United States Department of Energy
Environmental Management Program DOE/OR/01-2695&D1

Proposed Plan for the Disposal of Future Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste

June 2016

This Proposed Plan describes:

- The need for a decision on the disposal of waste from cleanup of the Oak Ridge National Priority List site
- Waste disposal alternatives considered
- Onsite disposal locations considered
- Preferred alternative for waste disposal
- How to participate in the selection or modification of the preferred alternative
- Where to get more information

This proposed plan presents the onsite disposal alternative located at Central Bear Creek Valley as the preferred remedy for disposal of waste from the U.S. Department of Energy's (DOE's) Oak Ridge Site cleanup program. This alternative is proposed for the following reasons:

1. Onsite disposal facilitates timely cleanup of the Oak Ridge site by being a cost-effective, safe disposal option, by providing an onsite disposal facility within Bear Creek Valley at a location that provides the soundest justification for applicable or relevant and appropriate waivers or exemptions. Having an onsite disposal option increases the amount of limited government funds available to be directed to the environmental cleanup efforts.
2. Disposal at the proposed site meets all regulatory requirements or provides a sound basis for waiving the regulation.
3. Onsite disposal at the proposed site is protective of human health and the environment, including existing residents, workers, and future hypothetical residents in Bear Creek Valley.
4. The proposed site is located well within the DOE reservation in an area not considered for reindustrialization or reuse.
5. Onsite disposal has the lowest short-term risks to humans through transportation or industrial accidents.

YOUR OPINION IS INVITED

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

Community involvement is critical to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 process. The DOE has established a 45-day public comment period, during which time local residents and interested parties can express their views and concerns on all aspects of this plan. The DOE has scheduled a public meeting to discuss cleanup alternatives and to address questions and concerns the public may have.

INTRODUCTION

This Proposed Plan presents the U.S. Department of Energy's (DOE's) preferred alternative for the disposal of future waste generated from cleanup actions under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) at the DOE Oak Ridge Site for which the existing onsite low-level (radioactive) waste (LLW) disposal facility does not have the capacity.

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

BACKGROUND

The 33,477-acre DOE-owned Oak Ridge Reservation (ORR) is located within the city limits of Oak Ridge, Tennessee, in Roane and Anderson counties (Fig. 1). The three major industrial, research, and production facilities originally constructed on the ORR as part of the World War II-era Manhattan project and currently managed by DOE are the East Tennessee Technology Park (ETTP), the Oak Ridge National Laboratory (ORNL), and the Y-12 National Security Complex (Y-12) (Fig. 1). The principal mission of ETTP was uranium enrichment, which has been completed. The ETTP is now being cleaned up to allow reuse of the land and infrastructure. The ORNL has historically hosted and continues to host a variety of research and development facilities, including the use of research nuclear reactors for DOE. The Y-12 has served several missions, including uranium enrichment, lithium refining, nuclear weapons component manufacturing, and weapons disassembly, and has a continuing mission in some of these areas. These historic operations on the ORR have led to the contamination of soil, surface water, sediment, groundwater, and buildings, and have resulted in burial of material. Because of these contaminant releases, the Oak Ridge Site (entitled the ORR) was placed on the U.S. Environmental Protection Agency (EPA) National Priorities List established under CERCLA (54 *Federal Register* 48184, November 21, 1989). All environmental restoration activities are performed in accordance with CERCLA under the requirements of the ORR Federal Facility Agreement (FFA) (DOE 1992) established between DOE, EPA, and the Tennessee Department of Environment and Conservation (TDEC).

The DOE Oak Ridge Office of Environmental Management Program's major focus has been CERCLA remediation of soil, surface water, sediment, groundwater, and buildings at all three facilities that were contaminated by the historic Manhattan project and Cold War operations and activities. While much of the cleanup activities are complete at ETTP, finishing the cleanup mission

