

**Fiscal Year 2015
Phased Construction Completion Report
for the Oak Ridge Reservation
Environmental Management Waste Management Facility**



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9/21/15
Date

DOE/OR/01-2683&D2

**Fiscal Year 2015
Phased Construction Completion Report
for the Oak Ridge Reservation
Environmental Management Waste Management Facility**

Date Issued—September 2015

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

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

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ACRONYMS

ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
AWQC	ambient water quality criteria
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
<i>CFR</i>	<i>Code of Federal Regulations</i>
D&D	decontamination and decommissioning
DAC	derived air concentration
DOE	U.S. Department of Energy
EMWMF	Environmental Management Waste Management Facility
EPA	U.S. Environmental Protection Agency
ETTP	East Tennessee Technology Park
FY	fiscal year
LCS	leachate collection system
LDS	leak detection system
LUCIP	Land Use Control Implementation Plan
NESHAP	National Emission Standards for Hazardous Air Pollutants
NT	North Tributary
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
PCCR	Phased Construction Completion Report
PEMS	Project Environmental Management System
PP	pneumatic piezometer
RDR	Remedial Design Report
RER	Remediation Effectiveness Report
ROD	Record of Decision
SMO	Sample Management Office
SOF	sum of fractions
TDEC	Tennessee Department of Environment and Conservation
VWSF	volume-weighted sum of fractions
WAC	waste acceptance criteria

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1. INTRODUCTION

The purpose of this Phased Construction Completion Report (PCCR) is to provide the fiscal year (FY) 2014 status of operations, land use controls, monitoring, capacity assurance, and closure for the Environmental Management Waste Management Facility (EMWMF) and to monitor the performance of EMWMF consistent with the applicable or relevant and appropriate requirements (ARARs). Since EMWMF is not discussed in the annual Remediation Effectiveness Report (RER) for the Oak Ridge Reservation (ORR), this PCCR is specific to EMWMF only.

Following is the outline for this PCCR:

- Chapter 1—Introduction
- Chapter 2—Project Description
- Chapter 3—Operations
- Chapter 4—Land Use Controls
- Chapter 5—Environmental Monitoring
- Chapter 6—Summary of Conclusions
- Chapter 7—References

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2. PROJECT DESCRIPTION

The *Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee* (ROD) (DOE/OR/01-1791&D3) presents the design, construction, operation, and closure of an on-site disposal facility (EMWMF) as the selected remedy for waste generated from Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup projects conducted on the ORR and associated sites. EMWMF is located in East Bear Creek Valley (Fig. 1) and provides for the permanent disposal of radioactive, hazardous, and mixed wastes from these cleanup projects. Individual remedial decisions for each CERCLA cleanup action will determine the type and amount of waste generated from that action.

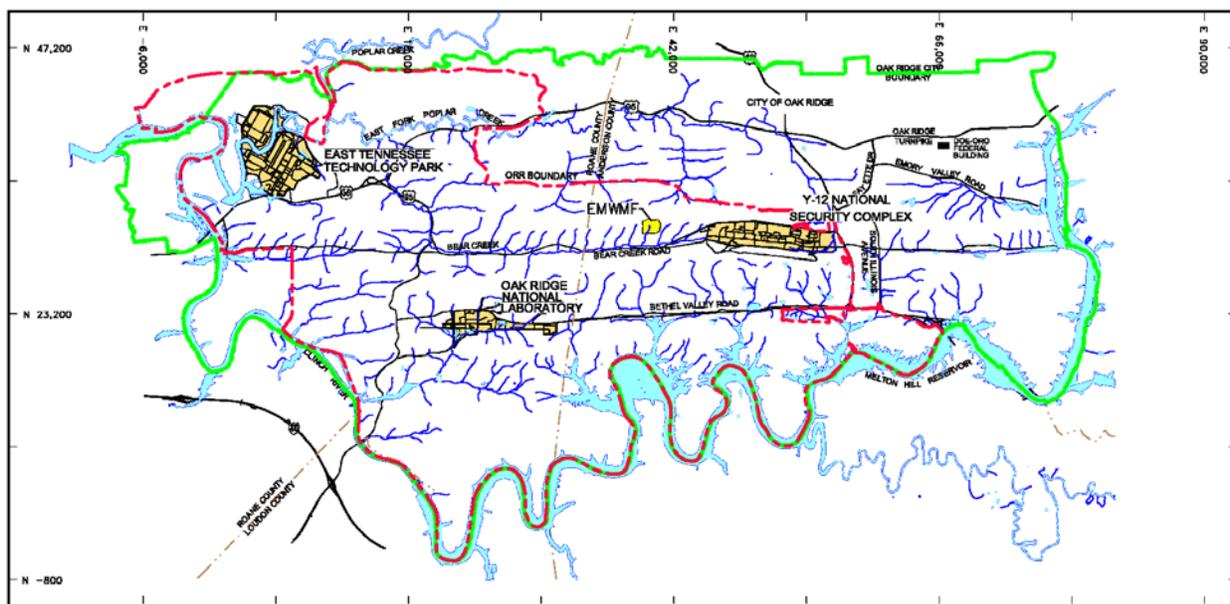


Fig. 1. Location of EMWMF.

The design of EMWMF discourages physical penetration, limits infiltration, and minimizes contaminant releases. Land use controls will discourage the current and future use of groundwater that may be impacted by releases.

The contaminants of concern for EMWMF were developed from the EMWMF WAC. The *Environmental Management Waste Management Facility (EMWMF) Environmental Monitoring Plan, Oak Ridge, Tennessee* (UCOR-4001) and the *Sampling and Analysis Plan/Quality Assurance Project Plan for Environmental Monitoring at the Environmental Management Waste Management Facility, Oak Ridge, Tennessee* (UCOR-4156/R2) contain the EMWMF contaminants of concern.

The ARARs for EMWMF are identified in the ROD (DOE/OR/01-1791&D3). The ARARs crosswalk indicates how the project complies with those ARARs applicable to operations. For the ARARs associated with design and construction and not associated with EMWMF Operations, the crosswalk indicates where those ARARs are addressed. This crosswalk is included as Appendix A.

The road map for the design, construction, expansion, waste acceptance, operations, performance assessment, and closure of EMWMF is illustrated in Fig. 2 and described in Table 1.

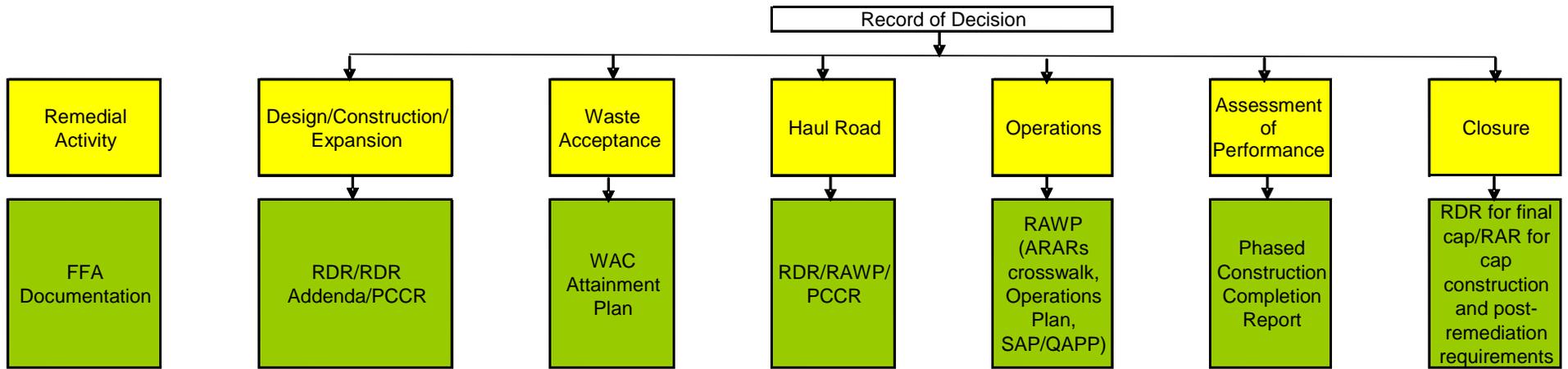


Fig. 2. Road map for EMWMF.

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ARARs = applicable or relevant and appropriate requirements
 FFA = *Federal Facility Agreement for the Oak Ridge Reservation (DOE/OR-1014)*
 PCCR = Phased Construction Completion Report
 QAPP = Quality Assurance Project Plan
 RAWP = Remedial Action Work Plan
 RAR = remedial action report
 RDR = remedial design report
 SAP = Sampling and Analysis Plan
 WAC = waste acceptance criteria

Table 1. Road map documentation

Record of Decision		
<i>Remedial Investigation/Feasibility Study for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste and Addendum</i>	DOE/OR/02-1637&D2 (January 1998); and DOE/OR/02-1637&D2/A1 (September 1998)	Describes the screening of alternatives, projected waste volumes and types, and waste acceptance criteria methodology and calculations, and Performance Objectives
<i>Proposed Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/02-1652&D1 (December 1998)	Includes the composite analysis used to meet the requirement of DOE O 435.1
<i>Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/01-1791&D3 (November 1999)	Describes the selected remedy for the disposal of waste generated from CERCLA cleanup activities performed by DOE on the ORR and associated sites
<i>Explanation of Significant Difference from the Remedy in the Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/01-1905&D2 (May 2001)	Adds classified waste to the description of waste approved for disposal in EMWMF
<i>Explanation of Significant Differences for the Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/01-2194&D2 (January 2005)	Adds a dedicated haul road for the transportation of waste from the East Tennessee Technology Park to EMWMF
<i>Explanation of Significant Differences for the Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/01-2426&D2/A5/R2 (May 2010)	Adds to the total volume capacity of the landfill by including Cell 6
Design, Construction, and Expansion		
<i>Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/01-1873&D2 (January 2001)	Describes the design, construction, expansion, and closure of EMWMF
<i>Addendum to the Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/01-1873&D2/A1/R2 (August 2002)	Describes the design to collect and control gas generated in EMWMF and revises the Environmental Monitoring Plan

Table 1. Road map documentation (cont.)

Design, Construction, and Expansion (cont.)		
<i>Addendum to the Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/01-1873&D2/A2 (November 2003)	Describes 60% design for expansion of Cells 3 and 4
<i>Addendum to the Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/01-1873&D2/A3 (May 2004)	Contains issued-for-construction design for expansion of Cells 3 and 4
<i>Addendum to the Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/01-1873&D2/A4/R2 (October 2006)	Contains 100% Technical Design Report for Cell 5
<i>Addendum to the Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/01-1873&D2/A5/R2 (August 2010)	Contains issued-for-construction Technical Design Report for Cell 5
<i>Addendum to the Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/01-1873&D2/A6 (June 2010)	Adds to the total volume capacity of the landfill by including Cell 6
<i>Modification of the Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/01-1873&D4 (January 2013)	Removes operations information
Waste Acceptance		
<i>Attainment Plan for Risk/Toxicity-Based Waste Acceptance Criteria</i>	DOE/OR/01-1909&D3 (October 2002)	Explains how EMWMF WAC are met
Haul Road		
<i>Remedial Design Report for the Construction of the East Tennessee Technology Park to Environmental Management Waste Management Facility (ETTP-EMWMF) Haul Road and Addendum</i>	DOE/OR/01-2228&D1 (May 2005); DOE/OR/01-2228&D1/A1 (September 2005)	Contains design of Haul Road

Table 1. Road map documentation (cont.)

Haul Road (cont.)		
<i>Modification of the Remedial Action Work Plan for the Operation of the East Tennessee Technology Park to Environmental Management Waste Management Facility (ETTP-EMWMF) Haul Road on the Oak Ridge Reservation</i>	DOE/OR/01-2220&D2 (December 2005)	Explains how Haul Road is to be constructed
<i>Phased Construction Completion Report for the Construction of the East Tennessee Technology Park to Environmental Management Waste Management Facility (ETTP-EMWMF) Haul Road on the Oak Ridge Reservation</i>	DOE/OR/01-2296&D1 (March 2006)	Documents construction of the Haul Road
Operations		
<i>Remedial Action Work Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/01-1874&D2 (January 2000)	Describes the project schedule, description of plans to be used during construction, operation, expansion, and closure, and how the ARARs are met
<i>Remedial Action Work Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste</i>	DOE/OR/01-1874&D4/R1 (February 2014)	Includes the updated operational information, e.g., ARARs crosswalk, <i>Environmental Management Waste Management Facility (EMWMF) Operations Plan, Oak Ridge, Tennessee</i> (UCOR-4135), and <i>Sampling and Analysis Plan/Quality Assurance Project Plan for Environmental Monitoring at the Environmental Management Waste Management Facility</i> (UCOR-4156), and outlines for the closure documentation, e.g., Remedial Design Report for the final cap and the Remedial Action Report for EMWMF
Phased Construction Completion Report		
<i>Fiscal Year 2013 Phased Construction Completion Report for the Disposal of Oak Ridge Reservation Environmental Management Waste Management Facility</i>	DOE/OR/01-2603&D2 (September 2013)	Describes the operational status, e.g., volume of waste received, water management, changes to implementing documents, enhancements, monitoring results, status of the volume-weighted sum of fractions, the projected date at which EMWMF will be full, a closure schedule, and confirmation that the performance objectives are being met
<i>Fiscal Year 2014 Phased Construction Completion Report for the Oak Ridge Reservation Environmental Management Waste Management Facility</i>	DOE/OR/01-2643&D2 (September 2014)	Describes the operational status, e.g., volume of waste received, water management, changes to implementing documents, enhancements, monitoring results,

Table 1. Road map documentation (cont.)

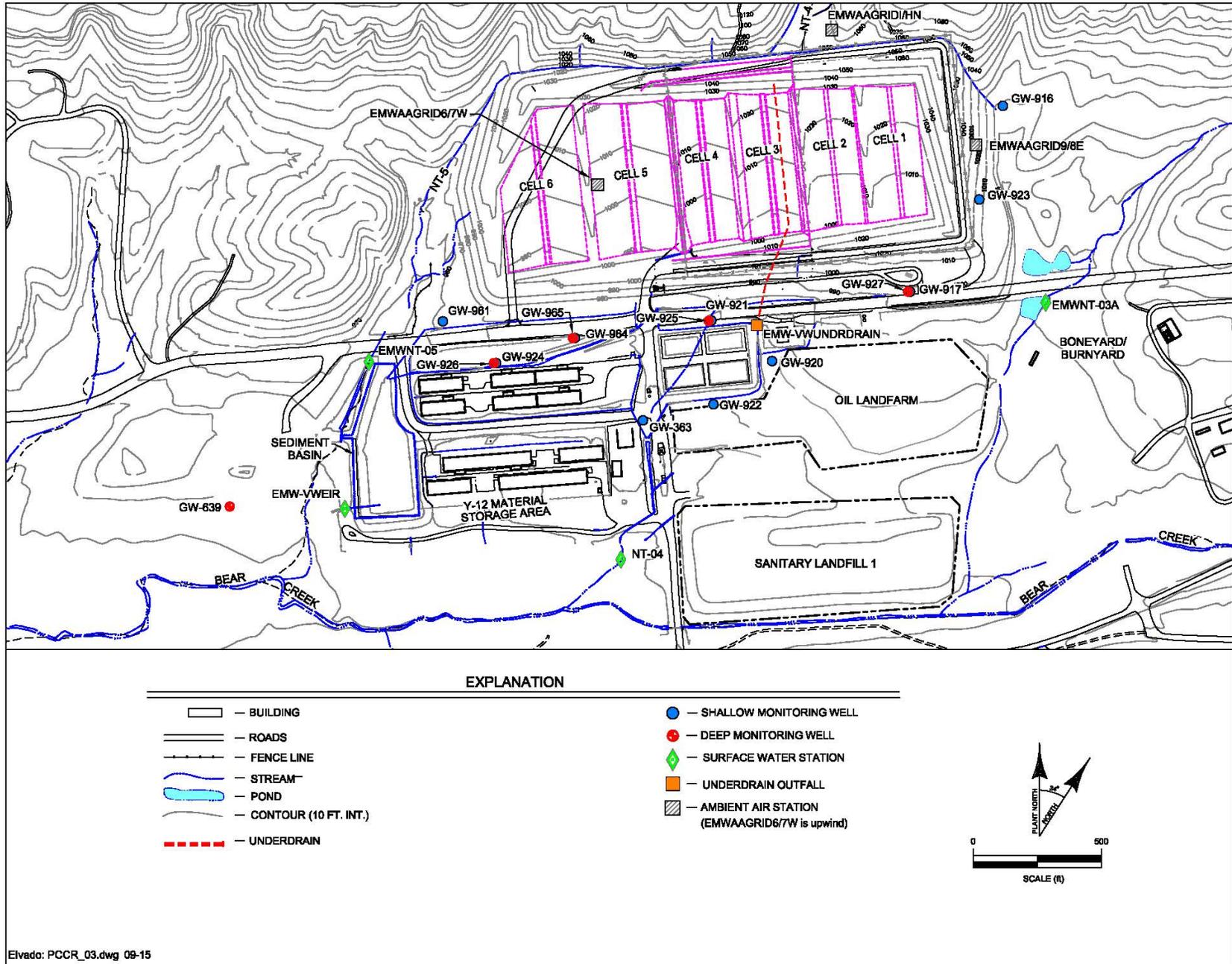
		status of the volume-weighted sum of fractions, the projected date at which EMWMF will be full, a closure schedule, and confirmation that the performance objectives are being met
Closure		
Remedial Design Report	None	Will include the final closure design to update and finalize the existing design in the <i>Remedial Design Report</i> , DOE/OR/01-1873&D2 (January 2001).
Remedial Action Report	None	Will document operations, closure, and post-closure land use controls and monitoring

3. OPERATIONS

3.1 INTRODUCTION

EMWWMF currently consists of five active disposal cells and a sixth cell ready for operational use (Fig. 3). Following is a discussion of:

- Waste disposed
- Waste forecast compared to capacity
- Proposed closure schedule
- Volume-weighted sum of fractions (VWSF)
- Airspace
- Water management
- Enhancements
- Unexpected incidents
- Cell status
- Implementing documents
- Changes from past operational practices
- Findings from 5-year review
- Conclusions, issues, and recommendations



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Fig. 3. Layout of EMWMF.

3.2 WASTE DISPOSED

The amount of waste disposed at EMWMF is summarized by FY in Table 2. Table 3 describes the waste disposed at EMWMF by waste lot in FY2014. The following terms are important for understanding the waste disposed and waste forecast discussions in subsequent sections:

- “As-generated” volume is an estimate of waste volume based upon the excavated volume of soil and sediment and demolished volume of building debris. It is substantially equivalent to the volume expected to be shipped and includes the highest amount of void spaces for all wastes. The “as-generated” volume is used for the waste forecast.
- “As-disposed” volume is an estimate of volume of waste after disposal in the EMWMF, at which point debris wastes, waste suitable for use as fill, and clean fill have been mixed and processed to meet compaction and void space mitigation requirements. It includes the least amount of void space of the estimates and is physically equivalent to the civil survey results taken quarterly to estimate EMWMF airspace utilized to date. The “as-disposed” volume is used for the waste disposed discussion.

Table 2. Fiscal year and cumulative waste receipts at EMWMF

Fiscal year	As-disposed volume (yd³)
FY2002	60,604
FY2003	42,397
FY2004	38,259
FY2005	38,976
FY2006	81,556
FY2007	53,590
FY2008	42,999
FY2009	89,690
FY2010	130,530
FY2011	116,570
FY2012	94,632
FY2013	33,908
FY2014	29,238
Cumulative totals	852,949

Table 3. Waste disposed at EMWMF in FY2014

Waste lot	Project name	As-disposed volume received (yd³)
6.4	Hazardous Material Abatement at K-27 Units 402-8 and 402-9	14
6.58	K-25 Building East Side/North End Non-Techneium-99 Converters	363
6.59	K-25/27 D&D, East Wing and North End Low-Risk Compressors	132
6.71	K-25 East Wing Purge Cascade Exterior Transite	5
6.72	K-25/27 D&D, K-25 Building Post Mined Surge Tanks	21
6.997	K-25/27 D&D, K-25 East Wing Purge Cascade Proxy Waste Lot Profile	19,138
6.998	K-25/27 D&D, East Wing and North End Proxy Waste Lot Profile	8,993
6.999	K-25/27 D&D, West Wing Proxy Waste Lot	2
62.5	Demolition Debris from Poplar Creek Bldgs. K-1231 and K-1233	1
78.2	Building K-31 Exterior Asbestos Containing Materials	313
89.1	MSRE Debris	7
207.1	ORNL 3026 Hot Cells D&D	7
301.4	Y-12 Bldg. 9201-5 Legacy Material Removal – First and Third Floor Be areas and Bldg. 9204-4 Basement and First Floor	16
501.1	Sludge Test Area Soil and Debris at the TRU Waste Processing Center	193
997.1	ETTP Low-Risk/Low-Complexity Material	33
Totals		29,238

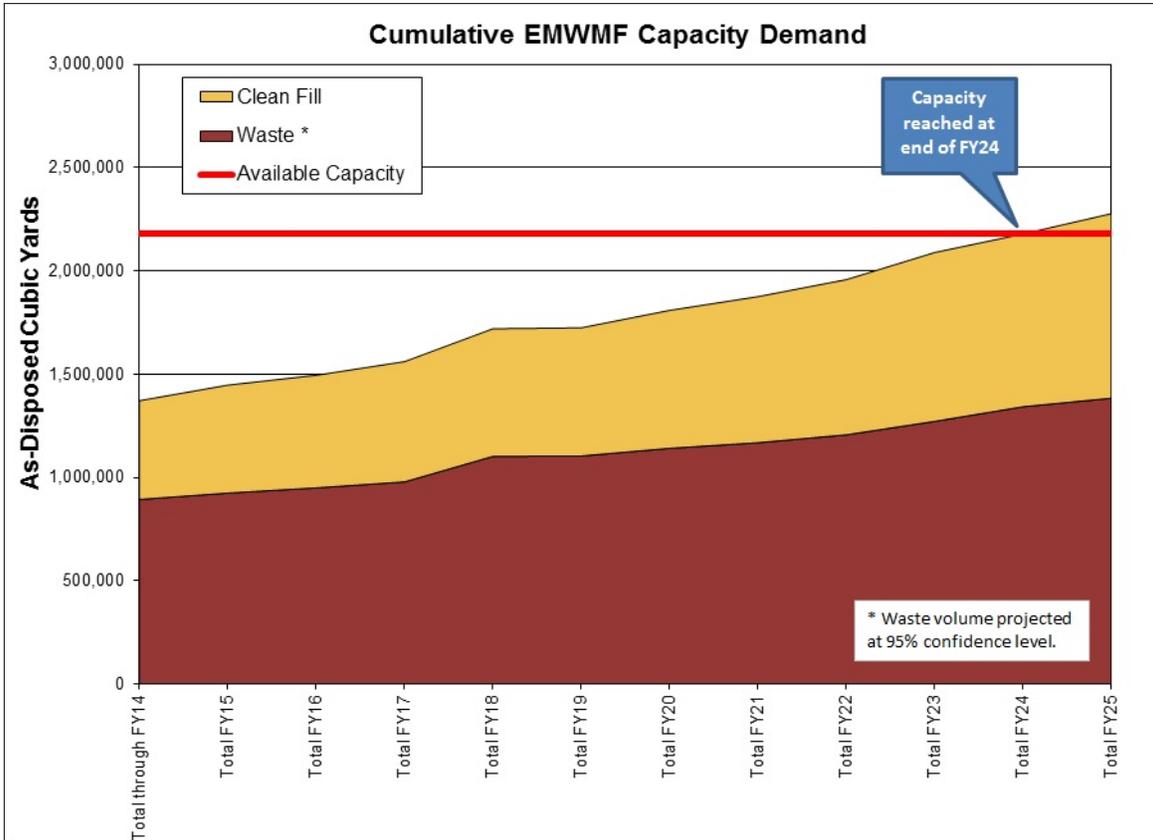
Be = beryllium
D&D = decontamination and decommissioning
ETTP = East Tennessee Technology Park
MSRE = Molten Salt Reactor Experiment
ORNL = Oak Ridge National Laboratory
TRU = transuranic
Y-12 = Y-12 National Security Complex

3.3 WASTE FORECAST COMPARED TO CAPACITY

The new capacity demand estimate for EMWMF (including past disposed volumes plus future estimates of disposed volumes through 2043, but not including uncertainty) is 3.7 million yd³. This represents a 9% decrease from the *Fiscal Year 2014 Phased Construction Completion Report for the Oak Ridge Reservation Environmental Management Waste Management Facility* (DOE/OR/01-2643&D2). The 9% decrease in waste volume is due to a forecast change, reducing the calculated volume of clean fill needed for waste disposal. The future estimates for waste volume are based on the “as-generated” volume.

As stated in the Remedial Investigation/Feasibility Study for Comprehensive Environmental Response, Cleanup, and Liability Act Oak Ridge Reservation Waste Disposal, Oak Ridge, Tennessee (DOE/OR/01-2535&D3), the uncertainty associated with the waste forecast is 25%. The capacity needed for disposal of future CERCLA waste depends on the as-generated waste volumes, the relative mix of debris waste and waste suitable for use as fill material (e.g., soil), the volume of clean fill needed for filling voids and for operational purposes, and the compaction of the combined materials. The optimum fill material is contaminated soil or soil-like material from a remediation project that can be mixed with the debris or be placed around or among containers. When contaminated fill is not available, clean fill must be used. Sequencing of waste soil and debris to take advantage of this optimization is carried out to the extent possible.

Figure 4 illustrates the waste disposed to date and the waste forecast compared to the capacity of EMWMF. Based on Fig. 4, EMWMF will be filled to capacity in FY2024. Plans are being made to complete remediation of ETTP by 2020, and this acceleration may result in reaching capacity much sooner. Budget uncertainty may not support this acceleration.



NOTE: Current forecast shows EMWMF capacity reached in 2024. D&D acceleration in conjunction with Vision 2016 and Vision 2020 is planned and could result in reaching capacity much sooner, but budget uncertainty may not support acceleration.

Fig. 4. EMWMF capacity forecast.

3.4 PROPOSED CLOSURE SCHEDULE

The dates for completion of operations and closure are based on assumed funding levels, pace of cleanup, sequence of cleanup, and quantity of generated waste. The current proposed schedule for completion of operations and closure of EMWMF is in Table 4. The finish date for each activity is expected to reflect the D1 document submittal date. This schedule assumes the new on-site waste disposal facility will be operational (April 2022) 18 months prior to disposal operations stopping at EMWMF (October 2024).

Table 4. Proposed closure schedule for EMWMF

Activity	Start	Finish
Prepare Remedial Design Work Plan to update and finalize the existing design in the <i>Remedial Design Report</i> , DOE/OR/01-1873&D2 (January 2001)	September 2021	August 2021
Procure design subcontractor	August 2021	February 2022
Prepare Remedial Design Report	February 2022	June 2023
Procure construction subcontractor/prepare pre-construction submittals	June 2023	October 2024
Stop disposal operation	October 2024	
Perform closure	October 2024	March 2026
DOE performance of the DOE O 435.1 closure performance assessment	October 2025	March 2026
Prepare Remedial Action Report	March 2026	February 2027

The closure activities include a Remedial Design Work Plan that will contain the design criteria and 30% design; a Remedial Design Report (RDR) D0 that will be a 60% design; an RDR D1 that will be a complete design; construction; and a Remedial Action Report that will document closure of EMWMF and list the post-closure requirements. The appropriate enforceable agreement milestones for closure will be established in accordance with the *Federal Facility Agreement for the Oak Ridge Reservation* (DOE/OR-1014).

3.5 VOLUME-WEIGHTED SUM OF FRACTIONS

When EMWMF is filled to capacity, the VWSF will be less than 1.0. The VWSF through FY2014 is 0.3, and it is forecast to be 0.6 (upper confidence limit - 90 = 0.7) when EMWMF is filled in FY2024 (Fig. 5).

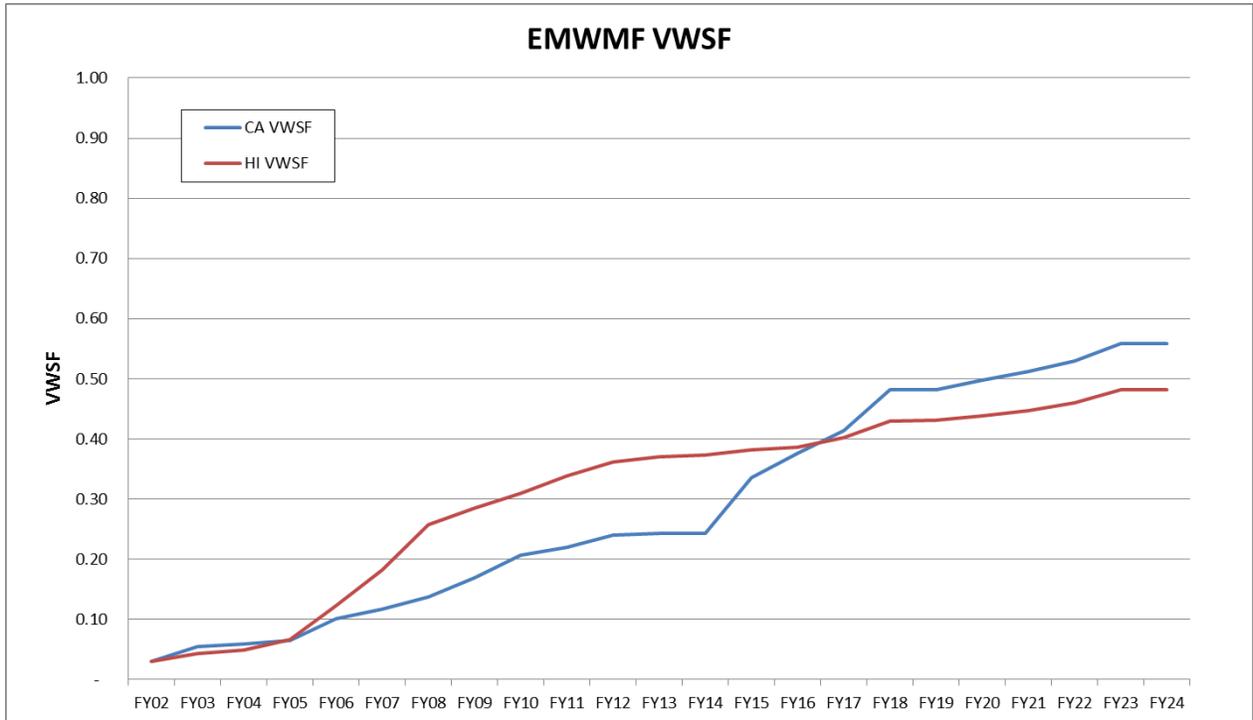


Fig. 5. EMWMF volume-weighted sum of fractions forecast.

3.6 AIRSPACE

In-cell civil surveys continued to be performed on a quarterly basis. Results of the civil surveys conducted near the end of FY2014 are summarized in Table 5.

**Table 5. Airspace at end of FY2014
(million yd³)**

Airspace constructed (6 cells)	Airspace used	Airspace remaining	% remaining
2.18	1.43	0.75	34

3.7 WATER MANAGEMENT

EMWFM Operations effectively managed over 13 million gal of leachate and contact water during FY2014. All contact water met release criteria and there were no exceedances. A water management summary is provided in Table 6.

Table 6. FY2014 contact water and leachate management (gal)

	Contact water	Leachate	Total
Generated	7,909,000	5,216,281	13,125,281*
Transported	0	5,090,056	5,090,056*
Discharged	9,760,500	0	9,760,500*

*Difference between the generated and shipped/disposed quantities take into account the "heel" that remains in each impoundment following discharge and the on-site volumes at the start and the end of the FY.

Leachate was transported via tanker to the Oak Ridge National Laboratory (ORNL) Liquid/Gaseous Waste Operations Facility for treatment and release.

Contact water was collected, analyzed, and released to the Sediment Basin after determining that it met the discharge limits specified in the *Environmental Management Waste Management Facility (EMWFM) Environmental Monitoring Plan, Oak Ridge, Tennessee* (UCOR-4001). No contact water had to be transported for treatment in FY2014.

The total water generated from the disposal cells in FY2014 was nearly 10 million gal less than in FY2013, with 98% of the decrease due to a significant reduction in contact water (Table 7).

Table 7. Comparison of FY2013 and FY2014 contact water and leachate quantities (gal)

	Contact water transferred from cells	Leachate shipped for treatment	Total
FY2013*	17,706,500	5,283,034	22,989,534
FY2014	7,909,000	5,090,056	13,125,281
Difference	-9,797,500	-192,978	-9,990,478

*Indicated data are from the *Fiscal Year 2014 Phased Construction Completion Report for the Oak Ridge Reservation Environmental Management Waste Management Facility* (DOE/OR-01-2643&D2).

The decrease in contact water is primarily due to a significant decrease (17.7 in.) in precipitation from FY2013 to FY2014. Leachate generation decreased only slightly because, with much of the cells covered with clay, the leachate fraction is primarily driven by the water in the Cell 5 catchment.

As shown in Fig. 6, the total amount of water generated in the disposal cells can vary significantly over time. This amount is primarily a function of the amount of precipitation and the watershed area (i.e., areas not under the enhanced operational cover).

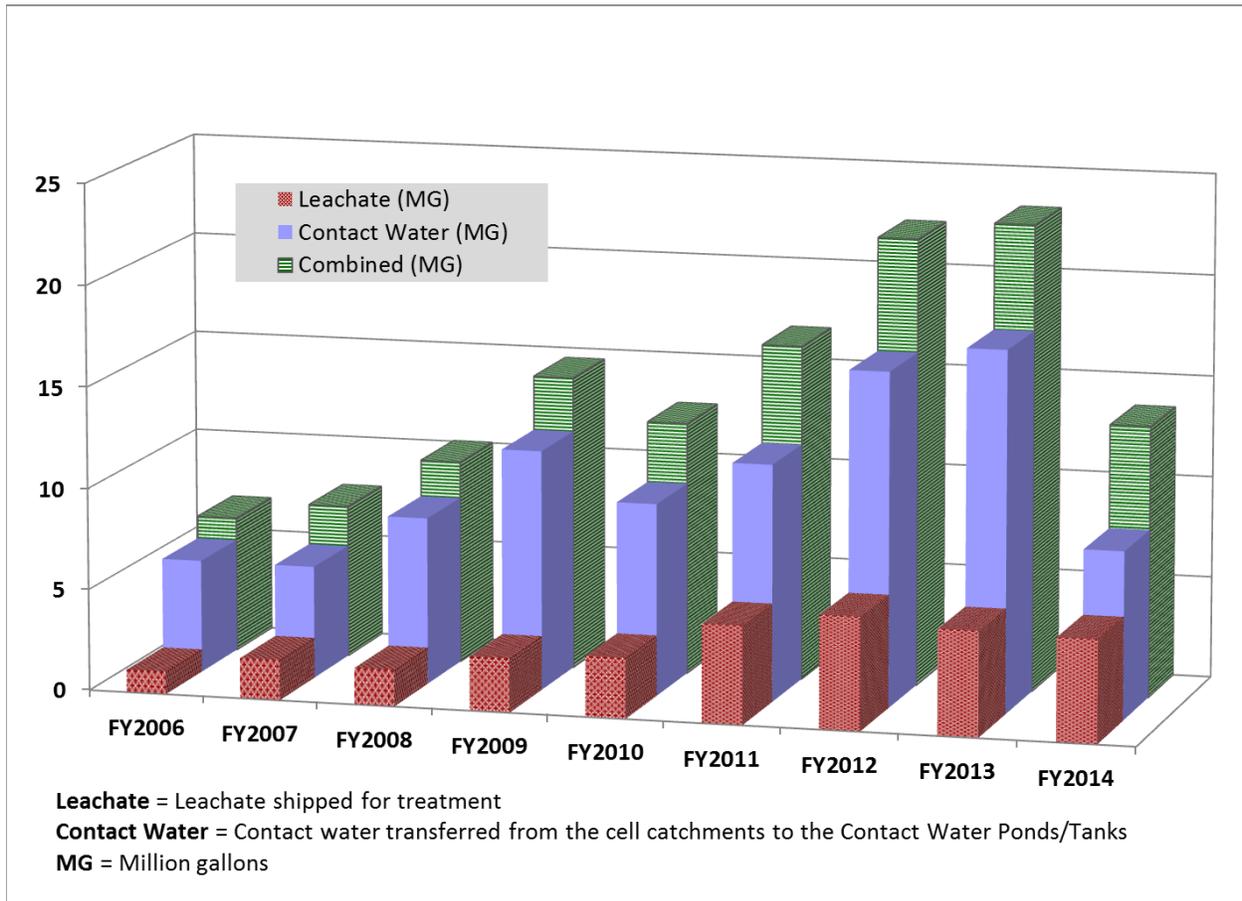


Fig. 6. Leachate and contact water generated per FY.

