation is documented in *Natural Resource Assessment for the Proposed Environmental Management Disposal Facility (EMDF), Oak Ridge, Tennessee* (ORNL/TM-2018-515). The natural resource assessment included wetland delineation and evaluation, stream surveys, timber assessments, and rare species surveys. Walkdowns were also conducted in the fall/winter of 2022 to evaluate an extension of Haul Road reroute and the Spoils Area that were not covered by the initial natural resource evaluation. Additional walkdowns were performed in early 2023 to identify potential bat-roosting trees and to evaluate the ESP areas for potential tri-color bat-roosting locations.

The natural resource evaluation is provided in the GWFD RDWP/RAWP and is summarized below. Mitigation from impacts to the ecological resources will be performed as part of the GWFD and documented in the RDR/RAWP.

Wetlands: Potential wetlands were evaluated for the entire EMDF Project site relative to the dominance of wetland vegetation, soils, and hydrological characteristics. Seventeen wetlands, including one created wetland, were identified within the entire EMDF study area, covering 11.813 acres (Fig. 4). The landfill will be designed and constructed to minimize impacts to these wetlands.

Approximately 6.03 acres of wetlands will be eliminated by the EMDF Project. During construction of the GWFD and subsequent construction of the landfill, streamflow in D-10W will be rerouted to NT-10 and the wetlands in D-10W will be eliminated by construction of both the GWFD and balance of landfill. The disrupted wetlands include the engineered wetlands recently constructed in D-10W. The wetlands in NT-11 will also be impacted by these activities (Fig. 4).

Streams: Five tributary streams are present in the EMDF area: NT-9, NT-10, D-10W, NT-11, and an unnamed tributary between NT-9 and NT-10 (Fig. 4). All are considered first- or second-order streams characterized by low flows during non-rain events, shallow pools, and riffles. There are multiple road crossings on these streams, including Bear Creek Road, Haul Road, and some historical roads/culverts across the streams. Many of these road crossings present physical barriers for upstream migration of aquatic fauna, in particular fish, by creating large elevation changes in the stream channel just below culverts. In addition, the upstream side of these culverts often create wetlands with meandering stream channels filled with sediments, not typical of other higher gradient streams found across the ORR.

Timber: As described in ORNL/TM-2018-515, the majority of the landfill outside of the ESP activities is located in hardwood forest, potentially around 60+ years old. The EMDF area south of Bear Creek Road

was almost entirely subject to timber harvesting during a southern pine beetle outbreak in 2000 and is primarily dense, loblolly pine. Most trees were removed during site preparation for the GWFD.

Rare species: Previous investigations to identify threatened and endangered bat species on the ORR (ORNL/TM-2015/248, *Bat Species Distribution on the Oak Ridge Reservation*), in general, have confirmed the presence of Indiana bats, gray bats, and the northern long-eared bat, all federally listed endangered species; tricolored bats, which are proposed for federal listing; and little brown bats, which are under consideration for federal listing. Results of the bat acoustic surveys indicated that forested portions of the EMDF Project area are used as summer habitat by state- and federally listed bat species. One federally listed endangered species (gray bat) may forage within the site boundaries but does not roost in these areas.

Additional rare species surveys were performed for the EMDF site in 2018. The EMDF Project surveys noted that there did not appear to be large populations of either the northern long-eared bat or the Indiana bat (ORNL/TM-2018-515). No maternity roosts for the Indiana bat were found in the EMDF area. Less than 50 potential bat-roosting trees were identified in the ESP areas, which are primarily forested with loblolly pine, as these are not the preferred roosting trees for bats. Additional evaluation was performed in 2023 to evaluate for the presence of potential roosts of tricolored bats, such as road culverts and riparian buffer zones, and potential roost areas were identified.

The Bear Creek watershed is home to a strong population of Tennessee dace, the only fish on the ORR listed as “in need of management” by the Tennessee Wildlife Resources Agency. One Tennessee dace was observed in the tributary streams at the EMDF site during ESP activities. EMDF stormwater controls will protect Tennessee dace in streams that may be impacted by EMDF construction activities. Prior to performing construction activities, streams will be walked down and sensitive resources, including Tennessee dace, will be relocated.

Other threatened and endangered species surveys were conducted by the Oak Ridge National Laboratory (ORNL) in 2018 (ORNL/TM-2018-515). The tubercled rein orchid, listed as threatened on the Tennessee Rare Plant List, was found in wetlands within the study area, particularly in wetlands along the NT-9 and D-10W streams. D-10W and NT-9 both have large populations of rein orchids. NT-9 will only be minimally impacted by GWFD and the remainder of EMDF activities. Two other plant species of interest found were the American ginseng and pink lady’s slipper, which are considered of concern because of commercial harvest. The four-toed salamander and the Wood Thrush (state-listed as In-Need-of-Management) were also confirmed to occur throughout forested portions of the study area. Wetlands and drainages within the area were found to contain the highest densities of four-toed salamander breeding sites known on the ORR (Fig. 4).

ORNL Natural Resources Group collected salamander nests and eggs in Spring 2023, prior to the start of the ESP construction activities. These nests were kept in climate-controlled mini-ecosystems until the salamanders hatched and matured into viable offspring. Approximately 300 salamanders were released in June 2023 into appropriate nearby drainages outside the EMDF footprint to minimize the impact to this species in the EMDF Project area.

ORNL Natural Resources Group scientists relocated tubercled rein orchids from EMDF wetlands in fall 2023 as these plants were becoming dormant. Approximately two hundred plants were removed from the site; approximately a third of these were mature orchids and two-thirds were juvenile orchids. The removed rein orchids were placed in a controlled area near the ORNL Natural Resources office for the winter. These will be planted in nearby suitable environments that are not impacted by EMDF construction activities.

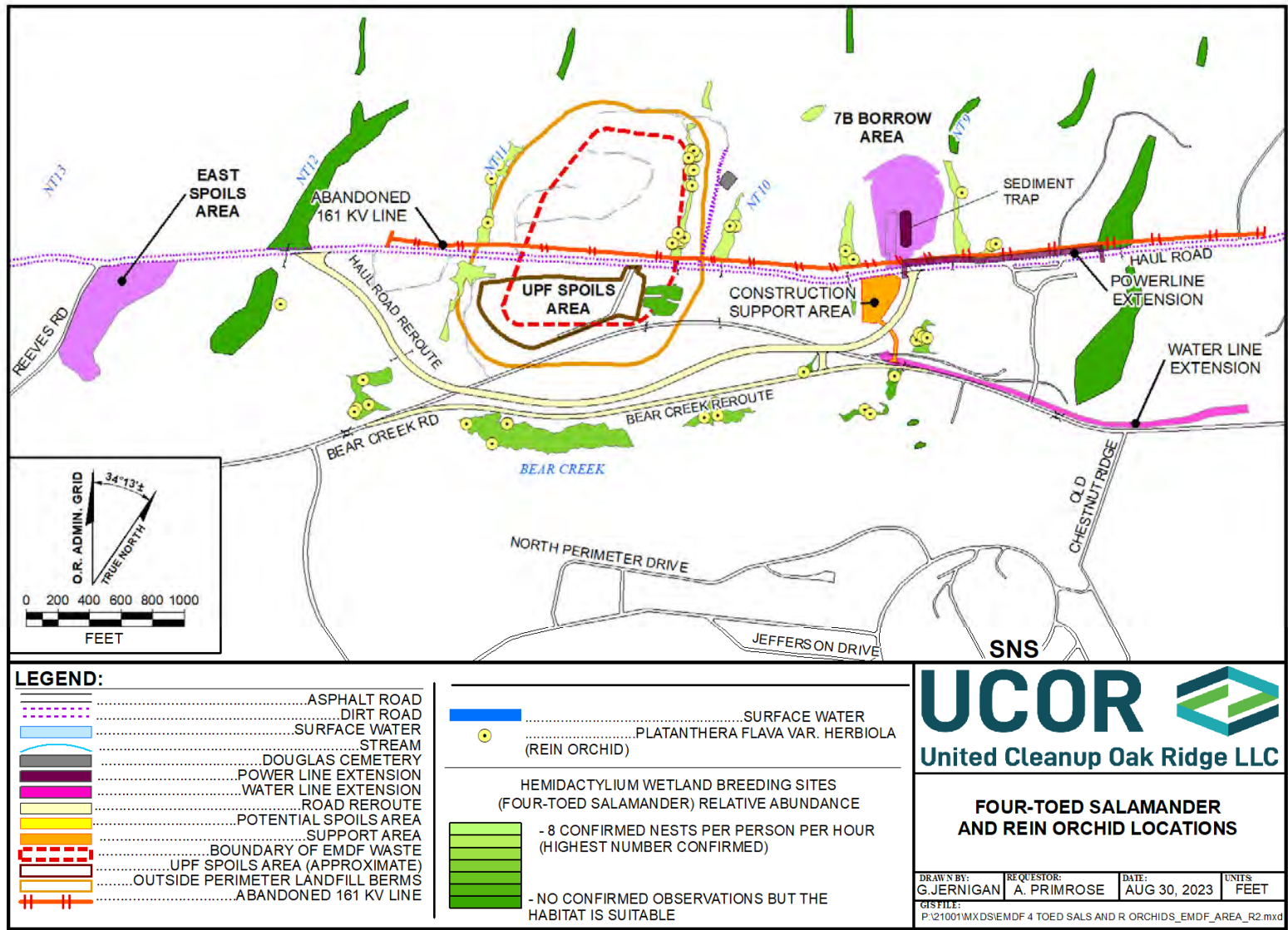


Fig. 4. Wetlands and streams locations—EMDF area.

No federally listed threatened or endangered bird species were noted during the surveys; however, certain species recorded during the surveys have other state and/or federal management designations. These include dozens of species of birds protected under the Migratory Bird Treaty Act and/or are considered Birds of Conservation Concern by the U.S. Fish and Wildlife Service. The site is on the southern edge of the largest area of contiguous interior forest on the ORR that supports rare bird species. These rare species are not typically found in more fragmented habitats (ORNL/TM-2018-515).

The approach to minimize impacts to rare species is as follows (from DOE/OR/01-2948&D2):

- Potential bat-roosting trees will be removed prior to start of field work and prior to the start of the foraging season. Most potential bat-roosting trees were removed during the GWFD.
- Potential roost areas for tri-colored bats will be identified. Prior to the start of field activities, candidate roosting sites will be fitted with one-way devices to allow bats to exit but not return.
- Fish and aquatic wildlife sweeps and removal will be conducted prior to start of construction activities, including prior to culvert grouting or replacement, given the possible presence of crayfish and four-toed salamanders in all drainages. Tennessee dace will be included in the sweeps and relocated if present. As previously described, four-toed salamander nests and tubercled rein orchids were removed from the disturbed areas and relocated to similar areas nearby, but not impacted by EMDF construction activities.

3.1.5 Cultural Resources

The Douglas Chapel Cemetery and four historical home site/structures are present near the EMDF site (*Phase I Archaeological Survey of the Proposed Environmental Management Disposal Facility in Central Bear Creek Valley, Roane County, Tennessee*, CRA 2018). Douglas Chapel Cemetery is located on the knoll between NT-10 and D-10W. DOE intends to avoid and preserve the Douglas Chapel Cemetery, as well as maintain access to the cemetery for visitors. Access requirements will continue to be controlled through the DOE Office of Science.

The four home sites were demolished when the federal government purchased the land for the Manhattan Project. A prehistoric habitation was located near Bear Creek where lithic flakes were found, an indication of prehistoric tool production. All the sites were highly disturbed and appeared to contain no buried cultural deposits. The sites were not recommended for inclusion in the National Register of Historic Places.

No historically significant sites are located within the EMDF area. The Douglas Chapel Cemetery is located nearby, but will not be disturbed by landfill construction activities (Fig. 4).

3.2 REMEDY COMPONENTS

The components of the selected remedy, as described in Sects. 1.4 and 2.12.2 of the EMDF ROD (DOE/OR/01-2794&D2/R2), are provided in Table 1, along with the implementing primary document.

Table 1. Components of the EMDF ROD selected remedy

Remedy component	Primary implementing document(s)
<p>Maintain a 15-ft separation between the base of emplaced wastes and seasonal high water table of the uppermost unconfined aquifer, consistent with TDEC 0400-11-01-.04(4)(a)(2). This requirement has been added as an RAO in order to assure protectiveness during operation and post-closure. Included within the 15 ft would be the facility’s 10-ft geologic buffer and the 5-ft liner system. Site-specific groundwater investigations indicate that parts of the site footprint can clearly meet this requirement; however, for higher elevations in the site—particularly in the area of the knoll feature in the CBCV Site 7c footprint—TDEC and EPA have expressed concern that predicted post-construction groundwater conditions used for preliminary design may not be achievable. Therefore, a post-ROD field demonstration (see Sect. 2.14.4 [of the EMDF ROD]) will be performed in coordination with TDEC and EPA to obtain additional groundwater data that will be reviewed and evaluated in order to support a final design.</p>	<p>GWFD RDWP/RAWP RDR/RAWP</p>
<p>Final waste acceptance criteria (WAC) for EMDF that include administrative and analytical waste limitations to only accept waste for disposal that can be compliantly managed within the facility to ensure protection of human health and the environment. There are numerous ARARs within the EMDF WAC, including controls on the disposal of Resource Conservation and Recovery Act of 1976 (RCRA)-regulated hazardous waste and Toxic Substances Control Act of 1976 (TSCA)-regulated waste. The remedy requires that wastes not meeting the EMDF WAC either be treated to meet the WAC or sent offsite for disposal. Additional operational-based constraints on the size, weight, dimensions, and similar physical characteristics, as well as radionuclide inventory, will be established and proceduralized to ensure waste can be safely received and disposed using available equipment and provide daily protection to workers, the public, and the environment. (Note: operational-based constraints are not relied upon to demonstrate CERCLA protectiveness.)</p>	<p>WAC Compliance Plan</p>
<p>The design, construction, and operation of EMDF at the CBCV Site 7c to satisfy design-based and performance-based requirements of DOE and ARARs and to include climate resiliency measures.</p>	<p>RDR/RAWP and Operations RAWP</p>
<p>The construction of EMDF with up to 2.2 million cy of disposal capacity, with multiple waste cells to accept CERCLA waste. Final capacity will be determined during the facility design process. Construction of EMDF will be completed in phases as remediation progresses.</p>	<p>RDR/RAWP</p>
<p>Engineered features such as a [perimeter berm] clean-fill dike to meet stability and seismic requirements, a multi-layer base liner system with a double leachate collection/detection system to isolate waste from groundwater, and a multi-layer cover to reduce infiltration and isolate the waste from human and environmental receptors over the long term. The EMDF liner system and cover system will be consistent with RCRA and Toxic Substance Control Act (TSCA) substantive requirements as defined by this ROD’s ARARs.</p>	<p>RDR/RAWP</p>
<p>Inclusion of a low-hydraulic conductivity geologic buffer layer (either native or engineered) between the landfill liner and the seasonal high water table.</p>	<p>RDR/RAWP</p>
<p>Construction of groundwater and surface water drainage features to divert water around the facility, as needed, to ensure long-term protection of human health and the environment and to achieve ARARs.</p>	<p>GWFD RDWP/RAWP RDR/RAWP</p>

Table 1. Components of the EMDF ROD selected remedy (cont.)

Remedy component	Primary implementing document(s)
Construction of support facilities adjacent to the footprint of the landfill. Support facilities and infrastructure may include operations/support trailers; staging/laydown areas; borrow areas; stockpile areas; parking areas; wastewater storage tanks or basins; truck loading stations; electrical, water, and communication utilities; truck weigh scale; guard stations; wastewater and stormwater management systems; storage/staging areas; material stockpile areas; and spoil areas.	ESP RDR/RAWP GWFD RDWP/RAWP RDR/RAWP
Construction and operation of a landfill wastewater treatment system consistent with ARARs to minimize the release of contaminants into adjacent and downstream surface water bodies for uptake by potential receptors. The specific remediation goals for landfill wastewater are presented in Sect. 2.12.2.4 [of the EMDF ROD].	RDR/RAWP Operations RAWP
Use of fill material during operation of EMDF, including, but not limited to, crushed concrete, block and brick masonry, waste soil, clean soil, and other soil-like material consistent with ARARs.	Operations RAWP
Engineered perimeter structures, such as mechanically stabilized earth walls or similar structures, if needed. These structures may be necessary and will be allowed to meet the required separation between waste and groundwater specified by the RAO.	RDR/RAWP
Closure of EMDF, consistent with ARARs, after operations are complete.	Closure RDR/RAWP or addendum.
Performance monitoring during the operation and post-closure periods of EMDF, consistent with ARARs and to inform the need for corrective actions, if necessary.	Operations RAWP Post-closure RAWP
Long-term maintenance, surveillance, and monitoring of EMDF, consistent with ARARs, to ensure the integrity of the engineered facility for as long as the waste remains a threat to human health or the environment.	Post-closure RAWP
Institutional controls at EMDF implemented and monitored to prevent access to the waste in the future for as long as the waste remains a threat to human health or the environment, consistent with ARARs.	Land Use Control Implementation Plan Five-Year Reviews
Change of the initial land use designations (from the Bear Creek Valley [BCV] Phase I ROD) used to set remediation goals in BCV Zones 1 and 2. Zone 1 is modified to restricted recreational, and Zone 2 is modified to DOE-controlled industrial land use for purposes of setting remediation goals for near-term and long-term consideration, as introduced in Sect. 1.2 and further discussed in Sect. 2.6 [of the EMDF ROD]. Note: The land use changes do not affect the surface water use classification.	Explanation of Significant Differences to the Phase I Bear Creek Valley ROD

3.3 DESIGN COMPONENTS

The EMDF design will include the following components:

- Landfill with disposal capacity of up to 2.2 million cy
- Upgradient stormflow interceptor channel sediment basins for stormwater control.
- LWTS
- Operations support facilities
- Performance monitoring network

Lessons learned from EMWMF have been incorporated into the preliminary design and will continue to be incorporated into the final EMDF Design. EMWMF Lessons Learned included:

- Providing EMWMF-determined turn radius and truck maneuvering requirements around roadways and dumping stations
- One-way delivery routing for vehicle ingress and egress to waste placement areas

Sect 2.12.2.1 of the EMDF ROD (DOE/OR/01-2794&D2/R2) provides the following specific design requirements for the EMDF:

EMDF is anticipated to be designed to have a capacity of up to 2.2 million cy; however, the capacity could vary as site conditions dictate. The landfill will not be constructed over NT-10 or NT-11, but the berm may be placed over D-10W. The landfill will be sited to provide a minimum 300-ft buffer zone between the waste and the Maynardville Limestone geologic unit. Figure 2.6 [of the EMDF ROD] provides a conceptual site layout of EMDF.