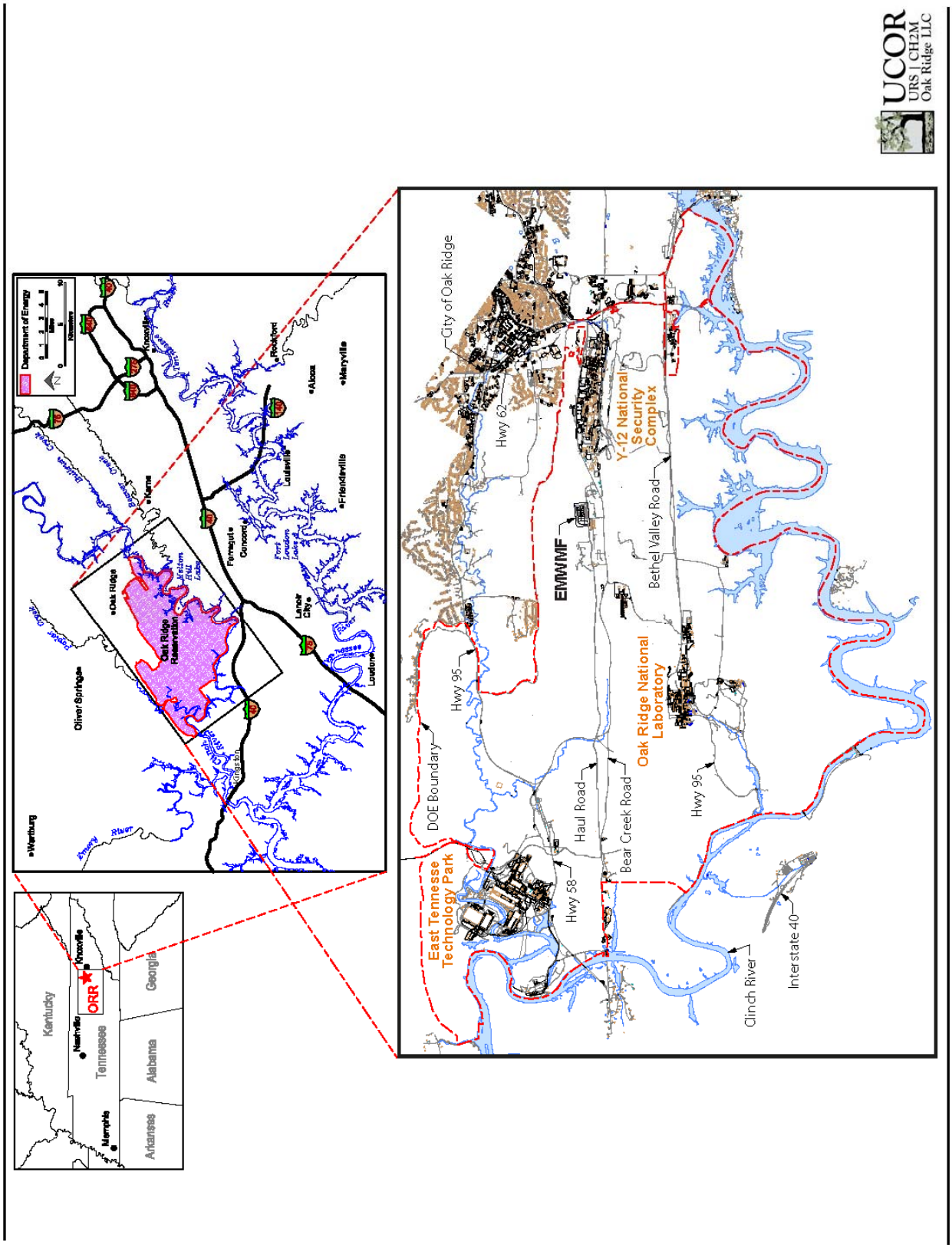

Fig. 1. Location of the Oak Ridge Reservation.

at all three facilities is projected to take the next three decades and is anticipated to result in large volumes of radioactive, hazardous, and mixed waste requiring disposal.

In 1997, based upon a State recommendation to expand community involvement, DOE sponsored the establishment of the End Use Working Group (EUWG). The group, composed of citizens from diverse stakeholder organizations, was asked to develop recommendations for end uses of contaminated areas on the ORR and community values that could be used to guide the cleanup decision-making process. The EUWG process preceded CERCLA decisions for the Oak Ridge Site watersheds, with the result that the EUWG recommendations and community guidelines were factored into these decisions. As documented in the EUWG Stakeholder Report on Stewardship (DOE 1998a), recommendations on the end use of Bear Creek Valley and for siting an onsite CERCLA waste disposal facility were made. The end use recommendation for the Bear Creek Valley included the establishment of a restricted waste disposal zone in the area of existing long-term waste disposal areas. The EUWG recommendation stated that any CERCLA waste facility should be located on or adjacent to an area that is already contaminated and used for long-term waste disposal and identified East Bear Creek Valley as the most appropriate location.

Consistent with the EUWG recommendation, the onsite Environmental Management Waste Management Facility (EMWMF) was located in East Bear Creek Valley (Fig. 2). The EMWMF began operations in 2002 and has received radioactive, hazardous, and mixed wastes from CERCLA cleanup activities on the Oak Ridge Site continuously for the last 13 years. The EMWMF consists of six disposal cells with a total capacity of 2.2 million cubic yards. Approximately 95 percent of the volume of wastes associated with cleanup to date has been disposed onsite, with 5 percent of the volume being disposed offsite, while only 15 percent of the radioactive curie content has been disposed at EMWMF with the remaining 85 percent of the activity being disposed offsite. Roughly 70 percent of the air space volume has been used as of January 2016, with no environmental Notice of Violations or operational accidents. There have been just under 150,000 waste shipments to EMWMF, primarily on the dedicated haul road with no transportation accidents.