The distribution between leachate and contact water also changes over time, depending on multiple factors:

- **Precipitation**
 - Amount of precipitation
 - Intensity of individual precipitation events
 - Seasonal distribution
- **Evaporation**
- **Waste characteristics**
 - Permeability of the waste matrix
 - Amount of clay near the surface of the waste

- Waste placement
 - Slope
 - Distance of travel before water either infiltrates the waste or reaches the catchment
 - Number of cells open for waste disposal
- Extent of the enhanced operational cover
- In-cell catchments
 - Amount of water within the catchments
 - Footprint of the catchment area, which affects the depth of water in the catchment
 - Residence time of contact water within the catchments (Depends of available storage space in the Contact Water Ponds and Contact Water Tanks)

3.8 ENHANCEMENTS

3.8.1 Enhanced Operational Cover

Another 3.9 acres of enhanced operational cover was completed over the disposal cells during FY2014, but stormwater runoff did not begin shedding from this area to outside the cells. Of the 3.9 acres, plastic sheeting was placed over about 3 acres, leaving about 0.9 acres awaiting the plastic sheeting for additional protection of the clay. The total area covered with the enhanced operational cover and shedding clean stormwater to outside the cells remained at 5.28 acres.

Down drain DD-19 was installed to allow draining clean stormwater runoff from the northern slopes of Cells 1–3 to the ditch north of the cells that leads to North Tributary (NT)-5. Until DD-19 is opened, runoff from the northern slopes of Cells 1–3 will continue along its existing path to the Cell 5 catchment. When DD-19 is opened, clean stormwater runoff from this area will be routed to North Tributary (NT)-5. The reason for changing the routing is to implement the enhanced operational cover strategy (i.e., divert clean stormwater runoff out of the cells, thus minimizing the amount of contact water and leachate generated).

The ditch north of the cells that leads to NT-5 is designed and armored appropriately to handle this stormwater flow without causing erosion and sediment control issues. Design details are in the *Remedial Design Report for Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 Waste, Oak Ridge, Tennessee (DOE/OR/01-1873&D2)*.

Clean stormwater runoff from the covered area is expected to be diverted out of the cells in January 2015.

3.8.2 Transite Reused to Armor the Catchment Floor

EMWMF reused transite from the demolition of various process buildings at the East Tennessee Technology Park (ETTP) as armor over the waste cell liner. The transite acts as a protective barrier, preventing waste from damaging the underlying cell liner system. This reuse eliminated the need for extensive and costly radiological surveys at the decontamination and demolition site, saved space at the ORR Landfill, and eliminated the need for 2000 tons of rip-rap.

Handling of the transite was consistent with EMWMF waste placement objectives and practices, including TSCA requirements to prevent exposure to friable asbestos. The transite was packaged at the

demolition site to meet established regulatory requirements (e.g., wrapped in plastic, labelled, etc.) as well as EMWMF Physical WAC (e.g., stacked and secured to pallets within stipulated weight and size limits, configured to allow lifting without puncturing the plastic wrapping, and loaded onto flatbeds to facilitate unloading). The packages were individually off-loaded at EMWMF in accordance with approved work control documents and carefully placed in the designated area in a tight configuration. Any gaps between packages were infilled with riprap. Air sampling by industrial hygienists at the point of disposal (EMWMF) included personnel breathing zone monitoring, as well as ambient air at the boundary of the disposal area. Personnel sampling was performed on employees with the highest potential for exposure. Personnel sampling results were all below the administrative action limit of 0.04 fibers/cc for a 10-hour day for asbestos fibers. Area samples were all below the EPA NESHAP limit of 0.01 fibers/cc.

3.8.3 Leachate Sample Port

During negotiations for changes to UCOR-4156/R2, the Tennessee Department of Environment and Conservation (TDEC) and the U.S. Environmental Protection Agency (EPA) requested that leachate samples be collected as the flow leaves each disposal cell—a prohibitively difficult and costly task. An alternative was proposed and accepted to sample from a port installed where the line enters the Leachate Tank Farm.

This change allows a single grab sample to be collected at an ergonomically placed port, rather than composite samples from eight locations that required walking over and around pipe congestion while carrying a 5-gal glass jar. Ergonomics are improved as the sampler will not have to kneel at multiple ports. With the eight original sample ports no longer operated, the potential for a valve failure or leak is diminished. Sampling time is reduced. Analytical costs are significantly reduced, in large part because the new sample port requires only one set of volatile organic compound samples, rather than the previous eight sets of three bottles each.

In addition to satisfying the regulators' concerns, this new sample location is safer, more efficient, and less costly, while providing quality analytical data.

3.8.4 Installation of TDEC Instrumentation in Piezometers

EMWMF staff worked with TDEC staff and provided access to allow instrumentation of seven monitoring wells in September 2014 as part of the TDEC Groundwater Parameter Measurement Instrumentation Plan. These data loggers will record temperature, conductivity, and pressure (water level) for up to 18 months.

3.8.5 Erosion and Sediment Control

EMWMF Operations supported a reservation-wide TDEC initiative in August 2014 to reduce sediment and color in Bear Creek. A manager for TDEC Water Pollution Control (Bob Alexander) visited EMWMF on August 5, 2014, and was very complimentary about the overall site appearance, noting a “remarkable improvement” since his visit in April 2011. Likewise, TDEC Oversight personnel (Robert Storms and Wes White) visited the site on August 6, 2014, and acknowledged that EMWMF is contributing very little sediment to the creek and complimented EMWMF Operations on the sediment control in place.

3.8.6 Process Improvements for Bldg. K-25 Purge Cascade Waste and Elevated Technetium-99 Levels

EMMWF Operations initiated several process improvements to deal with issues associated with the Bldg. K-25 Purge Cascade waste and elevated levels of technetium (Tc)-99. Improvements included:

- Placing waste in a “bowl” to eliminate runoff to the in-cell catchment and funnel the water toward the leachate collection system
- Halting waste placement when precipitation resulting in runoff was imminent or occurring
- Placing a minimum 6-in. layer of compacted clay over the Tc-99 waste on a daily basis
- Keeping active disposal area small and minimizing push paths
- Requiring plastic bed liners to reduce contamination of tailgate gaskets and surrounding area
- Requiring supersacks for waste with the highest levels of contamination
- Installing sorbent “pigs” in the truck beds prior to releasing the trucks
- Applying a non-stick spray on the tailgate gaskets prior to releasing the trucks
- Performing enhanced inbound and outbound radiological surveys of all trucks

These improvements helped contain the highly mobile Tc-99 and reduced the potential for external contamination on dump trucks, while promoting efficient, cost effective, waste management. Tc-99 in contact water and leachate remained less than 3.2% of the discharge limits specified in the *Environmental Management Waste Management Facility (EMWMF) Environmental Monitoring Plan, Oak Ridge, Tennessee* (UCOR-4001). VWEIR results remained consistent with those prior to receipt of this waste, with no change noted in VWEIR sum of fractions (SOF) data.

3.8.7 Process Improvements for Waste Transport Efficiency

EMWMF Operations initiated and championed efforts to help the Building K-25 Demolition Project increase payloads in the dump trucks:

- Evaluated the maximum allowable transport weights considering constraints required for bridges, Haul Road, EMWMF safety basis and design basis, truck capacities, etc.
- Tracked waste disposal on a basis of tons/day rather than shipments/day, which better reflects actual progress
- Shared metrics with the Building K-25 Demolition Project on a weekly basis to aid in waste shipment planning
- Co-transported Waste Lot 6.997 and 6.998 waste

These efforts significantly increased the amount of waste shipped per truck; thereby reducing the number of shipments, worker exposure/risk, fuel consumption, schedule, environmental risks, and costs.

3.8.8 Miscellaneous Enhancements

Other key enhancements in FY2014 included:

- Completed a major grouting campaign to fill voids associated with several waste containers and tanks in Cell 5
- Completed major repairs to the roofs of trailers 9983-HN, -HO, -HQ, and -HR
- Transferred two underutilized hydroseeders to the Paducah, Kentucky Environmental Management Program
- Installed a 6-in. diameter high density polyethylene pipeline from the Contact Water Ponds to the discharge ditch, allowing for a significantly higher discharge rate
- Installed astronomic timers for the three outdoor light systems that operate on timers to minimize the hours of use, thus saving energy, conserving the life of the bulbs, and improving safety

3.9 UNEXPECTED INCIDENTS

The following unexpected incidents occurred or were discovered in FY2014.

3.9.1 Action Leakage Rate Exceedances

Inflow into the leak detection system (LDS) was below the action leakage rate of 803 gal/day/cell for all cells in FY2014. LDS inflow exceeded the notification leakage rate of 206 gal/day/cell on two occasions in FY2014:

- Cell 5 averaged 261 gal/day for the 7-day reporting period ending December 31, 2013.
- Cell 5 averaged 229 gal/day for the 7-day reporting period ending January 8, 2014.

Both instances were related to periods of heavy rainfall.

40 CFR 264.301(c)(3)(v) (*Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, “Design and operating requirements”) is being met. However, when leachate generation increases suddenly during storm events with excessive precipitation, the volume of leachate generated may temporarily exceed available storage capacity. Response actions may include temporary closure of the leachate collection system (LCS) valves. To minimize the overall impact to the function of the LCS and the LDS, the valves are closed, based on the observed volumes of leachate collected in the LDS for each cell. This sequence minimizes the potential to increase the leakage rate measured in the LDS. The LCS drain valves are opened as soon as practical after the triggering rain event.

3.9.2 Closure of Leachate Collection System Valves

In response to increased leachate flow due to heavy precipitation, selected LCS valves were closed on three occasions in accordance with established procedures (Table 8).

Table 8. Closure of leachate collection system valves

Cell(s)	Date closed	Date fully opened
5	12/24/13	01/15/14
5	02/04/14	02/06/14
4 and 5	06/14/14	06/25/14

3.9.3 Elevated Tc-99 Levels in the Work Area

On Saturday, November 23, 2013, routine radiological exit surveys at EMWFM found elevated levels of Tc-99 on truck tires and in the disposal area. Waste disposal activities were promptly suspended and appropriate notifications were made. There were no injuries or personal contamination. Contamination was contained within the controlled areas. A recovery plan was developed to (1) restore the ability to receive waste using available trucks, (2) change tires and decontaminate trucks, and (3) implement additional process improvements. EMWFM, the Building K-25 Demolition Project, and the transportation subcontractor worked closely together to implement the recovery plan. Shipments resumed on Tuesday, December 3, 2013—only 4.5 business days after the initial suspension. Contaminated tires were removed and disposed from a total of 15 trucks. The most heavily contaminated truck, Truck #29, was decontaminated and the truck bed was disposed on May 22, 2014.

3.9.4 Loss of Ballast from Enhanced Operational Cover due to Winter Storm

Following a winter storm on February 12–13, 2014, the entire ballast system (e.g., sandbags, ropes, and anchor posts) for the enhanced operational cover slid down the southern slopes of Cells 1 and 2. The enhanced operational cover, including the synthetic membrane, remained intact. EMWFM Operations reinstalled most ropes and sandbags on Friday, February 14, 2014, to return the cover to a stable configuration. The ballast system was reconfigured to preclude recurrence. Timely discovery, careful recovery planning, and great teamwork kept an upset condition from becoming a problem.

3.10 CELL STATUS

As of the end of FY2014, the status of each disposal cell is illustrated in Fig. 7 and in the tables below.

Table 9. Status of waste disposal

Cell No.	1	2	3	4	5	6	Composite
Date active	05/28/02	11/04	02/06	04/14/10	08/22/11	Future ¹	05/28/02
Area (acres)	5.07	3.94	4.25	3.65	5.64	5.24	27.79 acres
% Filled	100	100	99	86	18	0	66

¹Cell 6 construction was completed and available for waste disposal as of August 2011. As a Best Management Practice, placing waste into Cell 6 is being deferred as long as practicable to minimize generation of contact water and leachate.

Table 10. Status of enhanced operational cover

Total area of active cells (Cells 1–5)	22.55 acres
Total watershed area contributing to contact water and leachate	17.27 acres (77%)
Area under enhanced operational cover and shedding water out of the landfill	5.28 acres (23%)

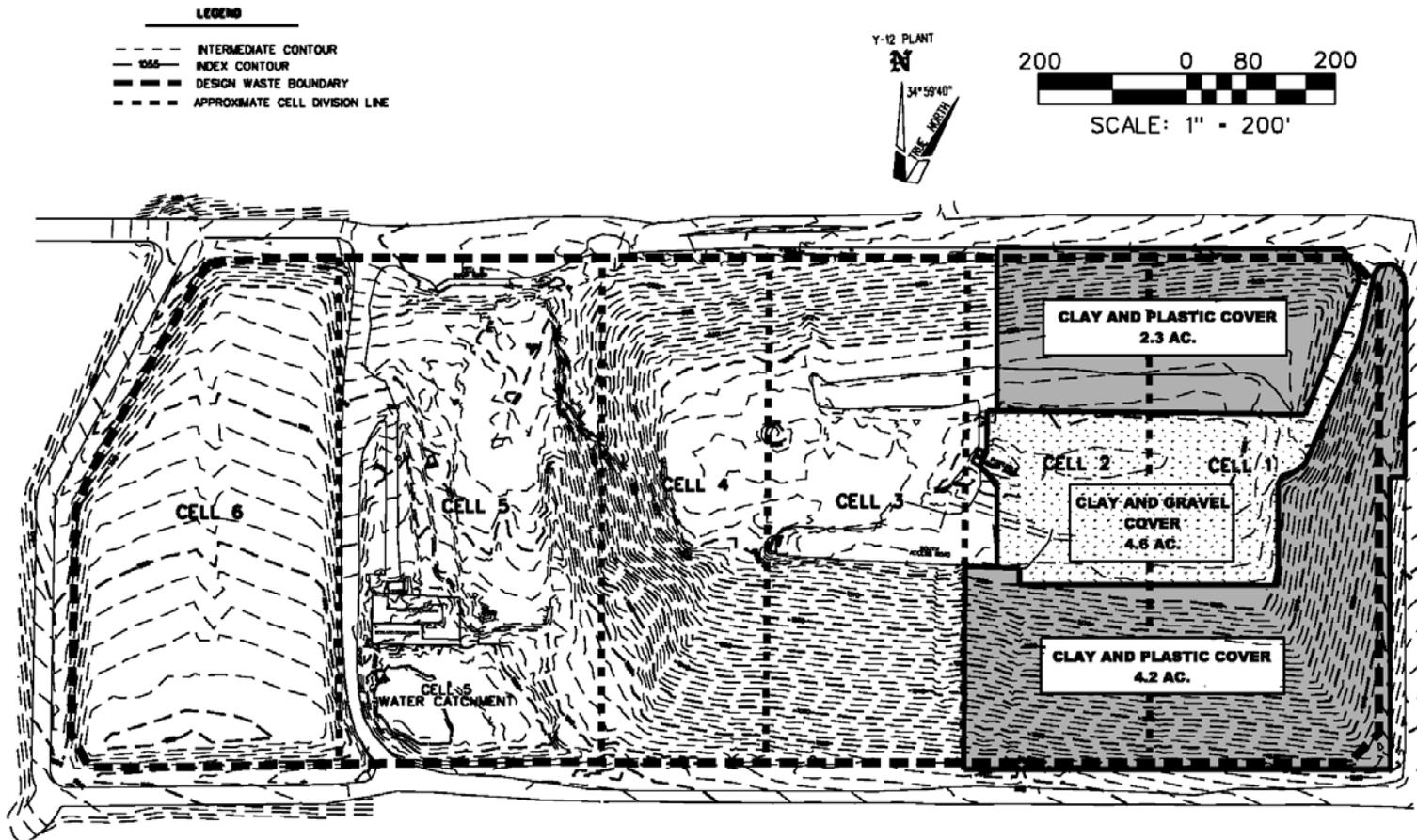


Fig. 7. Status of disposal cells at the end of FY2014.

(Note: The enhanced operational over is present over 11.1 acres, of which 5.28 acres shed clean stormwater runoff out of the cells.)

3.11 IMPLEMENTING DOCUMENTS

The *Environmental Management Waste Management Facility (EMWMF) Operations Plan, Oak Ridge, Tennessee* (UCOR-4135) describes the critical components required for safe, compliant, and efficient operation of EMWMF. However, the details of how EMWMF is operated are contained in implementing documents that are prepared, maintained, and approved by the operations staff. Examples of operational activities that are described in implementing documents are:

- Safety and health—to ensure the safety and health of workers
- Emergency management—to coordinate emergency response measures
- Radiation safety—to achieve doses to the public and workers as low as reasonably achievable (ALARA)
- Contingency planning—to plan for events such as fires, explosions, or sudden releases of hazardous waste, to minimize hazards to human health and the environment
- Pollution prevention/waste minimization—to reduce the volume of waste generated by EMWMF Operations
- Security—to ensure secure operations and the security of disposed material
- Compaction requirements and compaction testing—to promote stability and compensate for potential subsidence
- Erosion/sediment control—to ensure the facility and receiving water are not adversely impacted from erosion
- Training—to ensure personnel are adequately trained for their jobs
- Transportation—to maintain roads to support operations and maintenance without causing hazardous conditions, safety, or nuisance problems
- Equipment and facilities maintenance—to ensure equipment and facilities are maintained without causing environmental or human health hazard
- Inspection—to inspect for malfunctions, deterioration, operator errors, and discharges and to remedy any findings on a schedule that ensures no environmental or human health hazard
- EMWMF-generated waste—to store, package, transport, and dispose of waste generated by EMWMF Operations in a compliant manner

The compliance matrix that relates the ARARs to the implementing documents is in Appendix A. This compliance matrix demonstrates that EMWMF Operations are in compliance with ARARs. The implementing documents can be found at <https://regdocs.ettp.energy.gov> in the folder EMWMF Project Team: Implementing Documents.

3.12 CHANGES FROM PAST OPERATIONAL PRACTICES

3.12.1 Leachate Sample Port

As described in Sect. 3.8.3, a leachate sampling port was installed where the leachate line enters the Tank Farm. This change allows collecting a single grab sample, rather than a composite sample from each of the eight Leachate Storage Tanks.

3.12.2 Installation of TDEC Instrumentation in Piezometers

As described in Sect. 3.8.4, TDEC installed instrumentation in seven monitoring well/piezometers to record temperature, conductivity, and pressure (water level) for up to 18 months.

3.12.3 Process Improvements for Bldg. K-25 Purge Cascade Waste and Elevated Tc-99 Levels

As described in Sect. 3.8.6, EMWMF Operations implemented several changes to improve management of the Bldg. K-25 Purge Cascade waste and deal with elevated levels of Tc-99. These changes served to reduce cost, shorten the schedule, and reduce the environmental threat at ETTP. Key changes are summarized below.

- Conducted periodic 3D laser civil surveys of remaining waste piles at Bldg. K-25 to compare to the volume remaining in the disposal area and to accurately estimate the remaining number of shipments. Waste volume estimates at the generators' sites had previously been performed by the Projects.
- Rinsed all the Bldg. K-25 trucks and released them to the Hub.
- Installed sorbent "pigs" in the truck beds for the final round of the day.
- Applied a non-stick spray (e.g., Pam®) on the tailgate gaskets for the final round of the day. This task is normally performed by the demolition project during freezing conditions to allow the tailgate to open without damaging the gasket. EMWMF Operations began performing this task after offloading waste as a Best Management Practice in keeping with ALARA.
- Added additional outbound stations for decontamination and radiological surveys.

3.13 FINDINGS FROM FIVE-YEAR REVIEW

The *2011 Third Reservation-Wide CERCLA Five-Year Review for the U.S. Department of Energy Oak Ridge Reservation, Oak Ridge, Tennessee* (DOE/OR/01-2516&D2) determined EMWMF to "be protective of human health and the environment" and did not include any recommendations. However, embedded in the text were the following suggestions:

- Sporadic detections of metals, especially lead, are documented and should be evaluated to determine if the detections are legitimate and associated with EMWMF.

Current Status: These results are being evaluated as part of the EMWMF data evaluation effort. Results of the data evaluation, including updated background data, will be included in the upcoming, revised Sampling and Analysis Plan/Quality Assurance Plan for the EMWMF.

- ARARs associated with EMWMF have changed since the ROD was approved, and implementing documents have been revised to accommodate these changes, as appropriate, because the changes were not significant in terms of protectiveness. The ARARs should be revised to match up more easily with the implementing documents.

Current Status: The ARARs were evaluated as part of the recent Remedial Action Work Plan revision (DOE/OR/01-1874&D4/R1) and are being evaluated as part of the Focused Feasibility Study for the management of landfill water from EMWMF and the Environmental Management Disposal Facility. Following approval of the Focused Feasibility Study, the need to update and/or revise the ARARs will be determined.

- The EMWMF contaminants of concern have grown to a very large list of chemicals and radionuclides. Many of these contaminants have a low probability of migrating. Therefore, the

contaminants of concern list should be reviewed to identify those that should not be included in the monitoring protocol, and the process for adding contaminants of concern should be reevaluated. The presence of a new contaminant may not require a change in the contaminants of concern and require monitoring.

Current Status: The ongoing EMWMF data evaluation effort and the Focused Feasibility Study for the management of leachate and contact water include evaluations of the contaminants of concern.

3.14 CONCLUSIONS, ISSUES, AND RECOMMENDATIONS

The conclusions from this section are provided below. Issues and recommendations are summarized in Table 11.

Conclusions:

- 29,238 yd³ of waste was received and disposed safely and compliantly.
- EMWMF is projected to reach full volume capacity in FY2024, and the total waste demand has decreased 9% since FY2013 to a maximum volume of 3.7 million yds³. Decontamination and decommissioning (D&D) acceleration is planned and could result in reaching capacity much sooner, but budget uncertainty may not support this acceleration.
- Over 5 million gal of leachate was transported to the ORNL Liquid/Gaseous Waste Operations Facility for disposal.
- Over 9 million gal of contact water was discharged after determining that it met the discharge limits. No contact water exceeded discharge limits.
- The enhanced operational cover was expanded by 3.9 acres and sheds clean runoff out of the cells from 5.28 acres.
- Inflow into the LDS was below the action leakage rate of 803 gal/day/cell for all cells in FY2014. LDS inflow exceeded the notification leakage rate of 206 gal/day/cell on two occasions in FY2014.
- Several process improvements were initiated successfully to deal with issues associated with the Bldg. K-25 Purge Cascade waste and elevated levels of Tc-99.

Table 11. Operations issues and recommendations

Issue	Action/recommendation	Status	Target response date
The ARARs in the EMWMF ROD do not reflect current water management practices.	Resolve as part of the FFS for water management. Following approval of the FFS, the need to modify the ROD to revise the ARARs will be addressed.	ARARs will be included in the FFS for water management.	FY2015 in FFS and possibly revised EMWMF ROD
The EMWMF contaminants of concern have grown to a very large list of chemicals and radionuclides. Many of these contaminants have a low probability of migrating. Therefore, the contaminants of concern list should be reviewed to identify those that should not be included in the monitoring protocol, and the process for adding contaminants of concern should be reevaluated. The presence of a new contaminant may not require a change in the contaminants of concern and require monitoring.	Resolve as part of the data evaluation effort and incorporate into the revised Sampling and Analysis Plan.	These are being evaluated as part of the EMWMF data evaluation effort.	FY2015 in revised Sampling and Analysis Plan
The history of the number of exceedances of the Notification Leakage Rate and Action Leakage Rate is not contained in the PCCR to evaluate trends.	Include this information in future PCCRs so trends can be identified.	The appropriate method of including the information is being evaluated.	FY2016 PCCR
The PCCR does not demonstrate that closure of the leachate collection system valves meets 40 <i>CFR</i> 264.301(d)(3)(v).	Include this information in future PCCRs.	Closed. This is in the FY2015 PCCR.	FY2015 PCCR

ARARs = applicable or relevant and appropriate requirements
CFR = Code of Federal Regulations
EMWMF = Environmental Management Waste Management Facility
FFS = Focused Feasibility Study
FY = fiscal year
PCCR = Phased Construction Completion Report
ROD = record of decision

4. LAND USE CONTROLS

Since the remedy in the ROD leaves hazardous substances in place at levels above unrestricted use, land use controls are required to prevent receptors from encountering the residual hazard. This remedy is consistent with the end-use established for Bear Creek Valley in the *Record of Decision for the Phase 1 Activities in Bear Creek Valley at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee* (DOE/OR/01-1750&D4), and EMWMF is located in an industrial zone for current and future use. Land use controls will be maintained to ensure long-term protectiveness until they are deemed unnecessary.

Land use controls are briefly discussed in the ROD as part of the remedy, but the *Land Use Control Implementation Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee* (DOE/OR/01-1884&D2) (LUCIP) contains more detail. The LUCIP was an appendix to DOE/OR/01-1874&D2 and will be finalized in conjunction with the RDR for final closure and the Remedial Action Report documenting closure.

The objectives of land use controls for EMWMF before closure and the EMWMF site after closure are to:

- Prevent unauthorized excavation into EMWMF and the EMWMF site
- Restrict access to EMWMF and the EMWMF site by unauthorized personnel
- Preclude alternate use of the EMWMF site
- Prevent unauthorized use or access to groundwater under EMWMF and the EMWMF site

Table 12 provides the types of controls, purpose of controls, duration, implementation, and affected areas from the ROD.

The land use controls for EMWMF were in place and effective during FY2014.

Table 12. Land use controls for the EMWMF site

Type of control	Purposes of control	Duration	Implementation	Affected areas ^a
1. Property record restrictions ^b				
A. Land use B. Groundwater	Restrict use of property by imposing limitations. Prohibit use of groundwater.	Indefinitely	Drafted and implemented by DOE upon closure of EMWMF and/or transfer of affected areas. Recorded by DOE in accordance with state law at county Register of Deeds office.	EMWMF site
2. Property record notice ^c	Provide notice to anyone searching records about the existence and location of a hazardous waste landfill(s).	Indefinitely	Recorded by DOE in accordance with state law at county Register of Deeds office upon closure of EMWMF.	EMWMF site
3. Zoning notice ^d	Provide notice to city about the existence and location of hazardous waste landfill(s) for zoning/planning purposes.	Indefinitely	Survey plat of EMWMF site filed by DOE with City Planning Commission upon closure of EMWMF.	EMWMF site
4. Permits program ^e	Provide notice to developer (i.e., permit requester) on extent of contamination and prohibit or limit excavation/penetration activity.	As long as EMWMF and EMWMF site remains under DOE control	Implemented by DOE and its contractors. Provide permits program with contamination information upon completion of remedial actions. Initiated by permit request.	EMWMF and EMWMF site
5. Access controls ^f	Control and restrict access to workers/public to prevent unauthorized uses.	Indefinitely	Access control (fence and security personnel) to be established before EMWMF construction and maintained at EMWMF by DOE until closure. Fencing to be maintained by TDEC following EMWMF closure.	EMWMF and EMWMF site
6. Signs ^g	Provide notice or warning to prevent unauthorized access.	Indefinitely	Signage at EMWMF established before construction and maintained by DOE. Signage on ORR maintained by DOE. Additional signs to be determined by DOE following EMWMF closure and maintained by TDEC.	EMWMF At select locations throughout Bear Creek Valley EMWMF site
7. Security guards ^h	Control and monitor access by workers/public.	As long as EMWMF and EMWMF site remains under DOE control	Established and maintained by DOE. Necessity of patrols evaluated upon completion of remedial actions.	Patrol of EMWMF and EMWMF site

^aAffected areas – Specific locations of such areas to be further described or depicted in the Land Use Control Implementation Plan.

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

^cProperty record notice – Refers to any non-enforceable, purely informational document recorded, along with the original property acquisition records of DOE and its predecessor agencies, that alerts anyone searching property records to important information about residual contamination/waste disposal on the property.

^dZoning Notice – Includes information on the location of hazardous waste disposal areas depicted on a survey plat, which is provided to a zoning authority (i.e., City Planning Commission) for consideration in appropriate zoning decisions for non-DOE property.

^ePermits program – Refers to the internal DOE/DOE contractor administrative program(s) that require the permit requestor to obtain authorization, usually in the form of a permit, before beginning any excavation/penetration activity (e.g., well drilling) for the purpose of ensuring that the proposed activity will not affect underground utilities/structures, or in the case of contaminated soil or groundwater, will not disturb the affected area without the appropriate precautions and safeguards.

^fAccess controls - Barriers to entry.

^gSigns - Posted command, warning, or direction.

^hSecurity guards - EMWMF operator personnel. Additional DOE security guards will be posted during operations and periodically during post-closure period.

DOE = U.S. Department of Energy

EMWMF = Environmental Management Waste Management Facility

ORR = Oak Ridge Reservation

TDEC = Tennessee Department of Environment and Conservation

5. ENVIRONMENTAL MONITORING

5.1 INTRODUCTION

Environmental monitoring was performed in accordance with the *Environmental Management Waste Management Facility (EMWMF) Environmental Monitoring Plan* to demonstrate compliance with ARARs specified in the ROD and includes seasonal groundwater fluctuations in the uppermost aquifer beneath the site, groundwater, surface water, stormwater, contact water, leachate, Sediment Basin discharge, and ambient air. Post-closure monitoring will be addressed in the future as part of the Remedial Action Report. Environmental monitoring is performed, both for compliance with ARARs and as a Best Management Practice, to support operations.

This section:

- Describes the data verification, validation, assessment/acceptance, and management
- Describes the results of EMWMF baseline monitoring
- Evaluates the data obtained from groundwater detection monitoring
- Evaluates the data obtained from operations monitoring—groundwater levels, surface water, stormwater, contact water, leachate, Sediment Basin discharge, and ambient air monitoring data
- Summarizes conclusions, recommendations, and issues

5.1.1 Data Verification, Validation, Assessment/Acceptance, and Management.

The Sample Management Office (SMO) performed data verification on 100% of all laboratory analytical results. Verification involved the use of standardized review criteria to (1) ensure that the content and presentation of each laboratory data package met contract requirements and that the electronic data deliverables were consistent with hardcopy results; (2) verify that the field measurements and laboratory analytes specified for each sampling location were performed; (3) review the associated chain-of-custody information, analytical turnaround times, and sample holding times; and (4) resolve any discrepancies or inconsistencies between electronic and hardcopy data provided by each applicable analytical laboratory.

More than 10% of the FY2014 data underwent rigorous validation in accordance with SMO Analytical Support Level 3 guidelines and procedures. Based on the findings of Level 3 data validation and the professional judgment of the data validation personnel, analytical results for the applicable groundwater, surface water, and ambient air monitoring stations considered unusable were flagged with an “R” (unusable) data qualifier (in addition to any laboratory data qualifiers). Reason codes for validation data qualifiers are documented in the Project Environmental Measurements System (PEMS) database. Accordingly, the monitoring data are technically defensible and can withstand scientific validation, with data integrity documented through proper implementation of quality assurance/quality control measures as described in the *Quality Assurance Project Plan for the Water Resources Restoration Program, U.S. Department of Energy, Oak Ridge Reservation, Oak Ridge, Tennessee* (UCOR-4049) and SMO Analytical Support Level 3 guidelines and procedures.

In addition to the data validation, sampling results were assessed to systematically identify (1) false positive results for volatile organic compound and semi-volatile organic compounds, (2) results for radiological analytes that do not exceed both the minimum detectable activity and the associated total propagated uncertainty, (3) analytical results for duplicate samples that differ by an order of magnitude or more, and (4) sampling results that are inconsistent with historical measurements (suspected outliers) for each location.

Sampling and analysis data were maintained in the PEMS database. Qualified personnel initially pre-populated the PEMS database with relevant sampling information (e.g., sampling locations and laboratory analytes). As sampling activities progressed throughout the FY, associated field measurements and chain-of-custody information was manually added to the pre-populated PEMS database. The SMO-approved commercial laboratory that performed the required analyses was responsible for uploading the corresponding analytical results for each sampling location into the PEMS database. Hardcopy reports containing the analytical results were also submitted to the SMO. All verified and validated data (including data assessment qualifiers) were uploaded to the Oak Ridge Environmental Information System for long-term archival.

5.2 BASELINE GROUNDWATER MONITORING

The baseline groundwater monitoring sampling was performed during FY2002 per the ARAR §264.97(g), and the results were compiled in the *Baseline Groundwater Monitoring Report for the Environmental Management Waste Management Facility, Oak Ridge, Tennessee* (DOE/OR/01-2021&D3). Baseline monitoring involved 13 groundwater monitoring wells, with samples collected from each well on an approximate quarterly frequency between late March 2001 and the end of January 2002. Analytical results were used to calculate groundwater threshold values. The threshold values are considered representative of baseline conditions for the EMWMF Detection Monitoring Program and should not be exceeded under normal operation conditions of EMWMF. However, for most radionuclides, proxy values based on quantitation limits were used for threshold values. Review of baseline and monitoring data collected through September 2004 indicated the need to change threshold values designated for potassium and iodine-129, due to the variability of concentrations of these contaminants of concern across wells. The threshold values are contained in the *Environmental Monitoring Plan*.

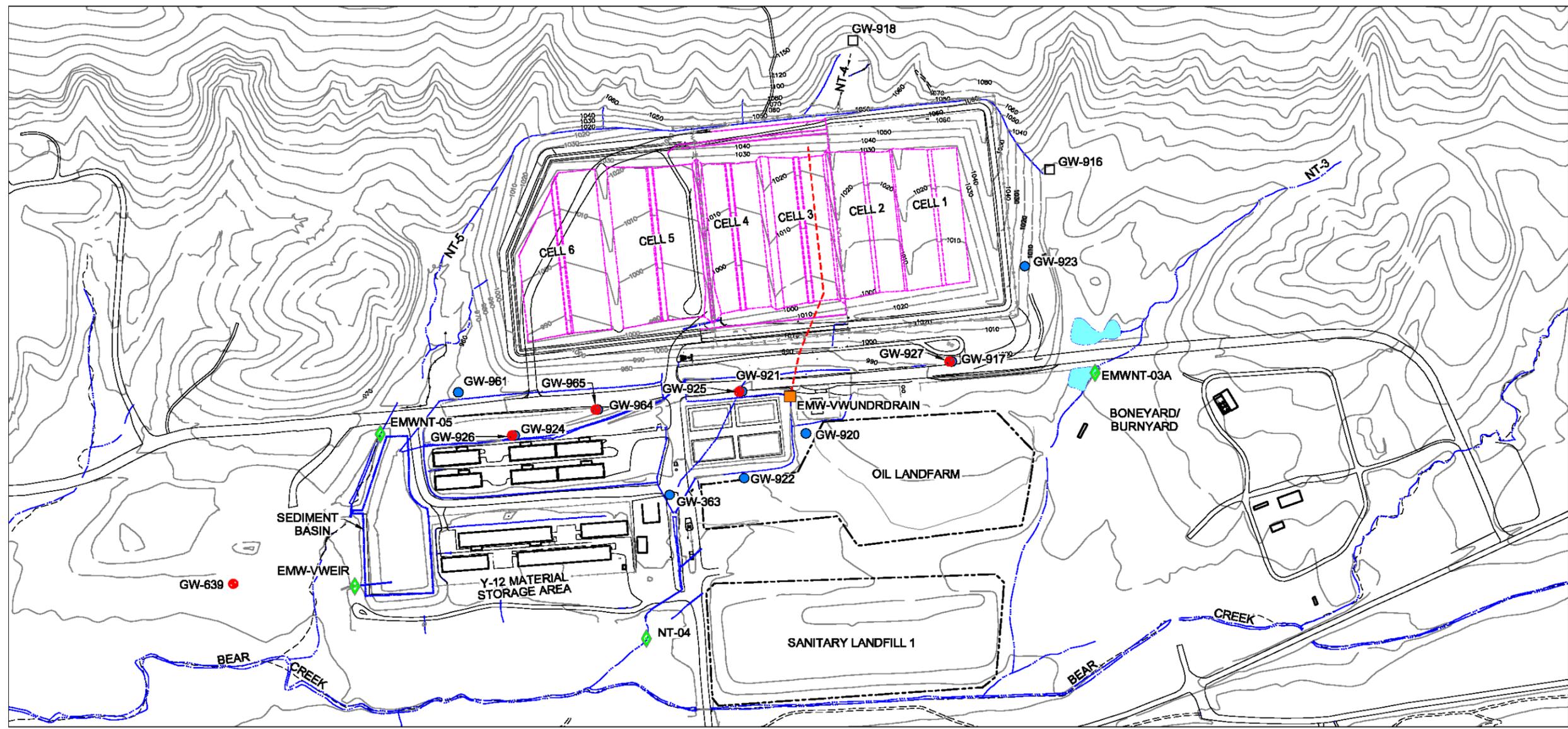
5.3 GROUNDWATER DETECTION MONITORING

5.3.1 Introduction

Groundwater detection monitoring is performed in accordance with the ARAR §264.98(a) to obtain groundwater data needed to determine if hazardous constituents derived from wastes disposed at EMWMF have entered the uppermost aquifer. Groundwater contamination is present in the vicinity of EMWMF as a result of historical operations at several of the adjacent waste disposal sites. The 2015 RER includes maps that illustrate the overall extent of the groundwater contamination plumes that originate from these sites. A review of the RER plume data (Fig. 8-2) does not indicate current impacts to the EMWMF monitoring system.