As needed around the periphery of the lined footprint (i.e., beneath and/or outside the berms), a network of water intercepts will direct shallow groundwater and surface water away from the footprint and into the natural drainages. A geologic buffer beneath the multi-layer liner system will be designed to provide vertical separation between the bottom of the liner system and the seasonal high water table.

The multi-layer liner system will be constructed to prevent leachate from migrating from the disposal unit and impacting the environment. The composite liner system will consist of geosynthetics layered with natural materials to isolate waste as well as to collect leachate and detect leakage. Leachate will flow from the leachate and leak detection collection and removal systems piping within the disposal cells to manholes for transfer into the landfill wastewater management system.

Contact water (stormwater resulting from precipitation that falls into an active cell and comes in direct contact with landfill waste and does not infiltrate to the leachate collection system) will be removed through a series of catchment basins, pumps, manholes, and pump stations, as needed, to transfer contact water to the landfill wastewater storage system prior to treatment.

The landfill wastewater storage, collection systems, and associated mechanical equipment for landfill wastewater management; conveyance systems for transferring wastewater; and the LWTS will be constructed to manage both the leachate and contact water generated at

the landfill. Secondary containment is an important design consideration, and the wastewater collection tanks will have secondary containment.

The landfill siting and design reduce concerns from climate change and provide resiliency to potential increase in rainfall and flood events through the following measures:

- *Located outside the 100-year floodplain and on Pine Ridge, away from and at a greater elevation than Bear Creek. Waste elevation is approximately 60 ft higher than Bear Creek elevation in this area.*
- *Landfill does not cross one of the northern tributaries. Tributary immediately west of the landfill will be armored and widened to improve run-off. Tributary immediately east of the landfill will be diverted into an adjacent tributary. Culverts beneath the existing Haul Road will be oversized to improve drainage from the area and eliminate ponding.*
- *Upgradient diversion ditch [stormflow interceptor channel] is considerably oversized – greater than 100-year storm event. [Note: The upgradient diversion ditch/stormflow interceptor channel is sized to accommodate peak stormwater runoff from both the GWFD and future disposal cells. Ponding is expected at the culvert that drains NT-10 to preserve the quality of the wetland area immediately north of the Haul Road.]*

Additional considerations will be part of the post-ROD RDR for the final design that will be submitted for FFA party review and approval.

3.3.1 Siting

The disposal cell was sited to meet the following requirements (Fig. 5):

- Outside the 100-year floodplain on Pine Ridge, and outside the 500-year floodplain.
- Provide a minimum 300-ft buffer zone between the waste and the Maynardville Limestone geologic unit.
- At a greater elevation than Bear Creek.
- Landfill will not cross over the northern tributaries, e.g., the landfill will not be constructed over NT-10 or NT-11, but the berm will be placed over D-10W.
- Avoids Douglas Chapel Cemetery.

In addition, wetlands and sensitive resources were avoided, as possible and practical.

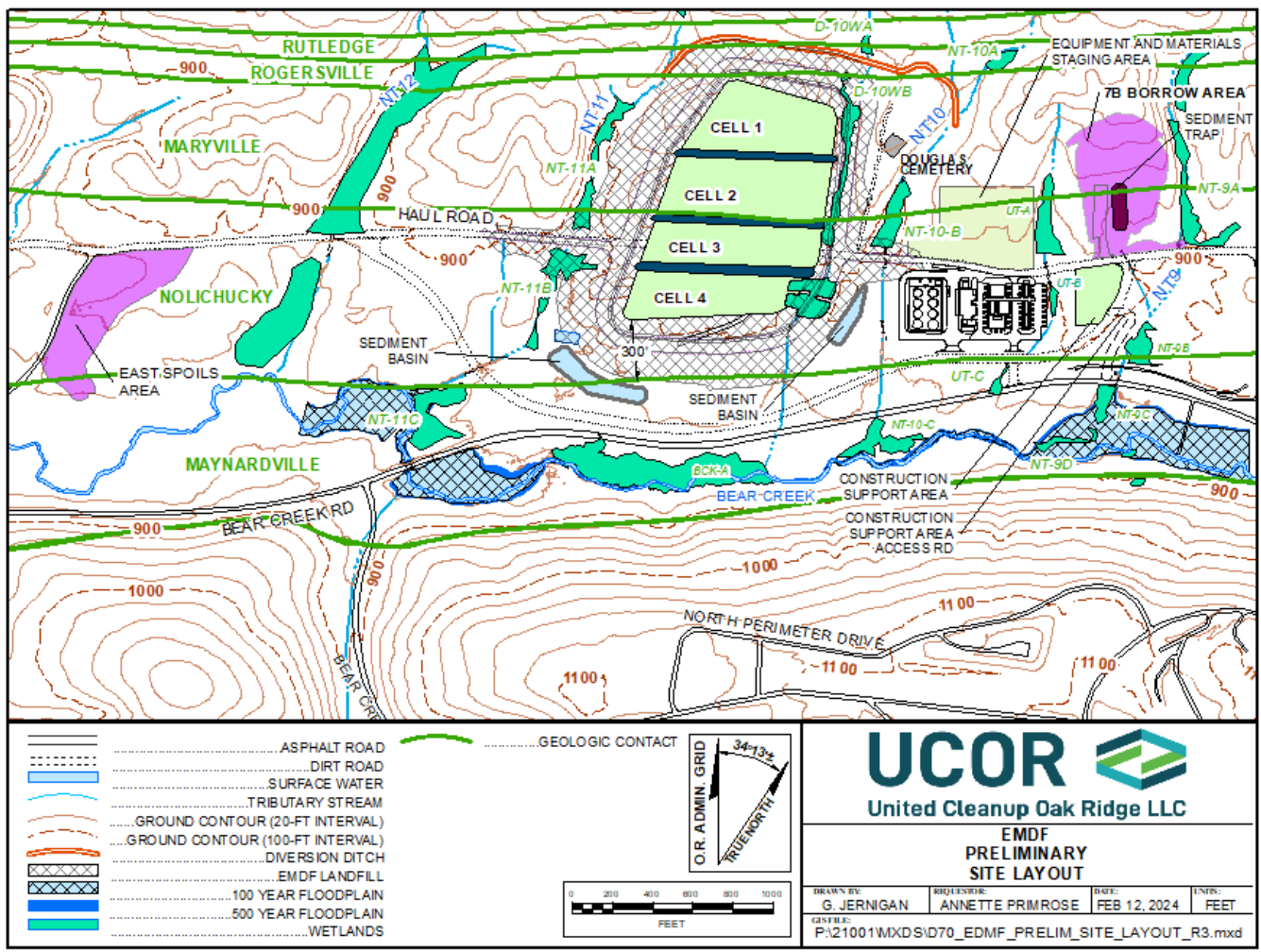


Fig. 5. EMDF siting and preliminary layout

3.3.2 Surface water/Stormwater Controls

As part of the GWFD Project, an upgradient stormflow interceptor channel and diversion ditch that diverts surface water from D-10W to NT-10 were designed and installed (Fig. 6). The stormflow interceptor channel is oversized to allow for potential increased flow from climate change. These surface water controls will continue to be used for the EMDF landfill.

Sediment basins planned for support of the EMDF landfill were also designed and constructed as part of the GWFD Project (note that Fig. 5 represents the current configuration for the sediment basins). These will continue to be used for the EMDF landfill.

As needed around the periphery of the lined footprint (i.e., beneath and/or outside the berms), a network of water intercepts will direct shallow groundwater and surface water away from the footprint and into the natural drainages.

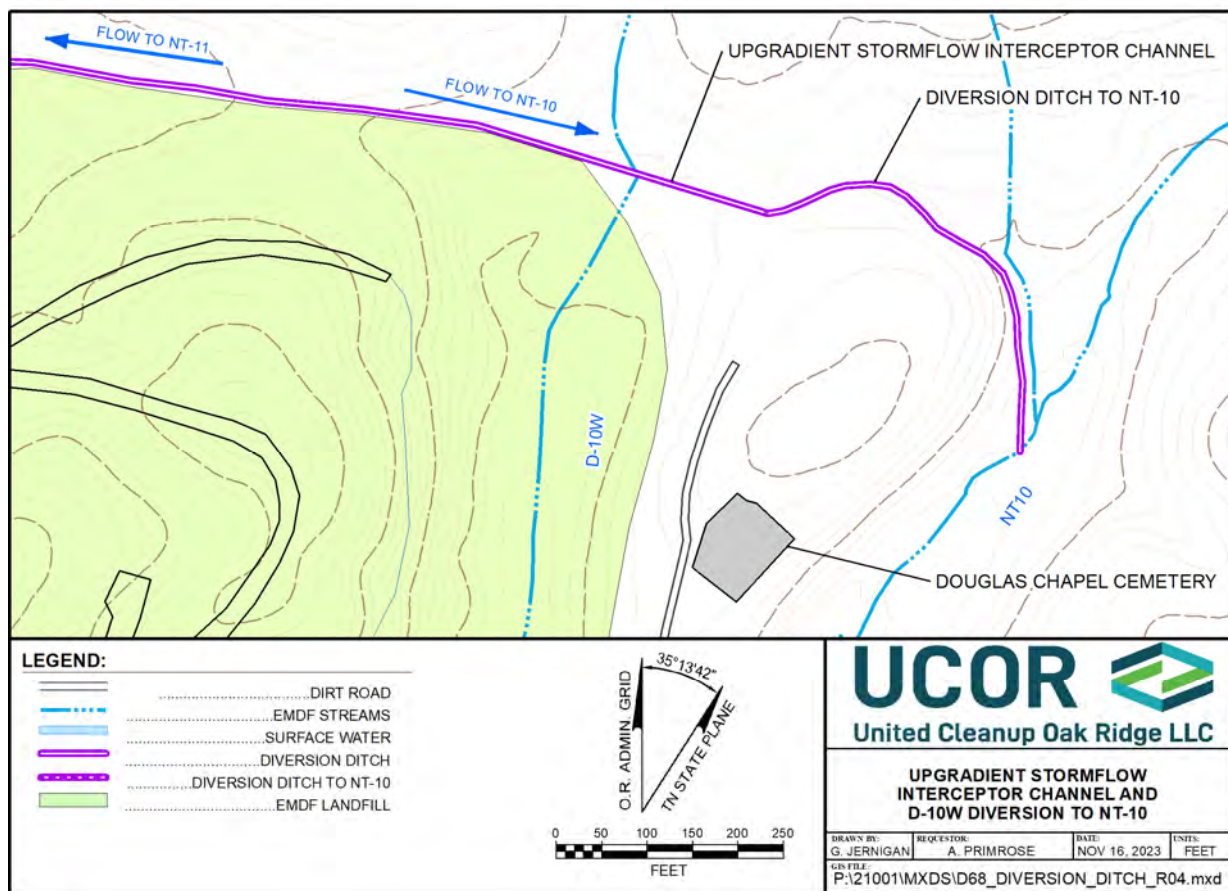


Fig. 6. Upgradient stormflow interceptor channel and D-10W diversion to NT-10.

3.3.3 Landfill Design

The landfill will be designed as an above-ground waste disposal facility, as defined by EMDF ROD ARARs (see Chap. 6) and equivalent to a RCRA Subtitle C landfill. The landfill will be designed and constructed in phases, with an overall capacity up to 2.2 million cy. The final landfill capacity will be determined as the design progresses for each phase of design and construction and as the waste generation forecast continues

to be refined. Significant changes to either the waste acceptance criteria or preliminary design may require additional evaluation of the design during development of the final design.

The disposal cells will be surrounded by berms constructed of uncontaminated material that will be designed to be structurally and seismically stable (Fig. 5).

Disposal cell layout is bounded by placing landfill berms east of NT-11 (not crossing over NT-11 or NT-10), and allowing berms, but not waste placement, over D-10W. In addition, the southern extent of the disposal cell will be 300 ft or greater from the Maynardville Formation—a karstic formation in Bear Creek Valley. The location selected is north of and outside the Bear Creek Valley 100-year floodplain (Fig. 5), and the entire geologic buffer is above the elevation of Bear Creek.

The EMDF design will include a 10-ft thick, low-hydraulic conductivity geologic buffer (i.e., 1×10^{-5} cm/s) beneath the multi-layer liner system to provide vertical separation between the bottom of the liner system and the seasonal high water table (Fig. 7). The GWFD (in progress) will establish the base elevation of the liner system such that the bottom of the liner is a minimum of 10 ft above the bottom of geologic buffer zone based on the seasonal high water table. The geologic buffer can be either native or engineered material. The design will ensure that the RAO will be met to maintain a 15-ft separation between the base of emplaced wastes and seasonal high water table of the uppermost unconfined aquifer, consistent with TDEC 0400-11-01-.04(4)(a)(2), *Solid Waste Processing and Disposal*, “Specific Requirements for Class I, II, III, and IV Disposal Facilities.”

The 15-ft separation consists of a 5-ft liner system plus a 10-ft geologic buffer. The conceptual approach for the liner system is shown in Fig. 7.

Permanent underdrains are not required to control the groundwater table or to meet the RAO to maintain a 15-ft separation between the bottom of waste and the seasonal high water table. Underdrains will not be used as corrective actions for groundwater intrusion into the geologic buffer. Temporary drainage features may be necessary to divert surface water, perched groundwater, and infiltration from excavations and improve ground conditions to aid construction.

The EMDF liner system will be consistent with RCRA and the Toxic Substance Control Act (TSCA) substantive requirements, as defined by EMDF ROD ARARs (see Chap. 6), and is equivalent to a RCRA Subtitle C liner. The liner will be designed to meet the RAOs:

- *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 (ELCR) or HI 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} ELCR or HI of 1*

Disposal cells will be sloped to drain landfill wastewater to sumps from where it will be effectively removed and pumped to the LWTS. Contact water will also drain to low areas within the cells and be pumped to the LWTS.

The liner includes a leachate collection system to collect and remove leachate from the disposal cells, and a leak detection system that collects the very low volumes of leachate that percolates through the primary geomembrane liner. This leachate will also be collected and pumped to the LWTS. The Action Leakage

Rate (ALR) expected for the liner system will be calculated based on the materials used in construction, as well as the geometry of the disposal cell (collection sump size, hydraulic gradients) using the analytical method presented in *Designing with Geosynthetics* by Robert M. Koerner (Koerner 2012). This approach is used by geotechnical engineers in designs involving a wide range of geosynthetic materials, including geocomposite drainage layers typically used in leak detection systems for landfills. Leakage rates observed during operations will be compared to this rate to determine if there are anomalous leakage rates requiring evaluation and possible actions. The ALR will be documented in either the RDR/RAWP or the follow-on Operations RAWP. Leakage rates observed during operations will be compared to this rate to determine if there are anomalous leakage rates requiring evaluation and possible actions.

A monitoring system will be designed and proposed as part of the RDR/RAWP. This preliminary groundwater and surface water monitoring system will be used as the basis for the follow-on Operations RAWP, which will contain the Sampling and Analysis Plan/Quality Assurance Project Plan for EMDF Operations.

The design for the final cover system will also be included in the RDR/RAWP. This cover system will be in compliance with RCRA and TSCA substantive requirements as defined by EMDF ROD ARARs (see Chap. 6) and will continue to ensure meeting the RAOs for preventing exposures following closure.