SCOPE AND ROLE OF THE DECISION

The scope of the cleanup program has increased since the original waste estimates were developed. Consequently, the *Remedial Investigation/Feasibility Study for Comprehensive Environmental Response, Compensation, and Liability Act Oak Ridge Reservation Waste Disposal, Oak Ridge Tennessee* (DOE 2016a) (herein referred to as the RI/FS) was prepared to evaluate alternatives for disposal of CERCLA waste (after EMWMF capacity is reached) that will be generated from future cleanup of the Oak Ridge Site.

The estimated waste volumes in the original disposal decision were from the anticipated cleanup of ETTP, with a few high risk sites at Y-12 and ORNL, including Melton Valley. New cleanup actions were added to DOE's cleanup program by a major modification to the FFA in 2009 (DOE 2009) to address the remaining contamination at Y-12 and ORNL, including contamination in soils, sediment, and buildings. The balance of cleanup, forecasted to occur over the next three decades, significantly increases the volume of CERCLA waste projected to be generated over that known when the EMWMF Record of Decision (ROD) (DOE 1999) was signed. The EMWMF ROD estimated a waste volume[a] of 280,000 cubic yards would require disposal, however, later FFA documents estimated 1.3 million cubic yards. Eventually an Explanation of Significant Differences (DOE 2010) was signed that brought the total capacity allowed at EMWMF to 2.2 million cubic yards. Over 1.6 million cubic yards of additional CERCLA waste is expected to be generated and require disposal after EMWMF has reached capacity.

The scope of this Proposed Plan is to propose an alternative for disposal of CERCLA waste (after EMWMF capacity is reached) that will be generated from the future cleanup efforts planned for the Oak Ridge Site.

The associated RI/FS analyzed four primary alternatives: (1) no action, (2) onsite disposal in a newly constructed facility on the ORR, (3) a combination of onsite and offsite disposal,

[a]The volumes given are waste debris and soils only (as-generated) and does not include additional fill material used in land disposing of waste, compaction of waste during disposal, or any uncertainty.

Fig. 2. Environmental Management Waste Management Facility.

and (4) all offsite disposal at permitted and licensed facilities. As part of the onsite disposal alternative, the RI/FS also evaluated various siting options in Bear Creek Valley for the proposed new Environmental Management Disposal Facility (EMDF).

The DOE, EPA, and TDEC agreed to evaluate combined EMWMF and EMDF landfill water management alternatives in a separate focused feasibility study (FFS) while presenting the preferred alternative in this Proposed Plan. The *Focused Feasibility Study for Water Management for the Disposal of CERCLA Waste on the Oak Ridge Reservation, Oak Ridge, Tennessee* (DOE 2016b) (herein referred to as the Water Management FFS) evaluates options for the management of landfill wastewater generated from the operations of EMWMF and, if selected, at the proposed EMDF.

This Proposed Plan serves the following four primary purposes:

1. Summarizes the volume projections, waste types/characteristics, and risks associated with disposal of waste generated from CERCLA cleanup actions at the Oak Ridge Site.
2. Summarizes alternatives and compares them against the CERCLA remedy selection criteria and relevant NEPA values.
3. Identifies and provides, based on the CERCLA criteria and NEPA value evaluation, DOE's rationale for preferring the proposed alternative.
4. Facilitates public involvement in the remedy selection process.

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

WASTE CHARACTERIZATION AND VOLUME

Cleanup activities will generate soil, debris, and sediment containing a range of chemical and radioactive contaminants. However, the specific

volume and composition of waste that will be generated from future CERCLA actions cannot be fully defined at this time. The estimated as generated (no compaction, no fill, and no contingency) CERCLA waste volume that could be considered for onsite disposal, but will not be able to be disposed in EMWMF, is 1.6 million cubic yards. There is an additional small volume of waste that would be destined for offsite disposal no matter which alternative is developed, therefore, this small offsite volume was not included in the alternative development and analysis.

The development and evaluation of onsite disposal is dependent on how much waste will be disposed (how much landfill capacity is needed) and, therefore, the onsite disposal alternatives used an as-disposed volume. The development and evaluation of offsite disposal is dependent on how much waste is shipped and, therefore, used an as-generated/shipped volume. The as-disposed volume considers compaction in the cell and includes additional fill that would be needed to avoid subsidence. The as-generated/ shipped volume does not include either compaction or fill. All volumes included a 25 percent contingency for unknowns. The final as-disposed volume used in the RI/FS for development and analysis of a completely onsite alternative was 2.2 million cubic yards, and the final as-generated/shipped volume used for the completely offsite alternative was 1.9 million cubic yards.