Sampling of surface water is also included in groundwater detection monitoring because groundwater in the shallow flow system (uppermost aquifer) discharges into surface drainage features. Monitoring and evaluation of surface water is performed to augment the groundwater monitoring at several locations as a Best Management Practice because of the close interaction between groundwater and surface water at EMWMF.

Figure 8-1 shows the ARAR §264.97(a)-compliant groundwater detection monitoring network. Total depths of the wells and other relevant information, including the hydrologic relationship with EMWMF, are summarized in Table 13. In addition to the wells, the outfall for EMWMF underdrain, which captures groundwater from beneath Cell 3 and Cell 4, also serves as a downgradient groundwater sampling location, as shown in Fig. 8-2.



EXPLANATION

- | | |
|-------------------------|--|
| — BUILDING | — UPGRADIENT MONITORING WELL (SHALLOW) |
| — ROADS | — SHALLOW MONITORING WELL |
| — FENCE LINE | — DEEP MONITORING WELL |
| — STREAM | — SURFACE WATER STATION |
| — POND | — UNDERDRAIN OUTFALL |
| — CONTOUR (10 FT. INT.) | |
| — UNDERDRAIN | |

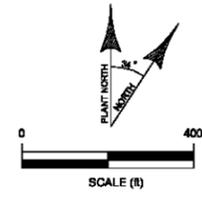


Fig. 8-1. Groundwater and surface water sampling locations for groundwater detection monitoring.

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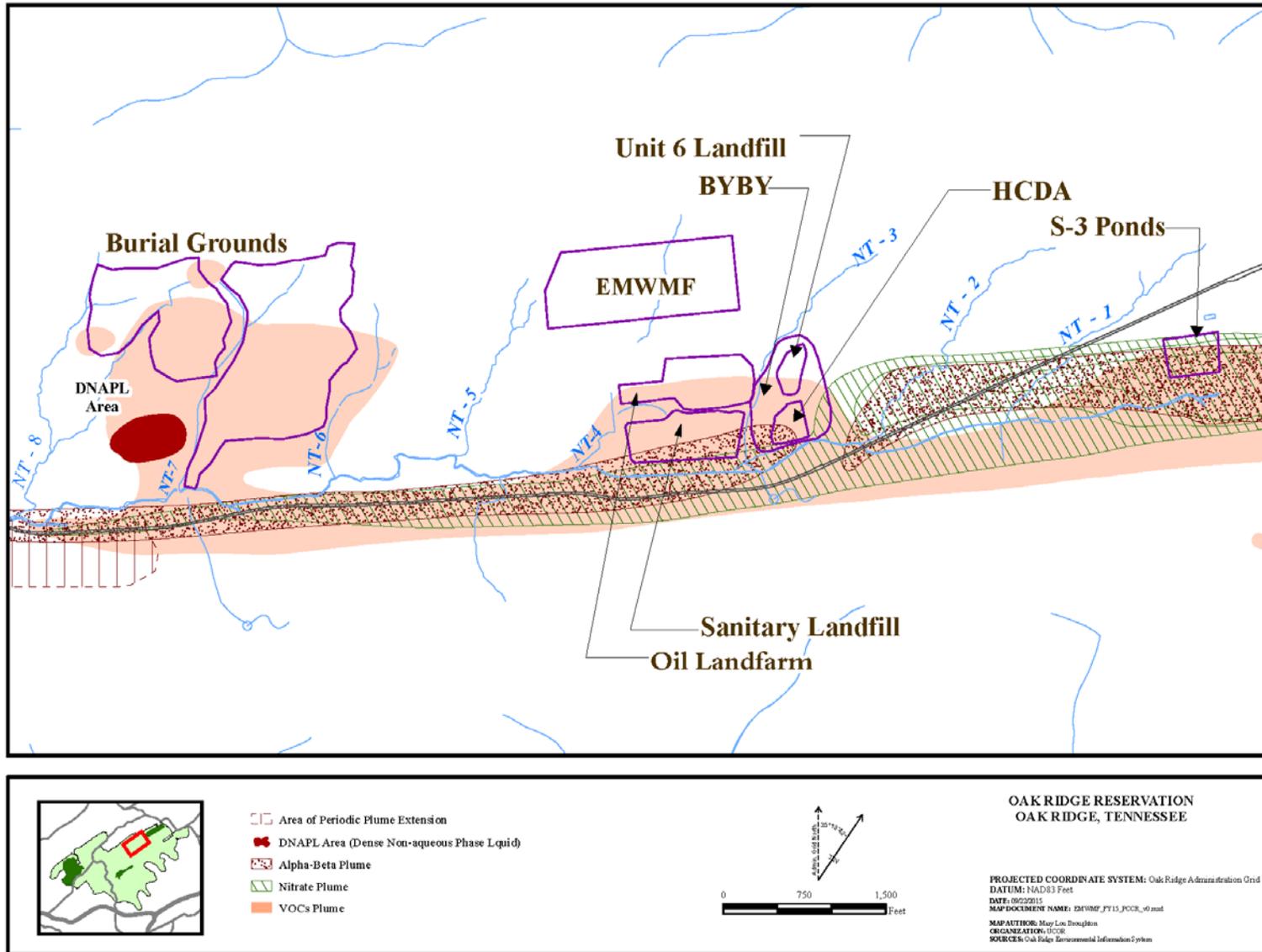


Fig.8-2. Bear Creek Valley groundwater plumes.

Table 13. Groundwater wells used for detection monitoring

Well			Conasauga Group formation ²	Approximate distance and direction from EMWMF boundary	Hydraulic relationship to EMWMF		
Number	Total depth ¹	Mid-point ¹			Upgradient	Downgradient	
						Across geologic strike	Along geologic strike
GW-363	75.0	62.5	Nolichucky Shale	550 ft South		•	
GW-639	125.5	110.5	Nolichucky Shale	1800 ft Southwest		•	•
GW-916	36.0	24.5	Rogersville Shale	250 ft East	•		
GW-917	51.0	34.5	Maryville Limestone	200 ft South		•	
GW-927	172.0	74.5					
GW-918	75.0	25.5	Pumpkin Valley Shale	300 ft North	•	•	
GW-920	55.0	38.5	Nolichucky Shale	400 ft South		•	
GW-921	50.0	33.0	Maryville Limestone	200 ft South		•	
GW-925	170.0	120.0					
GW-922	46.0	34.5	Nolichucky Shale	500 ft South		•	
GW-924	54.0	37.5	Nolichucky Shale	350 ft Southwest		•	•
GW-926	145.0	124.0					
GW-961	25.5	14.5	Nolichucky Shale	300 ft Southwest		•	
GW-964	31.9	19.9	Maryville Limestone	250 ft South		•	
GW-965	72.0	59.8					

¹Depth in feet below ground surface.

²Wells completed in bedrock of the specified Conasauga Group formation as estimated from the location and depth of the wells relative to the projected surface expression of geologic contacts reported in ORNL/TM-10112 (*Subsurface-Controlled Geological Maps for the Y-12 Plant and Adjacent Areas of Bear Creek Valley*), assuming the prevailing general geologic strike and dip of strata in Bear Creek Valley.

Groundwater and surface water samples were collected quarterly for the purpose of groundwater detection monitoring during FY2014, with sampling performed during seasonally dry weather/low-flow conditions (November/December 2013 and August 2014) and seasonally wet weather/high-flow conditions (February 2014 and May 2014). Table 14 shows the specific sampling dates for each groundwater well, the EMWMF underdrain, and the surface water station.

Table 14. FY2014 groundwater and surface water sampling dates for groundwater detection monitoring

Sampling location ¹		Quarter of FY2014 and sampling date ²			
		Q1	Q2	Q3	Q4
Groundwater	GW-363	11/19/13	02/18/14	05/07/14	08/11/14
	GW-639	11/19/13	02/18/14	05/07/14D,S	08/11/14
	GW-916	11/12/13	02/24/14	05/20/14	08/13/14
	GW-917	11/25/13D	02/17/14	05/08/14	08/11/14D
	GW-918	11/13/13	02/18/14	05/14/14S	08/13/14
	GW-920	11/20/13	02/11/14	05/13/14	08/11/14
	GW-921	11/20/13	02/17/14	05/14/14	08/11/14
	GW-922	11/14/13	02/11/14	05/14/14	08/13/14
	GW-924	11/21/13	02/12/14	05/19/14	08/14/14
	GW-925	12/02/13	02/18/14	05/19/14	08/13/14
	GW-926	11/21/13	02/12/14	05/12/14S	08/14/14
	GW-927	12/02/13	02/17/14	05/12/14	08/12/14
	GW-961	11/13/13	02/17/14	05/15/14	08/12/14
	GW-964	11/12/13	02/11/14	05/15/14S	08/13/14
	GW-965	11/12/13	02/19/14D	05/15/14	08/14/14
VWUNDR	11/21/13	02/18/14	05/15/14S	08/13/14	
Surface water	EMW-VWEIR	11/19/13	02/10/14	05/08/14	08/11/14
	EMWNT-03A	11/19/13	02/10/14	05/08/14	08/11/14
	EMWNT-05	11/19/13	02/10/14D	05/08/14	08/11/14D
	NT-04	11/19/13D	02/10/14	05/08/14D,S	08/11/14

¹VWUNDR = EMW-VWUNDRDRAIN; designation for the outfall of the EMWMF underdrain, which captures groundwater from beneath the liner of Cell 3 and Cell 4.

²Initial sampling date when field measurements were obtained; D = Duplicate sample collected; S=Split sample collected.

During FY2012, samples were collected from downgradient well, GW-923, which has been used for previous detection monitoring. However, this well no longer provides representative hydrologic or groundwater quality data because of extensive post-installation changes to the well construction. As previously described in the *Annual Report for FY 2011 Detection Monitoring at the Environmental Management Waste Management Facility, Oak Ridge, Tennessee* (DOE/OR/01-2562&D1), when the area surrounding GW-923 was excavated during construction of the EMWMF berm, the top of the monitored interval changed to approximately 6 ft below ground surface, substantially above the saturated zone. The well no longer meets the construction standards defined for the Resource Conservation and Recovery Act groundwater monitoring per the ARARs, and the analytical data for the groundwater samples from Well GW-923 are considered unusable for detection monitoring purposes. Replacement of this well is an issue currently under discussion (Table 28).

5.3.2 Groundwater Flow Direction and Rate

As required by ARAR §264.98(e), following is the annual determination of the direction and rate of groundwater flow in the uppermost aquifer at EMWMF. This evaluation is based on groundwater elevations determined from selected monitoring wells and piezometers during representative seasonally wet/high-flow conditions (February 2014) and seasonally dry/low-flow conditions (August 2014). The data for these wells and piezometers show that, during seasonally high- and low-flow conditions, groundwater in the uppermost aquifer of EMWMF flows generally from north to south-southwest, as illustrated in Figs. 9 and 10.

In the underlying bedrock aquifers, groundwater movement tends to be parallel to the geologic strike. At EMWMF, there is an upward hydrostatic head in these formations that minimizes the potential for deep groundwater contaminant transport.

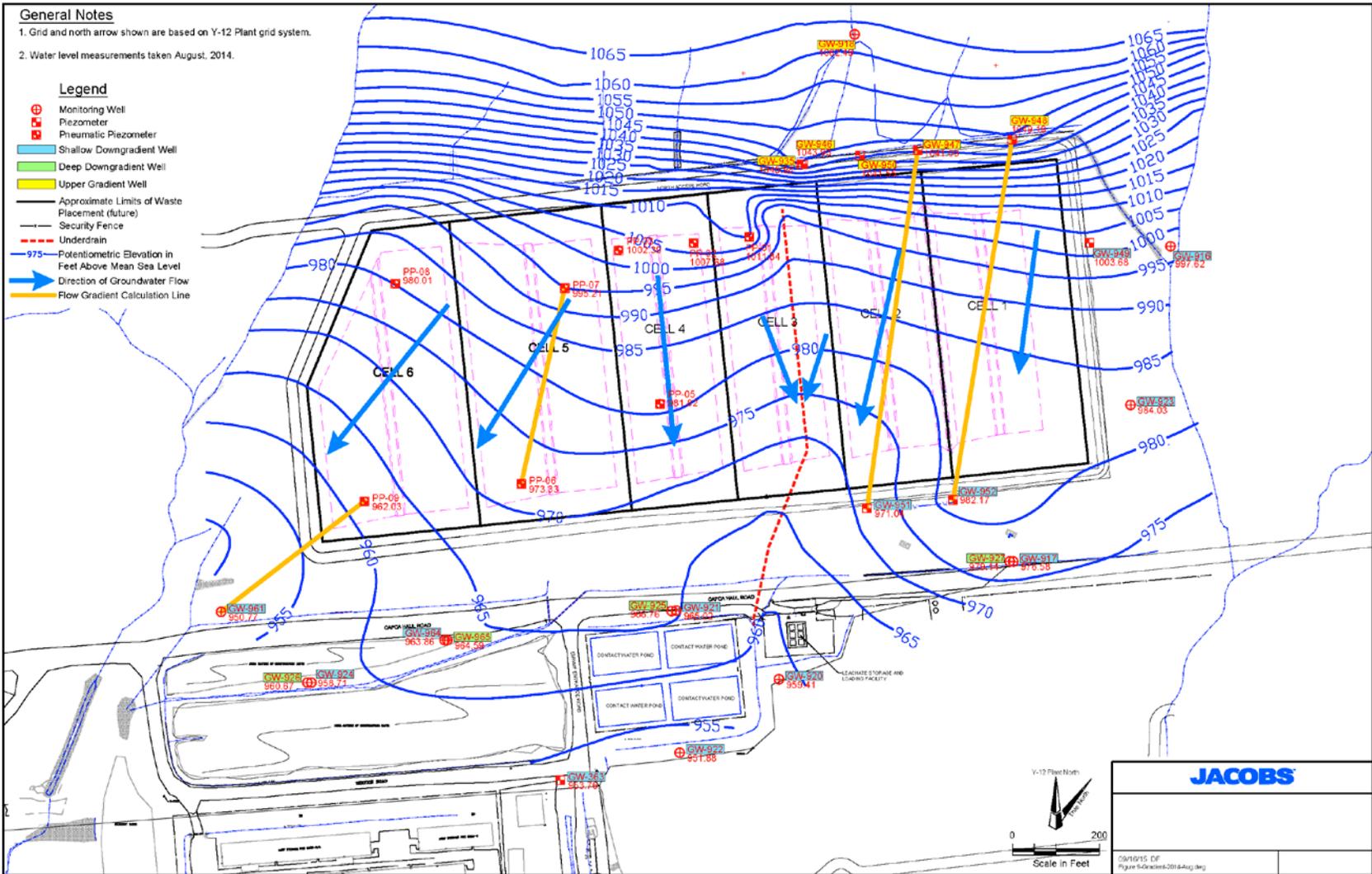


Fig. 10. Generalized directions of groundwater flow in the uppermost aquifer at EMWMF (August 2014).

Rates of groundwater flow in the fractured, interbedded shale and limestone bedrock that subcrop beneath the EMWMF footprint were estimated using the modified Darcy equation: $V = KI/\eta$, where V is the flow velocity, K is the hydraulic conductivity of the medium, I is the horizontal hydraulic gradient, and η is the effective porosity. The calculated flow rates are representative of average velocities in the shallow flow system (< 100 ft below ground surface), assuming the continuum of saturated interconnected fractures can be considered an equivalent porous medium. Rates of groundwater flow deeper in the bedrock were not estimated, but are probably as low as a few centimeters per year via poorly connected and very low-permeability fracture flowpaths (ORNL/TM-12053, *Status Report-A Hydrologic Framework for the Oak Ridge Reservation*).

Hydraulic test data for wells and boreholes in Bear Creek Valley provide a wide range of estimated values for the hydraulic conductivity (K) of the fractured bedrock of the Conasauga Group formations that underlie EMWMF. Groundwater flow rates in the uppermost aquifer were based on hydraulic conductivity values of 0.03 ft per day for low-permeability fractured intervals (USGS 89-4062, *Statistical and Simulation Analysis of Hydraulic Conductivity Data for Bear Creek and Melton Valleys, Oak Ridge Reservation, Tennessee*) and 0.6 ft per day for the continuum of low- and high-permeability fractured intervals (ORNL/TM-12191, *Supplement to a Hydrogeologic Framework for the Oak Ridge Reservation*).

Representative horizontal hydraulic gradients (I) in the uppermost aquifer were determined from groundwater elevations indicated by depth-to-water measurements recorded during February 2013 and August 2013 for selected pairs of shallow (< 50 ft below ground surface) wells and piezometers at EMWMF, and the lateral distance between the paired wells/piezometers (see Fig. 9). As shown in Table 15, the calculated horizontal hydraulic gradients range between 0.024 and 0.088, with relatively minor differences (10% or less) between the gradients evident during (presumed) seasonally high and low groundwater flow conditions.

Table 15. Representative horizontal hydraulic gradients in the uppermost aquifer at EMWMF

Month (Season) and well/piezometer number		Groundwater elevation (feet above mean sea level)	Hydraulic head (ft)	Lateral distance (ft)	Horizontal hydraulic gradient (I)
February 2014 (Wet season)	GW-948	1058.91			
	GW-952	985.36	73.55	837.63	0.088
	GW-947	1052.32			
	GW-920	961.67	90.65	1255.12	0.072
	PP-07	994.98			
	PP-06	972.41	22.57	459.92	0.049
	PP-09	960.18			
	GW-961	951.59	8.59	416.10	0.019
August 2014 (Dry season)	GW-948	1049.19			
	GW-952	982.17	67.02	837.63	0.080
	GW-947	1041.09			
	GW-920	959.41	81.68	1255.12	0.065
	PP-07	995.21			
	PP-06	973.33	21.88	459.92	0.048
	PP-09	962.03			
	GW-961	950.77	11.26	416.10	0.024

Available data for wells and boreholes in Bear Creek Valley provide estimates of the effective porosity (η) ranging from 0.00035 to 0.099 (ORNL/GWPO-021, *Effective Porosity and Pore-Throat Sizes of Conasauga Group Mudrock: Application, Test, and Evaluation of Petrophysical Techniques*) for the geologic formations that subcrop beneath EMWMF. The median value (0.049) between these endpoints

was used as the effective porosity for the purpose of calculating rates of groundwater flow in the uppermost aquifer at EMWMF.

Based on the input parameters described above, rates of groundwater flow calculated with the modified Darcy equation (summarized in Table 16) range from approximately 0.012 ft/day (5 ft/year) to approximately 1 ft/day. The wide range of calculated groundwater flow rates reflects the heterogeneous hydraulic properties and anisotropy of the interconnected fracture networks in the interbedded shale and limestone formations that comprise the uppermost aquifer beneath EMWMF. However, there is the potential for shallow fracture flow at greater flow rates, particularly in the saprolite overlying the unweathered bedrock (McKay, et. al., “Field-Scale Migration of Colloidal Tracers in a Fractured Shale Saprolite”).

Table 16. Calculated rates of groundwater flow in the uppermost aquifer at EMWMF

Groundwater flow rates ($V = KI/\eta$)			
V (ft/day)	K (ft/day)	I	η
0.012	0.03	0.019	0.049
0.1	0.03	0.088	0.049
0.233	0.6	0.019	0.049
1.1	0.6	0.088	0.049

V = flow velocity
 K = hydraulic conductivity
 I = horizontal hydraulic gradient
 η = effective porosity

Overall, data obtained during FY2014 do not indicate any substantial change in the groundwater flow direction and rate in the uppermost aquifer at EMWMF.

5.3.3 Groundwater Detection Monitoring Data Evaluation

Evaluation of the FY2014 groundwater detection monitoring data focused on the groundwater and surface water sampling/analysis results for the indicator contaminants described in the *Environmental Monitoring Plan* and listed in Table 17. Selection of the listed metals, organic compounds, and isotopes as indicator contaminants was based on their prevalence/volume in wastes disposed in EMWMF; concentration and detection frequency in contact water and leachate; and physical/chemical characteristics, such as toxicity, mobility, and persistence, in the environment. Additional indicator parameters were included to ensure all analytical groups were well represented.

Table 17. Indicator contaminants for groundwater detection monitoring

Metals		Organic compounds		Isotopes
Antimony	Lead	Acetone	Trichloroethene	Uranium-233/234
Arsenic	Mercury	Benzene	Vinyl chloride	Uranium-235/236
Barium	Nickel	Benzoic acid	1,1-Dichloroethane	Uranium-238
Beryllium	Selenium	Carbon tetrachloride	1,1-Dchloroethene	Strontium-90
Cadmium	Thallium	Chloroform	1,1,1-Trichloroethane	Technetium-99
Chromium	Uranium	Tetrachloroethene		Tritium (H-3)

The objective of the groundwater detection monitoring data evaluation was to identify FY2014 groundwater and/or surface water sampling/analysis results for any indicator contaminants that meet the following criteria:

- The concentration(s) of the indicator contaminant exceeds the threshold value determined from the EMWMF baseline monitoring data, which include statistically-derived upper tolerance limits for the metals and some isotopes, proxy values for some isotopes, and analytical reporting limits for organic compounds. Comparison to calculated upper tolerance limits is an approved statistical data evaluation alternative listed under §264.97(h).
- The concentration(s) of the indicator contaminant exceeds the action levels specified in the *Environmental Monitoring Plan*, which were negotiated by the U.S. Department of Energy (DOE), TDEC, and EPA. Action levels are levels that signal an apparent deviation from normal operating conditions and require immediate action when exceeded.
- A statistically significant increasing concentration trend is defined by quantitative analysis of the time-series sampling/analysis results for the indicator contaminant.

The following summarizes and highlights the review and evaluation of the FY2014 groundwater and surface water detection monitoring results for the indicator contaminants:

- **Tentative Data Quality Objectives were met.** Assessment of the groundwater and surface water sampling/analysis results for the indicator contaminants, with respect to applicable data quality objectives, indicates the following:
 - Sufficient data were collected - Samples were collected from the monitoring locations and were analyzed in accordance with the SAP/QAPP.
 - Data were of appropriate quality to make the decisionsResults were comparable to previous groundwater and surface water samples from wells, the EMWMF underdrain, and the surface water station were compared to the FY2014 concentrations of detected indicator contaminants. Analytical results for the organic compounds designated as indicator contaminants were comparable to the associated blank sample.
 - For each of the applicable isotopes designated as indicator contaminants, all of the analytical results that exceed the specified minimum detectable activity also exceed the associated total propagated uncertainty.
 - Elevated radiological analytical results were noted and evaluated this year. After review of the laboratory QA/QC data and other information, these were determined to be laboratory errors. Corrective action plans were put into place at the labs to prevent recurrence. Results are comparable between corresponding analytical results for the indicator contaminants detected in the duplicate samples collected from each applicable well and surface water station (see Table 14).
- **Metals.** Barium, chromium, lead, nickel, and uranium are the metals designated as indicator contaminants that were detected in one or more of the groundwater samples from the downgradient wells and the EMWMF underdrain (Table 18). Maximum concentrations for each of these metals are below respective threshold values and corresponding actions levels. Barium, chromium, and uranium were detected in the surface water samples collected for detection monitoring and the respective maximum concentrations are below threshold values and action levels (Table 18).
 - **Organic Compounds.** None of the organic compounds designated as indicator contaminants were detected (including estimated concentrations below analytical reporting limits) in the groundwater

samples from the downgradient wells and the EMWMF underdrain or in the surface water samples collected for detection monitoring (Table 18).

- **Isotopes.** Tc-99, strontium (Sr)-90, hydrogen (H)-3, uranium (U)-233/234, U-235/236, and U-238 are the isotopes designated as indicator contaminants that were detected in one or more groundwater samples from the downgradient wells and the EMWMF underdrain, and the maximum concentration of each isotope is below the respective threshold value (Table 18). Additional analyses of these very low level detects above the minimum detectable activity levels will be performed. This analyses is expected to be completed in 2016 and will be used as a tool during the SAP/QAPP revision process. These same isotopes were also detected in surface water samples collected for detection monitoring at the EMW-VWEIR, which is the discharge outfall for the Sediment Basin (Fig. 8). These analytical results show maximum concentrations of Tc-99, U-233/234, and U-235/236 above respective groundwater threshold values (Table 18), but compliant with the contact water discharge criteria and consistent with the compliant discharges of contact water through the EMW-VWEIR. Results for these isotopes are included in data used to calculate the SOF for Sediment Basin discharge (see Sect. 5.4.7).
- **Contaminant release.** There is no conclusive evidence that a reportable contaminant release has occurred.

Table 18. FY2014 maximum concentrations of indicator contaminants for detection monitoring

Indicator contaminants and threshold values ¹			Groundwater sampling results ²			Surface water sampling results ³		
			FY2014 Max	Location	Date	FY2014 Max	Location	Date
Metals (mg/L)	Antimony	0.006	ND	.	.	ND	.	.
	Arsenic	0.0064	ND	.	.	ND	.	.
	Barium	0.71	0.661	GW-922	02/11/14	0.461	NT-04	08/15/13
	Beryllium	0.001	ND	.	.	ND	.	.
	Cadmium	0.001	ND	.	.	ND	.	.
	Chromium	0.015	0.00547	GW-964	11/12/13	0.0075	VWEIR	02/10/14
	Lead	0.025	0.00971	GW-964	11/12/13	ND	.	.
	Mercury	0.0002	ND	.	.	ND	.	.
	Nickel	0.018	0.00915	GW-964	11/12/13	ND	.	.
	Selenium	0.005	ND	.	.	ND	.	.
	Thallium	0.002	ND	.	.	ND	.	.
Uranium	0.012	0.00105	GW-925	12/03/13	0.00433	VWEIR	02/10/14	
Organic compounds (µg/L)	Acetone	10	ND	.	.	ND	.	.
	Benzene	5	ND	.	.	ND	.	.
	Benzoic acid	10	ND	.	.	ND	.	.
	CTET	5	ND	.	.	ND	.	.
	Chloroform	5	ND	.	.	ND	.	.
	PCE	5	ND	.	.	ND	.	.
	TCE	5	ND	.	.	ND	.	.
	Vinyl chloride	2	ND	.	.	ND	.	.
	1,1-DCA	5	ND	.	.	ND	.	.
	1,1-DCE	5	ND	.	.	ND	.	.
1,1,1-TCA	5	ND	.	.	ND	.	.	
Isotopes (pCi/L)	Sr-90	4	2.33	GW-961	08/12/14	3.61	VWEIR	08/11/14
	Tc-99	10	3.01	GW-916	11/12/14	211	VWEIR	08/11/14
	H-3	500	362	GW-926	11/21/14	351	VWEIR	08/11/14
	U-233/234	2	0.97	VWUNDR	05/15/14	13.3	VWEIR	02/10/14
	U-235/236	1	0.25	GW-639	02/17/14	1.6	VWEIR	05/08/14
	U-238	1.7	0.81	VWUNDR	05/15/14	1.59	NT-03A	02/10/14

¹ Threshold values for groundwater determined from EMWMF baseline monitoring data. Bold typeface denotes analytical results that exceed specified threshold value.

² Data for all downgradient wells and the EMWMF underdrain outfall (see Table 12).

³ Data for all surface water sampling stations.

CTET= Carbon tetrachloride
mg/L = milligrams per liter
ND = Not detected
NT-03A = EMWNT-03A
PCE = tetrachloroethene
pCi/L = picoCuries per liter

TCE = Trichloroethene
µg/L = micrograms per liter
VWEIR = EMW-VWEIR
“.” = No data (not applicable)
1,1-DCA = 1,1-Dichloroethane
1,1-DCE = 1,1-Dichloroethene
1,1,1-TCA = 1,1,1-Trichloroethane

5.4 OPERATIONS MONITORING

5.4.1 Introduction

Operations monitoring is performed in addition to the groundwater detection monitoring to ensure safe and compliant operations at EMWMF. Operations monitoring is performed to provide data needed to support facility operation and management decision-making, to assess the environmental impacts of facility operations, and to demonstrate compliance with release limits. Operations monitoring at EMWMF encompasses the following monitoring activities:

- Potentiometric—Supports compliance with the EMWMF ARAR §264.98(e) for the annual determination of the direction and rate of groundwater flow in the uppermost aquifer
- Surface water—Supports compliance with the EMWMF ARAR 40 *CFR* Part 761.75(b)(6)(iii) (*Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in commerce, and Use Prohibitions*, “Chemical waste landfills”) based on wastes that contain polychlorinated biphenyls (PCBs) as a Best Management Practice, due to the close interaction between surface water and groundwater in the EMWMF area
- Stormwater—Ensures proper management of stormwater
- Contact water—Demonstrates compliance with the applicable release criteria
- Leachate—Verifies that leachate meets the WAC of the receiving facility
- Sediment Basin Discharge—Supports the calculation of the annual average SOF
- Ambient air—Determines whether there is a release of hazardous or radioactive materials

5.4.2 Potentiometric Monitoring

Potentiometric monitoring data for selected wells, piezometers, and pneumatic piezometers (PPs) at EMWMF is performed to support compliance with the ARAR §264.98(e) for the annual determination of the direction and rate of groundwater flow in the uppermost aquifer and to assess the relationship between seasonal water table fluctuations and the geologic buffer, which is the 10-ft vertical zone extending directly below the bottom of the clay liner for each waste cell. Groundwater elevations from potentiometric monitoring performed during each quarter of FY2014 (November 2013, February 2014, May 2014, and August 2014) are summarized in Table 19.

Potentiometric data obtained during each quarter of FY2014 were input into a numeric groundwater flow model that mapped groundwater elevation contours across the EMWMF footprint and generated a graphical comparison between the groundwater surface (water table) and the bottom of the geologic buffer. Output from the groundwater flow modeling showed groundwater elevations below the bottom of the geologic buffer everywhere, except along the north-central boundary of Cell 3 and Cell 4, near PP-01 and PP-02.

Table 19. FY2014 quarterly potentiometric data

Pneumatic piezometer		Quarter of fiscal year and static water level elevation (feet above mean sea level) ¹			
Piezometer		Q1	Q2	Q3	Q4
Well		(11/11/13)	(02/10/14)	(05/06/14)	(08/11/14)
GW-363	●	953.44	954.59	954.39	953.76
GW-639	●	928.62	930.28	930.26	928.47
GW-916	●	997.75	996.16	997.70	997.62
GW-917	●	976.49	979.49	979.18	976.58
GW-918	●	1062.51	1063.05	1063.09	1062.49
GW-920	●	958.69	961.67	960.51	959.41
GW-921	●	964.02	965.85	965.31	965.02
GW-922	●	951.80	952.10	952.02	951.88
GW-923	●	983.86	991.83	986.45	984.03
GW-924	●	957.09	960.15	958.63	958.71
GW-925	●	966.34	967.78	967.53	966.76
GW-926	●	959.38	962.27	961.72	960.67
GW-927	●	979.35	984.22	982.86	979.14
GW-935	●	1046.09	1047.67	1047.85	1045.98
GW-946	●	1043.60	1048.49	1047.86	1043.93
GW-947	●	1040.71	1052.32	1049.87	1041.09
GW-948	●	1048.20	1058.91	1055.71	1049.19
GW-949	●	1001.26	1003.09	1004.65	1003.68
GW-950	●	1041.19	1050.13	1048.71	1041.55
GW-951	●	971.33	972.11	972.35	971.04
GW-952	●	983.02	985.36	985.28	982.17
GW-961	●	950.29	951.59	951.71	950.77
GW-964	●	962.34	964.59	964.16	963.86
GW-965	●	963.06	965.76	965.38	964.59
PP-01	●	1011.15	1012.53	1013.22	1011.84
PP-02	●	1006.52	1007.45	1007.91	1007.68
PP-03	●	1002.39	1002.39	1002.39	1002.39
PP-05	●	981.82	981.82	981.82	981.82
PP-06	●	973.56	972.41	973.33	973.33
PP-07	●	995.44	994.98	995.21	995.21
PP-08	●	979.31	980.24	980.47	980.01
PP-09	●	960.18	960.18	961.80	962.03

¹For wells and piezometers, groundwater elevations determined from the depth to the static water surface manually measured from the surveyed reference point on the top of the riser casing for each well and piezometer. Groundwater elevations for the pneumatic piezometers converted from electronic pressure transducer readings.

5.4.2.1 Elevated Groundwater Measurements in the Vicinity of PP-01

As noted previously, the geologic buffer at EMWFM is the 10-ft vertical zone within the recompacted or natural soil underlying the bottom of the clay liner for each waste cell. The clay liner is covered by an impermeable flexible membrane liner, which is immediately overlain by the LDS, consisting of a geocomposite sandwiched between two layers of flexible membrane liner, and the drainage layer for the LCS (Fig. 11). Operational data have demonstrated the effectiveness of these layers in collecting and removing leachate from the disposal cells. As a result, it is highly improbable for any significant quantity of groundwater to infiltrate through these geomembranes and into the waste cells.

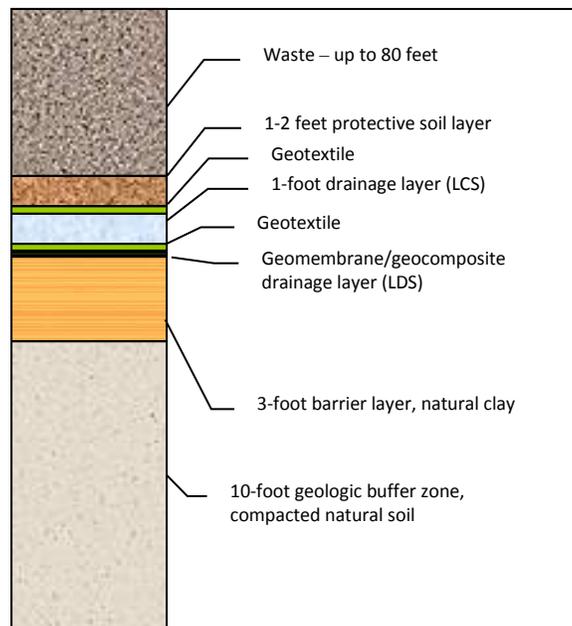


Fig.11. Geobuffer and liner system.

Water level readings obtained from PP-01 and PP-02 during FY2014 indicate groundwater elevations approximately 3.5 ft and 5 ft, respectively, above the bottom of the geologic buffer zone at each piezometer location. Hydrographs of water level data for PP-01 and PP-02 show groundwater above the bottom of the geologic buffer zone since April 2011 and November 2013, respectively, with groundwater level readings apparently increasing more than 12 ft at PP-01 since November 2008 and more than 4 ft at PP-02 since November 2010 (Fig. 12). Water level readings for both PPs are lower in August 2014 than in May 2014 (Table 19), and potentially indicate that the readings may have stabilized and the increasing trends may have abated.

As described in the *Engineering Feasibility Plan for the Elevated Groundwater Levels in the Vicinity of PP-01, EMWMF, Oak Ridge, Tennessee* (UCOR-4517), increased water level readings at PP-01 and PP-02 may be the result of several conditions, including greater recharge from increased amounts of precipitation over the past several years, localized (anomalous) hydrogeologic conditions near these PPs, and increased saturated pore pressures resulting from Cell 3 waste loading. It is also possible, as noted in the *Engineering Feasibility Plan*, that the water level data are not accurate because the PPs may not effectively reflect increased groundwater levels into the geologic buffer zone.

Water level readings obtained during FY2014 from PP-03 and PP-07 (Table 19), which is located along the northern portion of Cells 4 and 5, west of PP-02 (Fig. 1), show groundwater elevations below the bottom of the geologic buffer. Hydrographs based on water level data for these PPs show minimal water level fluctuations, with no increasing trend similar to the trends observed at PP-01 and PP-02 (Fig. 10). Groundwater elevations below the bottom of the geologic buffer are also shown by the water level data for the other PPs (PP-5, PP-6, PP-8, and PP-9), which show little if any water level fluctuations and no apparent increasing trend (Table 19).

Conditions where the water level rises above the base of the compacted clay liner as measured at any pneumatic piezometer location, or within two feet of the base of the liner at any two PP locations, will initiate an Engineering Feasibility Plan to assess the feasibility of installation of new monitoring points and measures to reduce water levels under the facility.