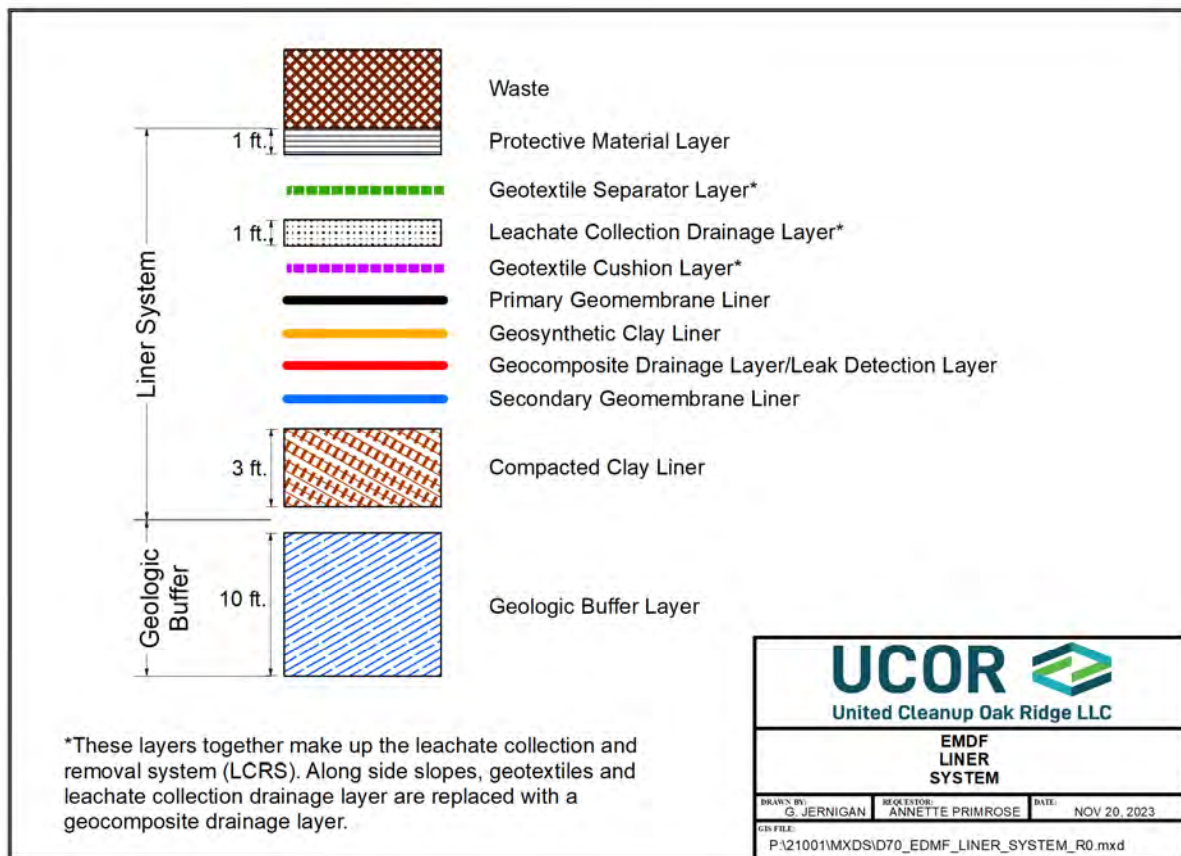


Fig. 7. Design approach for liner system.

3.3.4 LWTS

The LWTS will be designed to treat all landfill wastewater derived from the EMDF, both contact water and leachate. Sanitary wastewater and clean stormwater will not be treated at the LWTS. The preliminary layout of the LWTS is shown in Fig. 8.

As described in the EMDF ROD:

The selected remedy for the EMDF's landfill wastewater, defined as leachate and contaminated stormwater (i.e., contact water), for both radionuclides and non-radionuclides, is primary treatment of all wastewaters, with secondary treatment when required to meet cleanup goals. The primary wastewater treatment will be a flocculation and chemical precipitation process. Secondary wastewater treatment will be determined during the design phase and documented in a post-ROD FFA primary document. In the event that the selected remedy does not meet the identified protective goals for a pollutant, an ESD or ROD amendment will be used to modify the remedy, such as changing the treatment approach or changing operational methods, so that the identified protective goals are met. When the EMDF effluent limits are calculated, the limits will be made available for public comment through either an ESD or ROD amendment.

Landfill wastewater will be stored in collection tanks with secondary containment prior to treatment in the LWTS. Two treatment trains are currently planned, each able to treat landfill wastewater at a treatment volume of 30 gpm, providing up to 60 gpm treatment volume depending on whether one or two treatment trains are utilized. The primary treatment system is planned to be iron co-precipitation in combination with suspended solids settling and filtration, which will treat the primary expected contaminants of concern (COCs). However, the capability to treat additional COCs is provided by the secondary treatment system, planned to be ion exchange and/or granulated activated carbon treatment systems for treating additional COCs that may be present in the landfill wastewater as waste lots change over time. COC concentrations in landfill wastewater will be used to determine if and when the secondary treatment may be needed and whether ion exchange and/or granulated activated carbon treatment are used.

Construction and operation of the LWTS consistent with ARARs will minimize the release of contaminants into adjacent and downstream surface water bodies for uptake by potential receptors and will meet the RAOs to:

- *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} ELCR or HI 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} ELCR or HI of 1*
- *Prevent unacceptable exposure to ecological receptors from CERCLA waste contaminants through meeting chemical-, location-, and action-specific ARARs*

The preliminary flow diagram for the primary treatment system is provided in Fig. 9. The preliminary flow diagrams for the secondary treatment systems are provided in Fig. 10 (ion exchange) and Fig. 11 (granulated activated carbon). These will be updated as part of the final design.

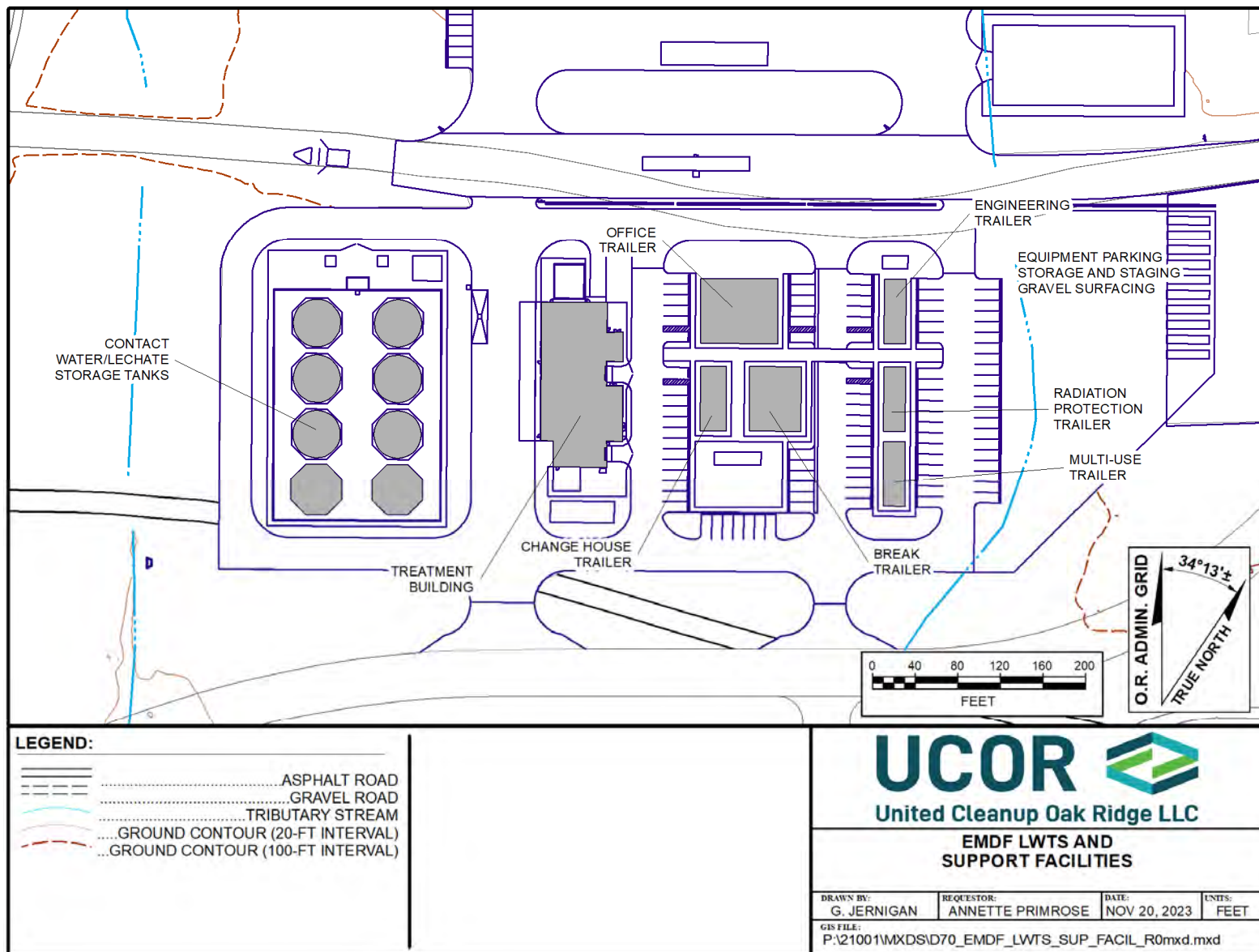


Fig. 8. Preliminary design layout for LWTS.

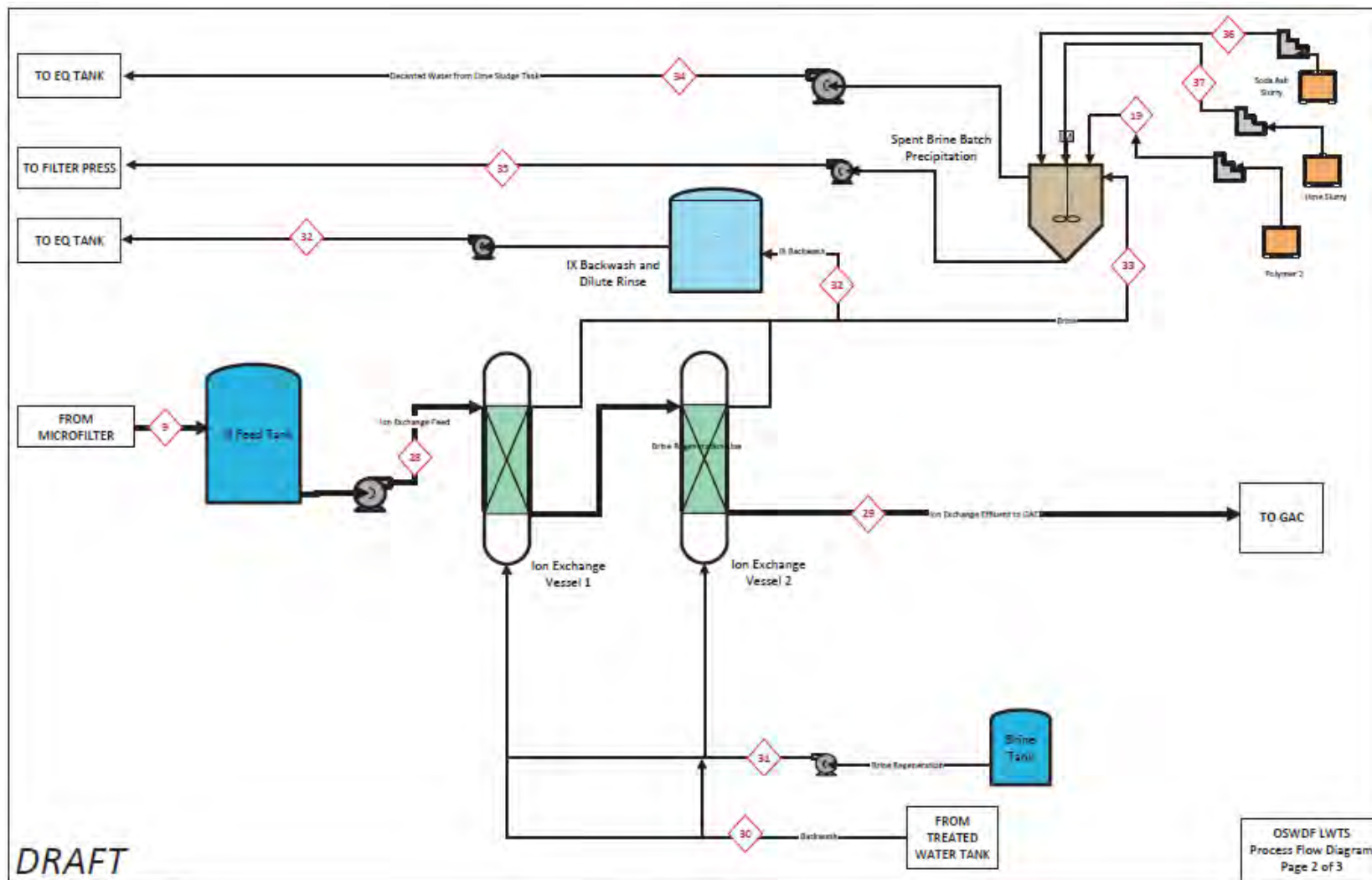


Fig. 10. Preliminary flow diagram for the secondary treatment system—ion exchange unit.

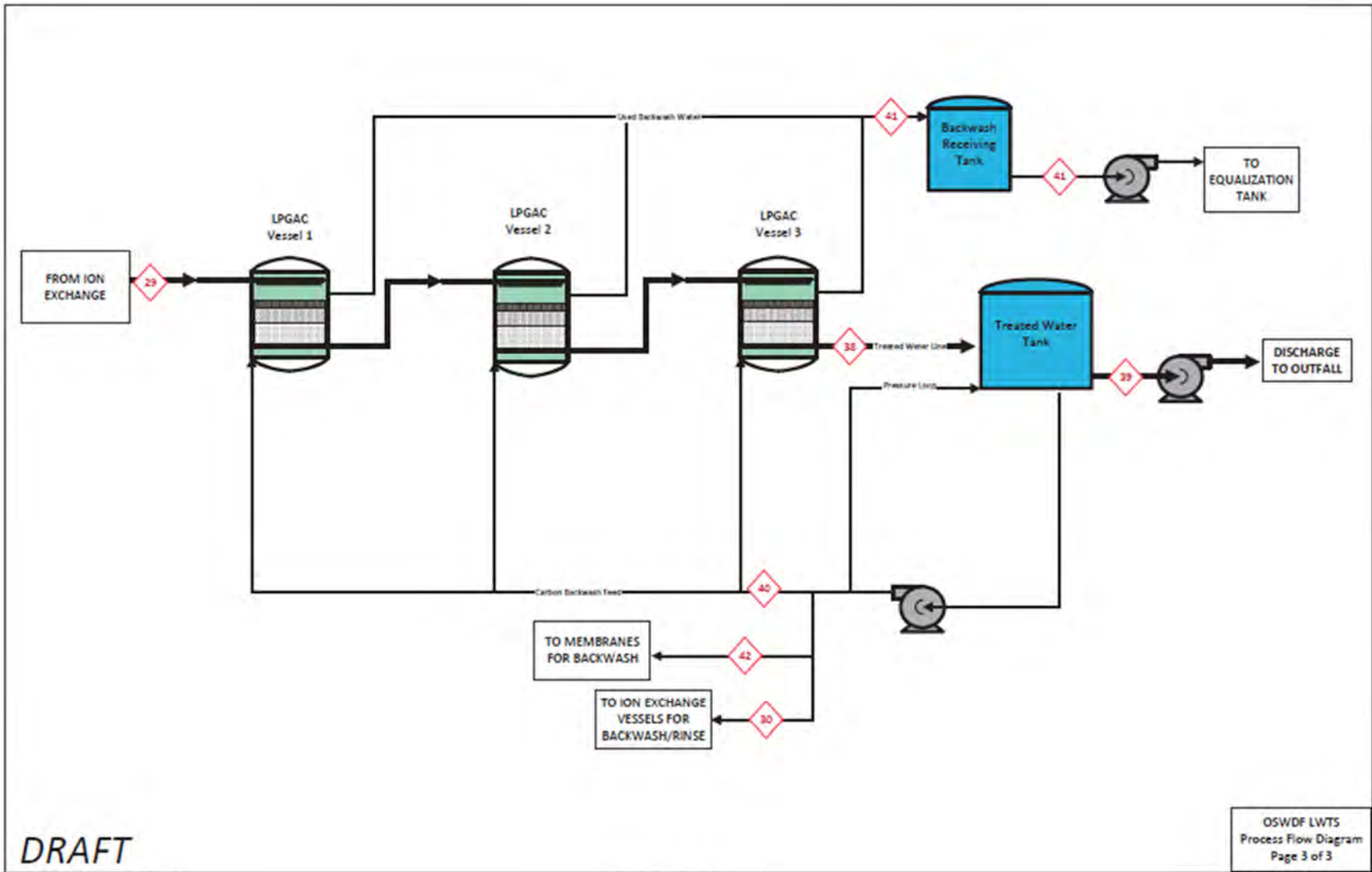


Fig. 11. Preliminary flow diagram for the secondary treatment system—granulated activated carbon unit

3.3.4.1 LWTS remediation goals

EMDF ROD (DOE/OR/01-2794&D2/R2), Sect. 2.12.2.4, presents the specific remediation goals for landfill wastewater and are provided below.