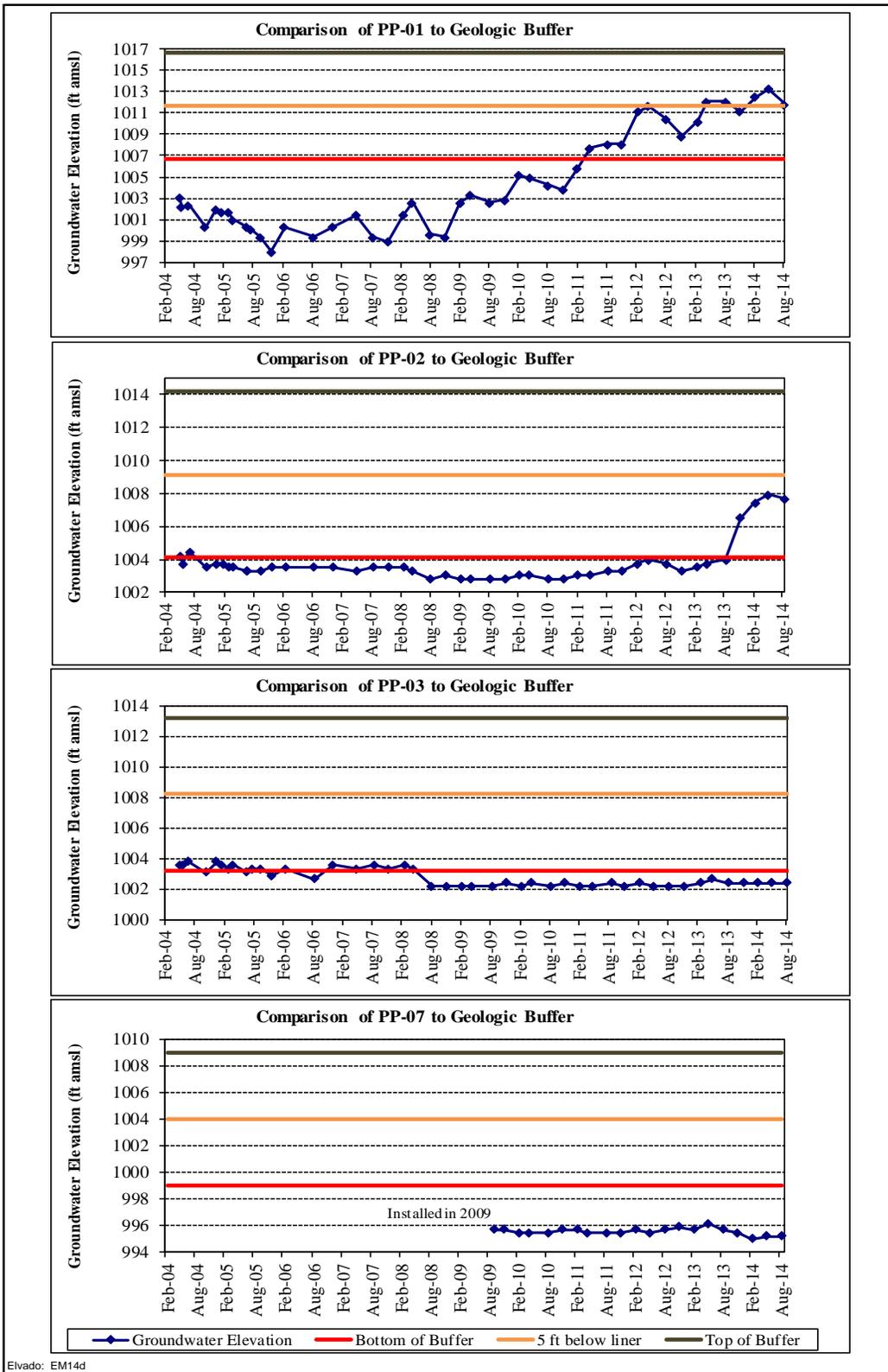


Fig.12. Groundwater hydrographs based on water level measurements for PP-01, PP-02, PP-03, and PP-07.

5.4.3 Surface Water

Sampling/analysis of surface water monitoring at stations EMWNT-03A, EMWNT-05, and EMW-VWEIR (Fig. 7) was performed monthly for EMWMF Operations monitoring during FY2014. Specific sampling dates are in Table 20.

Table 20. FY2014 surface water sampling dates

Sampling location	Quarter of FY2014 and sampling date ¹			
	Q1	Q2	Q3	Q4
EMW-VWEIR	10/07/13	01/13/14	04/14/14	07/14/14
EMWNT-03A	11/19/13	02/10/14	05/08/14	08/11/14
EMWNT-05	12/12/13	03/10/14	06/09/14	09/15/14

¹Bold typeface denotes surface water sampling dates that also serve detection monitoring purposes.

Monthly surface water monitoring is required by the EMWMF ARAR 40 *CFR* Part 761.75(b)(6)(iii), based on acceptance of wastes that contain PCBs. Additional surface water monitoring of releases to Bear Creek was performed as a Best Management Practice, due to the close interaction between surface water and groundwater, to evaluate water quality in the EMWMF area. Data are compared to the ambient water quality criteria (AWQC) specified in the *Environmental Monitoring Plan*.

Along with field measurements recorded when the surface water samples were collected, laboratory analyses of each sample were performed for PCBs, organic compounds, gross alpha activity, and gross beta activity. Analytical results for the surface water samples, summarized in Table 21, indicate the following:

- None of the PCBs or organic compounds were detected in the surface water samples from any of the sampling stations.
- Gross alpha activity and gross beta activity were detected (i.e., > minimum detectable activity and total propagated uncertainty) in surface water samples from each sampling station, with maximum concentrations within the range of background levels in Bear Creek.
- Aside from low levels of dissolved oxygen evident when surface water samples were collected from stations EMWNT-05 and NT-04 during May and August 2014, respectively, the surface water monitoring results demonstrate compliance with the AWQC specified in the *Environmental Monitoring Plan*.

Table 21. Summary of FY2014 surface water monitoring results

<i>All surface water sampling results</i>						
Field measurement		Units ¹	Minimum		Maximum	
Laboratory analyte			Result	Location	Result	Location
Conductivity	. •	µmho/cm	62	EMWNT-03A	621	EMW-VWEIR
Dissolved oxygen	. •	ppm	4.85	EMWNT-05	8.7	EMW-VWEIR
pH	. •	Std units	6.94	EMWNT-03A	8.63	EMW-VWEIR
REDOX	. •	mV	-11.3	EMWNT-05	173.8	EMW-VWEIR
Water temperature	. •	Degrees C	5.49	EMWNT-03A	25.52	EMW-VWEIR
Turbidity	. •	NTU	4	EMW-VWEIR	101	EMW-VWEIR
Water flow	. •	L/min	8	EMWNT-03A	2435	EMWNT-03A
Gross alpha activity	• .	pCi/L	0.44	EMWNT-05	2	EMWNT-03A
Gross beta activity	• .	pCi/L	2.96	EMWNT-03A	5.99	EMWNT-05
<i>Surface water sampling results that do not meet AWQC</i>						
Sampling location	Analyte	Units	Sampling date	Result	Criteria ²	
EMWNT-05	Dissolved oxygen	ppm	05/08/14	4.8	> 5	
NT-04	Dissolved oxygen	ppm	08/11/14	4.27		

¹Units:

- Degrees C = Degrees Celsius
- L/min = liters per minute
- mV = millivolts
- NTU = nephelometric turbidity units
- ppm = parts per million
- pCi/L = picoCuries per liter
- REDOX = oxidation-reduction potential
- µmho/cm = micromhos per centimeter

²AWQC = Ambient Water Quality Criteria

5.4.4 Stormwater

Uncontaminated stormwater is precipitation that falls outside the disposal cells, into an inactive cell or active cell (but without contacting waste in the cell), and includes runoff from the landfill cap, cover, intermediate cover, and/or final cover of the landfill. Uncontaminated stormwater may be collected and directed via surface drainage conveyances into the Sediment Basin and into northern tributaries of Bear Creek to the east-southeast (NT-3) and to the west-southwest (NT-5) of EMWMF (Fig.7). Decisions to release stormwater from the disposal cell(s) or manage it as contact water are based on process knowledge. As a Best Management Practice, stormwater may be sampled and compared to AWQC to ensure proper management of surface water from precipitation into the disposal cells, including appropriate discharge of the uncontaminated stormwater.

Stormwater sampling during FY2014 was performed as a Best Management Practice at stations EMWNT-03A, NT-04, EMWNT-05, and EMW-VWEIR (Fig. 7). Stormwater samples were collected semiannually from each station and monthly from EMW-VWEIR, as shown in Table 22, and were obtained within 72 hours of rainfall measuring > 0.1 in.

Table 22. FY2014 stormwater sampling dates

Monitoring frequency and location		Quarter of FY2014 and sampling date			
		Q1	Q2	Q3	Q4
Semiannual	EMW-VWEIR	.	01/02/14	.	07/09/14
	EMWNT-03A	.	01/02/14	.	07/09/14
	EMWNT-05	.	01/02/14	.	07/09/14
	NT-04	.	01/02/14	.	07/09/14
Monthly	EMW-VWEIR	10/17/13	*	04/03/14	*
		11/07/13	02/03/14	05/12/14	08/04/14
		12/03/13	03/03/14	06/10/14	09/03/14

*Semiannual and monthly stormwater events are combined at the EMW-VWEIR location.

In addition to field measurements recorded during sample collection, laboratory analyses of the stormwater samples from each station were performed for gross alpha activity, gross beta activity, and designated stormwater parameters. Analytical results for the stormwater samples are summarized in Table 23.

The stormwater sampling/analysis results obtained during FY2014 demonstrate compliance with currently required Fish and Aquatic Life AWQC throughout FY2014. However, pH and low levels of dissolved oxygen exceed AWQC at times. These exceedances are expected to be related to algae growth in the Sediment Basin (Table 23). As is typical during the summer, low levels of dissolved oxygen were reported for the stormwater samples collected from stations NT-04, EMWNT-03A, and EMW-VWEIR in July 2014. Total suspended solids levels were below the operations monitoring goal (110 mg/L) at EMW-VWEIR.

Table 7. Summary of FY2014 stormwater monitoring results

<i>All stormwater sampling results</i>									
Stormwater parameters			Units ¹	Minimum ²		Maximum ²		Criteria ³	
Field measurements		Radiological analytes		Result	Sampling location	Result	Sampling location		
Conductivity	.		• .	µmho/cm	62	EMWNT-03A	613	NT-04	.
Dissolved oxygen	.	• .	ppm	4.37	EMW-VWEIR	10.05	EMW-VWEIR	>5	
pH	.	• •	Std units	6.2	NT-04	8.48	EMW-VWEIR	6 - 9	
REDOX	.	• .	mV	58.9	EMWNT-05	230.8	EMW-VWEIR	.	
Turbidity	.	• .	NTU	6	NT-04	142	EMW-VWEIR	.	
Water Flow	.	• .	L/min	12	NT-04	446	EMW-VWEIR	.	
Water Temperature	.	• .	Deg. C	5.09	NT-04	24.29	EMW-VWEIR	<30.5	
Ammonia as nitrogen	.	. •	mg/L	0.128	EMW-VWEIR	0.136	NT-04	<0.2	
Biological oxygen demand	.	. •	mg/L	1.01	EMWNT-05	1.65	NT-04	<40	
Total suspended solids	.	. •	mg/L	2.65	EMWNT-05	50.6	EMW-VWEIR	<110	
Oil and grease	.	. •	mg/L	ND	.	ND	.	<30	
Gross alpha activity	•	. .	pCi/L	1.2	EMWNT-03A	12.8	EMW-VWEIR	<15	
Gross beta activity	•	. .	pCi/L	2.97	NT-04	30.9	EMW-VWEIR	<50	

Table 23. Summary of FY2014 stormwater monitoring results (cont.)

<i>Stormwater sampling results that do not meet AWQC</i>					
Sampling location	Analyte	Units ¹	Sampling date	Result	Criteria ³
EMWNT-03A	Dissolved Oxygen	ppm	07/09/14	4.61	> 5
NT-04	Dissolved Oxygen	ppm	07/09/14	4.48	> 5
EMW-VWEIR	Dissolved Oxygen	ppm	07/09/14	4.37	> 5

¹Units:

- Deg. C = Degrees Celsius
- L/min = liters per minute
- mg/L = milligrams per liter
- mV = millivolts
- NTU = nephelometric turbidity units
- ppm = parts per million
- pCi/L = picoCuries per liter
- µmho/cm = micromhos per centimeter

²ND = Not detected

³Applicable criteria from AWQC or ALARA.

REDOX = oxidation-reduction potential

5.4.5 Contact Water

Contact water is precipitation that falls into an active cell, comes in direct contact with landfill waste, and does not infiltrate to the LCS. Because contact water may be contaminated, it is collected and pumped into one of four lined impoundments (Contact Water Ponds) and/or four above-ground storage tanks (Contact Water Tanks) (Fig. 13). Contact water in the applicable storage units is discharged to the Sediment Basin if characterization sampling results demonstrate compliance with approved discharge limits specified in the *Environmental Monitoring Plan*. Fig. 13 shows the contact water characterization sampling locations.

Contact water monitoring is performed to demonstrate compliance with the dose limits required by EMWMF ARARs 10 *CFR* 20.1301(a) (*Standards for Protection Against Radiation*, “Dose limits for individual members of the public”), 10 *CFR* 20.1301(a) (ALARA), and TDEC 1200-2-11-.16(2) (*Licensing Requirements for Land Disposal of Radioactive Waste*, “Performance Objectives”) [now TDEC 0400-20-11-.16(2)] and to ensure compliance with TDEC 1200-04-03-.03(3) (*General Water Quality Criteria*, “Criteria for Waste Users”) [now TDEC 0400-40-03-.03(3)] AWQC, as specified in the *Environmental Monitoring Plan*. Compliance with these ARARs ensures that the EMWMF is also in compliance with applicable DOE radiological protection orders. All contact water in FY2014 met the discharge limits.

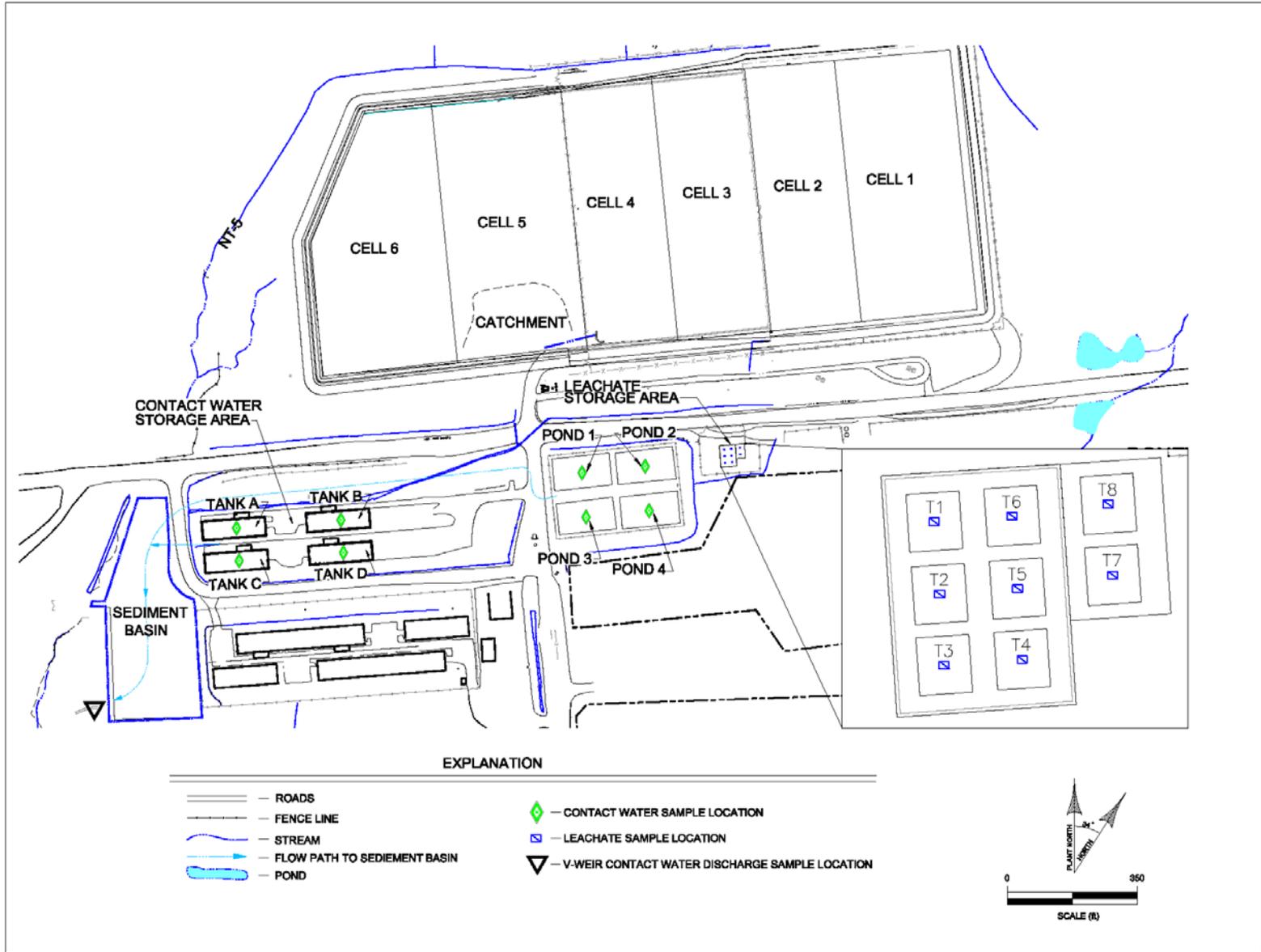


Fig.13. Contact water and leachate sampling locations.

5.4.6 Leachate

Leachate is water (typically precipitation and water applied for dust control) that infiltrates through waste and is collected by the LCS. Leachate is pumped from the collection system into eight above-ground storage tanks (Fig. 13) and transported to ORNL for disposal. The ORNL treatment facility to which leachate is transported for treatment is on-site. Samples are collected from the leachate to ensure that it meets the WAC of the receiving facility. All leachate met the WAC.

5.4.7 Sediment Basin Discharge

Stormwater and contact water are discharged from the Sediment Basin through the EMW-VWEIR (Fig. 7). Samples of the discharge from the EMW-VWEIR are collected on a batch basis and analyzed for various isotopes to provide the data used to support the calculation of the annual average SOF for Sediment Basin discharge, which is calculated on a calendar-year basis. Results of the isotopic analyses are summarized in Table 24.

Table 24. Summary of radiological results for surface water samples collected at EMW-VWEIR during FY2014

Isotope	Number of detected results ¹	Activity (pCi/L) ²	
		Minimum	Maximum
Actinium-227	2	0.16	3.64
Americium-243	4	0.17	0.34
Carbon-14	2	16.2	16.5
Cesium-137	1	7.36	7.36
Chlorine-36	4	2.98	7.85
Curium-243/244	1	0.35	0.35
Curium-245	8	0.17	0.35
Curium-246	8	0.17	0.35
Curium-247	1	0.43	0.43
Europium-152	1	22.6	22.6
Europium-154	2	7.65	8.41
Iodine-129	17	0.81	2.68
Lead-210	8	0.78	1.98
Neptunium-237	1	0.21	0.21
Nickel-63	2	20.2	21.8
Plutonium-239/240	1	0.24	0.24
Plutonium-242	1	1	1
Plutonium-244	2	0.16	0.16
Potassium-40	5	54	112
Protactinium-234m	47	0.32	2.7
Radium-226	12	0.28	1.37
Radium-228	15	0.68	2.22
Strontium-90	49	1.71	17.5
Technetium-99	47	5.08	305
Thorium-227	2	0.16	3.64
Thorium-228	5	0.14	0.4
Thorium-229	3	0.16	1.64

Table 24. Summary of radiological results for surface water samples collected at EMW-VWEIR during FY2014 (cont.)

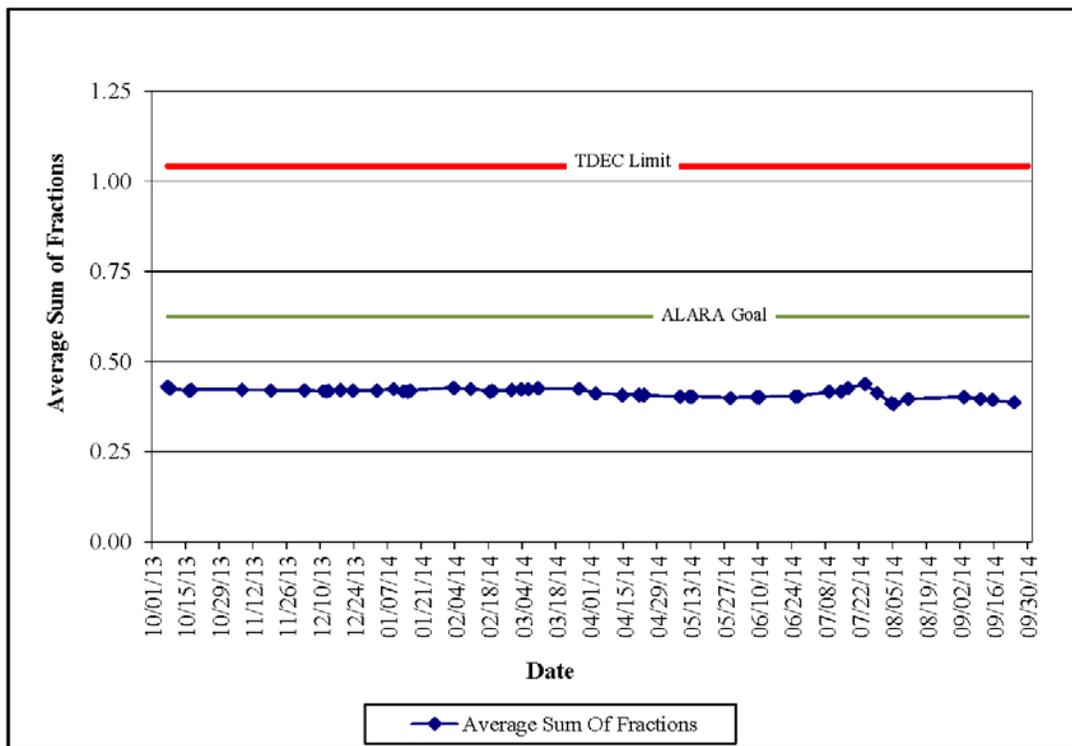
Thorium-230	39	0.15	0.58
Isotope	Number of detected results ¹	Activity (pCi/L) ²	
		Minimum	Maximum
Thorium-232	15	0.14	0.31
Thorium-234	47	0.32	2.7
Tritium	26	267	1950
Uranium-233/234	53	1.69	47.4
Uranium-235/236	42	0.42	3.44
Uranium-238	47	0.32	2.7
Yttrium-90	49	1.71	17.5

¹Number of analytical results for specified isotope with activity above the applicable minimum detectable activity and total propagated uncertainty.

²pCi/L = picoCuries per liter

The Sediment Basin discharge water is monitored to demonstrate compliance with the dose limits required by EMWMF ARARs 10 *CFR* 20.1301(a), 10 *CFR* 20.1301(a) (ALARA), and TDEC 1200-2-11-.16(2) and to ensure compliance with TDEC 1200-04-03-.03(3) AWQC, as specified in the *Environmental Monitoring Plan*.

Based on the isotopic sampling/analysis data, the rolling 12-month average SOF values for Sediment Basin discharged into Bear Creek during calendar year 2014 had a maximum of 0.44 pCi/L, a minimum of 0.38 pCi/L, and an average of 0.41 pCi/L. The rolling 12 month average results are considerably more stable than the individual sample results (Fig. 14). None of the calculated SOF values exceed the 25 mrem SOF limit of 1 established by DOE and TDEC or the SOF value (0.625) that serves as the EMWMF environmental ALARA goal set to further limit the dose resulting from EMWMF discharges. The calculated SOF values for the discharges from the Sediment Basin in FY2014 demonstrate EMWMF compliance with the discharge limit of 25 mrem annual effective dose equivalent and the EMWMF ALARA goal of 15 mrem.



Notes:

DOE 5400.5 Derived Concentration Guidelines (DCG) are based on 100 mrem annual effective dose equivalent. The TDEC Limit is 25 mrem annual effective dose equivalent (TDEC 1200-2-11-.16), or 25% of the DCG. An EMWMF Annual Average Radionuclide Sum of Fractions of 1.0 represents 24% of the DCG. The EMWMF As Low As Reasonably Achievable (ALARA) Goal is < 15% of the DCG.

Elvado: PCCR15 sof

Fig.14. Cumulative annual SOF for Sediment Basin discharge at EMW-VWEIR.

5.4.8 Ambient Air

Compliance with the EMWMF ARAR for Rad-NESHAP regulatory dose limit of 10 mrem/year is demonstrated for all DOE ORR operations combined using EPA approved measurement and dose determination methods described in *Compliance Plan – National Emission Standards for Hazardous Air Pollutants for Airborne Radionuclides on the Oak Ridge Reservation, Oak Ridge Tennessee* (DOE/ORO/2196, Rev. 1). The 10 mrem/year limit is the maximum dose allowed on the most exposed member of the public.

Demonstration of compliance with Rad-NESHAP is through the submittal of an annual report to EPA and TDEC that provides both the total dose impact from DOE ORR operations point sources (stacks) and fugitive sources. The Calendar Year 2014 report stated a total point source dose of 0.6 mrem to the most exposed member of the public. The maximum ambient air result from the ORR perimeter air monitoring network was 0.03 mrem/year at the sampling station, well below the 10 mrem/year maximum allowable dose to the most exposed member of the public.

In addition, ambient air samples are collected from one upwind and two downwind locations using samplers located on perimeter cell fences to monitor for hazardous air pollutants. These samples are compared to the most recently published values identified for specific pollutants by the American Conference of Government Industrial Hygienists (or the current permissible exposure limits specified in 29 *CFR* 1910.1000 [*Occupational Safety and Health Standards*, “Air contaminants for chemicals and particulates”]) and DOE-derived concentration guidelines (by derived air concentration [DAC] values in 10 *CFR* 835 [*Occupational Radiation Protection*], Appendix A) for radionuclides. The DAC values represent the concentration of radioactive material in air that will result in an annual limit of intake if an individual breathes that air for a year. Radiological results are reported through the Y-12 National Security Complex Radiological NESHAPs Program and are included here for completeness.

Quarterly ambient air samples were obtained from the designated sampling stations shown in Fig. 3 that are located upwind (EMWAAGRID6/7W) and downwind (EMWAAGRID9/8E and EMWAAGRID1/HN) of EMWMF. Maximum concentrations of the laboratory analytes detected in the ambient air samples from the upwind and downwind monitoring locations, summarized in Table 25, are below respective exposure limits.

Table 25. Summary of ambient air monitoring results for FY2014

Air monitoring location and date			Detected analyte	Units	Maximum	Exposure limit
Upwind of EMWMF	EMWAAGRID6/7W	12/16/13	Copper	µg/m3	2.8	1,000
	EMWAAGRID6/7W	09/10/14	Particulate Matter, Total	µg/m3	60.8	15,000
	EMWAAGRID6/7W	12/10/13	Asbestos	fibers/cc	0.075	0.1
	EMWAAGRID6/7W	06/02/14	2-Butanone	ppb	1.2	200,000
	EMWAAGRID6/7W	12/18/13	4-Methyl-2-pentanone	ppb	0.55	200,000
	EMWAAGRID6/7W	12/18/13	Acetone	ppb	5.2	1,000,000
	EMWAAGRID6/7W	09/17/14	Hexane	ppb	1	500,000
	EMWAAGRID6/7W	09/17/14	Methylene chloride	ppb	1.4	500,000
	EMWAAGRID6/7W	06/02/14	Toluene	ppb	0.39	200,000
Downwind of EMWMF	EMWAAGRID1/HN	12/16/13	Copper	µg/m3	1.9	1,000
	EMWAAGRID9/8E	05/27/14	Manganese	µg/m3	1.7	5,000
	EMWAAGRID1/HN	05/22/14	Particulate Matter, Total	µg/m3	47.8	15,000
	EMWAAGRID9/8E	12/10/13	Asbestos	fibers/cc	0.09	0.1
	EMWAAGRID1/HN	06/02/14	2-Butanone	ppb	2.4	200,000
	EMWAAGRID1/HN	09/17/14	Hexane	ppb	0.6	500,000
	EMWAAGRID9/8E	09/17/14	Methylene chloride	ppb	1.6	500,000
	EMWAAGRID9/8E	12/18/13	Tetrachloroethene	ppb	0.2	100,000
	EMWAAGRID1/HN	12/18/13	Toluene	ppb	0.64	200,000

Weekly air samples are collected during waste dumping and movement operations from a minimum of three air samplers located on the perimeters of the EMWMF cells. The DAC values from the waste lots received during that week are reviewed and the waste load(s) with the most restrictive DAC values are determined. The sample results are compared to the most conservative DAC values from the waste received over the course of the week. Perimeter air samples over 2% of the DAC would be investigated, if and when these ever occur.

During FY2014, 204 air samples were collected and analyzed. The comparison to the alpha DAC for 169 of these samples was 0.0%. None of the 204 comparisons to the beta DAC were greater than zero. Table 26 summarizes these samples. None of the air sample results were over 2% of the DAC, and no further investigation was required.

Table 8. Summary of ambient air radiological monitoring results for FY2014

Up/Downwind	Location	No of samples	Detects	Detected alpha DAC fraction	Detected beta DAC fraction	Detected total DAC fraction
Upwind	Northwest guard shack	52	5	.001 - .002	0	.001 - .002
Upwind	Southwest guard shack	52	9	.001 - .005	0	.001 - .005
Downwind	Northeast guard shack	52	12	.001 - .007	0	.001 - .007
Downwind	Cell 1 BCS	48	9	.001 - .004	0	.001 - .004
Totals		204	35			

BCS = boundary control station

Note: Gross Beta values were rounded. Very low detects may be present

The EMWMF air monitoring data are used to verify that workers outside of the EMWMF perimeter are sufficiently protected and to serve as an early indicator of potential releases. These air monitors are not specific RAD NESHAP measurement points.

5.5 CHANGES FROM PAST MONITORING PRACTICES

There were no changes to the monitoring program in FY2014.

5.6 CONCLUSIONS, ISSUES, AND RECOMMENDATIONS

The conclusions from this section are provided below. Issues and recommendations are summarized in Table 27.

Conclusions:

- There is no conclusive evidence that contaminants potentially derived from wastes disposed in EMWMF have entered the groundwater.
- Groundwater elevations were below the bottom of the 10-ft geologic buffer everywhere, except for an area with elevated groundwater readings near PP-01 and PP-02.
- Surface water complies with AWQC. However, pH and low levels of dissolved oxygen exceed AWQC at times. These exceedances are expected to be related to algae growth in the Sediment Basin.
- Contact water met the discharge limits.
- Leachate shipped to ORNL met the WAC.
- None of the calculated SOF values or the annual average SOF at the EMW-VWEIR exceeded the limit (1.0 or 25 mrem/yr) or the ALARA SOF value (0.625).
- All ambient air concentrations were substantially below respective exposure limits. These results suggest that EMWMF Operations during FY2014 had minimal adverse impact on ambient air quality.
- No changes to operating programs and/or procedures are required as a result of this review.

Table 27. Environmental monitoring issues and recommendations

Issue	Action/recommendation	Status	Target response date
<p>The trend for water levels in relation to the geobuffer needs to be developed. Groundwater elevations in PP-01 and PP-02 have increased over the past several years, and the FY2013 water level measurements for PP-01 were within the upper 5 ft of the geologic buffer, i.e., less than 5 ft below the bottom of the clay liner.</p>	<p>Continued monitoring and evaluation as recommended in the <i>Engineering Feasibility Plan</i>. If a worsening trend is identified, another engineering evaluation will be performed.</p>	<p>Groundwater levels are continuing to be monitored and are reported in the FY2015 PCCR and will be reported in future PCCRs with the objective to identify trends.</p>	<p>FY2016 PCCR</p>
<p>EPA has raised a concern that the existing groundwater action levels are risk-based, not based on protection of the groundwater resource.</p>	<p>Resolve as part of the ongoing data evaluation efforts and incorporate any change into the revised Sampling and Analysis Plan .</p>	<p>As part of the ongoing data evaluation, groundwater threshold values and the need for and use of action levels will be reevaluated.</p>	<p>FY2015 in revised Sampling and Analysis Plan</p>
<p>There are sporadic exceedances in groundwater of threshold values or action levels of metals, especially lead, and uranium. These exceedances should be evaluated to determine if the exceedances are legitimate, represent a trend, and are associated with EMWMF.</p>	<p>Resolve as part of the data evaluation effort. The definitions of threshold values, action levels, and outliers will be evaluated. The resolution will be incorporated into a revised Sampling and Analysis Plan.</p>	<p>These results are being evaluated as part of the FY2014 EMWMF data evaluation effort.</p>	<p>FY2015 in revised Sampling and Analysis Plan</p>
<p>The need for a replacement well for GW-923 should be evaluated.</p>	<p>Resolve as part of the data evaluation effort. The groundwater wells to be monitored will be evaluated and included in the revised Sampling and Analysis Plan.</p>	<p>The need for this well is being evaluated and will be discussed in the FY2015 PCCR.</p>	<p>FY2015 in revised Sampling and Analysis Plan</p>
<p>Why is the SOF limit greater than 1.0 or 15 mrem/year? Resolve any issues pertaining to the EPA 8/22/97 Policy Memorandum</p>	<p>Resolve as part of the revised Sampling and Analysis Plan and incorporate any change into the revised Sampling and Analysis Plan.</p>	<p>The releases meet the current requirements for sediment basin discharge and ALARA goal of 15 mrem/year.</p>	<p>FY2015 in revised Sampling and Analysis Plan</p>
<p>Surface water monitoring is included in the groundwater detection monitoring program.</p>	<p>Resolve as part of the revised Sampling and Analysis Plan.</p>	<p>The inclusion of this monitoring in groundwater detection monitoring is being evaluated.</p>	<p>FY2015 in revised Sampling and Analysis Plan</p>

Table 27. Environmental monitoring issues and recommendations (cont.)

DQOs are not included in the <i>Environmental Monitoring Plan</i> , but are mentioned in the PCCR. This term should be removed.	Resolve as part of the revised Sampling and Analysis Plan.	The FY2015 PCCR does not reference DQOs.	FY2016 PCCR
Trends for contact water compared to discharge limits are not included in the PCCR.	Resolve as part of FFS for water management and the revised Sampling and Analysis Plan.	The FFS is being prepared, and the key COCs and appropriate discharge limits will be identified.	FY2015 in FFS, revised Sampling and Analysis Plan, and FY2015 PCCR
Elevated pH levels have been recorded at the sediment basin V-weir likely caused by algae.	Resolve as part of the revised Sampling and Analysis Plan.	Ongoing operational efforts to reduce algae are in progress.	FY2015 in revised Sampling and Analysis Plan

ALARA = as low as reasonably achievable
 COC = contaminants of concern
 DQO = data quality objective
 EMWMF = Environmental Management Waste Management Facility
 EPA = U.S. Environmental Protection Agency
 FFS = Focused Feasibility Study
 FY = fiscal year
 PCCR = Phased Construction Completion Report
 PP = pneumatic piezometer
 SOF = sum of fractions

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6. SUMMARY OF CONCLUSIONS, ISSUES, AND RECOMMENDATIONS

Following are the FY2014 conclusions, issues, and recommendations (see Table 28).

Conclusions:

- EMWMF operates in compliance with ARARs and DOE Orders. No changes to operating programs and/or procedures are required as a result of this annual review.
- 29,238 yd³ of waste was received and disposed safely and compliantly.
- EMWMF is projected to reach full volume capacity in FY2024, and the total waste demand has decreased 9% since FY2013 to a maximum volume of 3.7 million yds³. D&D acceleration is planned and could result in reaching capacity much sooner, but budget uncertainty may not support this acceleration.
- Over 5 million gal of leachate was transported to the ORNL Liquid/Gaseous Waste Operations Facility for disposal.
- Over 9 million gal of contact water was discharged after determining that it met the discharge limits. No contact water exceeded discharge limits.
- The enhanced operational cover was expanded by 3.9 acres and sheds clean runoff out of the cells from 5.28 acres.
- Inflow into the LDS was below the action leakage rate of 803 gal/day/cell for all cells in FY2014. LDS inflow exceeded the notification leakage rate of 206 gal/day/cell on two occasions in FY2014.
- Several process improvements were initiated successfully to deal with issues associated with the Bldg. K-25 Purge Cascade waste and elevated levels of Tc-99.
- No contaminants potentially derived from wastes disposed in EMWMF have entered the groundwater.
- Groundwater elevations were below the bottom of the 10-ft geologic buffer everywhere, except a localized area in the upper northeast area of EMWMF.
- Surface water complies with the currently required AWQC. However, pH and low levels of dissolved oxygen exceed AWQC at times. These exceedances are expected to be related to algae growth in the Sediment Basin.
- Contact water met the discharge limits.
- Leachate shipped to ORNL met the WAC.
- None of the calculated SOF values or the annual average SOF at the EMW-VWEIR exceeded the limit (1.0 or 25 mrem/yr) or the ALARA SOF value (0.625).
- All ambient air concentrations were substantially below respective exposure limits. These results suggest that EMWMF Operations during FY2014 had minimal adverse impact on ambient air quality.
- Sporadic exceedances of uranium threshold values should continue to be evaluated.

Table 28. Overall issues and recommendations

Issue	Action/recommendation	Status	Target response date
The ARARs in the EMWMF ROD do not reflect current water management practices.	Resolve as part of the FFS for water management. Following approval of the FFS, the need to modify the ROD to revise the ARARs will be addressed.	ARARs will be included in the FFS for water management.	FY2015 in FFS and possibly revised EMWMF ROD
The EMWMF contaminants of concern have grown to a very large list of chemicals and radionuclides. Many of these contaminants have a low probability of migrating. Therefore, the contaminants of concern list should be reviewed to identify those that should not be included in the monitoring protocol, and the process for adding contaminants of concern should be reevaluated. The presence of a new contaminant may not require a change in the contaminants of concern and require monitoring.	Resolve as part of the data evaluation effort and incorporate into the revised Sampling and Analysis Plan.	These are being evaluated as part of the EMWMF data evaluation effort.	FY2015 in revised Sampling and Analysis Plan
The history of the number of exceedances of the Notification Leakage Rate and Action Leakage Rate is not contained in the PCCR to evaluate trends.	Include this information in future PCCRs so trends can be identified.	The appropriate method of including the information is being evaluated.	FY2016 PCCR
The PCCR does not demonstrate that closure of the leachate collection system valves meets 40 <i>CFR</i> 264.301(d)(3)(v).	Include this information in future PCCRs.	Closed. This is in the FY2015 PCCR.	FY2015 PCCR
The trend for water levels in relation to the geobuffer needs to be developed. Groundwater elevations in PP-01 and PP-02 have increased over the past several years, and the FY2013 water level measurements for PP-01 were within the upper 5 ft of the geologic buffer, i.e., less than 5 ft below the bottom of the clay liner.	Continued monitoring and evaluation as recommended in the <i>Engineering Feasibility Plan</i> . If a worsening trend is identified, another engineering evaluation will be performed.	Groundwater levels are continuing to be monitored and are reported in the FY2015 PCCR and will be reported in future PCCRs with the objective to identify trends.	FY2016 PCCR
EPA has raised a concern that the existing groundwater action levels are risk-based, not based on protection of the groundwater resource.	Resolve as part of the ongoing data evaluation efforts and incorporate any change into the revised Sampling and Analysis Plan.	As part of the ongoing data evaluation, groundwater threshold values and the need for and use of action levels will be reevaluated.	FY2015 in revised Sampling and Analysis Plan

Table 28. Overall issues and recommendations (cont.)

There are sporadic exceedances in groundwater of threshold values or action levels of metals, especially lead, and uranium. These exceedances should be evaluated to determine if the exceedances are legitimate, represent a trend, and are associated with EMWMF.	Resolve as part of the data evaluation effort. The definitions of threshold values, action levels, and outliers will be evaluated. The resolution will be incorporated into a revised Sampling and Analysis Plan.	These results are being evaluated as part of the FY2014 EMWMF data evaluation effort.	FY2015 in revised Sampling and Analysis Plan
The need for a replacement well for GW-923 should be evaluated.	Resolve as part of the data evaluation effort. The groundwater wells to be monitored will be evaluated and included in the revised Sampling and Analysis Plan.	The need for this well is being evaluated and will be discussed in the FY2015 PCCR.	FY2015 in revised Sampling and Analysis Plan
Why is the SOF limit greater than 1.0 or 15 mrem/year? Resolve any issues pertaining to the EPA 8/22/97 Policy Memorandum	Resolve as part of the revised Sampling and Analysis Plan and incorporate any change into the revised Sampling and Analysis Plan.	The releases meet the current requirements for Sediment Basin discharge and ALARA goal of 15 mrem/year.	FY2015 in revised Sampling and Analysis Plan
Surface water monitoring is included in the groundwater detection monitoring program.	Resolve as part of the revised Sampling and Analysis Plan.	The inclusion of this monitoring in groundwater detection monitoring is being evaluated.	FY 2015 in revised Sampling and Analysis Plan.
DQOs are not included in the <i>Environmental Monitoring Plan</i> , but are mentioned in the PCCR. This term should be removed.	Resolve as part of the revised Sampling and Analysis Plan.	DQOs are being evaluated.	FY2015 PCCR and revised Sampling and Analysis Plan
Trends for contact water compared to discharge limits are not included in the PCCR.	Resolve as part of FFS for water management and the revised Sampling and Analysis Plan	The FFS is being prepared, and the key COCs and appropriate discharge limits will be identified.	FY2015 in FFS, revised Sampling and Analysis Plan, and FY2015 PCCR
Elevated pH levels have been recorded at the sediment basin V-weir likely caused by algae.	Resolve as part of the revised Sampling and Analysis Plan.	Ongoing operational efforts to reduce algae are in progress.	FY2015 in revised Sampling and Analysis Plan

ALARA = as low as reasonably achievable
ARARs = applicable or relevant and appropriate requirements
CFR = Code of Federal Regulations
COC = contaminants of concern
DQO = data quality objectives
EPA = Environmental Protection Agency
EMWMF = Environmental Management Waste Management Facility
FFS = Focused Feasibility Study
FY = fiscal year
PCCR = phased construction completion report
PP = pneumatic piezometer
ROD = record of decision
SOF = sum of fractions

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7. REFERENCES

- 10 *CFR* Part 20, *Standards for Protection against Radiation*, Sect. 1301, “Dose limits for individual members of the public,” Washington, D.C.
- 10 *CFR* Part 835, *Occupational Radiation Protection*.
- 29 *CFR* Part 1910, *Occupational Safety and Health Standards*, Sect.1000, “Air contaminants.”
- 40 *CFR* Part 264, *Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, Sect.301, “Design and operating requirements.”
- 40 *CFR* Part 761, *Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in commerce, and Use Prohibitions*, Sect.75, “Chemical waste landfills.”
- DOE O 435.1, Change 1. *Radioactive Waste Management*, 2001, U.S. Department of Energy, Washington, DC.
- DOE/OR-1014. *Federal Facility Agreement for the Oak Ridge Reservation*, 1992, U.S. Environmental Protection Agency Region IV, U.S. Department of Energy, and Tennessee Department of Environment and Conservation, Oak Ridge, TN.
- DOE/OR-01-1750&D4. *Record of Decision for the Phase 1 Activities in Bear Creek Valley at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee*, 2000, U.S. Department of Energy, Office of Environmental Management, Oak Ridge, TN.
- DOE/OR/01-1791&D3. *Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee*, 1999.
- DOE/OR/01-1873&D2. *Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee*, 2001.
- DOE/OR/01-1873&D2/A1/R2. *Addendum to the Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee*, 2002.
- DOE/OR/01-1873&D2/A2. *Addendum to the Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee*, 2003.
- DOE/OR/01-1873&D2/A3. *Addendum to the Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee*, 2004.
- DOE/OR/01-1873&D2/A4/R2. *Addendum to the Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee*, 2006.

- DOE/OR/01-1873&D2/A5/R2. *Addendum to the Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee, 2010.*
- DOE/OR/01-1873&D2/A6. *Addendum to the Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee, 2010.*
- DOE/OR/01-1873&D4. *Remedial Design Report for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee, 2013.*
- DOE/OR/01-1874&D2. *Remedial Action Work Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee, 2000.*
- DOE/OR/01-1874&D4/R1. *Remedial Action Work Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee, 2014.*
- DOE/OR/01-1884&D2. *Land Use Control Implementation Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee, 2001.*
- DOE/OR/01-1905&D2. *Explanation of Significant Difference from the Remedy in the Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee, 2001.*
- DOE/OR/01-1909&D3. *Attainment Plan for Risk/Toxicity-Based Waste Acceptance Criteria at the Oak Ridge Reservation, Oak Ridge, Tennessee, 2002.*
- DOE/OR/01-2021&D3. *Baseline Groundwater Monitoring Report for the Environmental Management Waste Management Facility, Oak Ridge, Tennessee, 2002.*
- DOE/OR/01-2194&D2. *Explanation of Significant Differences for the Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee, 2005.*
- DOE/OR/01-2220&D2. *Remedial Action Work Plan for the Operation of the East Tennessee Technology Park to Environmental Management Waste Management Facility (ETTP-EMWMF) Haul Road on the Oak Ridge Reservation, Oak Ridge, Tennessee, 2005.*
- DOE/OR/01-2228&D1. *Remedial Design Report for the Construction of the East Tennessee Technology Park to Environmental Management Waste Management Facility (ETTP-EMWMF) Haul Road on the Oak Ridge Reservation, Oak Ridge, Tennessee, 2005.*
- DOE/OR/01-2228&D1/A1. *Addendum to the Remedial Design Report for the Construction of the East Tennessee Technology Park to Environmental Management Waste Management Facility (ETTP-EMWMF) Haul Road on the Oak Ridge Reservation, Oak Ridge, Tennessee, 2005.*

- DOE/OR/01-2296&D1. *Phased Construction Completion Report for the Construction of the East Tennessee Technology Park to Environmental Management Waste Management Facility (ETTP-EMWMF) Haul Road on the Oak Ridge Reservation, Oak Ridge, Tennessee, 2006.*
- DOE/OR/01-2426&D2/A5/R2. *Explanation of Significant Differences for the Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee, 2010.*
- DOE/OR/01-2516&D2. *2011 Third Reservation-Wide CERCLA Five-Year Review for the U.S. Department of Energy Oak Ridge Reservation, Oak Ridge, Tennessee, 2012.*
- DOE/OR/01-2562&D1. *Annual Report for FY 2011 Detection Monitoring at the Environmental Management Waste Management Facility, Oak Ridge, Tennessee, 2012.*
- DOE/OR/01-2603&D2. *Fiscal Year 2013 Phased Construction Completion Report for the Disposal of Oak Ridge Reservation Environmental Management Waste Management Facility, Oak Ridge, Tennessee, 2013.*
- DOE/OR/01-2643&D2. *Fiscal Year 2014 Phased Construction Completion Report for the Oak Ridge Reservation Environmental Management Waste Management Facility, 2014.*
- DOE/OR/02-1637&D2. *Remedial Investigation/Feasibility Study for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, 1998.*
- DOE/OR/02-1637&D2/A1. *Addendum to Remedial Investigation/Feasibility Study for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, 1998.*
- DOE/OR/02-1652&D1. *Proposed Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, 1998.*
- McKay, L.D., et. al. “Field-Scale Migration of Colloidal Tracers in a Fractured Shale Saprolite,” *Groundwater*, 2000, Vol. 38, No. 1, National Groundwater Association, Westerville, OH.
- ORNL/GWPO-021. *Effective Porosity and Pore-Throat Sizes of Conasauga Group Mudrock: Application, Test, and Evaluation of Petrophysical Techniques*, 1996, Lockheed Martin Energy Research, Corp., Oak Ridge, TN.
- ORNL/TM-10112. *Subsurface-Controlled Geological Maps for the Y-12 Plant and Adjacent Areas of Bear Creek Valley*, 1987, Oak Ridge National Laboratory, Oak Ridge, TN.
- ORNL/TM-12053. *Status Report-A Hydrologic Framework for the Oak Ridge Reservation*, 1992.
- ORNL/TM-12191. *Supplement to a Hydrogeologic Framework for the Oak Ridge Reservation*, 1992.
- TDEC 1200-2-11-.16 (2). *Licensing Requirements for Land Disposal of Radioactive Waste, “Performance Objectives,”* 1988, Tennessee Department of Environment and Conservation, Nashville, TN.

- TDEC 1200-04-03-.03 (3). *General Water Quality Criteria*, “Criteria for Water Users,” 2007.
- UCOR-4001. *Environmental Management Waste Management Facility (EMWMF) Environmental Monitoring Plan, Oak Ridge, Tennessee, August 2011*, URS | CH2M Oak Ridge LLC, Oak Ridge, TN.
- UCOR-4049. *Quality Assurance Project Plan for the Water Resources Restoration Program, U.S. Department of Energy, Oak Ridge Reservation, Oak Ridge, Tennessee*, latest revision.
- UCOR-4135. *Environmental Management Waste Management Facility (EMWMF) Operations Plan, Oak Ridge, Tennessee*, latest revision.
- UCOR-4156/R2. *Sampling and Analysis Plan/Quality Assurance Project Plan for Environmental Monitoring at the Environmental Management Waste Management Facility, Oak Ridge, Tennessee*, 2014.
- UCOR-4517. *Engineering Feasibility Plan for the Elevated Groundwater Levels in the Vicinity of PP-01, EMWMF, Oak Ridge, Tennessee*, latest revision.
- USGS 89-4062. *Statistical and Simulation Analysis of Hydraulic Conductivity Data for Bear Creek and Melton Valleys, Oak Ridge Reservation, Tennessee*, 1989, U.S. Geological Survey Water-Resources Investigations Report 89-4062, J.F. Connell and Z.C. Bailey, Nashville, TN.

**APPENDIX A.
ARARS CROSSWALK
AND COMPLIANCE MATRIX**

Note: This PCCR contains the reporting requirements that result from the implementation of the EMWMF ARARs.

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Updates to Implementing Documents

Implementing Documents are identified in the EMWMF Compliance Matrix. Current revisions are posted on the EMWMF SharePoint Site (see Sect. 3.11, above).

Following is a list of Implementing Documents that were revised in FY2014:

PPD-RP-4002	<i>UCOR ALARA Performance Goals</i>
PPD-WM-2400	<i>UCOR Waste Management Program Plan</i>
PROC-EMWMF-EN-003	<i>Field Quality Control Sampling</i>
PROC-EMWMF-EN-007	<i>Storm Water Sampling</i>
PROC-EMWMF-EN-019	<i>Groundwater Sampling</i>
PROC-EMWMF-OP-006	<i>Operation of the EMWMF Site Water Management System</i>
PROC-EMWMF-OP-009	<i>Storm Water Management</i>
PROC-FO-515	<i>Facility Management</i>
PROC-TC-0702	<i>Training Program</i>
PROC-WM-2021	<i>UCOR Waste Management Areas</i>
UCOR-4210	<i>Environmental Management Waste Management Facility Emergency Response and Contingency Plan for URS CH2M Oak Ridge LLC, Oak Ridge, Tennessee</i>

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Table 2.5. Chemical-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Medium/action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
1	Releases of radionuclides into the environment	Exposure to individual members of the public from radiation shall not exceed a total EDE of 0.1 rem/year (100 mrem/year), exclusive of the dose contributions from background radiation, any medical administration the individual has received, or voluntary participation in medical/research programs.	Releases of radionuclides into the environment from an active NRC licensed operation— relevant and appropriate	10 CFR 20.1301(a)	RAWP Section 5	PPD-RP-4002, UCOR ALARA Performance Goals; PROC-RP-4001, ALARA Program, PROC-EMWMF-RC-001, Rad Protection Parameters at EMWMF
2		Shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve doses to members of the public that are ALARA.	Releases of radionuclides into the environment from an active NRC licensed operation— relevant and appropriate	10 CFR 20.1101(b)	RAWP Section 4	PPD-RP-4002, UCOR ALARA Performance Goals; PROC-RP-4001, ALARA Program, PROC-EMWMF-RC-001, Rad Protection Parameters at EMWMF
3		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. Reasonable effort shall be made to maintain releases or radioactivity in effluents to the general environment AT ALARA	Releases of radionuclides into the environment from an active licensed operation— relevant and appropriate	TDEC 1200-2-11-.16(2)	RAWP Section 5	PPD-RP-4002, UCOR ALARA Performance Goals; PROC-RP-4001, ALARA Program, PROC-EMWMF-RC-001, Rad Protection Parameters at EMWMF

ALARA - as low as reasonably achievable

ARAR - applicable or relevant and appropriate requirement

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

CFR - Code of Federal Regulations

EDE - effective dose equivalent

mrem - millirem

ORR - Oak Ridge Reservation

RAWP - Remedial Action Work Plan D3

ROD - record of decision

TBC - to be considered

TDEC - Tennessee Department of Environment and Conservation

Table 2.6. Location-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Location characteristic(s)	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
	<i>Floodplains/ Wetlands</i>					
4	Presence of floodplain as defined in 10 CFR 1022.4(i)	Avoid, to the extent possible, the long-and short-term adverse effects associated with occupancy and modification of floodplains. Measures to mitigate adverse effects of actions in a floodplain include, but are not limited to: minimum grading requirements, runoff controls, design and construction constraints, and protection of ecology-sensitive areas as provided in 10 CFR 1022.12(a)(3)	Federal actions that involve potential impacts to, or take place within, floodplains - applicable	10 CFR 1022.3(a)	Remedial Design Report	This is a design requirement; not applicable to current operations
5		Potential effects of any action taken in a floodplain shall be evaluated. Identify, evaluate, and implement alternative actions that may avoid or mitigate adverse impacts on floodplains		10 CFR 1022.3(c) and (d)	Remedial Design Report	This is a design requirement; not applicable to current operations
6		Design or modify selected alternatives to minimize harm to or within floodplains and restore and preserve floodplain values		10 CFR 1022.5(b)	Remedial Design Report	This is a design requirement; not applicable to current operations
7	Presence of wetlands as defined in 10 CFR 1022.4(v)	Avoid, to the extent possible, the long- and short-term adverse effects associated with destruction, occupancy and modification of wetlands. Measures to mitigate adverse effects of actions in a wetland include, but are not limited to: minimum grading requirements, runoff controls, design and construction constraints, and protection of ecology-sensitive areas as provided in 10 CFR 1022.12(a)(3)	Federal actions that involve potential impacts to, or take place within, wetlands - applicable	10 CFR 1022.3(a)	Remedial Design Report	This is a design requirement; not applicable to current operations
8		Take action, to extent practicable, to minimize destruction, loss or degradation of wetlands, and to preserve, restore, and enhance the natural and beneficial values of wetlands		10 CFR 1022.3(b)	Remedial Design Report	This is a design requirement; not applicable to current operations
9		Potential effects of any new construction in wetlands that are not in a floodplain shall be evaluated. Identify, evaluate, and, as appropriate, implement alternative actions that may avoid or mitigate adverse impacts on wetlands		10 CFR 1022.3(c) and (d)	Remedial Design Report	This is a design requirement; not applicable to current operations
10	Within an area potentially impacting "waters of the State" as defined in TCA 69-3-103(33)	Must comply with the substantive requirements of the ARAP for erosion and sediment control to prevent pollution	Action potentially altering the properties of any "waters of the State" - applicable	TDEC 1200-4-10-.05(6)(n)	Remedial Design Report	This is a design requirement; not applicable to current operations
11		Erosion and sediment control requirements include, but are not limited to:	Action potentially altering the properties of any "waters of the State" - TBC	TDEC Aquatic Resource Alteration General Permit Program Requirements	Remedial Design Report	This is a design requirement; not applicable to current operations
		• Limit clearing, grubbing, and other disturbances in areas in or immediately adjacent to waters of the State to the minimum necessary to accomplish the proposed activity			Remedial Design Report	This is a design requirement; not applicable to current operations
		• Unnecessary vegetation removal is prohibited and all disturbed areas must be properly stabilized and revegetated as soon as practicable			Remedial Design Report	This is a design requirement; not applicable to current operations
		• Limit excavation, dredging, bank reshaping, or grading to the minimum necessary to install authorized structures, accommodate stabilization, or prepare banks for revegetation			Remedial Design Report	This is a design requirement; not applicable to current operations
		• Maintain the erosion and sedimentation control measures throughout the construction period			Remedial Design Report	This is a design requirement; not applicable to current operations

Table 2.6. Location-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Location characteristic(s)	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
	<i>Floodplains/ Wetlands</i>					
		<ul style="list-style-type: none"> Upon achievement of final grade, stabilize and revegetate, within 30 days, all disturbed areas by sodding, seeding, or mulching, or using appropriate native riparian species 			Remedial Design Report	This is a design requirement; not applicable to current operations
12	Within area impacting stream or any other body of water -and- presence of wildlife resources (e.g., fish)	The effects of water-related projects on fish and wildlife resources and their habitat should be considered with a view to the conservation of fish and wildlife resources by preventing loss of and damage to such resources	Action that impounds, modifies, diverts, or controls waters, including navigation and drainage activities - relevant and appropriate	Fish and Wildlife Coordination Act (16 USC 661 <i>et seq.</i>)	Remedial Design Report	This is a design requirement; not applicable to current operations
13	Location encompassing aquatic ecosystem as defined as 40 CFR 230.3(c)	Except as provided under Section 404(b)2 of the CWA, no discharge of dredged or fill material into an aquatic ecosystem is permitted if there is a practicable alternative that would have less adverse impact	Action that involves the discharge of dredged or fill material into "waters of the U.S.", including jurisdictional wetlands - applicable	40 CFR 230.10(a)	Remedial Design Report	This is a design requirement; not applicable to current operations
14		No discharge of dredged or fill material shall be permitted unless appropriate and practicable steps per 40 CFR 230.70 <i>et seq.</i> have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem		40 CFR 230.10(d)	Remedial Design Report	This is a design requirement; not applicable to current operations

Table 2.6. Location-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Location characteristic(s)	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
	<i>Floodplains/ Wetlands</i>					
<i>Cultural resources</i>						
15	Presence of archaeological resource	May not excavate, remove, damage or otherwise alter or deface such resource unless by permit or exception	Action that would impact archaeological resources on public land - applicable	43 CFR 7.4(a)	Remedial Design Report	This is a design requirement; not applicable to current operations
16		Must protect any such archaeological resources if discovered	Excavation activities that inadvertently discover archaeological resources - applicable	43 CFR 7.5(b)(1)	Remedial Design Report	This is a design requirement; not applicable to current operations
17	Presence of human remains, funerary objects, sacred objects, or objects of cultural patrimony for Native Americans	Must stop activities in the area of discovery and make a reasonable effort to secure and protect the objects discovered	Excavation activities that inadvertently discover such resources on federal lands or under federal control - applicable	43 CFR 10.4(c)	Remedial Design Report	This is a design requirement; not applicable to current operations
18		Must consult with Indian tribe likely to be affiliated with the objects to determine further disposition per 40 CFR 10.5(b)		40 CFR 10.4(d)	Remedial Design Report	This is a design requirement; not applicable to current operations
<i>Endangered, threatened or rare species</i>						
19	Presence of Tennessee nongame species (Tennessee dace) as defined in TCA 70-8-103	May not take (i.e., harass, hunt, capture, kill or attempt to kill), possess, transport, export, or process wildlife species	Action impacting Tennessee nongame species, including wildlife species which are "in need of management" (as listed in TWRCPC 94-16 and 94-17) - applicable	TCA 70-8-104(c)	Remedial Design Report	This is a design requirement; not applicable to current operations
20/21		May not knowingly destroy the habitat of such wildlife species		TWRCP 94-16(II)(1)(a); TWRCP 94-17(II)	Remedial Design Report	This is a design requirement; not applicable to current operations
22/23		Upon good cause shown and where necessary to protect human health or safety, endangered or threatened species may be removed, captured or destroyed		TCA 70-8-106(e); TWRCP 94-16(II)(1)(c)	Remedial Design Report	This is a design requirement; not applicable to current operations
24	Presence of Tennessee-listed endangered or rare plant species as listed in TDEC 0400-6-2-.04	May not knowingly uproot, dig, take, remove, damage or destroy, possess or otherwise disturb for any purposes any endangered species	Action impacting rare plant species including but not limited to federally listed endangered species - relevant and appropriate	TCA 70-8-309	Remedial Design Report	This is a design requirement; not applicable to current operations

ARARs - applicable or relevant and appropriate requirements

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ROD - record of decision

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Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Site preparation, construction, and excavation activities</i>				
25	Activities causing fugitive dust emissions	Shall take reasonable precautions to prevent particulate matter from becoming airborne. Reasonable precautions shall include, but are not limited to the following:	Fugitive emissions from land-disturbing activities (e.g., excavation, construction) - applicable	TDEC 1200-3-8-.01(1)	Remedial Design Report	This is a construction requirement; not applicable to current operations
26		<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; 		TDEC 1200-3-8-.01(1)(a)	Remedial Design Report	This is a construction requirement; not applicable to current operations
27		<ul style="list-style-type: none"> Application of asphalt, oil, water, or suitable chemicals on dirt roads, materials stock piles, and other surfaces which can create airborne dusts; 		TDEC 1200-3-8-.01(1)(b)	Remedial Design Report	This is a construction requirement; not applicable to current operations
28		Shall not cause or allow fugitive dust to be emitted in such a manner to exceed 5 minute/hour or 20 minute/day beyond property boundary lines on which emission originates		TDEC 1200-3-8-.01(2)	Remedial Design Report	This is a construction requirement; not applicable to current operations
29/30	Activities causing radionuclide emissions	Exposures to the public from all radiation sources released into atmosphere from DOE facility shall not cause EDE > 10 mrem (0.1 mSv) per year	Radionuclide emissions from point sources at a DOE facility - applicable	40 CFR 61.92 TDEC 1200-3-11.08(3)	RAWP Section 5	PPD-RP-4002, UCOR ALARA Performance Goals; PROC-RP-4001, ALARA Program, PROC-EMWMF-RC-001, Rad Protection Parameters at EMWMF
31/32	Activities causing stormwater runoff	Implement good construction management techniques, sediment and erosion, structural, and vegetative controls to ensure stormwater discharge:	Stormwater discharges associated with construction activities at industrial sites - disturbance of ≥ 5 acres total - applicable ; < 5 acres - relevant and appropriate	40 CFR 122 TDEC 1200-4-10-.05(6)	Remedial Design Report	This is a construction requirement; not applicable to current operations
33		<ul style="list-style-type: none"> does not contain distinctly visible floating scum, oil, or other matter; 		TDEC 1200-4-10-.05(6)(n)	Remedial Design Report	This is a construction requirement; not applicable to current operations
34		<ul style="list-style-type: none"> does not cause an objectionable color contract in the receiving stream; 		TDEC 1200-4-10-.05(6)(o)	Remedial Design Report	This is a construction requirement; not applicable to current operations
35		<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 <p>The following conditions apply to all land disturbance work:</p>		TDEC 1200-4-10-.05(6)(p)	Remedial Design Report	This is a construction requirement; not applicable to current operations
						This is a construction requirement; not applicable to current operations

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
36		<p style="text-align: center;"><i>Site preparation, construction, and excavation activities</i></p> <ul style="list-style-type: none"> • clearing and grubbing must be held to the minimum necessary for grading and equipment operation; 		TDEC 1200-4-10-.05(6)(a)	Remedial Design Report	This is a construction requirement; not applicable to current operations

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Site preparation, construction, and excavation activities</i>				
37		<ul style="list-style-type: none"> • construction must be sequenced to minimize the exposure time of cleared surface area; 		TDEC 1200-4-10-.05(6)(b)	Remedial Design Report	This is a construction requirement; not applicable to current operations
38		<ul style="list-style-type: none"> • construction must be staged or phased for large projects, areas of one phase must be stabilized before another can be initiated; stabilization shall be accomplished by temporarily or permanently protecting the disturbed soil surface from rainfall impacts and runoff; 		TDEC 1200-4-10-.05(6)(c)	Remedial Design Report	This is a construction requirement; not applicable to current operations
39		<ul style="list-style-type: none"> • erosion and sediment control measures must be in place and functional before earth moving operations begin, and must be constructed and maintained throughout the construction period; 		TDEC 1200-4-10-.05(6)(d)	Remedial Design Report	This is a construction requirement; not applicable to current operations
40		<ul style="list-style-type: none"> • all control measures shall be checked, and repaired as necessary, weekly in dry periods and within 24 hr after any rainfall of 0.5 inches with a 24-hr period, during prolonged rainfall, daily checking and repairing is necessary; 		TDEC 1200-4-10-.05(6)(e)	Remedial Design Report	This is a construction requirement; not applicable to current operations
41		<ul style="list-style-type: none"> • pre-construction vegetative ground cover shall not be destroyed, removed, or disturbed more than 20 calendar days prior to grading or earth moving; 		TDEC 1200-4-10-.05(6)(g)	Remedial Design Report	This is a construction requirement; not applicable to current operations
42		<ul style="list-style-type: none"> • appropriate cover (e.g., grass, sod, straw, mulch, fabric mats) shall be applied within seven days on areas that will remain unfinished for more than 30 calendar days; 		TDEC 1200-4-10-.05(6)(h)	Remedial Design Report	This is a construction requirement; not applicable to current operations
43		<ul style="list-style-type: none"> • permanent soil stabilization with perennial vegetation shall be applied as soon as practicable after final grading; 		TDEC 1200-4-10-.05(6)(i)	Remedial Design Report	This is a construction requirement; not applicable to current operations
44		<ul style="list-style-type: none"> • all surface water flowing toward the construction area shall be diverted by using berms, channels, or sediment traps, as necessary; 		TDEC 1200-4-10-.05(6)(j)	Remedial Design Report	This is a construction requirement; not applicable to current operations
45		<ul style="list-style-type: none"> • erosion and sediment control measures shall be designed according to the size and slope of disturbed or drainage areas, to detain runoff and trap sediment; 		TDEC 1200-4-10-.05(6)(k)	Remedial Design Report	This is a construction requirement; not applicable to current operations
46		<ul style="list-style-type: none"> • discharges from sediment basins and traps must be through a pipe or lined channel so that the discharge does not cause erosion; and 		TDEC 1200-4-10-.05(6)(l)	Remedial Design Report	This is a construction requirement; not applicable to current operations
47		<ul style="list-style-type: none"> • muddy water to be pumped from excavation and work areas must be held in settling basins or treated by filtration prior to its discharge into surface waters and water must be discharged through a pipe or lined channel so that the discharge does not cause erosion and sedimentation 		TDEC 1200-4-10-.05(6)(m)	Remedial Design Report	This is a construction requirement; not applicable to current operations

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Site preparation, construction, and excavation activities</i>				
48		Shall develop and implement stormwater management controls to minimize the discharge of pollutants and to ensure the discharge:	Stormwater discharges associated with industrial activity from a landfill - applicable	TDEC 1200-4-10-.04(5)(b)	Remedial Design Report	This is a construction requirement; not applicable to current operations
49		• does not contain distinctly visible floating scum, oil, or other matter;		TDEC 1200-4-10-.04(8)(a)	Remedial Design Report	This is a construction requirement; not applicable to current operations
50		• 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; and		TDEC 1200-4-10-.04(8)(b)	Remedial Design Report	This is a construction requirement; not applicable to current operations
51		• does not cause an objectionable color contrast in the receiving stream		TDEC 1200-4-10-.04(8)(d)	Remedial Design Report	This is a construction requirement; not applicable to current operations
52		Shall develop and maintain a stormwater pollution prevention/control plan which includes a description of potential pollutant sources and paths to outfalls and otherwise contains information required under this section		TDEC 1200-4-10-.04(5)(a)	Remedial Design Report	This is a construction requirement; not applicable to current operations
53		Shall monitor at least semiannually the identified stormwater outfalls for the parameters specified in 1200-4-10-.04(7)(b)(1) and (2)(iv)		TDEC 1200-4-10-.04(7)(a)	Remedial Design Report	This is a construction requirement; not applicable to current operations
54		Shall address runoff in a monitoring plan as required in 1200-4-10-.04(5)(i), indicating sampling locations, parameters and monitoring procedures		TDEC 1200-4-10-.04(7)(b)(2)(iv)	Remedial Design Report	This is a construction requirement; not applicable to current operations

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Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		Waste generation/management				
55/56	Characterization of solid waste (e.g., contaminated PPE, equipment, wastewater)	Must determine if that waste is hazardous waste or if waste is excluded under 40 CFR 261.4; and	Generation of solid waste as defined in 40 CFR 261.2 - applicable	40 CFR 262.11(a) TDEC 1200-1-11-.03(1)(b)(1)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile
57/58		Must determine if waste is listed under 40 CFR Part 261; or		40 CFR 262.11(b) TDEC 1200-1-11-.03(1)(b)(2)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile
59/60		Must characterize waste by using prescribed testing methods or applying generator knowledge based on information regarding material or processes used. If waste is determined to be hazardous, it must be managed in accordance with pertinent provisions of 40 CFR 261-268		40 CFR 262.11(c) and (d) TDEC 1200-1-11-.03(1)(b)(3)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile
61/62	Characterization of hazardous waste	Must obtain a detailed chemical and physical analysis of a representative sample of the waste(s) which at a minimum contains all the information which must be known to treat, store, or dispose of the waste in accordance with 40 CFR 264 and 268	Generation of RCRA hazardous waste for storage, treatment or disposal - applicable	40 CFR 264.13(a)(1) TDEC 1200-1-11-.06(2)(d)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile
63/64		Must determine if the waste is restricted from land disposal under 40 CFR 268 <i>et seq.</i> by testing in accordance with prescribed methods or use of generator knowledge of waste		40 CFR 268.7 TDEC 1200-1-11-.10(1)(g)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile
65	Characterization of LLW (e.g., contaminated PPE, equipment, wastewater)	Shall be characterized using direct or indirect methods and the characterization documented in sufficient detail to ensure safe management and compliance with the WAC of the receiving facility	Generation of LLW for storage and disposal at a DOE facility - TBC	DOE M 435.1-1(IV)(I)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile
66		Characterization data shall, at a minimum, include the following information relevant to the management of the waste:				
67		• physical and chemical characteristics;		DOE M 435.1-1(IV)(I)(2)(a)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile
68		• volume, including the waste and any stabilization or absorbent media;		DOE M 435.1-1(IV)(I)(2)(b)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile
69		• weight of the container and contents;		DOE M 435.1-1(IV)(I)(2)(c)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		Waste generation/management				
70		<ul style="list-style-type: none"> identities, activities, and concentrations of major radionuclides; 		DOE M 435.1-1(IV)(I)(2)(d)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile
71		<ul style="list-style-type: none"> characterization date; 		DOE M 435.1-1(IV)(I)(2)(e)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile
72		<ul style="list-style-type: none"> generating source; and 		DOE M 435.1-1(IV)(I)(2)(f)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile
73		<ul style="list-style-type: none"> any other information which may be needed to prepare and maintain the disposal facility performance assessment, or demonstrate compliance with performance objectives 		DOE M 435.1-1(IV)(I)(2)(g)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile
74	Management of PCB waste (e.g., contaminated PPE, equipment, wastewater)	Any person storing or disposing of PCB waste must do so in accordance with 40 CFR 761, Subpart D	Generation of waste containing PCBs at concentrations \geq 50 ppm - applicable	40 CFR 761.50(a)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile
75		Any person cleaning up and disposing of PCBs shall do so based on the concentration at which the PCBs are found	Generation of PCB remediation waste as defined in 40 CFR 761.3 - applicable	40 CFR 761.61	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profile
76/77	Temporary storage of hazardous waste in containers (e.g., PPE, rags, etc.)	A generator may accumulate hazardous waste at the facility provided that:	Accumulation of RCRA hazardous waste on site as defined in 40 CFR 260.10 - applicable	40 CFR 262.34(a) TDEC 1200-1-11-.03(4)(e)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
		<ul style="list-style-type: none"> waste is placed in containers that comply with 40 CFR 265.171-173 (Subpart I); and 			RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
		<ul style="list-style-type: none"> container is marked with the words "hazardous waste" or; 			RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
78/79		• container may be marked with other words that identify the contents	Accumulation of 55 gal or less of RCRA hazardous waste at or near any point of generation - applicable	40 CFR 262.34(c)(1) TDEC 1200-1-11-.03(4)(e)(5)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
80/81	Use and management of hazardous waste in containers	If container is not in good condition (e.g., severe rusting, structural defects) or if it begins to leak, must transfer waste into container in good condition	Storage of RCRA hazardous waste in containers - applicable	40 CFR 264.171 TDEC 1200-1-11-.05(9)(b)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
82/83		Use container made or lined with materials compatible with waste to be stored so that the ability of the container is not impaired;		40 CFR 264.172 TDEC 1200-1-11-.05(9)(c)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
84/85		Keep containers closed during storage, except to add/remove waste;		40 CFR 264.173(a) TDEC 1200-1-11-.05(9)(d)(1)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
86/87		Open, handle and store containers in a manner that will not cause containers to rupture or leak		40 CFR 264.173(b) TDEC 1200-1-11-.05(9)(d)(2)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
88/89	Design and operation of a RCRA container storage 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 of RCRA hazardous waste in containers that do not contain free liquids - applicable	40 CFR 264.175(c) TDEC 1200-1-11-.06(9)(f)(3)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
90/91		Area must have a containment system designed and operated as follows:	Storage of RCRA hazardous waste with free liquids or F020, F021, F022, F023, F026 and F027 in containers - applicable	40 CFR 264.175(a); TDEC 1200-1-11-.06(9)(f)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		Waste generation/management				
92/93		<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; 		40 CFR 264.175(b)(1) TDEC 1200-1-11-.06(9)(f)(2)(i)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
94/95		<ul style="list-style-type: none"> 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; 		40 CFR 264.175(b)(2) TDEC 1200-1-11-.06(9)(f)(2)(ii)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
96/97		<ul style="list-style-type: none"> must have sufficient capacity to contain 10% of the volume of containers or the volume of the largest container, whichever is greater; 		40 CFR 264.175(b)(3) TDEC 1200-1-11-.06(9)(f)(2)(iii)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
98/99		<ul style="list-style-type: none"> run-on into the system must be prevented unless the collection system has sufficient capacity to contain along with volume required for containers; and 		40 CFR 264.175(b)(4) TDEC 1200-1-11-.06(9)(f)(2)(iv)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
100/101		<ul style="list-style-type: none"> spilled or leaked waste and accumulated precipitation must be removed from the sump or collection area in a timely manner as necessary to prevent overflow 		40 CFR 264.175(b)(5) TDEC 1200-1-11-.06(9)(f)(2)(v)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
102	Temporary storage of LLW	Ensure that radioactive waste is stored in a manner that protects the public, workers, and the environment and that the integrity of waste storage is maintained for the expected time of storage	Management of LLW at a DOE facility - TBC	DOE M 435.1-1 (IV)(N)(1)	RAWP Section 4	PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021: UCOR WM Areas
103		Shall not be readily capable of detonation, explosive decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water		DOE M 435.1-1 (IV)(N)(1)	RAWP Section 4	PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas; PROC-WM-2001, Generator Requirements for Transferring Waste