Bear Creek is classified by the state for Recreation, Fish and Aquatic Life, Livestock Watering and Wildlife, and Irrigation uses. Each of the use classifications has water quality standards set under TDEC 0400-40-03. These criteria, both numeric and narrative, are ARARs for effluent discharges to Bear Creek. The most stringent of the applicable use criteria are applicable in accordance with TDEC 0400-40-03-.02(5). How and where the specific discharge limits will be applied will be specified in a post-ROD primary document for this action with approval by the FFA parties. The key COCs in the landfill wastewater and their respective chemical (non-radiological) ambient water quality criteria (AWQC) have been identified, as summarized in Table 2.8 [of the EMDF ROD]. Narrative water quality standards are included in Appendix A, ARAR Table A.1 [of the EMDF ROD and this document]. In addition to these AWQC, 40 CFR 445.11 effluent limits are ARARs.

Table 2 provides the numeric ambient water quality criteria (AWQC) for key chemical-specific COCs. Table 3 provides the instream water concentrations (preliminary remediation goals/cleanup levels) for the radiological COCs. Both of these tables are as shown in the EMDF ROD (DOE/OR/01-2794&D2/R2).

Table 2. Numeric AWQC that are chemical-specific ARARs for key COCs in EMDF Landfill Wastewater (EMDF ROD Table 2.8)

Chemical	Fish and Aquatic Life [TDEC 0400-40-03-.03(3)]		Recreation ^{a,b} [TDEC 0400-40-03-.03(4)]
	Criterion maximum concentration (CMC) (µg/L or ppb)	Criterion continuous concentration (CCC) (µg/L or ppb)	Organisms only (µg/L or ppb)
Aldrin (c)	3.0		0.00050
Arsenic (c)			10.0
Arsenic (III)	340 ^c	150 ^c	
b-BHC (c)			0.17
Cadmium	1.8 ^d	0.72 ^d	
Chromium (III)	570 ^d	74 ^d	
Chromium (VI)	16 ^c	11 ^c	
Copper	13 ^d	9.0 ^d	
Cyanide	22	5.2	140
4,4'-DDT (b)(c)	1.1	0.001	0.0022
4,4'-DDE (b)(c)			0.0022
4,4'-DDD (b)(c)			0.0031
Dieldrin (b)(c)	0.24	0.056	0.00054
Lead	65 ^d	2.5 ^d	
Mercury (b)	1.4 ^c	0.77 ^c	0.051
Nickel	470 ^d	52 ^d	4600

Table 2. Numeric AWQC that are chemical-specific ARARs for key COCs in EMDF Landfill Wastewater (EMDF ROD Table 2.8) (cont.)

Source: <https://publications.tnsosfiles.com/rules/0400/0400-40/0400-40.htm>

(b) = bioaccumulative parameter
(c) = carcinogenic parameter

^aA 10⁻⁵ risk level is used for setting TDEC recreational criteria for all carcinogenic pollutants.

^bAll chemical data reported under this rule shall be generated using “sufficiently sensitive” analytical methods approved under 40 CFR 136 (2018) or required under 40 CFR Chapter I, subchapter N or O (2018), pursuant to TDEC 0400-40-03-.05(8).

^cCriteria are expressed as dissolved.

^dCriteria are expressed as dissolved and are a function of total hardness (mg/L). Criteria displayed correspond to a total hardness of 100 mg/L.

CFR = Code of Federal Regulations

Table 3. Instream surface water and fish tissue PRG/cleanup levels for EMDF (EMDF ROD Table 2.9)

Radionuclide	Instream surface water PRG/cleanup level (pCi/L)	Fish tissue PRG/cleanup level (pCi/g of fish)
Am-241	1.88E+00	4.51E-01
C-14	7.53E-02	3.01E+01
Cl-36	2.89E+02	1.36E+01
Co-60	3.55E+01	2.70E+00
Cs-137	6.45E-01	1.61E+00
Eu-154	3.27E+01	4.25E+00
H-3	4.65E+05	4.18E+02
I-129	1.02E+01	3.06E-01
Np-237	2.34E+01	6.56E-01
Pu-238	1.69E-02	3.55E-01
Pu-239/240	1.65E-02	3.46E-01
Ra-226	5.34E-01	1.52E-02
Ra-228	1.05E+01	4.22E-02
Sr-90	4.79E+01	6.32E-01
Tc-99	1.00E+03	1.51E+01
Th-228	2.19E+01	1.42E-01
Th-230	8.42E+01	5.05E-01
Th-232	7.53E+01	4.52E-01
U-233/234	3.17E+02	5.59E-01
U-235/236	4.55E+02	6.01E-01
U-238	2.10E+02	4.99E-01

PRG = preliminary remediation goal

3.3.4.2 LWTS discharge location and effluent limits

The LWTS discharge location has not yet been determined but is expected to be selected during development of the final design. When agreement on the discharge location is reached, and details such as discharge point, discharge rate, assimilative capacity of the receiving surface water body, etc. are available, discharge limits will be established using reasonable potential evaluations to determine effluent limits for the LWTS based on the remediation goals established in the EMDF ROD (and shown in Sect. 3.3.4.1 of this RDWP).

As described in the EMDF ROD, a post-ROD, pre-operational FFA primary document (such as the RAWP for Operations) will establish details of the monitoring and compliance program. This primary document will include development of radiological effluent limits, which will be developed per the Clean Water Act methodology, analogous to how effluent limits are developed from the AWQC for non-radiological COCs. As needed, compliance criteria that correspond with the Preliminary Remediation Goals/cleanup levels may be documented in an Explanation of Significant Differences for the EMDF ROD.

Effluent limits will be used to refine the LWTS process design to ensure the LWTS discharges are compliant with the RAOs and ARARs.

3.3.5 Support Facilities

The design will provide for support facilities adjacent to or near the landfill disposal cells footprint. Support facilities and infrastructure may include operations/support trailers; staging/laydown areas; borrow areas; stockpile areas; parking areas; sanitary wastewater storage tanks; truck loading stations; electrical, water, and communication utilities; truck weigh scale; guard stations; wastewater and stormwater management systems; storage/staging areas; material stockpile areas; and spoil areas. The preliminary layout for many of the support facilities is provided in Fig. 8. This layout will change as the design progresses.

The East Spoils Area (Fig. 4) was developed as part of ESP (DOE/OR/01-2934&D2/A1) and will continue to be used for the EMDF landfill. The 7B Borrow Area was developed as part of the GWFD (DOE/OR/01-2948&D2) and will provide borrow material for the EMDF landfill construction.

3.3.6 Performance Monitoring

The design will provide the preliminary performance monitoring locations for EMDF detection monitoring in accordance with the ROD ARARs. This monitoring network will inform the need for corrective actions, if necessary. The monitoring network will be implemented through a Sampling and Analysis Plan/Quality Assurance Project Plan included with the Operations RAWP.

3.3.7 Design Uncertainty

As per agreement with the FFA parties, a GWFD will be performed to determine the seasonal high water table that will control the final design elevation of the geologic buffer in the knoll area. The GWFD scope is detailed in the *RDWP/RAWP for the Groundwater Field Demonstration at the Environmental Management Disposal Facility, Oak Ridge, Tennessee* (DOE/OR/01-2948&D2).

3.4 PLANNED ENGINEERING DRAWINGS

Approximately 350 engineering drawings are expected to be part of the EMDF engineering design, including for the landfill disposal cells, LWTS, and support facilities. These drawings will include:

- Site plans
- Layout and grading plans, including disposal cells and berms
- Liner system details, including the geologic buffer
- LWTS systems
- Erosion and sediment control
- Roadway and parking lot plans, sections, and details

- Stormwater and leachate controls
- Facilities building, structural, floor and roof, electrical, HVAC, piping, tanks, etc.
- Performance monitoring network and details
- Preliminary final cover plan

4. REMEDIAL DESIGN SCHEDULE

Key activities for the EMDF design are shown in Table 4. These dates are subject to change. The FFA parties will be kept informed as the project progresses. Note that milestones are subject to change via the FFA negotiation process.

Table 4. Key activities and dates for design elements for the Balance of Construction scope

Activity	Date
D1 RDWP FFA milestone	5/24/24
Completion of first GWFD monitoring season	March/April 2025
Tech Memo for first GWFD monitoring season	April/May 2025
EMDF design process:	May/June 2025 to August 2026
Informal 60% design review with FFA parties	May/June 2025
Informal 90% design review with FFA parties	Feb/March 2026
Informal 100% design review with FFA parties	August 2026
Completion of second GWFD monitoring season	March/April 2026
Tech Memo for second GWFD monitoring season	April/ May 2026
D1 RDR/RAWP FFA milestone	9/30/26
Construction Start	2028
Construction Complete	2030

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5. DESIGN CRITERIA, CODES, AND STANDARDS

The landfill will be based on development of the landfill in three phases. All phases will be developed at a high level for the initial design, but only Phase 1 design will be completed and issued for construction. Landfill elements established during the Phase 1 design process include landfill cell layout, perimeter berm cross-section, bottom liner materials and thicknesses (including the geologic buffer), access roads, and water management strategies. The remaining design phases will be completed, as needed, consistent with the EMDF ROD and this RDWP.

The design incorporates EMDF site-specific studies, EMWWMF Lessons Learned and input from DOE and EMWWMF operations staff, as well as input from the FFA parties during design reviews. EMWWMF lessons learned included:

- Providing EMWWMF-determined turn radius and truck maneuvering requirements around roadways and dumping stations
- One-way delivery routing for vehicle ingress and egress to waste placement areas

Specific design criteria from the EMDF ROD are included in the discussion in Sect. 3.3 of this RDWP. The design will also be in compliance with ARARs established in the ROD (see Chap. 6) and applicable DOE Orders, including those for Low-Level Waste Landfills. Additional design criteria include the following industry standards. Please note that the dates for the standards may change as the design is developed.

- American Concrete Institute (ACI)
 - *Building Code Requirements for Structural Concrete*, ACI 318-19
 - *Code Requirements for Environmental Engineering Concrete Structures*, ACI 350-06
- American National Standards Institute/American Institute of Steel Construction
 - 341-16, *Seismic Provisions for Structural Steel Buildings*
 - 360-16, *Specifications for Structural Steel Buildings*
- American Petroleum Institute (API), *Welded Tanks for Oil Storage*, API-650, 2013
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), *Ventilation for Acceptable Indoor Air Quality*, ASHRAE 62.1-2019
- American Society of Mechanical Engineers (ASME)
 - *Process Piping*, ASME B31.3, 2018
 - *Building Services Piping*, ASME B31.9, 2017
 - *Reinforced Thermoset Plastic Corrosion-Resistant Equipment*, RTP-1-2017
- American Society of Civil Engineers (ASCE), *Minimum Design Loads and Associated Design Criteria for Buildings and Other Structures*, ASCE 7-16
- *American Water Works Association Standards*, Latest Edition
- *Welded Carbon Steel Tanks for Water Storage*, D100-11
- *Earthquake Evaluation Guidance Document*, Tennessee Department of Environment and Conservation, Nashville, TN (TDEC 1994).

- *Illuminating Engineering Society of North America Standards, Latest Edition*
- *International Building Code (IBC) (ICC 2018) (includes seismic stability)*
- Institute of Electrical and Electronic Engineers (IEEE) Standards
 - IEEE 242-2001, *Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems*
 - IEEE 519-2014, *Recommended Practice and Requirements for Harmonic Control in Electric Power Systems*
- *International Fire Code, 2018*
- *International Mechanical Code, 2018*
- *International Plumbing Code, 2018*
- *National Electric Safety Code, 2017*
- National Electrical Manufacturers Association (NEMA)
 - NEMA PB 1-2011, *Panelboards*
 - NEMA 250-2014, *Enclosures for Electrical Equipment (1000 Volts Maximum)*
- National Fire Protection Association (NFPA), 2018
 - NFPA 1, *Fire Code*
 - NFPA 10, *Standard for Portable Fire Extinguishers*
 - NFPA 13, *Standard for the Installation of Sprinkler Systems*
 - NFPA 14, *Standard for the Installation of Standpipes and Hose Systems for Fire Protection*
 - NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*
 - NFPA 30, *Flammable and Combustible Liquids Code*
 - NFPA 70, *National Electrical Code*
 - NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance*
 - NFPA 70E, *Standard for Electrical Safety in the Workplace*
 - NFPA 72, *National Fire Alarm and Signaling Code*
 - NFPA 80, *Standards for Fire Doors and Other Opening Protectives*
 - NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilation Systems*
 - NFPA 90B, *Standard for the Installation of Warm Air Heating and Air Conditioning Systems*
 - NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids*
 - NFPA 110, *Standard for Emergency and Standby Power Systems*
 - NFPA 291, *Recommended Practice for Fire Flow Testing and Marking of Hydrants*
 - NFPA 400, *Hazardous Material Code*
 - NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response, U.S. Standards*

- NFPA 780, *Standard for the Installation of Lightning Protection Systems*
- NACE International RP0391-2001, *Materials for the Handling and Storage of Commercial Concentrated (90 to 100 percent) Sulfuric Acid at Ambient Temperatures*
- Underwriters Laboratories (UL):
 - UL 467-93, *Standard for Safety Grounding and Bonding Equipment*
 - UL 67-2013, *Standards for Panelboards*
 - UL 96A-2016, *Safety Lightning Protection Components*

Piezometers and monitoring wells will be installed and constructed in accordance with SPG-00000-A005. *Standard Specification for Well Drilling, Installation, and Abandonment*, latest revision.

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6. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The ARARs for the EMDF design are provided in Appendix A. These ARARs are a subset of the ARARs identified in the EMDF ROD. The project proposes no changes to these ARARs. The selected remedy in the EMDF ROD is designed to meet all identified ARARs.

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7. PUBLIC INVOLVEMENT

Because environmental restoration on the ORR is a large, complex program, public involvement is addressed at the program level and not the project level. DOE, in conjunction with EPA and TDEC, has conducted extensive public involvement and engagement activities throughout the EMDF Project, including development of the Proposed Plan and approval of the EMDF ROD. DOE continues to meet CERCLA requirements to encourage early and frequent involvement by members of the public through regular public meetings. DOE will partner with EPA and TDEC to build on the previous community involvement activities and continue public involvement and engagement, including revision (as necessary) to the existing *Community Outreach Plan for the Environmental Management Disposal Facility* (DOE/OREM-16-2583) and discussion of the EMDF Project at OREM public meetings.

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8. REFERENCES

- CRA 2018. *Phase I Archaeological Survey of the Proposed Environmental Management Disposal Facility in Central Bear Creek Valley, Roane County, Tennessee*, Contract Publication Series 18-139, June 2018, Cultural Resource Analysts, Inc., Lexington, KY.
- DOE/OREM-16-2583. *Community Outreach Plan for the Environmental Management Disposal Facility*, September 2016, U.S. Department of Energy, Oak Ridge Office of Environmental Management, Oak Ridge, TN.
- DOE/OR-1014. *Federal Facility Agreement for the Oak Ridge Reservation*, 1992, U.S. Environmental Protection Agency, Tennessee Department of Environment and Conservation, and U.S. Department of Energy, Oak Ridge, TN.
- DOE/OR/01-2695&D2/R1. *Proposed Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Waste*, September 2018, U.S. Department of Energy, Oak Ridge Office of Environmental Management, Oak Ridge, TN.
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- DOE/OR/01-2934&D2. *Remedial Design Report/Remedial Action Work Plan for the Environmental Management Disposal Facility, Oak Ridge, Tennessee: Early Site Preparation Activities, East Spoils Area*, March 2023.
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- ORNL/TM-2015/248. *Bat Species Distribution on the Oak Ridge Reservation*, October 2015, Oak Ridge National Laboratory, Oak Ridge, TN.
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- Robinson and Johnson 1995. *Results of a Seepage Investigation at Bear Creek Valley, Oak Ridge, Tennessee January – September 1994*, USGS Open-File Report 95-459, U. S. Geological Survey, Nashville, TN.
- SPG-00000-A005. *Standard Specification for Well Drilling, Installation, and Abandonment*, latest revision, United Cleanup Oak Ridge, Oak Ridge, TN

TDEC 0400-11-01-.04. *Solid Waste Processing and Disposal*, “Specific Requirements for Class I, II, III, and IV Disposal Facilities, latest revision, Tennessee Department of Environment and Conservation, Nashville, TN.

TDEC 1994. *Earthquake Evaluation Guidance Document*, Tennessee Department of Environment and Conservation, Nashville, TN.