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		Waste generation/management				
104		Shall be stored in a location and manner that protects the integrity of waste for the expected time of storage		DOE M 435.1-1 (IV)(N)(3)	RAWP Section 4	PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
105		Shall be managed to identify and segregate LLW from mixed waste		DOE M 435.1-1 (IV)(N)(6)	RAWP Section 4	PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas; PROC-WM-2001, Generator Requirements for Transferring Waste
106	Packaging of LLW (e.g., PPE, rags)	Shall be packaged in a manner that provides containment and protection for the duration of the anticipated storage period and until disposal is achieved or until the waste has been removed from the container	Storage of LLW in containers at a DOE facility - TBC	DOE M 435.1-1(IV)(L)(1)(a)	RAWP Section 4	PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas; PROC-WM-2001, Generator Requirements for Transferring Waste
107		Vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container		DOE M 435.1-1(IV)(L)(1)(b)	RAWP Section 4	PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas; PROC-WM-2001, Generator Requirements for Transferring Waste
108		Containers shall be marked such that their contents can be identified		DOE M 435.1-1(IV)(L)(1)(c)	RAWP Section 4	PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
109	Temporary storage of PCB waste (e.g., PPE, rags) in a container(s)	Container(s) shall be marked as illustrated in 40 CFR 761.45(a)	Storage of PCBs and PCB items at concentrations \geq 50 ppm for disposal - applicable	40 CFR 761.40(a)(1)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
110		Storage area must be properly marked as required by 40 CFR 761.40(a)(10)		40 CFR 761.65(c)(3)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas

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Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
	Waste generation/management					
111		Any leaking PCB items and their contents shall be transferred immediately to a properly marked non-leaking container(s)		40 CFR 761.65(c)(5)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
112		Container(s) shall be in accordance with requirements set forth in DOT HMR at 49 CFR 171-180		40 CFR 761.65(c)(6)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
113	Storage of PCB waste and/or PCB/ radioactive waste in a RCRA-regulated container storage area	Does not have to meet storage unit requirements in 40 CFR 761.65(b)(1) provided unit:	Storage of PCBs and PCB items designated for disposal - applicable	40 CFR 761.65(b)(2)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
114		• is permitted by EPA under RCRA §3004, or		40 CFR 761.65(b)(2)(i)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
115		• qualifies for interim status under RCRA §3005; or		40 CFR 761.65(b)(2)(ii)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
116		• is permitted by an authorized state under RCRA §3006 and,		40 CFR 761.65(b)(2)(iii)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
117		• PCB spills cleaned up in accordance with subpart G of 40 CFR 761		40 CFR 761.65(c)(1)(iv)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program;
118	Storage of PCB/radioactive waste in containers	For liquid wastes, containers must be non-leaking	Storage of PCB/radioactive waste in containers other than those meeting DOT HMR performance standards - applicable	40 CFR 761.65(c)(6)(i)(A)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
119		Waste generation/management For non-liquid wastes, containers must be designed to prevent buildup of liquids if such containers are stored in an area meeting the containment requirements of 40 CFR 761.65(b)(1)(ii); and		40 CFR 761.65(c)(6)(i)(B)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2021, UCOR WM Areas
120		For both liquid and non-liquid wastes containers must meet all regulations and requirements pertaining to nuclear criticality safety		40 CFR 761.65(c)(6)(i)(C)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2001, Generator Requirements for Transferring Waste; PROC-WM-2021, UCOR WM Areas

ARARs - applicable or relevant and appropriate requirements

ARAP - Aquatic Resource Alteration Permit

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

CFR - Code of Federal Regulations

CWA - Clean Water Act

ORR - Oak Ridge Reservation

ROD - record of decision

TBC - to be considered

TCA - Tennessee Code Annotated

TDEC - Tennessee Department of Environment and Conservation

TWRCP - Tennessee Wildlife Resources Commission Proclamation

USC - United States Code

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Treatment/Disposal</i>				
121	Treatment of LLW	Treatment to provide more stable waste forms and to improve the long-term performance of a LLW disposal facility shall be implemented as necessary to meet the performance objectives of the disposal facility	Generation for disposal of LLW at a DOE facility - TBC	DOE M 435.1-1(IV)(O)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
122	Disposal of LLW at an off-site disposal facility or in the EMWMF	LLW shall be certified as meeting waste acceptance requirements before it is transferred to the receiving facility	Generation for disposal of LLW - TBC	DOE M 435.1-1(IV)(J)(2)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	PROC-WM-2001, Generator Requirements for Transferring Waste
123/124	Disposal of RCRA/TSCA waste at an off-site commercial facility	Meet authorized limits established in accordance with basic dose limits and consistent with guidelines contained in DOE-EH guidance prior to release	Release of hazardous wastes potentially containing residual radioactive material throughout the volume - TBC	DOE Order 5400.5(II)(5)(c)(6) and 5400.5(IV)(5)(a)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2001, Generator Requirements for Transferring Waste
		Authorized limits shall be consistent with limits and guidelines established by other applicable Federal and State laws				
125	Disposal of bulk PCB remediation waste	Shall be disposed of:	Bulk PCB remediation waste (as defined in 40 CFR 761.3) which has been de-watered and with a PCB concentration \geq 50 ppm - applicable	40 CFR 761.61(a)(5)(i)(B)(2)(iii)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
		<ul style="list-style-type: none"> • in a hazardous waste landfill permitted by a State authorized under §3006 of RCRA, or • in a PCB disposal facility approved under 40 CFR 761.60 				
126	Performance-based disposal of PCB remediation waste	May dispose by one of the following methods:	Disposal of non-liquid PCB remediation waste - applicable	40 CFR 761.61(b)(2)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
127		<ul style="list-style-type: none"> • in a high-temperature incinerator approved under Section 761.70(b), 		40 CFR 761.61(b)(2)(i)		

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Treatment/Disposal</i>				
		<ul style="list-style-type: none"> • by an alternate disposal method approved under Section 761.60(e), • in a chemical waste landfill approved under Section 761.75, • in a facility with a coordinated approval issued under Section 761.77, or 				
128		<ul style="list-style-type: none"> • through decontamination in accordance with Section 761.79 		40 CFR 761.61(b)(2)(ii)		
129	Disposal of PCB cleanup wastes (PPE, rags, non-liquid cleaning materials)	Shall be disposed of either:	Generation of non-liquid PCBs at any concentration during and from the cleanup of PCB remediation waste - applicable	40 CFR 761.61(a)(5)(v)(A)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
		<ul style="list-style-type: none"> • in a facility permitted, licensed or registered by a State to manage municipal solid waste under 40 CFR 258 or non-municipal, nonhazardous waste subject to 40 CFR 257.5 through 257.30; or • in a RCRA Subtitle C landfill permitted by a State to accept PCB waste, or • in an approved PCB disposal facility, or • through decontamination under 40 CFR 761.79(b) or (c) 				

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Treatment/Disposal</i>				
130	Disposal of PCB cleaning solvents, abrasives, and equipment	May be reused after decontamination in accordance with 761.79	Generation of PCB wastes from the cleanup of PCB remediation wastes - applicable	40 CFR 761.61(a)(5)(v)(B)	RAWP Section 4	PPD-EC-1747, Environmental Compliance and Protection Program; PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2001, Generator Requirements for Transferring Waste
131	Performance-based disposal of PCB bulk product waste	May dispose of by one of the following:	Disposal of PCB bulk product waste as defined in 40 CFR 761.3 - applicable	40 CFR 761.62(a)	RAWP Section 4	Generator Waste Profiles
132		• in an incinerator approved under Section 761.70;		40 CFR 761.62(a)(1)		
133		• in a chemical waste landfill approved under Section 761.75;		40 CFR 761.62(a)(2)		
134		• in a hazardous waste landfill permitted by EPA under §3004 of RCRA or by authorized state under §3006 of RCRA;		40 CFR 761.62(a)(3)		
135		• under alternate disposal approved under Section 761.60(e);		40 CFR 761.62(a)(4)		
136		• in accordance with decontamination provisions of Section 761.79;		40 CFR 761.62(a)(5)		
137		• in accordance with thermal decontamination provisions of Section 761.79(e)(6) for metal surfaces in contact with PCBs		40 CFR 761.62(a)(6)		

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
138/139	Disposal of RCRA hazardous waste in a land-based unit	RCRA-restricted waste may be land disposed only if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 CFR 268.40 before land disposal	Land disposal, as defined in 40 CFR 268.2, of RCRA restricted waste - applicable	40 CFR 268.40 TDEC 1200-1-11-.10(3)(a)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
140		Prior to land disposal, soil contaminated with hazardous waste may be treated to meet the alternative treatment standards of 40 CFR 268.49(c)		40 CFR 268.49(b)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
141/142	Disposal requirements for particular RCRA waste forms and types	Must not be placed in a landfill unless the waste and the landfill meet applicable provisions of 40 CFR Part 268; and	Disposal of ignitable or reactive RCRA waste - applicable	40 CFR 264.312(a) TDEC 1200-1-11-.06(14)(m)(1)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
		<ul style="list-style-type: none"> the resulting waste, mixture or dissolution of material no longer is reactive or ignitable; and 40 CFR 264.17(b) is complied with (see below) 				
143/144		May be landfilled without meeting 40 CFR 264.312(a), provided wastes are disposed of in such a way that they are protected from any materials or conditions which may cause them to ignite;	Disposal of ignitable or reactive RCRA waste [except for prohibited wastes which remain subject to treatment standards in 40 CFR 268.40 <i>et seq.</i>] - applicable	40 CFR 264.312(b) TDEC 1200-1-11-.06(14)(m)(2)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
		Must be disposed of in non-leaking containers which are carefully handled and placed so as to avoid heat, sparks, rupture, or any other condition that might cause ignition of the wastes;				
		Must be covered daily with soil or other non-combustible material to minimize the potential of ignition;				

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Treatment/Disposal</i>				
		Must be disposed of in cells that contain or will contain other wastes which may generate heat sufficient to cause ignition of the waste; and				
145/146		Must not be placed into a cell unless 40 CFR 264.17(b) is complied with (see below)	Disposal of incompatible wastes in a RCRA landfill - applicable	40 CFR 264.313 TDEC 1200-1-11-.06(14)(n)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
147/148	Treatment and disposal of ignitable, reactive, or incompatible RCRA wastes	Must take precautions to prevent reactions which:	Operation of a RCRA facility that treats, stores, or disposes of ignitable, reactive, or incompatible wastes - applicable	40 CFR 264.17(b) TDEC 1200-1-11-.06(2)(h)(2)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
		<ul style="list-style-type: none"> • generate extreme heat, pressure, fire or explosion, or produce uncontrolled fumes or gases which pose a risk of fire or explosion; 				
		<ul style="list-style-type: none"> • produce uncontrolled toxic fumes or gases which threaten human health or the environment; 				
		<ul style="list-style-type: none"> • damage the structural integrity of the device or facility 				
149/150	Disposal of bulk or non-containerized liquids in a RCRA landfill	May not dispose of bulk or non-containerized liquid hazardous waste or hazardous waste containing free liquids in any landfill	Placement of bulk or non-containerized RCRA hazardous waste - applicable	40 CFR 264.314(b) TDEC 1200-1-11-.06(14)(o)(2)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Treatment/Disposal</i>				
151/152	Disposal of containers in RCRA landfill	May not place containers holding free liquid in a landfill unless the liquid is mixed with an absorbent, solidified, removed, or otherwise eliminated	Placement of containers containing RCRA hazardous waste in a landfill - applicable	40 CFR 264.314(d) TDEC 1200-1-11-.06(14)(o)(4)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
153/154		Sorbents used to treat free liquids to be disposed of in landfills must be nonbiodegradable as described in 264.315(e)(1)		40 CFR 264.314(e) TDEC 1200-1-11-.06(14)(o)(5)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
155/156		Unless they are very small, containers must be either at least 90% full when placed in the landfill, or crushed, shredded, or similarly reduced in volume to the maximum practical extent before burial in the landfill		40 CFR 264.315 TDEC 1200-1-11-.06(14)(p)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
157/158	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	Closure of RCRA landfill - applicable	40 CFR 264.114 TDEC 1200-1-11-.06(7)(e)	Remedial Design Report	This is a closure requirement not applicable to current operations
159	Treatment of uranium and thorium bearing LLW	Such wastes shall be properly conditioned so that the generation and escape of biogenic wastes will not cause exceedance of Rn-222 emission limits of DOE Order 5400.5(IV)(6)(d)(1)(b) and will not result in premature structure failure of the facility	Placement of potentially biodegradable contaminated wastes in a long-term management facility - TBC	DOE Order 5400.5(IV)(6)(d)(1)(c)	Not Applicable	Not Applicable
160	Disposal of TSCA PCB wastes	PCBs and PCB items shall be placed in a manner that will prevent damage to containers or articles	Disposal of PCBs or PCB items in chemical waste landfill - applicable	40 CFR 761.75(b)(8)(i)	Ops Plan Section 2.7.3	PROC-EMWMF-OP-003, Waste Placement
		Other wastes that are not compatible with PCBs shall be segregated from the PCBs throughout the handling and disposal process			EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Treatment/Disposal</i>				
		Bulk liquids not exceeding 500 ppm PCBs may be disposed of provided such waste is pretreated and/or stabilized (e.g., chemically fixed, evaporated, mixed with dry inert absorbent) to reduce its liquid content or increase its solid content so that a non-flowing consistency is achieved to eliminate the presence of free liquids prior to final disposal			EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
161		May be disposed of if container is surrounded by an amount of inert sorbent materials capable of absorbing all of the liquid contents of the container	Disposal of PCB container with liquid PCB between 50 ppm and 500 ppm - applicable	40 CFR 761.75(b)(8)(ii)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
162	Packaging of LLW for disposal (e.g., PPE, sludges)	Must not be packaged for disposal in cardboard or fiberboard boxes	Generation of LLW for disposal at a LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(7)(a)(1)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
163		Must be solidified or packaged in sufficient absorbent material to absorb twice the volume of liquid	Generation of liquid LLW for disposal at a LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(7)(a)(2)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
164		Shall contain as little free standing and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume	Generation of solid LLW containing liquid for disposal at a LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(7)(a)(3)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
165		Must not be capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures or of explosive reaction with water	Generation of LLW for disposal at a LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(7)(a)(4)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
166		Must not contain, or be capable of, generating quantities of toxic gases, vapor, or fumes	Generation of LLW for disposal at a LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(7)(a)(5)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
167		Must not be pyrophoric	Generation of LLW for disposal at a LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(7)(a)(6)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
168		Must have structural stability either by processing the waste or placing the waste in a container or structure that provides stability after disposal	Generation of LLW for disposal at a LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(7)(b)(1)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
169		Must be converted into a form that contains as little free standing and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume of the waste when the waste is in a disposal container designed to ensure stability, or 0.5% of the volume of the waste for waste processed to a stable form	Generation of liquid LLW or LLW containing liquids for disposal at a LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(7)(b)(2)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles
170		Void spaces within the waste and between the waste and its package must be reduced to the extent practicable	Generation of LLW for disposal at a LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(7)(b)(3)	EMWMF WAC Attainment Plan (DOE/OR/01-1909&D3)	Generator Waste Profiles

ARARs - applicable or relevant and appropriate requirements

ARAP - Aquatic Resource Alteration Permit

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

CFR - Code of Federal Regulations

CWA - Clean Water Act

ORR - Oak Ridge Reservation

ROD - record of decision

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TCA - Tennessee Code Annotated

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Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>General facility requirements</i>				
171/172	Security system	Must prevent the unknowing entry and minimize the possibility for unauthorized entry of persons or livestock onto active portion of the facility or comply with provisions of 40 CFR 264.14(b) and (c)	Operation of a RCRA landfill - applicable	40 CFR 264.14 TDEC 1200-1-11-.06(2)(e)	Remedial Design Report; Ops Plan Section 1.4	SP-0105, EMWMF Security Plan; PROC-EMWMF-SF-001, EMWMF Site Access Control
173		Unless a natural barrier adequately deters access by the general public, either warning signs and fencings must be installed and maintained or requirements of 40 CFR 61.154(c)(1) and (2) must be met	Operation of an active waste disposal site that receives asbestos-containing material from a source covered under 40 CFR 61.145 - applicable	40 CFR 61.154(b)	Remedial Design Report; Ops Plan Section 1.4	SP-0105, EMWMF Security Plan; PROC-EMWMF-SF-001, EMWMF Site Access Control; PROC-EMWMF-OP-003, Waste Placement (requires controls for no visible emissions and daily cover requirements in lieu of signage and fencing, therefore the requirements of Part 61.154 (c) (1) and (2) are met)
174		Warning signs must be displayed at all entrances and at intervals of 330 ft or less along the property line of the site		40 CFR 61.154(b)(1)	Remedial Design Report; Ops Plan Section 1.4	SP-0105, EMWMF Security Plan; PROC-EMWMF-SF-001, EMWMF Site Access Control; PROC-EMWMF-OP-003, Waste Placement (requires controls for no visible emissions and daily cover requirements in lieu of signage and
		The warning signs must:				
175		• be posted in a manner and location that a person can easily read the legend;		40 CFR 61.154(b)(1)(i)	Remedial Design Report; Ops Plan Section 1.4	PROC-EMWMF-OP-003: Waste Placement (requires controls for no visible emissions and daily cover requirements in lieu of signage, therefore the requirements of Part 61.154 (c) (1) and (2) are met)
176		• conform to the requirements of (20 in. x 14 in.) upright format signs specified in 29 CFR 1901.145(d)(4); and		40 CFR 61.154(b)(1)(ii)	Remedial Design Report; Ops Plan Section 1.4	PROC-EMWMF-OP-003: Waste Placement (requires controls for no visible emissions and daily cover requirements in lieu of signage, therefore the requirements of Part 61.154 (c) (1) and (2) are met)
177		• display the legend in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this paragraph		40 CFR 61.154(b)(1)(iii)	Remedial Design Report; Ops Plan Section 1.4	PROC-EMWMF-OP-003: Waste Placement (requires controls for no visible emissions and daily cover requirements in lieu of signage, therefore the requirements of Part 61.154 (c) (1) and (2) are met)

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>General facility requirements</i>				
178		The perimeter of the disposal site must be fenced in a manner adequately to deter access by the general public		40 CFR 61.154(b)(2)	Remedial Design Report; Ops Plan Section 1.4	PROC-EMWMF-OP-003: Waste Placement (requires controls for no visible emissions and daily cover requirements in lieu of fencing, therefore the requirements of Part 61.154 (c) (1) and (2) are met; however, access is controlled in accordance with site security requirements)
179		A 6-ft woven mesh fence, wall or similar device shall be placed around the site to prevent unauthorized access	Construction of a TSCA chemical waste landfill - applicable	40 CFR 761.75(b)(9)(i)	Remedial Design Report	PROC-FO-515, Facility Management; SP-0105 EMWMF Security Plan
180		Roads shall be maintained to and within the site which are adequate to support the operation and maintenance of the site without causing safety or nuisance problems or hazardous conditions		40 CFR 761.75(b)(9)(ii)	Remedial Design Report/RAWP Section 4	PROC-FO-515, Facility Management; BJC/OR-3158, EMWMF Erosion and Sediment Control Plan
181		Site shall be operated and maintained to prevent hazardous conditions resulting from spilled liquids and windblown materials		40 CFR 761.75(b)(9)(iii)	Ops Plan Section 1.1	PROC-FO-515, Facility Management
182/183	General inspections	Must inspect facility for malfunctions and deterioration, operator errors, and discharges, often enough to identify and correct any problems	Operation of a RCRA landfill - applicable	40 CFR 264.15(a) TDEC 1200-1-11-.06(2)(f)(1)	RAWP Section 4	PROC-FO-515, Facility Management
184/185		Must remedy any deterioration or malfunction of equipment or structures on a schedule that ensures that the problem does not lead to an environmental or human health hazard	Operation of a RCRA landfill - applicable	40 CFR 264.15(c) TDEC 1200-1-11-.06(2)(f)(3)	RAWP Section 4	PROC-FO-515, Facility Management
186/187	Personnel training	Must ensure personnel adequately trained in hazardous waste, emergency response, monitoring equipment maintenance, alarm system procedures, etc.	Operation of a RCRA landfill - applicable	40 CFR 264.16 TDEC 1200-1-11-.06(2)(g)	RAWP Section 4	PROC-TC-0702, Training Program; EMWMF Training Matrix
188/189	Construction quality assurance program	Must develop and implement a Construction Quality Assurance Program to ensure that the unit meets or exceeds all design criteria and specifications for all physical components including: foundations, dikes, liners, geomembranes, leachate collection and removal systems, leak detection systems and final covers in accordance with remaining provisions of 40 CFR 264.19	Operation of a RCRA landfill - applicable	40 CFR 264.19 TDEC 1200-1-11.06(2)(j)	Remedial Design Report	PROC-PQ-1820, Inspection Quality Control

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Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
190/191	Contingency plan	Must have a contingency plan, designed to minimize hazards to human health and the environment from fires, explosions or other unplanned sudden releases of hazardous waste to air, soil, or surface water in accordance with 40 CFR 264.52	Operation of a RCRA landfill - applicable	40 CFR 264.51 TDEC 1200-1-11.06(4)(b)	RAWP Section 4/Ops Plan Section 4.7	UCOR-4210, EMWMF Emergency Response and Contingency Plan
192/193		Must be at least one emergency coordinator on the facility premises responsible for coordinating emergency response measures in accordance with 40 CFR 264.56	Operation of a RCRA landfill - applicable	40 CFR 264.55 TDEC 1200-1-11-.06(4)(f)	RAWP Section 4	UCOR-4210, EMWMF Emergency Response and Contingency Plan
194/195	Preparedness and prevention	Facilities must be designed, constructed, maintained, and operated to prevent any unplanned release of hazardous waste or hazardous waste constituents into the environment and minimize the possibility of fire or explosion. All facilities must be equipped with communication and fire suppression equipment and undertake additional measures as specified in 40 CFR 264.30 <i>et seq</i>	Operation of a RCRA hazardous waste facility - applicable	40 CFR 264.30-264.37 TDEC 1200-1-11-.06(3)	Remedial Design Report/ Ops Plan	UCOR-4210, EMWMF Emergency Response and Contingency Plan
196/197	Inventory requirements	The location, dimensions, contents, and location of each cell must be recorded in reference to permanently surveyed benchmarks	Operation of a RCRA landfill - applicable	40 CFR 264.309 TDEC 1200-1-11-.06(14)(j)	Remedial Design Report: Ops Plan	PROC-EMWMF-OP-003, Waste Placement
198		Maintain, until closure, records of the location, depth and area, and quantity in cubic yards of asbestos containing material within the disposal site on a map or diagram	Operation of an active waste disposal site that receives asbestos-containing material from a source covered under 40 CFR 61.145 - applicable	40 CFR 61.154(f)	Ops Plan Section 2.5	PROC-EMWMF-OP-003, Waste Placement
199		Disposal records shall include information on the PCB concentration in the liquid wastes and the three dimensional burial coordinates for PCBs and PCB items	Operation of a TSCA chemical waste landfill - applicable	40 CFR 761.75(b)(8)(iv)	Ops Plan Section 2.5	PROC-EMWMF-OP-003, Waste Placement
200		The boundaries and locations of each disposal unit must be accurately located and mapped by means of a land survey.	Land disposal of LLW - relevant and appropriate	TDEC 1200-2-11-.17(3)(g)	Remedial Design Report	Completed prior to start of operations
201	Surface water monitoring	The groundwater and surface water from the disposal site area must be sampled prior to commencing operation for use as baseline data	Construction of TSCA chemical waste landfill - applicable	40 CFR 761.65(b)(6)(i)(A)	RAWP Section 5	Completed prior to start of operations

ARARs - applicable or relevant and appropriate requirements

ARAP - Aquatic Resource Alteration Permit

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

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
<i>General facility requirements</i>						

CFR - Code of Federal Regulations

CWA - Clean Water Act

ORR - Oak Ridge Reservation

ROD - record of decision

TBC - to be considered

TCA - Tennessee Code Annotated

TDEC - Tennessee Department of Environment and Conservation

TWRCP - Tennessee Wildlife Resources Commission Proclamation

USC - United States Code

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Disposal Site Suitability Requirements</i>				
202/203	Siting of a RCRA landfill	A facility located in a 100 year floodplain [as defined in 40 CFR 264.18(b)(2)] must be designed, constructed, operated and maintained to prevent washout of any hazardous waste, unless it can be demonstrated that procedures are in effect which will cause the waste to be removed safely, before flood waters can reach the facility	Construction of a RCRA hazardous waste landfill - applicable	40 CFR 264.18(b)(1) TDEC 1200-1-11-.06(2)(i)	Remedial Design Report	This is a siting requirement; not applicable to current operations
204	Siting of a TSCA landfill	The landfill must be located above the historical high groundwater table. The bottom of the landfill liner shall be at least 50 ft above the historical high water table There shall be no hydraulic connection between the site and standing or flowing surface water Floodplains, shorelands and groundwater recharge areas shall be avoided	Construction of a TSCA chemical waste landfill - applicable	40 CFR 761.75(b)(3)	Remedial Design Report	This is a siting requirement; not applicable to current operations
205		Shall provide diversion structures capable of diverting all surface water runoff from a 24-hour, 25-year storm	Construction of a TSCA chemical waste landfill (above the 100-year floodwater elevation) - applicable	40 CFR 761.75(b)(4)(ii)	Remedial Design Report	This is a siting requirement; not applicable to current operations
206		The landfill site shall be located in an area of low to moderate relief to minimize erosion and to help prevent landslides or slumping	Construction of a TSCA chemical waste landfill - applicable	40 CFR 761.75(b)(5)	Remedial Design Report	This is a siting requirement; not applicable to current operations
207	Siting of a LLW disposal facility	Disposal site shall be capable of being characterized, modeled, analyzed, and monitored	Land disposal of LLW - relevant and appropriate	TDEC 1200-2-11-.17(1)(b)	Remedial Design Report	This is a siting requirement; not applicable to current operations
208		Areas must be avoided having known natural resources which, if exploited, would result in failure of the cell to meet performance objectives	Land disposal of LLW - relevant and appropriate	TDEC 1200-2-11-.17(1)(d)	Remedial Design Report	This is a siting requirement; not applicable to current operations
209		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.	Land disposal of LLW - relevant and appropriate	TDEC 1200-2-11-.17(1)(e)	Remedial Design Report	This is a siting requirement; not applicable to current operations

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
	<i>Disposal Site Suitability Requirements</i>					
210		Upstream drainage area must be minimized to decrease the amount of runoff which could erode or inundate the disposal unit	Land disposal of LLW - relevant and appropriate	TDEC 1200-2-11-.17(1)(f)	Remedial Design Report	This is a siting requirement; not applicable to current operations
211		The disposal site must provide sufficient depth to the water table that ground water intrusion, perennial or otherwise, into the waste will not occur	Land disposal of LLW - relevant and appropriate	TDEC 1200-2011-.17(1)(g)	Remedial Design Report	This is a siting requirement; not applicable to current operations
		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 1200-2-11-.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				
212		The hydrogeologic unit used for disposal shall not discharge ground water to the surface within the disposal site	Land disposal of LLW - relevant and appropriate	TDEC 1200-2-11-.17(1)(h)	Remedial Design Report	This is a siting requirement; not applicable to current operations
213		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	Land disposal of LLW - relevant and appropriate	TDEC 1200-2-11-.17(1)(i)	ROD	This is a siting requirement; not applicable to current operations
214		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	Land disposal of LLW - relevant and appropriate	TDEC 1200-2-11-.17(1)(j)	ROD	This is a siting requirement; not applicable to current operations
215		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	Land disposal of LLW - relevant and appropriate	TDEC 1200-2-11-.17(1)(k)	ROD	This is a siting requirement; not applicable to current operations
216		A preoperational monitoring program must be conducted to provide basic environmental data on the disposal site characteristics	Land disposal of LLW - relevant and appropriate	TDEC 1200-2-11-.17(4)(a)	RAWP Section 5.2	This is a siting requirement; not applicable to current operations

ARARs - applicable or relevant and appropriate requirements

ARAP - Aquatic Resource Alteration Permit

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

CFR - Code of Federal Regulations

CWA - Clean Water Act

ORR - Oak Ridge Reservation

ROD - record of decision

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
<i>Disposal Site Suitability Requirements</i>						

TBC - to be considered

TCA - *Tennessee Code Annotated*

TDEC - Tennessee Department of Environment and Conservation

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Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
217/218	Liner and leachate collection design for a RCRA landfill	Must install two or more liners and a leachate collection and removal system above and between such liners	Construction of a RCRA landfill applicable	40 CFR 264.301(c) TDEC 1200-1-11-.06(14)(b)(3)(i)(I)	Remedial Design Report	This is a construction requirement; not applicable to current operations
219/220		The liner system must include: • 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		40 CFR 264.301(c)(1)(i)(A) TDEC 1200-1-11-.06(14)(b)(3)(i)(I)	Remedial Design Report	This is a construction requirement; not applicable to current operations
221/222		• a composite bottom liner consisting of at least two components: — upper component must be designed and constructed of materials to prevent migration of hazardous constituents into this component during the active life and post closure period; and — lower component designed and construction of materials to minimize the migration of hazardous constituents if a breach in the upper component were to occur; — constructed of at least 3 ft of compacted soil material with a hydraulic conductivity of no more than 1×10^{-7} cm/second		40 CFR 264.301(c)(1)(i)(B) TDEC 1200-1-11-.06(14)(b)(3)(i)(I)II	Remedial Design Report	This is a construction requirement; not applicable to current operations
223/224		• liners must comply with paragraphs (a)(1)(i), (ii), and (iii) of this section The liner must be:		40 CFR 264.301(c)(1)(ii) TDEC 1200-1-11-.06(14)(b)(3)(i)(I)II	Remedial Design Report	This is a construction requirement; not applicable to current operations
225/226		• 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 are exposed, climatic conditions, or stress from installation or daily operation;		40 CFR 264.301(a)(1)(i) TDEC 1200-1-11-.06(14)(b)(1)(i)(I)	Remedial Design Report	This is a construction requirement; not applicable to current operations
227/228		• 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		40 CFR 264.301(a)(1)(ii) TDEC 1200-1-11-.06(14)(b)(1)(i)(II)	Remedial Design Report	This is a construction requirement; not applicable to current operations
229/230		• installed to cover all areas likely to be in contact with the waste or leachate		40 CFR 264.301(a)(1)(iii) TDEC 1200-1-11-.06(14)(b)(1)(i)(III)	Remedial Design Report	This is a construction requirement; not applicable to current operations

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
					<i>Design, construction, and operation of a mixed (RCRA hazardous, TSCA chemical and low-level) waste landfill</i>	
231/232	Top 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; and	Construction of a RCRA landfill applicable	40 CFR 264.301(c)(2) TDEC 1200-1-11-.06(14)(b)(1)(ii)	Remedial Design Report; Ops Plan	PROC-EMWMF-OP-006, Operation of the EMWMF Water Management System; PROC-EMWMF-OP-031, Routine Checks and Verifications for the EMWMF Water Management Systems; PROC-EMWMF-OP-017, Transfer of Leachate and Contact Water to Tankers
233		Leachate collection system must be constructed of materials that are:		TDEC 1200-1-11-.06(14)(b)(1)(ii)(I)	Remedial Design Report	This is a construction requirement; not applicable to current operations
234		• chemically resistant to waste managed in landfill and leachate generated; and		TDEC 1200-1-11-.06(14)(b)(1)(ii)(II)	Remedial Design Report	This is a construction requirement; not applicable to current operations
235		• sufficient strength and thickness to prevent collapse under pressures exerted by overlying wastes, waste cover materials, and by any equipment used		TDEC 1200-1-11-.06(14)(b)(1)(ii)(III)	Remedial Design Report	This is a construction requirement; not applicable to current operations
236/237	Bottom leachate collection and removal system/leak detection system	Leachate collection and removal system must be capable of detecting, collecting, and removing leachate from all areas of the landfill during active life and the post closure care period. Requirements for a leak detection system are satisfied by installation of a system that is:	Construction of a RCRA landfill applicable	40 CFR 264.301(c)(3) TDEC 1200-1-11-.06(14)(b)(3)(iii)	Remedial Design Report	PROC-EMWMF-OP-006, Operation of the EMWMF Water Management System; PROC-EMWMF-OP-031, Routine Checks and Verifications for the EMWMF Water Management Systems; PROC-EMWMF-OP-017, Transfer of Leachate and Contact Water to Tankers
238/239		• constructed with a bottom slope of 1% or more;		40 CFR 264.301(c)(3)(i) TDEC 1200-1-11-.06(14)(b)(3)(iii)(I)	Remedial Design Report	This is a construction requirement; not applicable to current operations
240/241		• constructed of granular drainage materials with a hydraulic conductivity of 1 x 10 ⁻² cm/second and a thickness of 12 in. or more or synthetic or geo-net drainage materials with a transmissivity of 3 x 10 ⁻⁵ m ² /sec;		40 CFR 264.301(c)(3)(ii) TDEC 1200-1-11-.06(14)(b)(3)(iii)(II)	Remedial Design Report	This is a construction requirement; not applicable to current operations
242/243		• constructed of materials that are chemically resistant to waste managed and expected leachate to be generated, and structurally sufficient to resist pressures exerted by waste, cover, and equipment used at the landfill;		40 CFR 264.301(c)(3)(iii) TDEC 1200-1-11-.06(14)(b)(3)(iii)(III)	Remedial Design Report	This is a construction requirement; not applicable to current operations
244/245		• designed and operated to minimize clogging during the active life of the facility and post closure care period;		40 CFR 264.301(c)(3)(iv) TDEC 1200-1-11-.06(14)(b)(3)(iii)(IV)	Remedial Design Report	This is a construction requirement; not applicable to current operations
246/247		• constructed with sumps and liquid removal methods (e.g., pumps) adequate to prevent the backup of liquids into the drainage layer and capable of measuring and recording the volume of liquids present in the sump and of liquids removed		40 CFR 264.301(c)(3)(v) TDEC 1200-1-11-.06(14)(b)(3)(iii)(V)	Remedial Design Report	This is a construction requirement; not applicable to current operations