APPENDIX A.
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

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Table A.1. Chemical-specific applicable or relevant and appropriate requirements for selected alternative

Media/chemical	Requirements	Prerequisite	Citation
Radionuclide emissions	<p>Emissions of radionuclides (other than radon) to the ambient air from DOE 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.</p> <p>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 dose 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.</p>	Radionuclide emissions from point sources at a DOE facility— applicable	<p>40 <i>CFR</i> 61.92</p> <p>40 <i>CFR</i> 61.93(b)(4)(i)</p>
Radionuclide releases to the environment	<p>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 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ of any member of the public.¹</p> <p><i>NOTE: This requirement addresses radionuclide releases through all pathways. For the surface water pathway, landfill wastewater discharges must also meet the federal Clean Water Act, Tennessee Water Quality Control Act and other requirements that have been identified as relevant and appropriate to radionuclides in the wastewater discharge pursuant to the Dispute Resolution Decision regarding radiological discharges for landfill wastewater releases to the environment by the EPA Administrator on December 31, 2020. These requirements are listed as action-specific ARARs in Table A.3 under “Operation of an Onsite Landfill Wastewater Treatment System”.</i></p>	Releases of radionuclides into the environment from an active licensed land disposal operation – relevant and appropriate	<p>10 <i>CFR</i> 61.41</p> <p>TDEC 0400-20-11-.16(2)</p>
Radon releases to environment	No source at a DOE 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 <i>CFR</i> 61.192
Instream water quality criteria for release of landfill wastewater	<p>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 from 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.</p> <p>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.</p>	Release of wastewater or effluents into surface water— applicable as instream criteria beyond the mixing zone	<p>TDEC 0400-40-03-.03(3)(a)</p> <p>TDEC 0400-40-03-.03(4)(a)</p> <p>TDEC 0400-40-03-.03(5)(a)</p> <p>TDEC 0400-40-03-.03(6)(a)</p> <p>TDEC 0400-40-03-.03(3)(b)</p> <p>TDEC 0400-40-03-.03(4)(b)</p> <p>TDEC 0400-40-03-.03(5)(b)</p> <p>TDEC 0400-40-03-.03(6)(b)</p>

¹NOTE: Under these regulations, concentrations of radioactive material that 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 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ of any member of the public with flexibility on apportionment of that dose among exposure pathways.

Table A.1. Chemical-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Media/chemical	Requirements	Prerequisite	Citation
<p>Instream water quality criteria for release of landfill wastewater (cont.)</p>	<p>The hardness of or the mineral compounds contained in the water shall not impair its use for irrigation or livestock watering and wildlife.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>	<p>Release of wastewater or effluents into surface water—applicable as instream criteria beyond the mixing zone</p> <p>Point source discharge of radionuclides into surface water² – relevant and appropriate</p>	<p>TDEC 0400-40-03-.03(5)(c) TDEC 0400-40-03-.03(6)(c)</p> <p>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)</p> <p>TDEC 0400-40-03-.03(3)(d) TDEC 0400-40-03-.03(4)(d)</p> <p>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)</p> <p>TDEC 0400-40-03-.03(3)(f) TDEC 0400-40-03-.03(4)(g)</p> <p>TDEC 0400-40-03-.03(3)(g)</p> <p>TDEC 0400-40-03-.03(4)(j)</p> <p>TDEC 0400-40-03-.03(3)(h) TDEC 0400-40-03-.03(4)(k) TDEC 0400-40-03-.03(5)(f) and (g) TDEC 0400-40-03-.03(6)(f) and (g)</p>

²NOTE: under TDEC 0400-40-03-.05 INTERPRETATION OF CRITERIA, mixing zones shall not apply to the discharge of bioaccumulative pollutants to waters of the state where the risk-based factors in Rule 0400-40-03-.03(4)(l) are exceeded for the pollutant group.

Table A.1. Chemical-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Media/chemical	Requirements	Prerequisite	Citation
<p>Instream water quality criteria for release of landfill wastewater (cont.)</p>	<p>Water shall not contain iron at concentrations that cause toxicity or in such amounts that interfere with habitat due to precipitation or bacteria growth.</p>		<p>TDEC 0400-40-03-.03(3)(i)</p>
	<p>The concentration and 30-day average concentrations of ammonia shall not exceed the acute criterion and chronic criteria, respectively, calculated using the equations given in TDEC 0400-40-03-.03(3)(j).</p>		<p>TDEC 0400-40-03-.03(3)(j)</p>
	<p>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. Additionally, for waters classified for fish and aquatic life, the 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.</p>		<p>TDEC 0400-40-03-.03(3)(k) TDEC 0400-40-03-.03(4)(h)</p>
	<p>In waters classified for recreation, the concentration of the <i>e. coli</i> group shall not exceed 126 cfu per 100 mL as a geometric mean based on a minimum of 5 samples collected as specified in the regulation. The concentration of <i>e. coli</i> group in any individual sample shall not exceed 941 cfu per 100 mL.</p>		<p>TDEC 0400-40-03-.03(3)(l) TDEC 0400-40-03-.03(4)(f)</p>
	<p>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.</p>		<p>TDEC 0400-40-03-.03(3)(m)</p>
	<p>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.</p>		<p>TDEC 0400-40-03-.03(3)(n)</p>
	<p>Stream flow shall support fish and aquatic life criteria and recreational use.</p>		<p>TDEC 0400-40-03-.03(3)(o) TDEC 0400-40-03-.03(4)(m)</p>

Table A.1. Chemical-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Media/chemical	Requirements	Prerequisite	Citation
Antidegradation requirements	<p>Effluent limitations may be required to insure [sic] compliance with the Antidegradation Statement in TDEC 0400-40-03-.06.</p> <p>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.³</p> <p>No new or increased water withdrawals that will cause additional measurable degradation of the unavailable parameter shall be authorized.⁴</p> <p>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.</p>	<p>Point source discharge(s) of pollutants into waters of the U.S.—applicable</p> <p>Waters with “unavailable”[as defined in TDEC 0400-40-03-.06(2)] parameters—applicable</p>	<p>TDEC 0400-40-05-.10(4)</p> <p>TDEC 0400-40-03-.06(2)(a)</p> <p>TDEC 0400-40-03-.06(2)(b)</p> <p>TDEC 0400-40-03-.06(2)(c)</p>

ARAR = applicable or relevant and appropriate requirement
 CFR = Code of Federal Regulations
 CWA = Clean Water Act of 1972
 DOE = U.S. Department of Energy
 EPA = U.S. Environmental Protection Agency

EMDF = Environmental Management Disposal Facility
 PCB = polychlorinated biphenyl
 TDEC = Tennessee Department of Environment and Conservation
 U.S. = United States

³Tennessee determines whether a parameter is “unavailable” by referencing its CWA 303(d) list, available online. Based on the most recent (2020) report, Bear Creek is not meeting its designated recreational use for mercury and PCBs in fish, and nitrites/nitrates and cadmium in water. Mercury (in the form of methylmercury) and PCBs bioaccumulate in fish, and the rule allows “no additional loading.” For nitrites/nitrates and cadmium, the requirement is to allow no measurable degradation. This requirement will no longer be an ARAR if conditions improve, such that Bear Creek attains its designated use before EMDF begins discharging wastewater. If the currently “unavailable” parameters become “available” parameters under the rule, the new ARAR would be TDEC 0400-40-03-.06(3).

⁴The remedy does not involve water withdrawal.

Table A.2. Location-specific applicable or relevant and appropriate requirements for selected alternative

Location Resource	Requirements	Prerequisite	Citation
None			

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative

Action	Requirements	Prerequisite	Citation
<i>Siting</i>			
Siting of a RCRA landfill	<p>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.</p> <p>A facility located in a 100-year floodplain [as defined in TDEC 0400-12-0 1-.06(2)(iii)] 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.</p>	Construction of a RCRA hazardous waste landfill— applicable	<p>40 <i>CFR</i> 264.18(a)(1)</p> <p>40 <i>CFR</i> 264.18(b)(1) TDEC 0400-12-0 1-.06(2)(i)</p>
Siting requirements for a TSCA Landfill	<p>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:</p> <ul style="list-style-type: none"> (i) In place soil thickness, 4-ft or compacted soil liner thickness, 3 ft; (ii) Permeability (cm/sec), equal to or less than 1×10^{-7}; (iii) Percent soil passing No. 200 Sieve, > 30; (iv) Liquid Limit, > 30; and (v) Plasticity Index > 15. <p>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.</p> <p>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.</p> <p>The landfill site shall be located in an area of low to moderate relief to minimize erosion and to help prevent landslides or slumping.</p> <p><i>[NOTE: A waiver under TSCA 40 CFR 761.75(c)(4) is requested for (1) two portions of 40 CFR 761.75(b)(3) to address the hydraulic connection between the site and standing or flowing surface water and the requirement for an in-place soil barrier of at least 50 ft [other requirements of this citation will be met] and (2) 40 CFR 761.75(b)(5).]</i></p>	Construction of a TSCA chemical waste landfill— applicable	<p>40 <i>CFR</i> 761.75(b)(1)</p> <p>40 <i>CFR</i> 761.75(b)(3)</p> <p>40 <i>CFR</i> 761.75(b)(5)</p>

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
TSCA waivers	<p>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.</p> <p><i>[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.]</i></p>	Construction of a TSCA chemical waste landfill— applicable	40 <i>CFR</i> 761.75(c)(4)
Siting requirements and performance objectives for LLW disposal facility	<p>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.</p> <p><i>[NOTE: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), (4), and (5).]</i></p> <p>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.</p> <p>Disposal site shall be capable of being characterized, modeled, analyzed and monitored.</p> <p>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.</p> <p><i>[NOTE: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), (4), and (5).]</i></p> <p>Areas must be avoided having known natural resources which, if exploited, would result in failure of the cell to meet performance objectives.</p> <p><i>[NOTE: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), (4), and (5).]</i></p>	<p>Construction of a LLW disposal facility—relevant and appropriate</p> <p>Construction of a LLW disposal facility—relevant and appropriate</p> <p>Construction of a LLW disposal facility—relevant and appropriate</p> <p>Construction of a LLW disposal facility—relevant and appropriate</p> <p>Construction of a LLW disposal facility—relevant and appropriate</p>	<p>TDEC 0400-20-11-.16(1)</p> <p>TDEC 0400-20-11-.16(5)</p> <p>TDEC 0400-20-11-.17(1)(b)</p> <p>TDEC 0400-20-11-.17(1)(c)</p> <p>TDEC 0400-20-11-.17(1)(d)</p>

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
<p>Siting requirements and performance objectives for LLW disposal facility (cont.)</p>	<p>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.</p> <p>Upstream drainage area must be minimized to decrease the amount of runoff which could erode or inundate the disposal unit.</p> <p>The disposal site must provide sufficient depth to the water table that groundwater intrusion, perennial or otherwise, into the waste will not occur.</p> <p>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.</p> <p><i>[NOTE: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), (4), and (5).]</i></p> <p>The hydrogeologic unit used for disposal shall not discharge groundwater to the surface within the disposal site.</p> <p><i>[NOTE: An exception, variance or exemption to this requirement will be requested under TDEC 0400-20-04-.08.]</i></p>	<p>Construction of an LLW disposal facility—relevant and appropriate</p> <p>Construction of a LLW disposal facility—relevant and appropriate</p> <p>Construction of a LLW disposal facility—relevant and appropriate</p> <p>Construction of a LLW disposal facility—relevant and appropriate</p>	<p>TDEC 0400-20-11-.17(1)(e)</p> <p>TDEC 0400-20-11-.17(1)(f)</p> <p>TDEC 0400-20-11-.17(1)(g)</p> <p>TDEC 0400-20-11-.17(1)(h)</p>
<p>Exemption of TDEC 0400-20-11-17(h) requirement</p>	<p>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.</p> <p><i>[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.]</i></p>		<p>TDEC 0400-20-04-.08</p>
<p>Siting requirements and performance objectives for LLW disposal facility</p>	<p>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.</p> <p><i>[NOTE: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), (4), and (5).]</i></p>	<p>Construction of a LLW disposal facility—relevant and appropriate</p>	<p>TDEC 0400-20-11-.17(1)(i)</p>

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Siting requirements and performance objectives for LLW disposal facility (cont.)	<p>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 the ability of the disposal site to meet performance objectives or preclude defensible modeling and prediction of long-term impacts.</p> <p><i>[NOTE: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), (4), and (5).]</i></p> <p>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.</p> <p><i>[NOTE: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), (4), and (5).]</i></p>	<p>Construction of a LLW disposal facility—relevant and appropriate</p> <p>Construction of a LLW disposal facility—relevant and appropriate</p>	<p>TDEC 0400-20-11-.17(1)(j)</p> <p>TDEC 0400-20-11-.17(1)(k)</p>
Siting of new commercial hazardous waste management facility	<p>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).</p>	<p>Construction of a new commercial hazardous waste management facility—relevant and appropriate</p>	<p>TDEC 0400-12-02-.03(2)(e)(1)(i)(III)</p>
General Landfill Design			
Preparedness and prevention	<p>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 TDEC 0400-12-01-.06(3).</p>	<p>Operation of a RCRA hazardous waste facility—applicable</p>	<p>40 <i>CFR</i> 264.30-264.37 TDEC 0400-12-01-.06(3)</p>
Site design for a LLW disposal facility	<p>Site design features must be directed toward long-term isolation and avoidance of the need for continuing active maintenance after site closure.</p> <p>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.</p> <p><i>[NOTE: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), (4), and (5).]</i></p> <p>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.</p> <p><i>[NOTE: Performance Objectives are those given at TDEC 0400-20-11-.16(1), (2), (4), and (5).]</i></p>	<p>Design of a LLW disposal facility—relevant and appropriate</p> <p>Design of a LLW disposal facility—relevant and appropriate</p> <p>Design of a LLW disposal facility—relevant and appropriate</p>	<p>TDEC 0400-20-11-.17(2)(a)</p> <p>TDEC 0400-20-11-.17(2)(b)</p> <p>TDEC 0400-20-11-.17(2)(c)</p>

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Site design for an LLW disposal facility (cont.)	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>	<p>Design of a LLW disposal facility—relevant and appropriate</p> <p>Design of a LLW disposal facility—relevant and appropriate</p> <p>Design of a LLW disposal facility—relevant and appropriate</p> <p>Design of a LLW disposal facility—relevant and appropriate</p>	<p>TDEC 0400-20-11-.17(2)(d)</p> <p>TDEC 0400-20-11-.17(2)(e)</p> <p>TDEC 0400-20-11-.17(2)(f)</p> <p>TDEC 0400-20-11-.17(3)(h)</p>
<i>Landfill Liner System and Geologic Buffer</i>			
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 [sic] 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 mil.	Design of a TSCA chemical waste landfill— applicable	40 <i>CFR</i> 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 <i>CFR</i> 264.301(c) TDEC 0400-12-01-.06(14)(b)(3)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Liner system for RCRA landfill	<p>(i) The liner system must include:</p> <p>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</p> <p>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 ft (91 cm) of compacted soil material with a hydraulic conductivity of no more than 1×10^{-7} cm/sec.</p> <p>(ii) Liners must comply with paragraphs (I)(i)(I), (II), and (III) of this section.</p>	Design of a RCRA landfill— applicable	40 <i>CFR</i> 264.301(c)(1) TDEC 0400-12-01-.06(14)(b)(3)(i)(I)
Liner for a RCRA landfill	<p>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:</p> <p>(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;</p> <p>(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</p> <p>(iii) Installed to cover all surrounding earth likely to be in contact with waste or leachate.</p>	Design of a RCRA landfill— applicable	40 <i>CFR</i> 264.301(a)(1) TDEC 0400-12-01-.06(14)(b)(1)(i)
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 TDEC 0400-12-01-.06(14)(b)(1)(ii)(I) and (II).	Design of a RCRA landfill— applicable	40 <i>CFR</i> 264.301(c)(2) TDEC 0400-12-01-.06(14)(b)(1)(ii)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Leak detection system	<p>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:</p> <ul style="list-style-type: none"> (i) Constructed with a bottom slope of 1 percent or more; (ii) Constructed of granular drainage materials with a hydraulic conductivity of 1×10^{-2} cm/sec or more and a thickness of 12 in. (30.5 cm) or more; or constructed of synthetic or geonet drainage materials with a transmissivity of 3×10^{-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. 	Design of a RCRA landfill— applicable	40 <i>CFR</i> 264.301(c)(3) TDEC 0400-12-01-.06(14)(b)(3)(iii)
Leak detection system action leakage rate	<p>(1) The action leakage rate is the maximum design flow rate that the LDS can remove without the fluid head on the bottom liner exceeding 1 ft. 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.</p> <p>(2) 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 TDEC 0400-12-01-.06(14)(d)(3) to an average daily flow rate (gallons per acre per day) for each sump.</p>	Design of a RCRA landfill— applicable	40 <i>CFR</i> 264.302 TDEC 0400-12-01-.06(14)(c)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Geologic buffer	<p>Underlying the liners shall be a geologic buffer which shall have:</p> <ul style="list-style-type: none"> (i) A maximum hydraulic conductivity of 1.0×10^{-5} cm/s and measures at least 10 ft from the bottom of the liner to the seasonal high water table of the uppermost unconfined aquifer or the top of the formation of a confined aquifer or (ii) Have a maximum hydraulic conductivity of 1.0×10^{-6} cm/s and measures not less than 5 ft from the bottom of the 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 of a solid waste landfill— relevant and appropriate	TDEC 0400-11-01-.04(4)(a)(2)
<i>Stormwater Control for Landfill</i>			
Run-on/runoff control systems	<p>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.</p> <p>Runoff management system must be able to collect and control the water volume from a runoff resulting from a 24-hour, 25-year storm event.</p> <p>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 2 ft above the 100-year floodwater elevation.</p> <p>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.</p>	<p>Design of a RCRA landfill—applicable</p> <p>Design of a TSCA landfill—applicable</p>	<p>40 <i>CFR</i> 264.301(g) TDEC 0400-12-01-.06(14)(b)(7)</p> <p>40 <i>CFR</i> 264.301(h) TDEC 0400-12-01-.06(14)(b)(8)</p> <p>40 <i>CFR</i> 761.75(b)(4)(i) and (ii)</p>
<i>Construction Requirements</i>			
Activities causing fugitive dust emissions	<p>Shall take reasonable precautions to prevent particulate matter from becoming airborne. Reasonable precautions shall include, but are not limited to the following:</p> <ul style="list-style-type: none"> • 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; • Application of asphalt, water, or suitable chemicals on dirt roads, materials stock piles, and other surfaces which can create airborne dusts; and • 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. 	Use, construction, alteration, repair or demolition of a building, or appurtenances or a road or the handling, transport, or storage of material— applicable	<p>TDEC 1200-3-8-.01(1)</p> <p>TDEC 1200-3-8-.01(1)(a)</p> <p>TDEC 1200-3-8-.01(1)(b)</p> <p>TDEC 1200-3-8-.01(2)</p>

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Activities causing stormwater runoff	<p>Shall develop and implement stormwater management controls to ensure compliance with the terms and conditions of <i>General Permit No. TNR050000</i> (“Stormwater Multi-Sector General Permit for Industrial Activities”) or any applicable site-specific permit.</p> <p>Shall develop and maintain a stormwater pollution prevention/control plan prepared in accordance with good engineering practices and with the factors outlined in 40 <i>CFR</i> 125.3(d)(2) or (3) as appropriate and any additional requirements listed in Part 11 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 stormwater discharges associated with industrial activity.</p> <p>Stormwater pollution prevention plans shall include, at a minimum, the items identified in <i>General Permit No. TNR050000 Sector K.3</i>, including a description of potential pollution sources, stormwater management measures and controls, preventive maintenance, spill prevention and response procedures, and sediment and erosion controls.</p>	<p>Existing and new stormwater discharges associated with industrial activity—applicable</p> <p>Stormwater discharges associated with industrial activity at hazardous waste treatment, storage or disposal facilities—TBC</p>	<p><i>TCA</i> 69-3-108(e) through (j) <i>TCA</i> 69-3-108(l) TDEC 0400-40-10-.03(2)(a) <i>General Permit No. TNR05-0000</i>, Sector K (effective July 20, 2020) (TBC)</p> <p><i>General Permit No. TNR050000</i>, Sect. 4 (TBC)</p> <p><i>General Permit No. TNR050000 Sector K.3</i> (TBC)</p>
Construction quality assurance	<p>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:</p> <ol style="list-style-type: none"> (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 <i>CFR</i> 264.303(a) TDEC 0400-12-01-.06(14)(d)(1)
Construction of new outfall structure for discharge of wastewater	<p>Construction of intake and outfall structures activities along state waters must be conducted in accordance with the requirements of the ARAP Program (TDEC 0400-40-07). The substantive general permit requirements for stream bank stabilization include the following:</p> <p>Construction, maintenance, repair, rehabilitation or replacement of intake or outfall structures shall be carried out in such a way that work:</p> <ul style="list-style-type: none"> • Shall be located and oriented so as to avoid permanent alteration or damage to the integrity of the stream channel including the opposite stream bank. Alignment of the structure (except for diffusers) should be as parallel to the stream flow as is practicable, with the discharge pointed downstream. Underwater diffusers may be placed perpendicular to stream flow for more complex mixing. 	Construction of intake and outfall structures in waters of the state— applicable	<i>TCA</i> 69-3-108(l) TDEC 0400-40-07-.01 TDEC General Permit for Construction of Intake and Outfall Structures (effective April 7, 2020) (TBC)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
<p>Construction of new outfall structure for discharge of wastewater (cont.)</p>	<ul style="list-style-type: none"> • 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 • 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 bank. • The amount of fill, stream channel and bank modifications, or other impacts associated with the activity shall be limited to the minimum necessary to accomplish the project purpose. Shall utilize the least impactful practicable method of construction. • Clearing, grubbing, or other disturbance to riparian vegetation shall be kept at the minimum necessary for slope construction and equipment operations. Unnecessary native vegetation removal, including tree removal is prohibited. Native riparian vegetation must be reestablished in all areas of disturbance outside of any permanent structure after work is completed. • Widening of the stream channel is prohibited. • Activity may not result in a permanent disruption to the movement of fish or other aquatic life upon project completion. • Blasting within 50 ft of any jurisdictional stream or wetland is prohibited. • Backfill activities must be accomplished in the least impactful manner possible 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, stream banks, or any disturbed riparian areas within 30 ft of top of bank. 		

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Construction of new outfall structure for discharge of wastewater (cont.)	<ul style="list-style-type: none"> • Where practicable, all activities shall be accomplished in the dry. All surface water flowing towards the 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 the work. Any disturbance to the stream bed or banks must be restored to its original condition. 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 a short duration and with minimal impact and conform to the Division-approved methodology. • All activities must be carried out in such a manner as will prevent violations of water quality criteria or impairment of the designated uses of the waters of the state • Erosion and sedimentation control shall be in place and functional before earthmoving operations begin and shall be designed according to the department’s Erosion and Sediment Control Handbook. Permanent vegetation stabilization using native species of all disturbed areas in or near the stream channel must be initiated within 14 days of the 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 mechanized equipment, rather, the stream channel may be crossed perpendicularly with equipment provided no additional fill or excavation is necessary. 		
Activities causing stormwater runoff (e.g., clearing, grading, excavation)	<p>Implement good construction management techniques (including sediment and erosion, vegetative controls, and structural controls) in accordance with the substantive requirements of <i>General Permit No. TNR10-0000</i> and <i>TNR05-0000</i>, to ensure stormwater discharge is properly managed and:</p> <ul style="list-style-type: none"> • 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 	Stormwater discharges associated with construction activities that disturb ≥ 1 acre total— relevant and appropriate	<i>TCA 69-3-108(1)</i> Tennessee General Permit No. TNR10-0000, Sects. 5.3.2 and 5.4.1 (effective October 1, 2016) (TBC)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
<p>Activities causing stormwater runoff (e.g., clearing, grading, excavation) (cont.)</p>	<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> ○ Measures used at the site must be designed to control stormwater runoff generated by a 5-year, 24-hour storm event at a minimum. <p>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.</p>		
<i>Emissions and Effluents</i>			
<p>Control of emissions from a WWTU treatment system</p>	<p>Onsite 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 1000 lb per year of each hazardous air pollutant.</p>	<p>Emissions of air pollutants from new air contaminant sources—applicable</p>	<p>TDEC 1200-03-09-.04(4)(d)(24)</p>
<p>Activities causing stormwater runoff (e.g., during operations)</p>	<p>Shall develop and implement stormwater management controls to insure [sic] compliance with the terms and conditions of <i>General Permit No. TNR050000</i> (“Stormwater Multi-Sector General Permit for Industrial Activities”) or any applicable site-specific permit and with TDEC 0400-40-10-.03(2)(c).</p> <p>Shall develop and maintain a stormwater pollution prevention/control plan prepared in accordance with good engineering practices and with the factors outlined in 40 <i>CFR</i> 125.3(d)(2) or (3) as appropriate and any additional requirements listed in Part 11 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 stormwater discharges associated with industrial activity.</p> <p>Stormwater pollution prevention plans shall include, at a minimum, the items identified in <i>General Permit No. TNR050000 Sector K.3</i>, including a description of potential pollution sources, stormwater management measures and controls, preventive maintenance, spill prevention and response procedures, and sediment and erosion controls.</p>	<p>Stormwater discharges associated with industrial activity—applicable</p> <p>Stormwater discharges associated with industrial activity at hazardous waste treatment, storage or disposal facilities—TBC</p>	<p><i>TCA</i> 69-3-108(e) through (j) <i>TCA</i> 69-3-108(1) TDEC 0400-40-10-.03(2)(a) TDEC 0400-40-10-.03(2)(c)</p> <p><i>General Permit No. TNR050000, Sector K</i> (effective July 20, 2020) (TBC guidance)</p> <p><i>General Permit No. TNR050000, Sect. 4</i></p> <p><i>General Permit No. TNR050000 Sector K.3</i></p>

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
<i>Secondary Waste and Waste Acceptance Criteria Attainment</i>			
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 <i>CFR</i> 264.175(c) TDEC 0400-12-01-.06(9)(f)(3)
Storage of RCRA hazardous waste with free liquids in containers	<p>Area must have a containment system designed and operated in accordance with TDEC 0400-12-01-.06(9)(f)(2) as follows:</p> <ul style="list-style-type: none"> • 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 the volume required for containers as listed immediately above; and • 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. 	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	<p>40 <i>CFR</i> 264.175(a) and (d) TDEC 0400-12-01-.06(9)(f)(1)-(2)</p> <p>40 <i>CFR</i> 264.175(b)(1) TDEC 0400-12-01-.06(9)(f)(2)(i)</p> <p>40 <i>CFR</i> 264.175(b)(2) TDEC 0400-12-01-.06(9)(f)(2)(ii)</p> <p>40 <i>CFR</i> 264.175(b)(3) TDEC 0400-12-01-.06(9)(f)(2)(iii)</p> <p>40 <i>CFR</i> 264.175(b)(4) TDEC 0400-12-01-.06(9)(f)(2)(iv)</p> <p>40 <i>CFR</i> 264.175(b)(5) TDEC 0400-12-01-.06(9)(f)(2)(v)</p>
Temporary storage of PCB waste (e.g., PPE, rags) in a container(s)	<p>Storage area must be clearly marked as required by 40 <i>CFR</i> 761.40(a)(10).</p> <p>Any leaking PCB items and their contents shall be transferred immediately to a properly marked non-leaking container(s).</p> <p>Container(s) shall be in accordance with requirements set forth in DOT HMR at 49 <i>CFR</i> 171-180.</p>	Storage of PCBs and PCB items at concentration ≥ 50 ppm for disposal— applicable	<p>40 <i>CFR</i> 761.65(c)(3)</p> <p>40 <i>CFR</i> 761.65(c)(5)</p> <p>40 <i>CFR</i> 761.65(c)(6)</p>
Temporary storage of LLW	<p>Shall not be readily capable of detonation, explosive decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water.</p> <p>Shall be stored in a location and manner that protects the integrity of waste for the expected time of storage and minimizes worker exposure.</p>	Management of LLW at a DOE facility— TBC	<p>DOE M 435.1-1(IV)(N)(1)</p> <p>DOE M 435.1-1(IV)(N)(3)</p>

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Temporary storage of LLW (cont.)	<p>Shall be managed to identify and segregate LLW from mixed waste.</p> <p>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.</p> <p>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.</p> <p>Containers shall be marked such that their contents can be identified.</p>	Storage of LLW in containers at a DOE facility— TBC	<p>DOE M 435.1-1(IV)(N)(6)</p> <p>DOE M 435.1-1(IV)(L)(1)(a)</p> <p>DOE M 435.1-1(IV)(L)(1)(b)</p> <p>DOE M 435.1-1(IV)(L)(1)(c)</p>
General Operations			
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 TDEC 0400-12-01-.06(2)(j).	Operation of a RCRA hazardous waste landfill— applicable	40 <i>CFR</i> 264.19 TDEC 0400-12-01-.06(2)(j)
Operation of a landfill accepting asbestos waste	<p>(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:</p> <ul style="list-style-type: none"> (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 in. × 14 in.) upright format signs specified in 29 <i>CFR</i> 1910.145(d)(4) and this paragraph; and (iii) Display the legend, as listed in 40 <i>CFR</i> 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. <p>The perimeter of the disposal site must be fenced in a manner adequately to deter access by the general public.</p>		40 <i>CFR</i> 61.154(b)(2)
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 ft 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 10 ft 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 10 ft below grade.	Construction of a solid waste disposal facility— relevant and appropriate	TDEC 0400-11-01-.04(2)(l)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Operation of a Subtitle D solid waste landfill	There must be installed on-site a permanent benchmark (e.g., concrete marker) of known elevation.	Operation of a Subtitle D solid waste landfill— relevant and appropriate	TDEC 0400-11-01.04(2)(o)
<i>Environmental Monitoring Requirements</i>			
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 <i>CFR</i> 761.75(b)(6)(i)(A)
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 <i>CFR</i> 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 2 consecutive months.	Closure of a RCRA landfill— applicable	40 <i>CFR</i> 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 TDEC 0400-12-01-.06(6).	Closure of a RCRA landfill— applicable	40 <i>CFR</i> 264.310(b)(4) TDEC 0400-12-01-.06(14)(k)(2)(iv)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
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 0400-12-01-.06(6)(e), Table 1.	RCRA hazardous constituents detected in groundwater in the uppermost aquifer underlying a hazardous waste landfill— applicable	40 <i>CFR</i> 264.94(a) TDEC 0400-12-01-.06(6)(e)(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 groundwater 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 <i>CFR</i> 264.97(c) TDEC 0400-12-01-.06(6)(h)(3)
Groundwater monitoring requirements for RCRA hazardous waste landfills	<p>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:</p> <ul style="list-style-type: none"> • 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. <p>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.</p> <p>Groundwater monitoring program must include sampling and analytical methods that are appropriate and accurately measure hazardous constituents in groundwater samples.</p> <p>Groundwater monitoring program must include a determination of the groundwater surface elevation each time groundwater is sampled.</p> <p>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.</p> <p>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 TDEC 0400-12-01-.06(6)(h)(9)(v), 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 TDEC 0400-12-01-.06(6)(h)(9).</p>	Operation of a detection monitoring program under TDEC 0400-12-01-.06(6)(i)— applicable	<p>40 <i>CFR</i> 264.97(a) TDEC 0400-12-01-.06(6)(h)(1)</p> <p>40 <i>CFR</i> 264.97(d) TDEC 0400-12-01-.06(6)(h)(4)</p> <p>40 <i>CFR</i> 264.97(e) TDEC 0400-12-01-.06(6)(h)(5)</p> <p>40 <i>CFR</i> 264.97(f) TDEC 0400-12-01-.06(6)(h)(6)</p> <p>40 <i>CFR</i> 264.97(g) TDEC 0400-12-01-.06(6)(h)(7)</p> <p>40 <i>CFR</i> 264.97(h) TDEC 0400-12-01-.06(6)(h)(8)</p>

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
<p>Groundwater monitoring requirements for RCRA hazardous waste landfills (cont.)</p>	<ul style="list-style-type: none"> • A parametric 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. • An 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. • 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. • A control chart approach that gives control limits for each constituent. • Another statistical test method submitted by the owner or operator and approved by Tennessee and EPA through the CERCLA process. <p>Any statistical method chosen under TDEC 0400-12-01-.06(6)(h)(8) shall comply with the following performance standards, as appropriate:</p> <ul style="list-style-type: none"> • 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. • If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a groundwater 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. • 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. 	<p>Operation of a detection monitoring program under TDEC 0400-12-01-.06(6)(i)—applicable</p>	<p>40 <i>CFR</i> 264.97(h)(1) TDEC 0400-12-01-.06(6)(h)(8)(i)</p> <p>40 <i>CFR</i> 264.97(h)(2) TDEC 0400-12-01-.06(6)(h)(8)(ii)</p> <p>40 <i>CFR</i> 264.97(h)(3) TDEC 0400-12-01-.06(6)(h)(8)(iii)</p> <p>40 <i>CFR</i> 264.97(h)(4) TDEC 0400-12-01-.06(6)(h)(8)(iv)</p> <p>40 <i>CFR</i> 264.97(h)(5) TDEC 0400-12-01-.06(6)(h)(8)(v)</p> <p>40 <i>CFR</i> 264.97(i) TDEC 0400-12-01-.06(6)(h)(9)</p> <p>40 <i>CFR</i> 264.97(i)(1) TDEC 0400-12-01-.06(6)(h)(9)(i)</p> <p>40 <i>CFR</i> 264.97(i)(2) TDEC 0400-12-01-.06(6)(h)(9)(ii)</p> <p>40 <i>CFR</i> 264.97(i)(3) TDEC 0400-12-01-.06(6)(h)(9)(iii)</p>

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Groundwater monitoring requirements for RCRA hazardous waste landfills (cont.)	<ul style="list-style-type: none"> • 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 database, the data distribution, and the range of the concentration values for each constituent of concern. • 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 TDEC 0400-12-01-.06(6)(h)(8) 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. • 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. 	<p>Operation of a detection monitoring program under TDEC 0400-12-01-.06(6)(i)—applicable</p>	<p>40 <i>CFR</i> 264.97(i)(4) TDEC 0400-12-01-.06(6)(h)(9)(iv)</p> <p>40 <i>CFR</i> 264.97(i)(5) TDEC 0400-12-01-.06(6)(h)(9)(v)</p> <p>40 <i>CFR</i> 264.97(i)(6) TDEC 0400-12-01-.06(6)(h)(9)(vi)</p>
Detection monitoring	<p>Must monitor for specified indicator parameters, waste constituents, or reaction products that provide a reliable indication of the presence of hazardous constituents in groundwater.</p> <p>Must install a groundwater monitoring system at the compliance point as specified under TDEC 0400-12-01-.06(6)(f) that complies with TDEC 0400-12-01-.06(6)(h)(1)(ii) and TDEC 0400-12-01-.06(6)(h)(3).</p> <p>Must conduct a monitoring program for each specified chemical parameter and hazardous constituent.</p> <p>Sampling frequency shall be sufficient to determine whether there is statistically significant evidence of contamination.</p>	<p>Operation of a detection monitoring program under TDEC 0400-12-01-.06(6)(i)—applicable</p>	<p>40 <i>CFR</i> 264.98(a) TDEC 0400-12-01-.06(6)(i)(1)</p> <p>40 <i>CFR</i> 264.98(b) TDEC 0400-12-01-.06(6)(i)(2)</p> <p>40 <i>CFR</i> 264.98(c) TDEC 0400-12-01-.06(6)(i)(3)</p> <p>40 <i>CFR</i> 264.98(d) TDEC 0400-12-01-.06(6)(i)(4)</p>