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
248/249		Must collect and remove liquids in the leak detection system sumps to minimize the head on the bottom liner	Operation of a RCRA landfill - applicable	40 CFR 264.301(c)(4) TDEC 1200-1-11-.06(14)(b)(3)(iv)	Remedial Design Report	PROC-EMWMF-OP-006, Operation of the EMWMF Water Management System
250/251		If the leak detection system is located below the seasonal high water table, a demonstration must be made that the system will not be adversely affected by groundwater	Construction of a RCRA landfill - applicable	40 CFR 264.301(c)(5) TDEC 1200-1-11-.06(14)(b)(3)(v)	Remedial Design Report	This is a construction requirement; not applicable to current operations
252	Leachate collection monitoring system for TSCA landfill	A leachate collection monitoring system shall be installed above the chemical waste landfill. Acceptable system includes compound leachate collection	Construction of a TSCA chemical waste landfill - applicable	40 CFR 761.75(b)(7)	Remedial Design Report	This is a construction requirement; not applicable to current operations
253		Compound leachate collection system consists of a gravity flow drain field installed above the waste disposal facility liner and above a secondary installed liner		40 CFR 761.75(b)(7)(ii)	Remedial Design Report	This is a construction requirement; not applicable to current operations
254/255	Run-on/runoff control systems	Run-on control system must be capable of preventing flow onto the active portion of the landfill during peak discharge from a 25-year storm event	Construction of a RCRA landfill - applicable	40 CFR 264.301(g) TDEC 1200-1-11-.06(14)(b)(7)	Remedial Design Report	This is a construction requirement; not applicable to current operations
256/257		Run-off management system must be able to collect and control the water volume from a runoff resulting from a 24-hour, 25-year storm event		40 CFR 264.301(h) TDEC 1200-1-11-.06(14)(b)(8)	Remedial Design Report	This is a construction requirement; not applicable to current operations
258/259		Collection and holding facilities must be emptied or otherwise expeditiously managed after storm events to maintain design capacity of the system	Operation of a RCRA landfill - applicable	40 CFR 264.301(i) TDEC 1200-1-11-.06(14)(b)(9)	Ops Plan Section 4.7	PROC-EMWMF-OP-009, Storm Water Management
260/261	Wind dispersal control system	Must cover or manage the landfill to control wind dispersal of particulate matter	Operation of a RCRA landfill - applicable	40 CFR 264.301(j) TDEC 1200-1-11-.06(14)(b)(10)	Ops Plan Section 3.1	PROC-EMWMF-OP-003, Waste Placement
262		Must be no visible emissions to the outside air; or	Operation of an active waste disposal site that receives asbestos-containing material from a source covered under 40 CFR 61.145 - applicable	40 CFR 61.154(a)	Ops Plan Section 3.1	PROC-EMWMF-OP-003, Waste Placement
263		At the end of each operating day, or at least every 24-hour period while the site is in continuous operation, cover the asbestos containing waste with:		40 CFR 61.154(c)	Ops Plan Section 3.1	PROC-EMWMF-OP-003, Waste Placement
264		• at least 6 in. of compacted nonasbestos containing material, or		40 CFR 61.154(c)(1)	Ops Plan Section 3.1	PROC-EMWMF-OP-003, Waste Placement
265		• a resinous or petroleum based dust suppression agent that effectively binds dust and controls wind erosion in the manner and frequency specified by the manufacturer		40 CFR 61.154(c)(2)	Ops Plan Section 3.1	PROC-EMWMF-OP-003, Waste Placement
266/267	Monitoring and inspection of liners, leak detection, run-on/run-off systems during the active life of the facility	During construction or installation, liners and cover systems must be inspected for uniformity, damage and imperfections (e.g., hole, cracks, thin spots, etc.)	Construction of a RCRA landfill - applicable	40 CFR 264.303(a) TDEC 1200-1-11-.06(14)(d)	Remedial Design Report	This is a construction requirement; not applicable to current operations

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
268/269	Post-construction inspection	Immediately after construction or installations:	Construction of a RCRA landfill - applicable	40 CFR 264.303(a)(1) TDEC 1200-1-11-.06(14)(d)(1)(i)	Remedial Design Report	This is a construction requirement; not applicable to current operations
		<ul style="list-style-type: none"> • synthetic liners and covers must be inspected to ensure tight seams and joints and the absence of tears, punctures or blisters; 			Remedial Design Report	This is a construction requirement; not applicable to current operations
270/271		<ul style="list-style-type: none"> • soil based and mixed liners and covers must be inspected for imperfections including lenses, cracks, channels or other structural non-uniformities 		40 CFR 264.303(a)(2) TDEC 1200-1-11-.06(14)(d)(1)(ii)	Remedial Design Report	This is a construction requirement; not applicable to current operations
272/273		Must inspect landfill weekly and after storm events to ensure proper functioning of:	Operation of a RCRA landfill - applicable	40 CFR 264.303(b) TDEC 1200-1-11-.06(14)(d)(2)	RAWP Section 4	See below.
		<ul style="list-style-type: none"> • run-on and runoff control systems 				BJC/OR-3158, EMWMF Erosion and Sediment Control Plan PROC-EMWMF-OP-034, Enhanced Operational Cover Inspections
		<ul style="list-style-type: none"> • wind dispersal control systems 				PROC-EMWMF-OP-031, Routine Checks and Verifications for the EMWMF Water Management Systems
		<ul style="list-style-type: none"> • leachate collection and removal systems 				
274/275		Must record the amount of liquids removed from the leak detection system sumps at least weekly during the active life and closure period	Operation of a RCRA landfill - applicable	40 CFR 264.303(c)(1) TDEC 1200-1-11-.06(14)(d)(3)(i)	Ops Plan Section 4.5.1.1	PROC-EMWMF-OP-031, Routine Checks and Verifications for the EMWMF Water Management Systems
276/277	Response actions for leak detection system	Must have a response action plan which sets forth the actions to be taken if action leakage rate has been exceeded	Operation of a RCRA landfill leak detection system - applicable	40 CFR 264.304(a) TDEC 1200-1-11-.06(14)(e)(1)	Ops Plan Section 4.5.1.3	PROC-EMWMF-OP-031, Routine Checks and Verifications for the EMWMF Water Management Systems
278/279		Must determine to the extent practicable the location, size and cause of any leak	Flow rate into the leak detection system exceeds action leakage rate for any sump - applicable	40 CFR 264.304(b)(3) TDEC 1200-1-11-.06(14)(e)(2)(iii)	Ops Plan Section 4.5.1.3	PROC-EMWMF-OP-031 includes process for initial determination and notification; follow-on actions are based upon engineering evaluation, on a case-by-case basis
280/281		Must determine whether waste receipt should cease or be curtailed; whether any waste should be removed from the unit for inspection, repairs, or controls or closure		40 CFR 264.304(b)(4) TDEC 1200-1-11-.06(14)(e)(2)(iv)	Ops Plan Section 4.5.1.3	PROC-EMWMF-OP-031 includes process for initial determination and notification; follow-on actions are based upon engineering evaluation, on a case-by-case basis
282/283		Must determine any other short or long-term actions to be taken to mitigate or stop leaks		40 CFR 264.304(b)(5) TDEC 1200-1-11-.06(14)(e)(2)(v)	Ops Plan Section 4.5.1.3	PROC-EMWMF-OP-031 includes process for initial determination and notification; follow-on actions are based upon engineering evaluation, on a case-by-case basis

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
					<i>Design, construction, and operation of a mixed (RCRA hazardous, TSCA chemical and low-level) waste landfill</i>	
284/285		Must assess the source and amounts of the liquids by source;	Leak and/or remediation determinations required - applicable	40 CFR 264.304(c)(1)(i) TDEC 1200-1-11-.06(14)(e)(3)(i)(I)	Ops Plan Section 4.5.1.3	PROC-EMWMF-OP-031 includes process for initial determination and notification; follow-on actions are based upon engineering evaluation, on a case-by-case basis
286/287		Conduct analysis of the liquids to identify sources and possible location of the leaks; and		40 CFR 264.304(c)(1)(ii) TDEC 1200-1-11-.06(14)(e)(3)(i)(II)	Ops Plan Section 4.5.1.3	PROC-EMWMF-OP-031 includes process for initial determination and notification; follow-on actions are based upon engineering evaluation, on a case-by-case basis
288/289		Assess seriousness of leaks in terms of potential for escaping into the environment; or		40 CFR 264.304(c)(1)(iii) TDEC 1200-1-11-.06(14)(e)(3)(i)(III)	Ops Plan Section 4.5.1.3	PROC-EMWMF-OP-031 includes process for initial determination and notification; follow-on actions are based upon engineering evaluation, on a case-by-case basis
290/291		Document why such assessments are not needed		40 CFR 264.304(c)(2) TDEC 1200-1-11-.06(14)(e)(3)(ii)	Ops Plan Section 4.5.1.3	PROC-EMWMF-OP-031 includes process for initial determination and notification; follow-on actions are based upon engineering evaluation, on a case-by-
292	Liner design requirements for a TSCA landfill	Shall be located in thick, relatively impermeable formations such as large area clay pans. Where this is not possible, the soil shall have a high clay and silt content with the following parameters:	Construction of a TSCA chemical waste landfill - applicable	40 CFR 761.75(b)(1)	Remedial Design Report	This is a construction requirement; not applicable to current operations
293		• In place soil thickness, 4-ft or compacted soil liner thickness, 3 ft;		40 CFR 761.75(b)(1)(i)	Remedial Design Report	This is a construction requirement; not applicable to current operations
294		• Permeability (cm sec), equal to or less than 1×10^{-7} ;		40 CFR 716.75(b)(1)(ii)	Remedial Design Report	This is a construction requirement; not applicable to current operations
295		• percent soil passing No. 200 sieve > 30;		40 CFR 716.75(b)(1)(iii)	Remedial Design Report	This is a construction requirement; not applicable to current operations
296		• Liquid limit, > 30; and		40 CFR 716.75(b)(1)(iv)	Remedial Design Report	This is a construction requirement; not applicable to current operations
297		• Plasticity Index > 15; or		40 CFR 716.75(b)(1)(v)	Remedial Design Report	This is a construction requirement; not applicable to current operations
298		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. Adequate soil underlining and cover shall be provided to prevent excessive stress or rupture of the liner. The liner must have a minimum thickness of 30 mils		40 CFR 761.75(b)(2)	Remedial Design Report	This is a construction requirement; not applicable to current operations
299	Performance objectives for LLW disposal facility	Disposal facility must be sited, designed, operated, closed and controlled after closure so that reasonable assurance exists that exposures to humans are within limits established in the performance objectives in 1200-2-11-.16(2) and (5)	Operation and Closure of LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.16(1)	Remedial Design Report; PPD-RP-4000: Radiation Protection Program Description	PROC-RP-4000, Rad Protection Program Description PROC-RP-4001, ALARA Program PROC-EMWMF-RC-001, Rad Protection Parameters at EMWMF

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
					<i>Design, construction, and operation of a mixed (RCRA hazardous, TSCA chemical and low-level) waste landfill</i>	
300	LLW disposal site stability	The disposal facility must be sited, designed, used, operated and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required		TDEC 1200-2-11-.16(5)	Remedial Design Report; Ops Plan	PROC-EMWMF-OP-003, Waste Placement PROC-EMWMF-OP-007, Compaction Testing
301	LLW disposal facility design	Site design features must be directed toward long-term isolation and avoidance of the need for continuing active maintenance after site closure	Land disposal of LLW - relevant and appropriate	TDEC 1200-2-11-.17(2)(a)	Remedial Design Report	This is a design requirement; not applicable to current operations
302		The disposal site design and operation must be compatible with the disposal site closure and stabilization plan and lead to disposal site closure that assures compliance with the performance objectives	Land disposal of LLW - relevant and appropriate	TDEC 1200-2-11-.17(2)(b)	Remedial Design Report; Ops Plan	PROC-EMWMF-OP-003, Waste Placement PROC-EMWMF-OP-007, Compaction Testing
303		The disposal site design must compliment and improve, where appropriate, the ability of the disposal site's natural characteristics to assure that the performance objectives are met	Land disposal of LLW - relevant and appropriate	TDEC 1200-2-11-.17(2)(c)	Remedial Design Report	This is a design requirement; not applicable to current operations
304		Surface features must direct surface water drainage away from disposal units at velocities and gradients which will not result in erosion that will require on-going active maintenance in the future	Construction of LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(2)(e)	Remedial Design Report	This is a construction requirement; not applicable to current operations
305	LLW disposal operations	Wastes must be emplaced in a manner that maintains the package integrity during emplacement, and minimizes the void spaces to be filled	Operation of LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(3)(d)	Ops Plan Section 2.8.5	PROC-EMWMF-OP-003, Waste Placement
306		A buffer zone of land must be maintained between the disposal unit and disposal boundary and beneath the disposed waste	Operation of LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(3)(h)	Remedial Design Report	This is a design requirement; not applicable to current operations
		The buffer zone shall be of adequate dimensions to carry out environmental monitoring activities			Remedial Design Report	This is a design requirement; not applicable to current operations
307		Void spaces between waste packages must be filled with earth or other material to reduce future subsidence within the disposal unit	Operation of LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(3)(e)	Ops Plan Section 2.7.5	PROC-EMWMF-OP-003, Waste Placement

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
308		Closure and stabilization measures must be carried out as each disposal unit is filled and covered	Operation of LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(3)(i)	Remedial Design Report; Ops Plan	PROC-EMWMF-OP-003, Waste Placement
309		Active waste disposal operations must not have an adverse effect on completed closure and stabilization measures	Operation of LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(3)(j)	Ops Plan Section 2.7	PROC-EMWMF-OP-007, Compaction Testing; PROC-EMWMF-OP-003, Waste Placement
310	Monitoring of LLW disposal facility	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	Operation of LLW disposal facility - relevant and appropriate	TDEC 1200-2-11-.17(4)(c)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
311	Surface water monitoring	Designated surface water course shall be sampled at least monthly when the landfill is being used for disposal and on a frequency of no less than once every six months after final closure of the disposal area	Operation of a TSCA chemical waste landfill - applicable	40 CFR 761.75(b)(6)(i)(B) & (C)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
312		As a minimum, all samples shall be analyzed for the following parameters: <ul style="list-style-type: none"> • PCBs • pH • specific conductance • chlorinated organics Sampling methods and analytical procedures for these parameters shall comply with those specified in 40 CFR Part 136, as amended in 41 Federal Register 52779 on December 1, 1976		40 CFR 761.75(b)(6)(iii)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
313	Facility design, construction	Systems structures and components must be designed, constructed and operated to withstand the effects of natural phenomena as necessary to ensure confinement of hazardous material, the operation of essential facilities, and the protection of government property	Construction of new nonnuclear facility under DOE-STD-1027-92 - TBC	DOE Order 420.1	Remedial Design Report	This is a construction requirement; not applicable to current operations

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Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
	<i>Design, construction, and operation of a mixed (RCRA hazardous, TSCA chemical and low-level) waste landfill</i>					

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Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
314/315	Closure of RCRA landfill	<p>Must close the unit in a manner that:</p> <p style="text-align: center;"><i>Closure</i></p> <ul style="list-style-type: none"> • minimizes the need for further maintenance; and • controls, minimizes or eliminates to the extent necessary to protect human health and the environment, post-closure, escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to ground or surface waters or to the atmosphere, and • complies with the closure requirements of 40 CFR 265.310 	Closure of a RCRA hazardous waste management facility - applicable	40 CFR 265.111 TDEC 1200-1-11-.05(7)(b)	Remedial Design Report	This is a closure requirement; not applicable to current operations
316/317		<p>Must cover the landfill or cell with a final cover designed and constructed to:</p> <ul style="list-style-type: none"> • provide long-term minimization of migration of liquids through the closed landfill; • function with minimum maintenance • promote drainage and minimize erosion or abrasion of the cover; • accommodate settling and subsidence so that the cover's integrity is maintained; and 		40 CFR 265.310(a) TDEC 1200-1-11-.05(14)(k)	Remedial Design Report	This is a closure requirement; not applicable to current operations

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<ul style="list-style-type: none"> • have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present 				
318	Closure of a LLW disposal facility	Covers must be designed to minimize 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	Land disposal of LLW - relevant and appropriate	TDEC 1200-2-11-.17(2)(d)	Remedial Design Report	This is a closure requirement; not applicable to current operations
319	Closure of an inactive asbestos waste disposal site	Either discharge no visible emissions to the outside air; or	Disposal of asbestos-containing material - applicable	40 CFR 61.151(a)(1)	Remedial Design Report	This is a closure requirement; not applicable to current operations
320		Cover the asbestos-containing waste with at least 6 in. of compacted nonasbestos-containing material, and grow and maintain a cover of vegetation on the area adequate to prevent exposure of the asbestos containing waste; or		40 CFR 61.151(a)(2)	Remedial Design Report	This is a closure requirement; not applicable to current operations
321		Cover the asbestos-containing waste with at least 2 ft of compacted nonasbestos-containing material, and maintain it to prevent exposure of the waste		40 CFR 61.151(a)(3)	Remedial Design Report	This is a closure requirement; not applicable to current operations
322		Maintain warning signs and fencing (if installed as specified in 40 CFR 61.154(b))		40 CFR 61.151(b)(1)	Remedial Design Report	This is a closure requirement; not applicable to current operations
323/324	Clean closure of RCRA container storage area	<p>Must close the facility in a manner that:</p> <ul style="list-style-type: none"> • minimizes the need for further maintenance; • controls, minimizes or eliminates, to the extent necessary to protect human health and environment, post closure escape of hazardous waste, hazardous constituents, contaminated run-off or hazardous waste decomposition products to ground or surface waters or to the atmosphere; and • complies with closure requirements of 40 CFR 264.178 	Management of RCRA hazardous waste in containers - applicable	40 CFR 264.111 TDEC 1200-1-11-.06(7)(b)	Remedial Design Report	This is a closure requirement; not applicable to current operations

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Closure</i>				
325/326		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		40 CFR 264.178 TDEC 1200-1-11-.06(9)(i)	Remedial Design Report	This is a closure requirement; not applicable to current operations
327	Clean closure of TSCA storage facility	A TSCA/RCRA storage facility closed under RCRA is exempt from the TSCA closure requirements of 40 CFR 761.65(e)	Closure of TSCA/RCRA storage facility - applicable	40 CFR 761.65(e)(3)	Remedial Design Report	This is a closure requirement; not applicable to current operations
328	Closure of RCRA/TSCA groundwater monitoring well(s)	Shall be completely filled and sealed in such a manner that vertical movement of fluid either into or between formation(s) containing ground water classified pursuant to rule 1200-4-6-.05(1) through the bore hole is not allowed	Permanent plugging and abandonment of a well - relevant and appropriate	TDEC 1200-4-6-.09(6)(d)	Remedial Design Report	This is a closure requirement; not applicable to current operations
		Shall be performed in accordance with the provisions for Seals at 1200-4-6-.09(6)(e), (f), and (g), for Fill Materials at 1200-4-6-.09(6)(h) and (i), for Temporary Bridges at 1200-4-6-.09(6)(j), for Placement of Sealing Materials at 1200-4-6-.09(7)(a) and (b), and Special Conditions at 1200-4-6-.09(8)(a) and (b), as appropriate				

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Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
<i>Postclosure Care</i>						
329/330	Survey plat	Must submit to the local zoning authority or the authority with jurisdiction over local land use, a survey plot indicating the location and dimensions of landfill cells, with respect to permanently surveyed benchmarks. The plat must contain a note, prominently displayed which states the owner/operator obligation to restrict disturbance of the landfill	Closure of a RCRA landfill - applicable	40 CFR 264.116 TDEC 1200-1-11-.06(7)(g)	Remedial Design Report	This is a closure requirement; not applicable to current operations
331		<p>Within 60 days of closure 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 that:</p> <ul style="list-style-type: none"> • the land has been used for disposal of asbestos-containing waste; • survey plat and record of location and quantity of waste disposed within the site required in 40 CFR 61.154(f) have been filed; and • the site is subject to 40 CFR Part 61 subpart M 	Closure of an asbestos-containing waste disposal site - applicable	40 CFR 61.151(e)	Remedial Design Report	This is a closure requirement; not applicable to current operations
332/333	Duration	Post closure care must begin after closure and continue for at least 30 years after that date	Closure of a RCRA landfill - applicable	40 CFR 264.117(a) TDEC 1200-1-11-.06(7)(h)	Remedial Design Report	This is a closure requirement; not applicable to current operations
334/335	Protection of facility	Post-closure use of property must never be allowed to disturb the integrity of the final cover, liners, or any other components of the containment system or the facility's monitoring system unless necessary to reduce a threat to human health or the environment		40 CFR 264.117(c) TDEC 1200-1-11-.06(7)(h)(3)	Remedial Design Report	This is a closure requirement; not applicable to current operations
336/337	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 CFR 264.118 TDEC 1200-1-11-.06(7)(i)	Remedial Design Report	This is a closure requirement; not applicable to current operations
338/339	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	Closure of a RCRA landfill - applicable	40 CFR 264.119(a) TDEC 1200-1-11-.06(7)(j)	Remedial Design Report	This is a closure requirement; not applicable to current operations

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Postclosure Care</i>				
340/341		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	Closure of a RCRA landfill - applicable	40 CFR 264.119(b) TDEC 1200-1-11-.06(7)(j)(2)	Remedial Design Report	This is a closure requirement; not applicable to current operations
342/343	General post-closure care	Owner or operator must:	Closure of a RCRA landfill - applicable	40 CFR 264.310(b) TDEC 1200-1-11-.06(14)(k)	Remedial Design Report	This is a closure requirement; not applicable to current operations
344/345		<ul style="list-style-type: none"> maintain the effectiveness and integrity of the final cover including making repairs to the cap as necessary to correct effects of settling, erosion, etc.; 		40 CFR 264.310(b)(1) TDEC 1200-1-11-.06(14)(k)(2)(i)	Remedial Design Report	This is a closure requirement; not applicable to current operations
346/347		<ul style="list-style-type: none"> continue to operate the leachate collection and removal system until leachate is no longer detected; 		40 CFR 264.310(b)(2) TDEC 1200-1-11-.06(14)(k)(2)(ii)	Remedial Design Report	This is a closure requirement; not applicable to current operations
348/349		<ul style="list-style-type: none"> maintain and monitor the leachate detection system in accordance with 40 CFR 264.301(a)(3)(iv) and (4) and 40 CFR 264.303(c); 		40 CFR 264.301(b)(3) TDEC 1200-1-11-.06(14)(k)(2)(iii)	Remedial Design Report	This is a closure requirement; not applicable to current operations
350/351		<ul style="list-style-type: none"> maintain and monitor a ground water monitoring system and comply with all other applicable provisions of 40 CFR 264, Subpart F; 		40 CFR 264.310(b)(4) TDEC 1200-1-11-.06(14)(k)(2)(iv)	Remedial Design Report	This is a closure requirement; not applicable to current operations
352/353		<ul style="list-style-type: none"> prevent run-on and run-off from eroding or otherwise damaging final cover; and 		40 CFR 264.310(b)(5) TDEC 1200-1-11-.06(14)(k)(2)(v)	Remedial Design Report	This is a closure requirement; not applicable to current operations
354/355		<ul style="list-style-type: none"> protect and maintain surveyed benchmarks used to locate waste cells 		40 CFR 264.310(b)(6) TDEC 1200-1-11-.06(14)(k)(2)(vi)	Remedial Design Report	This is a closure requirement; not applicable to current operations
356/357	Operation of leachate collection system	Must record the amount of liquids removed from the leak detection system at least monthly after the final cover is installed and thereafter as specified in 40 CFR 264.303(c)(2)	Closure of a RCRA landfill - applicable	40 CFR 264.303(c)(2) TDEC 1200-1-11-.06(14)(d)(3)(ii)	Remedial Design Report	This is a closure requirement; not applicable to current operations
358		Shall be monitored monthly for quantity and physicochemical characteristics of leachate produced	Operation of a TSCA chemical waste landfill - applicable	40 CFR 761.75(b)(7)	Remedial Design Report	This is a closure requirement; not applicable to current operations

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Postclosure Care</i>				
		Water analysis shall be conducted as provided in 40 CFR 761.75(b)(6)(iii) - see above				
		The leachate should be either treated to acceptable limits for discharge or disposed of by another approved method				
359/360	General groundwater monitoring requirements	<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 • allows for the detection of contamination when the hazardous waste or constituents have migrated from the waste management area to the uppermost aquifer 	Operation of a detection monitoring program under 40 CFR 264.98 - applicable	40 CFR 264.97(a) TDEC 1200-1-11-.06(6)(h)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
361		<p>If underlying earth materials are homogenous, impermeable, and uniformly sloping in one direction, only three sampling points shall be necessary</p> <p>These three points shall be equally spaced on a line through the center of the disposal area and extending from the area of highest water table elevation to the area of the lowest water table elevation</p>	Operation of TSCA chemical waste landfill groundwater monitoring program - applicable	40 CFR 761.75(b)(6)(ii)(A)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
362/363	Monitoring well construction	All monitoring wells must be cased in a manner that maintains the integrity of the monitoring well bore hold. This casing must be screened or perforated and packed with gravel or sand, where necessary to enable collection of groundwater sampler. The annular space above the sampling depth must be sealed to prevent contamination of groundwater and samples	Construction of RCRA groundwater monitoring well - applicable	40 CFR 264.97(c) TDEC 1200-1-11-.06(6)(h)(3)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF

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Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
<i>Postclosure Care</i>						
364		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	Construction of a TSCA groundwater monitoring well - applicable	40 CFR 761.75(b)(6)(ii)(B)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
365/366	Monitoring program	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	Operation of a detection monitoring program under 40 CFR 264.98 - applicable	40 CFR 264.97(d) TDEC 1200-1-11-.06(6)(h)(4)	Remedial Design Report	This is a closure requirement; not applicable to current operations
367/368		Groundwater monitoring program must include sampling and analytical methods that are appropriate and accurately measure hazardous constituents in groundwater samples	Operation of a detection monitoring program under 40 CFR 264.98 - applicable	40 CFR 264.97(e) TDEC 1200-1-11-.06(6)(h)(5)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
369/370		Groundwater monitoring program must include a determination of the groundwater surface elevation each time groundwater is sampled	Operation of a detection monitoring program under 40 CFR 264.98 - applicable	40 CFR 264.97(f) TDEC 1200-1-11-.06(6)(h)(6)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
371/372	Sample collection	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 and otherwise comply with the provisions of this section	Operation of a detection monitoring program under 40 CFR 264.98 - applicable	40 CFR 264.97(g) TDEC 1200-1-11-.06(6)(h)(7)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
373		The groundwater monitoring well shall be pumped to remove the volume of liquid initially contained in the well before obtaining a sample for analysis	Operation of TSCA groundwater monitoring wells - applicable	40 CFR 761.75(b)(6)(ii)(B)	Remedial Design Report	This is a closure requirement; not applicable to current operations
		The discharge shall be treated to meet applicable State or Federal standards or recycled to the chemical waste landfill				
		As a minimum, all samples shall be analyzed for the following four parameters:				
		<ul style="list-style-type: none"> • PCBs • pH • specific conductance • chlorinated organics 				

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Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Postclosure Care</i>				
		Sampling methods and analytical procedures for these parameters shall comply with those specified in 40 CFR Part 136, as amended in 41 Register 52779 on December 1, 1976				
374/375	Detection monitoring	Must monitor for specified indicator parameters, waste constituents or reaction products that provide a reliable indication of the presence of hazardous constituents in groundwater	Operation of a detection monitoring program under 40 CFR 264.98 - applicable	40 CFR 264.98(a) TDEC 1200-1-11-.06(6)(i)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
376/377		Must install a groundwater monitoring system at the compliance point as specified under 40 CFR 264.95 that complies with 264.97(a)(2), (b), and (c)		40 CFR 264.98(b) TDEC 1200-1-11-.06(6)(i)(2)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
378/379		Must conduct a monitoring program for each specified chemical parameter and hazardous constituent in accordance with 264.97(g)		40 CFR 264.98(c) TDEC 1200-1-11-.06(6)(i)(3)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
380/381		A sequence of at least four samples from each well (background and compliance wells) must be collected at specified frequencies		40 CFR 264.98(d) TDEC 1200-1-11-.06(6)(i)(4)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
382/383		Must determine the groundwater flow rate and direction in the uppermost aquifer at least annually		40 CFR 264.98(e) TDEC 1200-1-11-.06(6)(i)(5)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
384/385		Must determine whether there is statistically significant evidence of contamination of any specified chemical parameter or hazardous constituent at a specified frequency		40 CFR 264.98(f) TDEC 1200-1-11-.06(6)(i)(6)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
386/387		If owner/operator determines that there is statistically significant evidence of contamination at any monitoring well at the compliance point, must follow the provisions of this section		40 CFR 264.98(g) TDEC 1200-1-11-.06(6)(i)(7)	RAWP Section 5	UCOR-4156, Sampling and Analysis/Quality Assurance Program Plan for Environmental Monitoring at EMWMF
388	Corrective measures for LLW disposal facility	Must have plans for taking corrective measures if migration of radionuclides would indicate that the performance objectives of Rules of the TDEC 1200-2-11-.16 may not be met	Closure of a LLW landfill - relevant and applicable	TDEC 1200-2-11-.17(4)(b)	Remedial Design Report	This is a closure requirement; not applicable to current operations
389	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	Closure of a LLW landfill - relevant and applicable	TDEC 1200-2-11-.17(4)(d)	Remedial Design Report	This is a closure requirement; not applicable to current operations

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Postclosure Care</i>				
		The monitoring system must be capable of providing early warning of releases of radionuclides from the disposal unit before they leave the site boundary			Remedial Design Report	This is a closure requirement; not applicable to current operations
390	Control and stabilization	Control and stabilization features shall be designed to:	Long-term management of uranium, thorium, and their decay products - TBC	DOE Order 5400.5(IV)(6)(d)(1)(a)	Remedial Design Report	This is a closure requirement; not applicable to current operations
		<ul style="list-style-type: none"> • provide to the extent reasonably achievable an effective life of 1000 years with a minimum of at least 200 years 				
391		<ul style="list-style-type: none"> • Limit Rn-222 emanation to the atmosphere from the wastes to less than an annual average release rate of 20 pCi/m²/s and prevent increase in the annual average RN-222 concentration at or above any location outside the boundary of the contaminated area by more than 0.5 pCi/L 		DOE Order 5400.5(IV)(6)(d)(1)(b)	Remedial Design Report	This is a closure requirement; not applicable to current operations

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Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Institutional Controls</i>				
392	Waste left in place	Institutional controls are required and shall include, at a minimum, deed restrictions for sale and use of property and securing area to prevent human contact with hazardous substances	Hazardous substances left in place which may pose an unreasonable threat to public health, safety, or the environment - relevant and appropriate	TDEC 1200-1-13-.08(10)	Remedial Design Report	This is a closure requirement; not applicable to current operations
393	Uranium- and thorium-bearing LLW left in place	Access to a property and use of material should be controlled through appropriate administrative and physical controls, designed to be effective to the extent reasonable for at least 200 years	On-site material contaminated by residual radioactive material (uranium and thorium) - TBC	DOE Order 5400.5(IV)(6)(d)(1)(e)	Remedial Design Report	This is a closure requirement; not applicable to current operations

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Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
		<i>Transportation</i>				
394	Transportation of LLW off site	LLW waste shall be packaged and transported in accordance with DOE O 1460.1A and DOE O 460.2	Shipment of LLW off site - TBC	DOE M 435.1-1(I)(1)(E)(11)	RAWP Section 4	PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2001, Generator Requirements for Transferring Waste
395		To the extent practicable, the volume of waste and number of shipments shall be minimized		DOE M 435.1-1(IV)(L)(2)	RAWP Section 4	PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2001, Generator Requirements for Transferring Waste
396	Transportation of PCB wastes off site	Must comply with the manifesting provisions at 40 CFR 761.207 through 218	Relinquishment of control over PCB wastes by transporting, or offering for transport - applicable	40 CFR 761.207(a)	RAWP Section 4	PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2001, Generator Requirements for Transferring Waste
397/398	Transportation of hazardous waste off-site	Must comply with the generator requirements of 40 CFR 262.20-23 for manifesting, Sect. 262.30 for packaging, Sect. 262.31 for labeling, Sect. 262.32 for marking, Sect. 262.33 for placarding, Sect. 262.41(a) for record keeping requirements, and Sect. 262.12 to obtain EPA ID number	Off site transportation of RCRA hazardous waste - applicable	40 CFR 262.10(h) TDEC 1200-1-11-.03(1)(a)(8)	RAWP Section 4	PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2001, Generator Requirements for Transferring Waste
399/400		Must comply with the requirements of 40 CFR 263.11-263.31	Transportation of hazardous waste within the United States requiring a manifest	40 CFR 263.10(a) TDEC 1200-1-11-.04(1)(a)(1)(6)(iii)	RAWP Section 4	PPD-WM-2400, UCOR Waste Management Program Plan; PROC-WM-2001, Generator Requirements for Transferring Waste
		A transporter who meets all applicable requirements of 49 CFR 171-179 and the requirements of 40 CFR 263.11 and 263.31 will be deemed in compliance with 40 CFR 263				

Table 2.7. Action-specific ARARs and TBC guidance for the ROD for disposal of ORR CERCLA waste, Oak Ridge, Tennessee

Number	Action	Requirements	Prerequisite	Citation	Document Where ARAR Addressed	Additional Implementing Document(s) (plans, procedures, WPs, other)
401	Transportation of hazardous materials	Shall be subject to and must comply with all applicable provisions of the HMTA and HMR at 49 CFR 171-180	Any person who, under contract with a department or agency of the federal government, transports "in commerce", or causes to be transported or shipped, a hazardous material - applicable	49 CFR 171.1(c)	RAWP Section 4	PROC-TR-9501, Loading and Securing Methods for Transport of Hazardous Materials; PROC-TR-9504, Placarding Requirements for Transport of Hazardous Materials; PROC-TR-9505, Labeling Requirements for Transport of Hazardous Materials; PROC-TR-9506, Marking Requirements for Transport of Hazardous Materials; PROC-TR-9509, Packaging Requirements for Transport of Hazardous Materials

- | | |
|--|---|
| ALARA - as low as reasonably achievable | HMR - Hazardous Materials Regulations |
| ARAR - applicable or relevant and appropriate requirement | HMTA - Hazardous Materials Transportation Act of 1975 |
| CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act of 1980 | ID - identification number |
| CFR - Code of Federal Regulations | LLW - low-level (radioactive) waste |
| DOE - U.S. Department of Energy | mrem - millirem |
| DOE M - Radioactive Waste Management Manual | mSv - millisievert |
| DOE O - DOE Order 435.1 Radioactive Waste Management | ORO - Oak Ridge Operations |
| DOT - U.S. Department of Transportation | ORR - Oak Ridge Reservation |
| EDE - effective dose equivalent | PCB - polychlorinated biphenyl |
| EH - Environment, Safety and Health | PPE - personal protective equipment |
| EMWMF - Environmental Management and Waste Management Facility | RAWP - Remedial Action Work Plan D3 |
| EPA - U.S. Environmental Protection Agency | RCRA - Resource Conservation and Recovery Act of 1976 |
| > greater than | ROD - record of decision |
| < less than | TBC - to be considered |
| ≥ greater than or equal to | TDEC - Tennessee Department of Environment and Conservation |
| ≤ less than or equal to | TSCA - Toxic Substance Control Act of 1976 |

DOE/OR/01-2683&D2

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COMMENT RESPONSE FORM

DOCUMENT TITLE: Fiscal Year 2015 Phased Construction Completion Report for the Oak Ridge Reservation Environmental Management Waste Facility (March 2015)	DOCUMENT NO. DOE/OR/01-2683&D1
NAME OF REVIEWER: Jeff Crane	ORGANIZATION: Environmental Protection Agency
DATE COMMENTS TRANSMITTED: May 29, 2015	

COMMENT NO.	SECT/ PAGE	COMMENT	RESPONSE
General Comments			
1		<p>It appears the D1 PCCR does not include federal drinking water standards, such as the Maximum Contaminant Levels (MCLs) as threshold values for groundwater at the Environmental Management Waste Facility (EMWMF). While Section 5, Environmental Monitoring, indicates that threshold values are contained in the Environmental Monitoring Plan and briefly describes their basis, it appears for clarity the D1 PCCR should state whether or not MCLs are included as threshold values for groundwater, and if not explained. This may be a matter of describing the purpose of Action Levels which should ensure no exceedances above MCLs. Provide a response and/or the appropriate D1 PCCR text revision which states why</p>	<p>Clarify. During FY 2014, the period for which this PCCR applies, groundwater monitoring was performed in accordance with the <i>Environmental Management Waste Management Facility (EMWMF) Environmental Monitoring Plan, Oak Ridge, Tennessee (UCOR-4001) (EMP)</i>. The EMP contains threshold values determined from the baseline groundwater monitoring data against which groundwater detection monitoring data is compared. Therefore, the PCCR describes performance against these threshold values. Table 27 of the PCCR includes the issue to evaluate action levels and incorporate the consensus approach for groundwater detection monitoring in the upcoming, revised SAP/QAPP. DOE will continue to coordinate development of this SAP/QAPP with EPA and TDEC.</p>