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Detection monitoring (cont.)	<p>Must determine the groundwater flow rate and direction in the uppermost aquifer annually at a minimum.</p> <p>Must determine whether there is statistically significant evidence of contamination of any specified chemical parameter or hazardous constituent at a specified frequency.</p> <p>If there is statistically significant evidence of contamination at any monitoring well at the compliance point, must follow the substantive provisions of this subsection [TDEC 0400-12-01-.06(6)(i)(7)].</p>		<p>40 <i>CFR</i> 264.98(e) TDEC 0400-12-01-.06(6)(i)(5)</p> <p>40 <i>CFR</i> 264.98(f) TDEC 0400-12-01-.06(6)(i)(6)</p> <p>40 <i>CFR</i> 264.98(g) TDEC 0400-12-01-.06(6)(i)(7)</p>
Surface water monitoring post-closure	Designated surface water course shall be sampled on a frequency of no less than once every 6 months after final closure of the disposal area.	Closure of a TSCA chemical waste landfill— applicable	40 <i>CFR</i> 761.75(b)(6)(i)(C)
<i>Closure and Post-closure Requirements</i>			
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 TDEC 0400-12-01-.06(10)(h), TDEC 0400-12-01-.06(11)(i), TDEC 0400-12-01-.06(12)(i), TDEC 0400-12-01-.06(13)(k), and TDEC 0400-12-01-.06(14)(k).	Closure of a RCRA landfill— applicable	40 <i>CFR</i> 264.114 TDEC 0400-12-01-.06(7)(e)
Closure of RCRA landfill and other RCRA hazardous waste management units	<p>Must close the unit in a manner that:</p> <p>(a) Minimizes the need for further maintenance; and</p> <p>(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 runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere; and</p> <p>(c) Complies with the closure requirements of this part, including, but not limited to, the requirements of TDEC 0400-12-01-.06(9)(i), TDEC 0400-12-01-.06(10)(h), TDEC 0400-12-01-.06(11)(i), TDEC 0400-12-01-.06(12)(i), TDEC 0400-12-01-.06(13)(k), TDEC 0400-12-01-.06(14)(k), TDEC 0400-12-01-.06(15)(l), TDEC 0400-12-01-.06(16) and (17), TDEC 0400-12-01-.06(27)(b) through (d), and TDEC 0400-12-01-.06(33)(c).</p>	Closure of a RCRA hazardous waste management facility— applicable	40 <i>CFR</i> 264.111 TDEC 0400-12-01-.06(7)(b)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Closure of RCRA landfill	<p>Must cover the landfill or cell with a final cover designed and constructed to:</p> <ol style="list-style-type: none"> (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 <i>CFR</i> 264.310(a) TDEC 0400-12-01-.06(14)(k)
Closure of RCRA temporary storage area – “90-Day Storage Area”	<p>The generator must close the waste accumulation unit in a manner that:</p> <ul style="list-style-type: none"> • Minimizes the need for further maintenance by controlling, minimizing, or eliminating, to the extent necessary to protect human health and the environment, the 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, • Removes or decontaminates all contaminated equipment, structures, and soil and any remaining hazardous waste residues from waste accumulation units, • Any hazardous waste generated in the process of closing either the generator’s facility or unit(s) accumulating hazardous waste must be managed in accordance with all applicable standards of Parts 262, 263, 265 and 268 of this chapter. 	Accumulation of RCRA hazardous waste on-site as defined in TDEC 0400-12-01-.01(2)(a)— applicable	40 <i>CFR</i> 262.17(a)(8)(iii)(1)-(3) TDEC 0400-12-01-.03(1)(h)(1) (viii)(III)I and II
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 <i>CFR</i> 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 <i>CFR</i> 761.65(e).	Closure of TSCA/RCRA storage facility— applicable	40 <i>CFR</i> 761.65(e)(3)
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 <i>CFR</i> 264.116 TDEC 0400-12-01-.06(7)(g)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Survey plat (cont.)	<p>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:</p> <p>(1) The land has been used for the disposal of asbestos-containing waste material;</p> <p>(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</p> <p>(3) The site is subject to 40 <i>CFR</i> part 61, subpart M.</p>	Closure of an asbestos-containing waste disposal site— applicable	40 <i>CFR</i> 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 <i>CFR</i> 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.	Closure of a RCRA landfill— applicable	40 <i>CFR</i> 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.	Closure of a RCRA landfill— applicable	40 <i>CFR</i> 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 <i>CFR</i> 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 <i>CFR</i> 264.119(b) TDEC 0400-12-01-.06(7)(j)(2)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
General post-closure care	<p>After final closure, owner or operator must:</p> <ul style="list-style-type: none"> (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 TDEC 0400-12-01-.06(14)(b)(3)(iii)(IV), TDEC 0400-12-01-.06(14)(b)(3)(iv), and TDEC 0400-12-01-.06(14)(d)(3); (iv) Maintain and monitor a groundwater monitoring system and comply with all other applicable provisions of TDEC 0400-12-01-.06(6); (v) Prevent run-on and runoff from eroding or otherwise damaging final cover; and (vi) Protect and maintain surveyed benchmarks used to locate waste cells. 	Closure of a RCRA landfill— applicable	40 <i>CFR</i> 264.310(b) TDEC 0400-12-01-.06(14)(k)(2)
LLW disposal facility pre-closure activities	<p>Prior to closure of the disposal site, the following information will be obtained:</p> <ul style="list-style-type: none"> • 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 post-closure care. <p>Any significant new information regarding the environmental impact of closure activities and long-term performance of the disposal site.</p>	Closure of a LLW disposal facility— relevant and appropriate	TDEC 0400-20-11-.12(1)
Closure of an asbestos-containing waste disposal area	<p>Upon closure, comply with the provisions of 40 <i>CFR</i> 61.151(a) – (c)[TDEC 1200-3-11-.02(2)(l)(1) – (3)]:</p> <p>Must either discharge no visible emissions to the outside air; <u>or</u></p> <p>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></p>	Closure/capping of a permitted asbestos disposal site— relevant and appropriate	40 <i>CFR</i> 61.154(g) TDEC 1200-3-11-.02(5)(g) 40 <i>CFR</i> 61.151(a)(1) TDEC 1200-3-11-.02(2)(l)(1)(i) 40 <i>CFR</i> 61.151(a)(2) TDEC 1200-3-11-.02(2)(l)(1)(ii)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Closure of an asbestos-containing waste disposal area (cont.)	<p>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.</p> <p>Unless a natural barrier adequately deters access by the general public, install and maintain warning signs and fencing as detailed in 40 <i>CFR</i> 61.151(b)(1) – (3) <u>or</u> comply with 40 <i>CFR</i> 61.151(a)(2) or (a)(3).</p> <p>Owner may use an alternative control method that has received prior approval of the Administrator rather than comply with the requirements of 40 <i>CFR</i> 61.151(a) or (b).</p>		<p>40 <i>CFR</i> 61.151(a)(3) TDEC 1200-3-11-.02(2)(1)(1)(iii)</p> <p>40 <i>CFR</i> 61.151(b) TDEC 1200-3-11-.02(2)(1)(2)</p> <p>40 <i>CFR</i> 61.151(c) TDEC 1200-3-11-.02(2)(1)(3)</p>
Closure of groundwater monitoring well(s)	<p>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.</p> <p>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.</p>	<p>Permanent plugging and abandonment of a well—relevant and appropriate</p>	<p>TDEC 0400-45-06-.09(6)(d)</p> <p>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)</p>
<i>Operation of an Onsite Landfill Wastewater Treatment System</i>			
Prevention of pollution through application of treatment	<p>In order to permit the reasonable and necessary uses of the Waters of the State, existing pollution should be corrected as rapidly as practicable, and future pollution prevented through the level of treatment technology applicable to a specific source or that greater level of technology necessary to meet water quality standards; i.e., modeling and stream survey assessments, treatment plants or other control measures.⁵</p> <p>Technology-based treatment requirements cannot be satisfied through the use of “non-treatment” techniques such as flow augmentation and in-stream mechanical aerators.</p>	<p>Point source discharge of pollutants as defined in 40 <i>CFR</i> 122.2 into surface water—applicable</p> <p>Point source discharge of radionuclides into surface water—relevant and appropriate</p>	<p>TDEC 0400-40-03-.02(4) <i>General considerations</i></p> <p>40 <i>CFR</i> 125.3(f)</p>
Application of most stringent criteria	<p>Since all Waters of the State are classified for more than one use, the most stringent criteria will be applicable.</p>		<p>TDEC 0400-40-03-.02(5) <i>General considerations</i></p>

⁵Treatment may be necessary to meet Tennessee water quality standards. Consistent with the Administrator’s Decision dated December 31,2020, TBEL requirements are not considered relevant and appropriate to discharges of radionuclides at this Site.

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Compliance with narrative water quality criteria	Interpretation and application of narrative criteria shall be based on available scientific literature and EPA guidance and regulations.	Point source discharge of pollutants as defined in 40 <i>CFR</i> 122.2 into surface water— applicable Point source discharge of radionuclides into surface water— relevant and appropriate	TDEC 0400-40-03-.02(10) <i>General considerations</i>
Application of stream flow for water quality criteria	Fish and aquatic life water quality criteria shall generally be applied on the basis of stream flows equal to or exceeding the 7-day minimum, 10-year recurrence interval. All other criteria shall be applied on the basis of stream flows equal to or exceeding the 30-day minimum 5-year recurrence interval. The frequency, magnitude and duration of deviations from normal water conditions shall be considered in interpreting the water quality criteria. When interpreting pathogen data, samples collected during or immediately after significant rain events may be treated as outliers unless caused by point source dischargers.	Discharge of pollutants as defined in 40 <i>CFR</i> 122.2 into surface water Classified as <i>Fish and Aquatic Life</i> — applicable Discharge of radionuclides into surface water Classified as <i>Fish and Aquatic Life</i> — relevant and appropriate Point source discharge of pollutants as defined in 40 <i>CFR</i> 122.2 into surface water— applicable Point source discharge of radionuclides into surface water— relevant and appropriate	TDEC 0400-40-03-.05(4) <i>Interpretation of criteria</i> TDEC 0400-40-03-.05(5) <i>Interpretation of criteria</i>
Application of water quality criteria	The criteria and standards provide that all discharges of sewage, industrial waste, and other waste shall receive the degree of treatment or effluent reduction necessary to comply with water quality standards, or state or federal laws and regulations pursuant thereto, and where appropriate will comply with the "Standards of Performance" as required by the Tennessee Water Quality Control Act, (T.C.A., §§ 69-3-101, et seq.). (See FN 1.)	Point source discharge of pollutants as defined in 40 <i>CFR</i> 122.2 into surface water— applicable Point source discharge of radionuclides into surface water— relevant and appropriate	TDEC 0400-40-03-.05(6) <i>Interpretation of criteria</i>

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Application of water quality criteria (cont.)	Where naturally formed conditions or background water quality conditions are substantial impediments to attainment of the water quality standards, these conditions shall be taken into consideration in establishing any effluent limitations or restriction on discharge to such waters. For purposes of water quality assessment, exceedances of water quality standards caused by natural conditions will not be considered the condition of pollution impairment.	Point source discharge of pollutants as defined in 40 <i>CFR</i> 122.2 into surface water— applicable Point source discharge of radionuclides into surface water— relevant and appropriate	TDEC 0400-40-03-.05(7) <i>Interpretation of criteria</i>
Use of Reporting Limits	<p>All chemical data reported under this rule shall be generated using “sufficiently sensitive” analytical methods approved under 40 <i>CFR</i> 136 (2018) or required under 40 <i>CFR</i> Chapter I, subchapter N or O (2018).</p> <p>An approved method is “sufficiently sensitive” when:</p> <ul style="list-style-type: none"> (a) The method ML is at or below the level of the applicable water quality criterion or the effluent limit established for the measured pollutant or pollutant parameter; or (b) The method ML is above the applicable water quality criterion or the effluent limit established, but the amount of the pollutant or pollutant parameter actually measured is high enough that the method detects and quantifies the level of the pollutant or pollutant parameter; or (c) Demonstration is made showing that the method used has the lowest ML of the approved methods for the measured pollutant or pollutant parameter in the sample/matrix being analyzed. (Documentation supporting this demonstration is to be submitted with reported data and shall include narrative justification for why the method chosen is believed to have the lowest ML of all approved methods identified in 40 <i>CFR</i> 136 (2018). The Director shall determine whether the submitted information demonstrates sufficient method sensitivity.) <p>When there is no analytical method that has been approved under 40 <i>CFR</i> 136 (2018) or required under 40 <i>CFR</i> Chapter I, subchapter N or O (2018), and a specific method is not otherwise required by the Director, the applicant may use any suitable method but shall provide a description of the method. When selecting a suitable method, factors such as a method’s precision, accuracy, or resolution must be considered when assessing the performance of the method.</p>	Point source discharge of pollutants as defined in 40 <i>CFR</i> 122.2 into surface water— applicable Point source discharge of radionuclides into surface water— relevant and appropriate	TDEC 0400-40-03-.05(8)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Target Risk Level for Recreation WQC	The 10 ⁻⁵ risk level is used for all carcinogenic pollutants.	Derivation of WQC for pollutants in surface water classified for Recreation use— applicable Derivation of WQC Equivalents for radionuclides in surface water classified for Recreation use— relevant and appropriate	TDEC 0400-40-03-.03(4)(j) Footnote c
Establishing effluent limits using a calculated numeric water quality criterion	Permitting authority must establish effluent limits using a calculated numeric water quality criterion for the pollutant which the permitting authority demonstrates will attain and maintain applicable narrative water quality criteria and will fully protect the designated use. Such criterion may be derived using an explicit State policy or regulation interpreting its narrative water quality criterion, supplemented with other relevant information which may include EPA’s Water Quality Standards Handbook, October 1983, risk assessment data, exposure data...and current EPA criteria documents. <i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the terms “permit” and “permittee” reflect regulatory language; in this remedial action, “permit” can generally be taken to mean the Record of Decision, and “permittee” to mean DOE.]</i>	Determination of effluent limits where a State has not established a water quality criterion for a specific pollutant— applicable Determination of effluent limits where a State has not established a water quality criterion for radionuclides— relevant and appropriate	40 <i>CFR</i> 122.44(d)(1)(vi)(A)
Operation and maintenance of treatment and control systems	Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the condition of this permit. This provision requires the operation of backup or auxiliary facilities or similar systems, which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit. <i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the terms “permit” and “permittee” reflect regulatory language; in this remedial action, “permit” can generally be taken to mean the Record of Decision, and “permittee” to mean DOE.]</i>	Point source discharge of pollutants as defined in 40 <i>CFR</i> 122.2 into surface water where treatment is used— applicable Point source discharge of radionuclides into surface water where treatment is used— relevant and appropriate	TDEC 0400-40-05-.07(2)(c)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Monitoring of effluent	<p>Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.</p> <p>Permittee shall take all reasonable steps to minimize any adverse impact to the waters of Tennessee resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the non-complying discharge.</p> <p><i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the terms “permit” and “permittee” reflect regulatory language; in this remedial action, “permit” can generally be taken to mean the Record of Decision, and “permittee” to mean DOE.]</i></p>	<p>Point source discharge of pollutants as defined in 40 <i>CFR</i> 122.2 into surface water—applicable</p> <p>Point source discharge of radionuclides into surface water—relevant and appropriate</p>	<p>TDEC 0400-40-05-.07(2)(h)</p> <p>TDEC 0400-40-05-.07(2)(q)</p>
Minimum monitoring requirements	<p>To assure compliance with permit limitations, requirements to monitor:</p> <p>(i) The mass (or other measurement specified in the permit) for each pollutant limited in the permit;</p> <p>(ii) The volume of effluent discharged from each outfall;</p> <p>(iii) Other measurements as appropriate including pollutants in internal waste streams under §122.45(i); pollutants in intake water for net limitations under §122.45(f); frequency, rate of discharge, etc., for non-continuous discharges under §122.45(e); pollutants subject to notification requirements under § 122.42(a); and pollutants in sewage sludge or other monitoring as specified in 40 <i>CFR</i> 503; or as determined to be necessary on a case-by-case basis pursuant to Sect. 405(d)(4) of the CWA.</p> <p><i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the terms “permit” and “permittee” reflect regulatory language; in this remedial action, “permit” can generally be taken to mean the Sampling and Analysis Plan, and “permittee” to mean DOE.]</i></p>	<p>Point source discharge of pollutants as defined in 40 <i>CFR</i> 122.2 into surface water—applicable</p> <p>Point source discharge of radionuclides into surface water—relevant and appropriate</p>	<p>40 <i>CFR</i> 122.44(i)(1) <i>Monitoring requirements</i></p>