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		the MCLs are not included, or include MCLs and a plan for updating ARARs accordingly.	
2	Table 4	<p>Revise Table 4 to clearly show the year (e.g., 2021). This letter requests a formal modification to the FFA to include the following new Appendix J milestone, consistent with Section 3.4 Table 4.</p> <p>a. D1 RDWP (Closure Start) FY 2021 b. D1 RAR (Closure Completion) FY 2026</p>	<p>Agree. Table 4 has been revised to include the year.</p> <p>Clarify. The transmittal letter for the D2 PCCR will discuss the addition of closure milestones to Appendix J of the FFA. The addition of milestones will be considered during the annual update,</p>
Specific Comments			
1	Table 1 ; page 5 and page 6	The right most cell in the last row of the "ROD" and second to last row of the "Design ..." should be restated to read: "Adds to the total volume capacity of the landfill by including Cell 6"	Agree. Table 1 has been revised accordingly.
2	Table 1; page 6 and page 7	The left most cell in the last row of "Design ..." should be restated to read: "Modification of the Remedial Design ..." and left most cell in the last row of "Haul Road" should be restated to read: "Modification of the Remedial Action Work Plan..."	Agree. Table 1 has been revised accordingly.
3	Table 2	It would be helpful if the text included a brief definition of "As-disposed volume" and "As-generated volume." The method of estimating each should be described. Section 3.3 may be appropriate for a brief presentation of this information.	<p>Agree. Section 3.1 has been revised to define "as-disposed" and "as-generated" volumes: "The following terms are important for understanding the waste disposed and waste forecast discussions in subsequent sections:</p> <ul style="list-style-type: none"> • "As-generated" volume is an estimate of waste volume based upon the

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			<p>excavated volume of soil and sediment and demolished volume of building debris. It is substantially equivalent to the volume expected to be shipped and includes the highest amount of void spaces for all wastes. The “as-generated” volume is used for the waste forecast.</p> <ul style="list-style-type: none"> • “As-disposed” volume is an estimate of volume of waste after disposal in the EMWMF, at which point debris wastes, waste suitable for use as fill, and clean fill have been mixed and processed to meet compaction and void space mitigation requirements. It includes the least amount of void space of the estimates and is physically equivalent to the civil survey results taken quarterly to estimate EMWMF airspace utilized to date. The “as disposed” volume is used for the waste disposed discussion. <p>Section 3.3 has been revised to make it clear that “as-generated” volume is used for waste forecasting: “The future estimates for waste volume are based on the “as-generated” volume.</p>
4	Section 3.3	A 9% decrease is a substantive change and should be explained more thoroughly .	Clarify. As stated in Section 3.3, the 9% decrease is attributed to changes in the forecast by both demolition and remediation projects. The level of uncertainty for these forecasts is relatively high, and the estimates are expected to be continuously refined as

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			<p>better information becomes available. The level of uncertainty for these forecasts will be better explained in the PCCR using information presented in the <i>Remedial Investigation/Feasibility Study for Comprehensive Environmental Response, Cleanup, and Liability Act Oak Ridge Reservation Waste Disposal, Oak Ridge, Tennessee</i> (DOE/OR/01-2535&D3) that indicates the uncertainty of the waste volume forecast is 25%.</p>
5	Section 3.3	Explain "Vision 2016" and "Vision 2020."	<p>Agree. Vision 2020 is the UCOR strategic plan to complete cleanup of ETTP by 2020. The demolition of all gaseous diffusion plants is planned for completion by 2016. Section 3.3 has been revised as follows: "Plans are being made to complete remediation of ETTP by 2020, and this acceleration may result in reaching capacity much sooner. Budget uncertainty may not support this acceleration."</p>
6	Section 3.7, Water Management , Page 15	<p>This section indicates that the EMWMF Operations managed over 14 million gallons of leachate and contact water during Fiscal Year 2014; however, this section does not include a description of the historical water production at EMWMF. As the total water generated in Fiscal Year 2014 is substantially less than Fiscal Year 2013, and this total is almost entirely contact water, for clarity it appears relevant to note this comparison. Further, the basis for the reduction in quantity of water</p>	<p>Agree. Section 3.7 has been revised to include a plot of contact water and leachate generated over time and to explain the reduction in quantity of water managed.</p>

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		<p>production at the EMWMF should be described, as this may impact the potential future design of an on-site wastewater treatment system being evaluated as part of preparation of a Focused Feasibility Study for the management of landfill water from EMWMF and the Environmental Management Disposal Facility (EMDF). It is noted that Section 3.8, Enhanced Operational Cover, indicates that the enhanced operational cover that sheds water was not enlarged in Fiscal Year 2014, and thus it is not clear if the reduction in water generated at EMWMF was based only on rainfall or if other factors were involved. Revise Section 3.7 to include additional details on the reasons for the reduction in volume of water from Fiscal Year 2013 to 2014.</p>	
7	Section 3.7, page 15 and 3.8.6, page 17	<p>It was stated that all contact water met release criteria but there is no reference to what release criteria. When such statements are made, the release criteria should be described or reference. In this case, did the release criteria include recreational AWQCs? Were dose-based release criteria used? If dose-based release criteria were used, how was it demonstrated to be protective within the CERCLA risk range?</p>	<p>Agree. Section 3.7 has been revised as follows: "Contact water was collected, analyzed, and released to the Sediment Basin after determining that it met the discharge limits specified in the <i>Environmental Management Waste Management Facility (EMWMF) Environmental Monitoring Plan, Oak Ridge, Tennessee (UCOR-4001)</i>."</p> <p>Section 3.8.6 has been revised as follows: "Tc-99 in contact water and leachate remained less than 3.2% of the discharge limits specified in the <i>Environmental Management Waste</i></p>

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			<i>Management Facility (EMWMF) Environmental Monitoring Plan, Oak Ridge, Tennessee (UCOR-4001)."</i>
8	Section 3.8.1. Enhanced Operational Cover, Page 15	This section indicates that down drain DD-19 was installed to allow draining of clean stormwater runoff from the northern slopes of Cells 1-3 to the ditch north of the cells that leads to North Tributary (NT)-5; however, this section does not describe where this water was routed prior to installation of down drain DD-19, or the reason for the change in routing of stormwater. Further, this section does not indicate if the ditch north of cells that lead to NT-5 is designed and armored appropriately to handle this stormwater flow without causing erosion and sediment control issues. Revise this section to indicate why stormwater is now routed to the north side of Cells 1-3 and how the ditch was designed /armored to account for this increased flow.	Agree. Section 3.8.1 has been revised to include the following text: "Until DD-19 is opened, runoff from the northern slopes of Cells 1–3 will continue along its existing path to the Cell 5 catchment. When DD-19 is opened, clean stormwater runoff from this area will be routed to North Tributary (NT)-5. The reason for changing the routing is to implement the enhanced operational cover strategy (i.e., divert clean stormwater runoff out of the cells, thus minimizing the amount of contact water and leachate generated). The ditch north of the cells that leads to NT-5 is designed and armored appropriately to handle this stormwater flow without causing erosion and sediment control issues. Design details are in the <i>Remedial Design Report for Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 Waste, Oak Ridge, Tennessee (DOE/OR/01-1873&D2).</i> "
9	Section 3.8.1, Enhanced Operational Cover, Page 15	This section states, "Clean stormwater runoff from the covered area is expected to be diverted out of the cells in January 2015, which will bring the total area covered with the enhanced	Agree. The original text omits some of the information necessary to derive the 14.4-acre value. Given that this text pertains to future work, it has been deleted from this PCCR and will be

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		operational cover and shedding clean stormwater outside the cells to approximately 14.4 acres.” However, it is not clear how the 14.4 acres was calculated as the first paragraph of this section indicates only the 3.9 acres was added to the existing 5.28 acres (i.e., a total of 9.18 acres). Revise this section to address this discrepancy.	addressed in the next PCCR. The final paragraph of Section 3.8.1 has been revised as follows: “Clean stormwater runoff from the covered area is expected to be diverted out of the cells in January 2015.”
10	Section 3.8.2	Expand the description of the use of the transite panels to armor the catchment floor area to confirm its handling in this manner is consistent with waste placement objectives and practices, including any TSCA requirements to prevent exposure to friable asbestos during armoring of this portion of the landfill liner system.	Agree. Section 3.8.2 has been revised to include the following text: “Handling of the transite was consistent with EMWMF waste placement objectives and practices, including TSCA requirements to prevent exposure to friable asbestos. The transite was packaged at the demolition site to meet established regulatory requirements (e.g., wrapped in plastic, labelled, etc.) as well as EMWMF Physical WAC (e.g., stacked and secured to pallets within stipulated weight and size limits, configured to allow lifting without puncturing the plastic wrapping, and loaded onto flatbeds to facilitate unloading). The packages were individually off-loaded at EMWMF in accordance with approved work control documents and carefully placed in the designated area in a tight configuration. Any gaps between packages were infilled with riprap. Air sampling by industrial hygienists at the point of disposal (EMWMF) included personnel breathing zone monitoring as well as ambient air at the boundary of the disposal area. Personnel sampling was performed on

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			employees with the highest potential for exposure. Personnel sampling results were all below the administrative action limit of 0.04 fibers/cc for a 10-hour day for asbestos fibers. Area samples were all below the EPA NESHAP limit of 0.01 fibers/cc.”
11	Figure 6 Status of Disposal Cells at the end of FY2014, Page 20	This figure shows clay and plastic cover over two areas encompassing 4.2 acres and 2.3 acres, and clay and gravel cover over 4.6 acres; however, the acreage depicted in this figure appears to be inconsistent with text in the D1 PCCR. For example, Table 9, Status of Enhanced Operational Cover, lists the area under enhanced operational cover and shedding water out of the landfill as 5.28 acres, and Section 3.8.1, Enhanced Operational Cover, indicates 3.9 acres of enhanced operational cover was added in Fiscal Year 2014, with the total acreage of enhanced cover totaling 5.28 acres. Revise Figure 6, Section 3.8.1 and Table 9 to address these apparent discrepancies.	Agree. Figure 6, Section 3.8.1, and Table 9 are correct. The following note has been added to Figure 6 to provide additional clarity: “The enhanced operational cover is present over 11.1 acres, of which 5.28 acres shed clean stormwater runoff out of the cells.”
12	Section 3.13, page 22	The current status of the first bullet should include a more definitive path to closure of this issue.	Agree. Additional text was added as follows: “Results of the data evaluation, including updated background data, will be included in the upcoming, revised Sampling and Analysis Plan/Quality Assurance Plan for the EMWMF.” DOE will continue to coordinate development

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			of this SAP/QAPP with EPA and TDEC.
13	Table 10	The "Target response date" for the SAP update is listed as the current fiscal year but should be more definitive.	Clarify. The schedule for updating the SAP/QAPP is tied to review of the focused feasibility study for water management, which is uncertain. Therefore, the Project Team must agree on the schedule that can be supported. The Project Team will meet October 22, 2015 to continue the process of updating the SAP/QAPP
14	Section 5.3.1, page 28	The first paragraph refers to the RER to show the existing groundwater contamination in the area. Update the annual PCCR to include a summary of the nearby groundwater contamination that describes and shows the proximity of the existing contaminant plumes to the EMWMF groundwater detection monitoring system required by 40 CFR 264.98. This annual review of nearby groundwater contamination is needed to assure the monitoring system is not in jeopardy of being compromised by other contaminant plumes. Figure 7 should be used to show this information.	Agree. The following has been added to the text: "A review of the RER plume data does not indicate current impacts to the EMWMF monitoring system." Figure 7 has been revised to add the groundwater plumes in Bear Creek.
15	Section 5.3.1, page 32	The final sentence of this section refers to an issue under discussion. Include a sentence referring to where in this report that issue is listed and the schedule for resolution. In this issue, include consideration of an additional monitoring well west of Cell 6. Sufficient coverage of down gradient wells is needed to address	Clarify. The issue with the GW-923 well is listed in Table 27, Overall issues and recommendations. The reference to this table has been added to the text. DOE will continue to coordinate development of the upcoming, revised SAP/QAPP, including potential additional monitoring locations, with EPA and

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		the potential for a component of groundwater flow that may be migrating along preferential flow paths laterally from Cells 1 and 6.	TDEC.
16	Figure 8, Generalized directions of groundwater flow in the uppermost aquifer at EMWMF, Page 33	This figure includes outdated groundwater flow data. Specifically, the figure references water level measurements from February 2012. Further, Section 5.3.2, Groundwater Flow Direction and Rate, discusses seasonally wet conditions (February 2014) and seasonally dry conditions (August 2014) and references Figure 8; however, Figure 8 does not include this data. Revise Figure 8 to present current groundwater flow conditions. In addition, present separate figures that depict seasonally wet and dry conditions.	Agree. Figure 8 has been revised to reflect current data.
17	Section 5.3.3, page 35	The indicator contaminants in the EMP are in the reference list as the latest version. Please identify the latest version of the EMP in the reference list. Confirm whether it has been approved for inclusion in the list of FFA approved Primary Documents.	Clarify. As discussed with the Project Team, the revision of the EMP that was the basis of this PCCR is dated August 2011. This reference has been updated, to indicate the date.
18	Section 5.3.3, page 36	The fourth bullet seems to be misstated. DQOs being met are not based on indicator contaminant exceedances or "do not differ substantially from previous years." DQOs are based on whether the data is of sufficient quality and quantity to meet the intended use of the data that supports decisions being presented here.	Agree. This section has been rewritten to show that the data were of sufficient quality to support the decision.

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		<p>in the sub-bullets based on data that meets the DQOs. In the fourth sub-bullet, the statement that "There are no substantial differences ..." is subjective. Although this appears to be more relevant to verifying whether data quality was sufficient to support the decision, the use of subjective statement could be made clear in the context of the process of data quality assessment.</p>	
19	Section 5.3.3, Groundwater Detection Monitoring, Page 37	<p>The first bullet on this page indicates the maximum concentration of technetium (Tc)-99, Uranium-233/234 (U-233/234), and Uranium-235/236 (U-235/236) in surface water samples were above the respective groundwater threshold values; however, this section does not describe the reasons for the threshold exceedances for Tc-99, U-233/234, or U-235/236. This section does not indicate if the increased handling of Tc-99 at EMWMF in Fiscal Year 2014 is responsible for the Tc-99 threshold exceedances or if the steps included in Section 3.8.6, Process Improvements for Bldg. K-25 Purge Cascade Waste and Elevated Technetium-99 Levels, improved the observed concentrations of these radionuclides. In general, the reference to use of groundwater values for surface water values (explained as BMP earlier); "compliant with the contact water discharge criteria" and "consistent with compliant discharges of contact</p>	<p>Clarify. The surface water location at the EMW-VWEIR is currently included in the SAP/QAPP as a groundwater detection monitoring location although it does not measure groundwater. DOE will continue to work with EPA and TDEC to revise the SAP/QAPP and remove surface water locations from the detection monitoring program.</p>

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		<p>water" are difficult to understand or verify in this summary context, especially in the context of Section 5.3.3. The threshold values for groundwater monitoring and Table 17 are appropriately sourced, described and listed. This summary for surface water is not clear. Revise this section to address these issues. Consider a new section 5.3.4 - Groundwater Detection Monitoring in Surface Water Best Management Practice." This should not be confused with appropriate and required monitoring for being protective of the surface water pathway as described in Section 5.4 related to surface water discharge limits.</p>	
20	Section 5.4.2.1, page 40	<p>The final two sentences on this page appear to redefine the objectives of the LDS and LCS to drain water infiltrating beneath the liner system rather than to collect and drain leachate and detect for any leaks passing through the primary liner from the LCS. Discuss whether this is a new consideration in this PCCR and/or define where this objective of the LDS and LCS has been defined elsewhere (e.g., ARAR, guidance, ROD).</p>	<p>Agree. The final two sentences of this section have been revised as follows: "Operational data have demonstrated the effectiveness of these layers in collecting and removing leachate from the disposal cells. As a result, it is highly improbable for any significant quantity of groundwater to infiltrate through these geomembranes and into the waste cells."</p>
21	Section 5.4.2.1 page 41, Table 26	<p>The discussion of waste cell loading should be expanded now that there has been more time for pore pressures to equilibrate. This issue is listed in Table 26 as closed. The issue is not closed and at a minimum needs to be retained as a standing issue until subsequent</p>	<p>Agree. Data are continuing to be collected and evaluated. An update including trends in pore pressure values will be provided and will be discussed with the Project Team. The issue has been changed to "open."</p>

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		actions are taken and completed. If monitoring continues to show elevated levels and/or faulty data readings are continued to be a possibility, then actions may be necessary to improve the assessment of the conditions without faulty data.	
22	Table 22	Similar to Table 17, include AWQC values in the table. Explain the exceedances in Table 17 in this section or Section 5.4.3 of the document.	<p>Agree. Table 22 has been revised to reference the AWQC used for comparison.</p> <p>Agree. Section 5.4.4 has been revised to explain exceedances better and to remove the phrase “nearly all”.</p>
23	Section 5.4.5	It is understood that the final sentence of this section is in the context of discharge limits that were established post ROD. Clarify and cite the source of the discharge limits (e.g., what version of the EMP and location within the EMP). Discuss the data as compared to AWQCs under consideration for inclusion in a modification to the ROD.	Clarify. The first paragraph of Section 5.4.5 already cites the source of the discharge limits: “Contact water in the applicable storage units is discharged to the Sediment Basin if characterization sampling results demonstrate compliance with discharge limits specified in the <i>Environmental Monitoring Plan</i> .” Since these are the discharge limits being used, it is inappropriate to compare the data to AWQC under consideration. The proposed change to the appropriate ARARs, including AWQC, is included as an issue in Table 27.
24	Section 5.4.7	Expand this section to include a review of the data to confirm discharges are protective within the Superfund Risk Range. EPA requests these data/results be evaluated utilizing the "Radionuclide ARAR Dose Compliance Concentration (DCCs) for Superfund" (See <a 625="" 738="" 896="" 903"="" href="http://epa-</td> <td data-bbox=">Clarify. As stated in Section 5, page 49, “The Sediment Basin discharge water is monitored to demonstrate compliance with the dose limits required by EMWMF ARARs... and to ensure compliance with TDEC 1200-04-030.03(3) AWQC, as specified in the <i>Environmental Monitoring Plan</i>.” The PCCR compares sampling	

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		dccc.ornl.gov/radionuclides/).	data to these approved discharge limits. When the SAP/QAPP is revised, the appropriate ARARs for the discharge of water from the Sediment Basin will be reevaluated.
25	Section 5.4.7, Sediment Basin Discharge, Page 49	This section states, "the calculated cumulative annual average SOF [sum of fractions] values for Sediment Basin discharged into Bear Creek during calendar year 2014 ranged between 0.256 and 0.442 (Fig. 12)." However, Figure 12, Cumulative annual SOF for Sediment Basin discharge at EMV-VWEIR, shows a much narrower range. Revise this section or Figure 12 to provide consistent SOF data.	Agree. The text has been revised to be consistent with the correct, narrower range in Fig. 12.
26	Table 26, Environmental monitoring issues and recommendations. Page 54	The first row, third column on page 54 indicates that the D1 PCCR does not reference data quality objectives (DQOs); however, the D1 PCCR does reference DQOs. For example, Section 5.3.3, Groundwater Detection Monitoring Data Evaluation, includes a bullet entitled, Data Quality Objectives were met, and includes an assessment of sampling results against the unstated DQOs. It should be noted that while removal of DQOs from the D1 PCCR may temporarily resolve this issue, DQOs should be evaluated and included in a revised Sampling and Analysis Plan (SAP) for the site and included in future PCCRs. Revise the D1 PCCR to state that DQOs will be developed and included in a revised SAP and future PCCRs.	Agree. Section 5.3.3 has been revised to state: "Tentative Data Quality Objectives were met." The development of DQOs is listed as an issue in Table 27. DOE will continue to coordinate development of the upcoming, revised SAP/QAPP, including DQOs, with EPA and TDEC.

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27	Table 26	The issues in the first row on each page are not closed.	Agree. Both issues now are shown as Open.

DOCUMENT REVIEW FORM

DOCUMENT TITLE: <i>Fiscal Year 2015 Phased Construction Completion Report for the Oak Ridge Reservation Environmental Management Waste Management Facility</i>	DOCUMENT NO. DOE/OR/01-2683&D1
NAME OF REVIEWER: Howard Crabtree	ORGANIZATION: TDEC
DATE COMMENTS TRANSMITTED: June 25, 2015	

COMMENT NO.	SECT/PAGE	COMMENT	RESPONSE
General Comments			
1		Based on the review of <i>Sampling and Analysis Plan/Quality Assurance Project Plan for the Environmental Management Waste Management Facility, Oak Ridge, Tennessee</i> (UCOR-4156/R2) and the Phased Construction Completion Report (PCCR), it appears environmental monitoring programs at the EMWMF have been predominately based on RCRA general monitoring requirements, which are not necessarily inclusive of the radiological monitoring requirements in state ARARs and DOE Orders. The EMWMF is primarily a Low Level Radioactive Waste (LLRW) Disposal Facility for Department of Energy (DOE) remedial waste operating under the authority of CERCLA and, therefore, subject to associated state ARARs and DOE Orders. TDEC 1200-2-11-.17(4)(c) requires a monitoring program capable of providing an early warning of releases of radionuclides from the disposal unit before	Agree. Performance monitoring of the EMWMF is conducted based on the ARARs in the <i>Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee</i> (DOE/OR/01-1791&D3), including DOE M 435.1-1 (IV)(I)(2)(g). The ambient water quality criteria were specified in the <i>Environmental Management Waste Management Facility (EMWMF) Environmental Monitoring Plan</i> (UCOR-4001). The EMWMF performance monitoring focuses on early detection of potential contaminant releases. Early detection allows for early mitigation of potential contaminant releases. DOE will continue to coordinate development of the upcoming, revised SAP/QAPP with EPA and TDEC to ensure it continues to provide an early warning of potential contaminant releases.

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		they leave the site boundary. DOE Order M 435.1-1 Section IV R expands on this requirement and introduces the concepts of performance monitoring and maintenance of the performance assessment and composite analysis on which the waste acceptance criteria are based. These requirements, associated guidance, and DOE Orders need to be integrated into the Sampling and Analysis Plan/Quality Assurance Project Plan for the EMWMF and reflected in future PCCRs.	
Specific Comments			
1	<u>Page 3, Paragraph 2</u>	If such an introductory paragraph is necessary, it should be re-written to be a bit more realistic. The EMWMF design will not prevent physical penetration. Hopefully, it will discourage it. Land use controls will hopefully discourage current and future use of groundwater that may be impacted by the facility. Nevertheless, contaminants have been released from the facility and will be released from the facility in the future, and the facility is likely to contribute at some level to the degradation of groundwater and surface water in Bear Creek. The jury is still out on whether these releases will expand the area of ground water contamination in the valley or add to degradation of the water quality in Bear Creek in a significant way.	Agree. The paragraph has been revised as follows: "The design of EMWMF discourages physical penetration, limits infiltration, and minimizes contaminant releases. Land use controls will discourage the current and future use of groundwater that may be impacted by releases."
2	<u>Page 12, Last Paragraph</u>	<i>"Decontamination and decommissioning acceleration in conjunction with Vision 2016 and Vision 2020 is planned and could result</i>	Agree. Vision 2020 is the UCOR strategic plan to complete cleanup of ETPP by 2020. The demolition of all gaseous diffusion plants is planned for

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		<i>in reaching capacity much sooner, but budget uncertainty may not support this acceleration.</i> Please explain what Vision 2016 and Vision 2020 are.	completion by 2016. Section 3.3 has been revised as follows: "Plans are being made to complete remediation of ETTP by 2020, and this acceleration may result in reaching capacity much sooner. Budget uncertainty may not support this acceleration."
3	<u>Page 12</u>	This summary should also include the amount of clean fill, since the clean fill/debris ratio is critical to the forecast of capacity demand. Additional details on changes in the fill/debris ratio would be welcome.	Clarify. Fig. 4, EMWMF capacity forecast, already includes clean fill. The amount of clean fill required in the future is uncertain and is refined as the waste forecast (volume, type, and sequence) is better understood. Additional details on the fill to debris ratio will be discussed in an upcoming Project Team meeting.
4	<u>Page 21, Section 3.11 Implementing Documents, last sentence</u>	<i>"The implementing documents can be found at http://regdocs.bechteljacobs.org/default.aspx in the folder EMWMM F Project Team: Implementing Documents"</i> The website cited evidently no longer exists. Please, make the implementing documents available elsewhere.	Agree. The new website is: https://regdocs.ettp.energy.gov ., and the text has been changed.
5	<u>Page 32, Paragraph 1</u>	<i>"...Well GW-923 is considered unusable for detection monitoring purposes. Replacement of this well is an issue currently under discussion.</i> "TDEC would like to be a part of this discussion. Among concerns is the lack of a down gradient well(s) parallel to geologic strike.	Agree. This issue will be considered during revision of the <i>Sampling and Analysis Plan/Quality Assurance Project Plan for the Environmental Management Waste Management Facility, Oak Ridge, Tennessee</i> . The Project Team will meet on October 22, 2015 to discuss revising the SAP/QAPP. DOE will continue to coordinate development of the upcoming, revised SAP/QAPP with EPA and TDEC.
6	<u>Page 32-35, Groundwater Flow and Direction Rates</u>	This discussion describes the potential heterogeneity of hydraulic conductivity, but does not discuss anisotropy, or the ranges of groundwater velocity that might be anticipated (except in reference). Figure 8 should be modified, or a caveat added, so that a reader unfamiliar with	Clarify. The detection monitoring system and groundwater flow paths shown on figure 8 reflect groundwater movement in the shallow aquifer immediately underlying the EMWMF. Text has been added to reflect groundwater movement parallel to the geologic strike in the bedrock aquifers, but at the EMWMF, there is an upward hydrostatic head in

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		<p>groundwater flow paths in East Tennessee will know that contaminants will preferentially migrate parallel to geologic strike. Groundwater monitoring that better reflects the probable flow paths from the facility should be initiated before facility closure. The effective porosity, which in fractured media can only be determined empirically for a given tracer test result, will vary, as does the groundwater velocity, as a function of scale. For the rather modest distances between the EMWMF and monitoring wells, the range of velocities in Table 15 are likely to be only one order of magnitude too low, and may not impact the viability of a monitoring network.</p>	<p>these formations that minimizes the potential for deep groundwater contaminant transport. DOE will continue to coordinate development of the upcoming, revised SAP/QAPP with EPA and TDEC.</p>
7	<p><u>Page 35,</u> <u>Section 5.3.3,</u> <u>Groundwater</u> <u>Detection</u> <u>Monitoring</u> <u>Data</u> <u>Evaluation</u></p>	<p><i>"Evaluation of the FY2014 groundwater detection monitoring data focused on the groundwater and surface water sampling/analysis results for the indicator contaminants described in the Environmental Monitoring Plan and listed in Table 16."</i> While the commenter is not necessarily opposed to reducing the number of radionuclides measured, results in ORES indicate a number of man-made radionuclides exceeded their MDA that were not included as indicator contaminants or discussed in the PCCR. While it seems likely these results are false positives, it should not be assumed this is the case without supporting evidence. It was the state's understanding that the on-going data evaluation was to investigate this recurrent problem with the results, in order to resolve the issue. Findings, if any, should be</p>	<p>Agree. Section 5.3.3 has been revised to status the previous anomalies that have been addressed and the evaluation of historical results above the MDA that are in ORES.</p>

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		reported in the PCCR.	
8	<u>Page 37, Last Bullet</u>	<i>"Contaminant release not indicated."</i> The 2014 results in OREIS for EMWMF groundwater monitoring indicate multiple man-made radionuclides were reported above the detection limit. The PCCR also states on page 36 that Tc-99 and Sr-90 were detected in samples of groundwater and the underdrain. How then, can it be definitively stated: <i>Groundwater and surface water sampling/analysis results obtained for the purposes of detection monitoring at EMWMF during FY2014 do not indicate a contaminant release to the uppermost aquifer."</i> ?	Agree. The text has been revised to state that "There is no conclusive evidence that a reportable contaminant release has occurred."
9	<u>Page 40-41, Section 5.4.2.1, Elevated Groundwater Measurement in the Vicinity of PP-01</u>	This discussion does not mention the more likely causes of permanent increases in water level, which would presumably result from equilibration of hydraulic heads to changes induced by the construction of the facility, including longer flow paths to groundwater discharge points and decreases in hydraulic conductivity of material underlying the facility footprint. Since water levels still continue to on a rising trend on the east side of the facility, some mention of a contingency plan to prevent water from entering the liner would be in order.	Agree. This continues to be an ongoing open issue reflected in Table 26. The contingency plan will be the development of an Engineering Feasibility Plan if conditions determine this is necessary. The following text has been added to Section 5.4.2.1: "Conditions where the water level rises above the base of the compacted clay liner as measured at any pneumatic piezometer location, or within two feet of the base of the liner at any two PP locations, will initiate an Engineering Feasibility Plan to assess the feasibility of installation of new monitoring points and measures to reduce water levels under the facility."
10	<u>Page 43, Section 5.4.3</u>	Currently, the underdrain is sampled quarterly. As the underdrain collects groundwater beneath the waste cells and discharges it to Bear Creek, it provides a direct and rapid pathway for contaminants released through the liner to Bear Creek	Clarify. Sampling in FY 2014 was performed in accordance with the EMP. DOE will continue to coordinate development of the upcoming, revised SAP/QAPP, which will include sampling the underdrain, with EPA and TDEC.

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		and the associated karst of the Maynardville Limestone. It is also the most likely monitoring point to detect such contamination. Given the above, the underdrain should be sampled at least monthly, as opposed to quarterly.	
11	<u>Page 44, Table 20</u>	In July of 2014, TDEC staff monitoring the sediment basin V-weir recorded a pH of 9.19, in August a pH of 9.13, and in September a pH 9.13. An investigation by TDEC staff determined algae in the sediment basin to be the most likely cause of the elevated pH levels. A concern should be noted in the PCCR and a remedy discussed with TDEC monitoring staff.	Agree. This issue has been added to Tables 26 and 27. The path forward for this issue is the upcoming, revised SAP/QAPP. DOE will continue to coordinate development of the upcoming, revised SAP/QAPP with EPA and TDEC. Ongoing operational efforts to reduce algae are in progress. In addition, Table 20 has been revised to change pH to Std. Units and Dissolved Oxygen to mg/L (ppm).
12	<u>Page 51, Paragraph 1</u>	<i>"While National Emission Standards for Hazardous Air Pollutants (NESHAP) is not an ARAR, as a Best Management Practice, ambient air samples are collected from one upwind and two downwind locations using samplers located on perimeter cellfences to monitor for hazardous air pollutant. While not an ARAR, these samples are compared to the most recently published values identified for specific pollutants by the American Conference of Government Industrial Hygienists (or the current permissible exposure limits specified in 29 CFR 1910.1000 [Occupational Safety and Health Standards, "Air contaminants for chemicals and particulates"] and DOE-derived concentration guidelines (by derived air concentration [DAC] values in 10 CFR 835 [Occupational Radiation Protection], Appendix A) for radionuclides."</i>	Agree. National Emission Standards for Hazardous Air Pollutants (NESHAPS) (40 CFR Part 61, Subpart H) is an ARAR, as is TDEC 1200-2-11-.17(4)(c). Section 5.4.8 has been revised to correct this and units have been added to the data table. Fig. 3 has been revised to include the locations of the air monitoring. Additional information has been added to this section to better explain the monitoring results.

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		<p>Provisions of 40 CFR Part 61, Subpart H - <i>National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities</i> applies to operations at any facility owned or operated by the Department of Energy that emits any radionuclide other than radon-222 and radon-220 into the air, except that this subpart does not apply to disposal at facilities subject to 40 CFR part 191, subpart B or 40 CFR part 192 (. § 61.90 Designation of facilities). A description of the equipment, monitoring protocol, and a location map would have been helpful, but, based on the text cited; the monitoring being referenced is for occupational purposes. Guidance for air monitoring at LLRW disposal facilities is provided is provided in NuReg 1388 (<i>Environmental Monitoring of Low-Level Radioactive Waste Disposal Facility</i>), DOE Order 458.1 (<i>Radiation Protection of the Public and Environment</i>), DOE's <i>Environmental Monitoring for Low Level Waste Disposal Sites</i>, and DOE's <i>Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance</i> (DOE 1991).</p> <p>The requirement also addresses a performance objective of DOE Order M 435. 1-1, which requires LLRW disposal facilities to limit the dose to members of the public via the air pathway to 10 mrem/year total effective dose equivalent, excluding the dose from radon and its progeny. In</p>	

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		<p>addition, air monitoring is a component of TDEC 1200-2-11-.17(4)(c), which provides: <i>"During site construction and operation, the licensee 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."</i></p>	
13	<p><u>Page 52,</u> <u>Table 25</u></p>	<p>The table needs to include the units and the annual dose cited in the text.</p>	<p>Agree. Table 25 has been revised to include the units and the annual dose, and the text has been revised to reflect the NESHAPS requirement of 10 mrem/yr.</p>
14	<p><u>Page 52</u></p>	<p>The first conclusion should be that <i>"There is no evidence that contaminants potentially derived have directly entered groundwater."</i> The conclusion is not deliberately misleading, but, as Bear Creek and NT-5 are losing streams, this conclusion is false as stated.</p>	<p>Agree. The first conclusion has been revised as follows: "There is no conclusive evidence that contaminants potentially derived from wastes disposed in EMWMF have directly entered the groundwater."</p>
15	<p><u>Page 52,</u> <u>Bullet 3</u></p>	<p>In reference to AWQC, TDEC believes pH concerns exist at the EMM-VWEIR. However, the concern is most likely related to algae blooms in the sediment basin. See comment above.</p>	<p>Agree. See response to comment #11.</p>
16	<p><u>Page 53,</u> <u>Table 26,</u> <u>Item 4</u></p>	<p>In reference to GW-923, TDEC concurs that a replacement well for GW-923 should be considered and properly placed to alleviate data gaps in the monitoring program.</p>	<p>Clarify. DOE will continue to coordinate development of the upcoming, revised SAP/QAPP, which will address appropriate groundwater monitoring wells, with EPA and TDEC.</p>
17	<p><u>Page 56,</u> <u>Summary of</u> <u>Conclusions,</u> <u>Issues, and</u> <u>Recommendati</u> <u>on</u></p>	<p><i>"Groundwater elevations were below the bottom of the 10-ft geologic buffer everywhere, except an area along the northern boundary of Cell 3 and Cell 4 near PP-01 and PP-02."</i></p>	<p>Clarify. The elevation of the top of the geologic buffer zone does vary from Cell 1 to Cell 3. The design elevation of these disposal cells steps down from east to west. As an example, using as-built survey records for the top of the geologic buffer, the north center elevation of Cells 1 to 3 is 1020.65,</p>

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		<p>The same water elevations near PP-01 and PP-02 are along the Northeast east of Cells 1 and 2 as shown on Figure 8. Is the buffer elevation so much different there? Please explain and/or correct this statement.</p> <p><i>“Surface water complies with AWQC, except for low levels of dissolved oxygen in samples collected from stations NT-04, EMWNT-03A, and EMW-VWEIR during July 2014.”</i></p> <p>TDEC agrees AWQC are met at the compliance point at NT-5. However, pH does exceed the AWQC at the EMW-VWEIR at times. The process that best explains the observed pH exceedances at the VWEIR is that underwater photosynthesis exceeds respiration, so pH rises as carbon dioxide is extracted from the water. As the sun begins to set, photosynthesis decreases and eventually stops, so pH falls throughout the night as respiring organisms add carbon dioxide to the water. The daily interplay of respiration and photosynthesis caused pH to cycle up and down during a 24-hour period. Extended episodes of high pH are particularly common in ponds where filamentous algae dominate the plant community. Also, high pH in aquaculture ponds appears to occur more frequently and with greater severity in waters with low total hardness and moderate to high</p>	<p>1019.14, and 1017.20 respectively. The north end of Cell 1 is 3.45 feet higher than the same location in Cell 3. The elevated water level measurements are localized to the upper northeast area of the EMWMF.</p> <p>Agree. See response to comment #11. The text has been revised as follows: “Surface water complies with the currently required AWQC. However, pH and low levels of dissolved oxygen exceed AWQC at times. These exceedances are expected to be related to algae growth in the Sediment Basin.”</p>

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		total alkalinity (Tucker and D'Abramo, 2008). See comments on page 44 and 52.	