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Waiver for monitoring certain pollutants under existing permit	<p>The Director may authorize a discharger subject to technology-based effluent limitations guidelines and standards in an NPDES permit to forego sampling of a pollutant found at 40 CFR Subchapter N of this chapter, if the discharger has demonstrated through sampling and other technical factors that the pollutant is not present in the discharge or is present only at background levels from intake water and without any increase in the pollutant due to activities of the discharger.</p> <p><i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the terms “permit” and “permittee” reflect regulatory language; in this remedial action, “permit” can generally be taken to mean the Record of Decision, and “permittee” to mean DOE.]</i></p>	Discharge of pollutants subject to TBELs in existing NPDES Permit— applicable	40 <i>CFR</i> 122.44(a)(2)(i) <i>Monitoring waivers for certain guideline-listed pollutants</i>
Monitoring parameter waiver demonstration	<p>Any request for this waiver must be submitted when applying for a reissued permit or modification of a reissued permit. The request must demonstrate through sampling or other technical information, including information generated during an earlier permit term that the pollutant is not present in the discharge or is present only at background levels from intake water and without any increase in the pollutant due to activities of the discharger.</p> <p><i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the terms “permit” and “permittee” reflect regulatory language; in this remedial action, “permit” can generally be taken to mean the Record of Decision, and “permittee” to mean DOE.]</i></p> <p>Any grant of the monitoring waiver must be included in the permit as an express permit condition and the reasons supporting the grant must be documented in the permit’s fact sheet or statement of basis.</p> <p><i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the terms “permit” and “permittee” reflect regulatory language; in this remedial action, “permit” can generally be taken to mean the Record of Decision, and “permittee” to mean DOE.]</i></p>	<p>Discharge of pollutants subject to TBELs in existing NPDES Permit—applicable</p> <p>Discharge of pollutants subject to TBELs in existing NPDES Permit—applicable</p>	<p>40 <i>CFR</i> 122.44(a)(2)(iii)</p> <p>40 <i>CFR</i> 122.44(a)(2)(iv)</p>
Development of effluent limitations	For new sources, technology-based effluent limitations shall require the greatest degree of effluent reduction achievable through application of the best available demonstrated control technology, which shall be new source performance standards, if available.	Discharges of pollutants as defined in 40 <i>CFR</i> 122.2 from “new sources”— applicable	TDEC 0400-40-05-.08(1)(b)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Development of effluent limitations (cont.)	<p>Toxic effluent limitations shall be based on consideration of the toxicity of the pollutant, its persistence, its degradability, the usual or potential presence of the affected organisms in any waters, the importance of the affective organisms, and the nature and extent of the effect of the toxic pollutant on such organisms.</p> <p>All effluent limitations or standards shall meet or exceed any minimum standards promulgated by the Administrator and currently effective under the Federal Water Pollution Control Act, P.L. 92-500 as amended or any subsequent applicable acts.</p> <p>All pollutants shall receive treatment or corrective action to insure compliance with effluent limitations established by the EPA pursuant to Sects. 301 and 302 and standards of performance for new sources pursuant to Sect. 306, effluent limitations and prohibitions and pretreatment standards pursuant to Sect. 307 of the Federal Water Pollution Control Act, P.L. 92-500 as amended; also to insure compliance with any approved water quality standard.</p>	<p>Discharge of toxic pollutants as defined in 40 <i>CFR</i> 122.2 into surface water—applicable</p> <p>Point source discharge of radionuclides into surface water—relevant and appropriate</p>	<p>TDEC 0400-40-05-.08(1)(d)</p> <p>TDEC 0400-40-05-.08(1)(f)</p> <p>TDEC 0400-40-05-.08(1)(g)</p>
Compliance Point for Discharge	<p>All permit effluent limitations, standards, and prohibitions shall be established for each outfall or discharge point of the permitted facility, except as otherwise provided for BMPs where limitations on effluent or internal waste streams are infeasible</p> <p><i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the term “permit” reflects regulatory language; in this remedial action, “permit” can generally be taken to mean the Record of Decision.]</i></p> <p>All permit effluent limitations, standards, and prohibitions shall be expressed as maximum daily and monthly average, unless impracticable.</p> <p><i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the term “permit” reflects regulatory language; in this remedial action, “permit” can generally be taken to mean the Record of Decision.]</i></p>	<p>Point source discharge of pollutants as defined in 40 <i>CFR</i> 122.2 into surface water—applicable</p> <p>Point source discharge of radionuclides into surface water—relevant and appropriate</p> <p>Continuous discharge of pollutants as defined in 40 <i>CFR</i> 122.2 into surface water—applicable</p> <p>Continuous discharge of radionuclides into surface water—relevant and appropriate</p>	<p>TDEC 0400-40-05-.08(1)(k)</p> <p>TDEC 0400-40-05-.08(1)(m)</p>

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Effluent Limitations for metals	<p>All permit effluent limitations, standards, or prohibitions for a metal shall be expressed as “total recoverable metal,” unless a promulgated effluent guideline specifies otherwise.</p> <p><i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the term “permit” reflects regulatory language; in this remedial action, “permit” can generally be taken to mean the Record of Decision.]</i></p>	<p>Point source discharge of pollutants as defined in 40 <i>CFR</i> 122.2 into surface water—applicable</p> <p>Point source discharge of radionuclides that are also metals into surface water—relevant and appropriate</p>	TDEC 0400-40-05-.08(1)(p)
Measurement of effluent standards	<p>Any discharge which is not a minor discharge or activity, or that contains a toxic pollutant for which an effluent standard has been established shall be monitored for the following:</p> <ul style="list-style-type: none"> • Flow (in million gal per day); and • Pollutants which are subject to reduction or elimination under the terms and conditions of the permit <p><i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the term “permit” reflects regulatory language; in this remedial action, “permit” can generally be taken to mean the Record of Decision. “Pollutant” in this requirement shall include all radionuclides for which an effluent limitation is established under this remedial action.]</i></p>	<p>Point source discharge of pollutants as defined in 40 <i>CFR</i> 122.2 into surface water—applicable</p> <p>Point source discharge of radionuclides into surface water—relevant and appropriate</p>	TDEC 0400-40-05-.08(1)(s)
Discharge of wastewater from RCRA hazardous waste landfills	<p>Except as provided in 40 <i>CFR</i> 125.30 through 125.32, any existing point source subject to this subpart must achieve the Effluent Limitations listed in the regulation for each regulated parameter⁶ which represent the application of BPT.</p>	<p>Discharge of wastewater⁷ from landfills subject to 40 <i>CFR</i> 264, from an “existing” source—applicable</p>	<p>40 <i>CFR</i> 445.11 <i>Effluent limitations attainable by the application of BPT.</i></p>

⁶Radionuclides are not on the list of *regulated parameters*.

⁷“*Landfill wastewater* means all wastewater associated with, or produced by, landfilling activities except for sanitary wastewater, non-contaminated stormwater, contaminated ground water, and wastewater from recovery pumping wells. Landfill wastewater includes, but is not limited to, leachate, gas collection condensate, drained free liquids, laboratory-derived wastewater, contaminated stormwater, and contact wash water from washing trucks, equipment, and railcar exteriors and surface areas that have come in direct contact with solid waste at the landfill facility.” 40 *CFR* 445.2(f). “Contaminated stormwater”, means stormwater that comes in direct contact with landfill wastes, the waste handling and treatment areas, or landfill wastewater as defined in paragraph (f) of this section. Some specific areas of a landfill that may produce contaminated stormwater include (but are not limited to): the open face of an active landfill with exposed waste (no cover added); the areas around wastewater treatment operations; trucks, equipment, or machinery that has been in direct contact with the waste; and waste dumping areas.” 40 *CFR* 445.2(b).

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
<p>Discharge of wastewater from RCRA hazardous waste landfills (cont.)</p>	<p>Except as provided in 40 <i>CFR</i> 125.30 through 125.32, any existing point source subject to this subpart must achieve the following effluent limitations, which represent the application of BAT: Limitations for ammonia (as N), a-terpineol, aniline, benzoic acid, naphthalene, p-cresol, phenol, pyridine, arsenic, chromium, and zinc are the same as the corresponding limitations specified in §445.11.</p> <p>Any new source subject to this subpart must achieve the following performance standards: Standards are the same as those specified in § 445.11.</p>	<p>Discharge of wastewater¹⁸ from landfills subject to 40 <i>CFR</i> Part 264, from a “new” source—applicable</p>	<p>40 <i>CFR</i> 445.13 <i>Effluent limitations representing the degree of effluent reduction attainable by the application of BAT.</i></p> <p>40 <i>CFR</i> 445.14 <i>New source performance standards</i></p>
<p>Establishing effluent limits for whole effluent toxicity</p>	<p>When determining whether a discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion above a narrative or numeric criteria within a State water quality standard, the permitting authority shall use procedures which account for existing controls on point and nonpoint sources of pollution, the variability of the pollutant or pollutant parameter in the effluent, the sensitivity of the species to toxicity testing (when evaluating whole effluent toxicity), and where appropriate, the dilution of the effluent in the receiving water.</p> <p><i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the term “permit” reflects regulatory language; in this remedial action, “permit” can generally be taken to mean the Record of Decision.]</i></p> <p>When the permitting authority determines, using the procedures in paragraph (d)(1)(ii) of this section, that a discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion above the numeric criterion for whole effluent toxicity, the permit must contain effluent limits for whole effluent toxicity.</p> <p><i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the term “permit” reflects regulatory language; in this remedial action, “permit” can generally be taken to mean the Record of Decision.]</i></p>	<p>Discharge of pollutant as defined under 122.2 or pollutant parameters that causes or has the reasonable potential to cause, or contributes to an excursion above any State water quality standard, including State narrative criteria for water quality – applicable</p> <p>Discharge of radionuclides that causes or has the reasonable potential to cause, or contributes to an excursion above any State water quality standard, including State narrative criteria for water quality – relevant and appropriate</p>	<p>40 <i>CFR</i> 122.44(d)(1)(ii)</p> <p>40 <i>CFR</i> 122.44(d)(1)(iv)</p>

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Establishing effluent limits for whole effluent toxicity (cont.)	<p>Except as provided in this subparagraph, when the permitting authority determines, using the procedures in paragraph (d)(1)(ii) of this section, toxicity testing data, or other information, that a discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion above a narrative criterion within an applicable State water quality standard, the permit must contain effluent limits for whole effluent toxicity. Limits on whole effluent toxicity are not necessary where the permitting authority demonstrates in the fact sheet or statement of basis of the NPDES permit, using the procedures in paragraph (d)(1)(ii) of this section, that chemical-specific limits for the effluent are sufficient to attain and maintain applicable numeric and narrative State water quality standards.</p> <p><i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the term “permit” reflects regulatory language; in this remedial action, “permit” can generally be taken to mean the Record of Decision.]</i></p>		40 <i>CFR</i> 122.44(d)(1)(v)
Discharge into surface waters	For industrial discharges without applicable federal effluent guidelines, best professional judgment should be employed to determine appropriate effluent limitations and standards.	Point source discharge of pollutants into surface water — applicable	TDEC 0400-40-05-.09(1)(b)
Discharge to a surface water not meeting water quality standards	<p>No permit may be issued: (i) To a new source or a new discharger, if the discharge from its construction or operation will cause or contribute to the violation of water quality standards. The owner or operator of a new source or new discharger proposing to discharge into a water segment which does not meet applicable water quality standards or is not expected to meet those standards even after the application of the effluent limitations required by Sects. 301(b)(1)(A) and 301(b)(1)(B) of CWA, and for which the State or interstate agency has performed a pollutants load allocation for the pollutant to be discharged, must demonstrate that:</p> <ol style="list-style-type: none"> (1) There are sufficient remaining pollutant load allocations to allow for the discharge; and (2) The existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards. The Director may waive the submission of information by the new source or new discharger required by paragraph (i) of this section if the Director determines that the Director already has adequate information to evaluate the request. <p><i>[NOTE: DOE is not required to obtain a permit for any part of a remedial action conducted entirely onsite, per CERCLA §121(e). Use of the term “permit” reflects regulatory language; in this remedial action, “permit” can generally be taken to mean the Record of Decision. “Pollutant” in this requirement shall include all radionuclides for which an effluent limitation is established under this remedial action.]</i></p>	Point source discharge of pollutants into surface water — applicable	40 <i>CFR</i> 122.4(i)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Radionuclide releases in effluents; protection of the public	Operations involving releases of radioactivity in effluents from the land disposal facility shall be governed by the 25/75/25 mrem/year dose limits in 10 <i>CFR</i> 61.41.	The operation of radioactive waste land disposal facilities— relevant and appropriate	TDEC 0400-20-11-.16(4) 10 <i>CFR</i> 61.43
Non-continuous batch discharges (those discharges which are not continuous as defined in 40 <i>CFR</i> 122.2) of landfill wastewater	Non-continuous discharges shall be particularly described and limited, considering the following factors, as appropriate: <ul style="list-style-type: none"> • 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 Point source discharge of radionuclides into surface water— relevant and appropriate	40 <i>CFR</i> 122.45(e)
Temporary bypass of waste stream	Bypass is prohibited unless: <ul style="list-style-type: none"> • 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. <p>A bypass that does not cause effluent limitations to be exceeded may be allowed only if bypass is necessary for essential maintenance to assure efficient operation.</p>	Bypass, as defined in TDEC 0400-40-05-.02(15), of waste stream— applicable Bypass, as defined in TDEC 0400-40-05-.02(15), of waste stream— relevant and appropriate to radionuclides	TDEC 0400-40-05-.07(2)(l) TDEC 0400-40-05-.07(2)(m)
LLW Treatment and Storage Facility Design	Low-level waste systems and components shall be designed to maintain waste confinement. Areas in new and modifications to existing low-level waste management facilities that are subject to contamination with radioactive or other hazardous materials shall be designed to facilitate decontamination. Engineering controls shall be incorporated in the design and engineering of low-level waste treatment and storage facilities to provide volume inventory data and to prevent spills, leaks, and overflows from tanks or confinement systems. Monitoring and/or leak detection capabilities shall be incorporated in the design and engineering of low-level waste treatment and storage facilities to provide rapid identification of failed confinement and/or other abnormal conditions.	Construction of a LLW treatment or storage facility - TBC	DOE M 435.1-1 (IV)M.(2)(a) DOE M 435.1-1 (IV)M.(2)(c) DOE M 435.1-1 (IV)M.(2)(d) DOE M 435.1-1 (IV)M.(2)(e)

Table A.3. Action-specific applicable or relevant and appropriate requirements for selected alternative (cont.)

Action	Requirements	Prerequisite	Citation
Management of water generated from EMDF landfill	Onsite wastewater treatment units that are part of a wastewater treatment facility subject to regulation under Sect. 402 or Sect. 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.	Onsite wastewater treatment units subject to regulation under §402 or §307(b) of the CWA— applicable if water is determined to be hazardous	40 <i>CFR</i> 264.1(g)(6) 40 <i>CFR</i> 260.10 40 <i>CFR</i> 270.1(c)(2)(v) TDEC 0400-12-01-.06(1)(b)(2)(v) TDEC 0400-12-01-.01(2)(a) TDEC 0400-12-01-.07(1)(b)(4)(iv)
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 TDEC 0400-12-01-.10(3)(a) 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 TDEC 0400-12-01-.10— applicable if water is determined to be hazardous	40 <i>CFR</i> 268.1(c)(4)(i) TDEC 0400-12-01-.10(1)(a)(3)(iv)(I)

ACM = asbestos-containing material

ANOVA = analysis of variance

ARAP = aquatic resource alteration permit

BAT = best available technology economically

BMP = best management practice

BPT = best practicable control technology

CERCLA = Comprehensive Environmental Response, Compensation and Liability Act of 1980

CFR = Code of Federal Regulations

CWA = Clean Water Act of 1972

DEACT = deactivation

DOE = U.S. Department of Energy

DOE M = U.S. Department of Energy Manual

DOT = U.S. Department of Transportation

DRH = Tennessee Division of Radiological Health

EMDF = Environmental Management Disposal Facility

EPA = U.S. Environmental Protection Agency

HMR = Hazardous Materials Regulations

LDS = leak detection system

LLW = low level (radioactive) waste

ML = minimum level

No. = number

NPDES = National Pollutant Discharge Elimination System

PCB = polychlorinated biphenyl

PPE = personal protective equipment

PQL = practical quantitation limit

RCRA = Resource Conservation and Recovery Act of 1976

TBEL = technology-based effluent limit

TBC = to-be-considered (guidance)

TCA = Tennessee Code Annotated

TDEC = Tennessee Department of Environment and Conservation

TSCA = Toxic Substances Control Act of 1976

U.S. = United States

WQC = water quality criteria

WWTU = wastewater treatment unit

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