The forecast waste types include LLW, LLW mixed waste (contains Resource Conservation and Recovery Act of 1976 [RCRA] hazardous waste), and radioactive/Toxic Substances Control Act of 1976 (TSCA) hazardous waste. Waste types are all solid wastes and will include soil, sediment, and sludge along with demolition debris. The majority of the waste (just over two thirds) is anticipated to be debris with just less than one third being soil/sediment/sludge.

Because detailed characterization data do not exist for many of the future demolition projects, much of the information assumed about the future debris waste streams is based on available data for waste disposed at EMWMF. Building characterization data was also used where available. While contaminants from future cleanup projects may differ in concentrations, the list of contaminants received at EMWMF (including waste received from all three ORR facilities) is extensive and reflects the contaminants expected in future waste lots. In addition, there is a large database of Y-12 and ORNL soil data resulting from historical investigations on this media. This database represents the soil contaminants and levels that can be expected in the waste, but also represents contaminants that are likely to be present in the buildings.

Waste from demolition and remediation of mercury-contaminated sources in the Y-12 main plant area is expected to have higher mercury levels than waste previously received at EMWMF. The developed alternatives considered this difference in the projected waste stream characteristics.

RISK SUMMARY

Under the typical CERCLA RI/FS process, baseline human health risk assessments are conducted to determine the need for specific action at a remediation site related to contamination present in media, either natural or manmade, to protect human health and the environment. However, the purpose of this disposal RI/FS is to evaluate the need for and merits of a comprehensive waste management and disposal process for multiple cleanup projects across the Oak Ridge Site. While cleanup decisions for the remediation sites have been made or will be made in separate, individual CERCLA decision documents, the decision being addressed in this case is the disposal of the projected volume of waste to be generated by these actions after capacity is reached at EMWMF. Therefore, a conventional baseline risk assessment does not apply to this evaluation. Rather, the summary of risks is focused on the goals required to assemble alternatives to safely address the projected waste volume while protecting human health and the environment and providing overall waste disposal efficiency.

There are numerous sites across the Oak Ridge Site in which action has been determined to be required under CERCLA that will generate waste that must be managed efficiently and in a protective manner. While the risks associated with the future generated waste may be managed individually, a coordinated waste disposal strategy is more practical and cost effective. Such a coordinated waste management effort is beneficial throughout waste transport and ultimately disposal in preventing exposures of both human and

ecological receptors to constituents in the waste and in preventing releases of constituents to environmental media such as groundwater, surface water, soil, and sediment. Additionally, a consolidated waste management effort may allow for a more extensive and timely cleanup of the Oak Ridge Site, further enhancing risk reduction and overall protection of human health and the environment.

REMEDIAL ACTION OBJECTIVES

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

The following RAOs are defined for this Proposed Plan:

- Prevent exposure of human receptors to CERCLA waste (or contaminants released from the waste into the environment) that exceeds a human health risk of 10^{-4} to 10^{-6} excess lifetime cancer risk or hazard index of 1.
- Prevent adverse impacts to water resources or unacceptable exposure to ecological receptors from CERCLA waste contaminants through meeting applicable or relevant and appropriate requirements (ARARs), including RCRA waste disposal and management requirements, Clean Water Act of 1972 ambient water quality criteria for surface water in Bear Creek, and Safe Drinking Water Act maximum contaminant levels in waters that are a current or potential source of drinking water.

The ARARs are environmental regulations promulgated under federal or more stringent state law that are either legally "applicable" or "relevant and appropriate" to the circumstance found at a CERCLA site. Where the ARARs defined in the RAOs are deemed insufficient in protecting ecological species, alternate remediation levels or discharge criteria will be defined using a risk-based approach.

Use of offsite disposal facilities meets these goals because waste is shipped for permanent disposal at existing, permitted offsite facilities. All offsite facilities presented and proposed for use under the Offsite Disposal Alternative have been vetted through the CERCLA offsite rule, Sect. 121(d)(3) of the NCP 40 *CFR* 300.440, and, as such, have been approved for disposal of CERCLA wastes. Use of onsite disposal facilities meet these goals through the design of the landfill and through setting waste acceptance criteria (WAC) to only allow the disposal of waste that can be demonstrated to be protective.

SUMMARY OF ALTERNATIVES

Seven alternatives were developed and evaluated, including no action, four alternatives using different onsite disposal locations, a hybrid of onsite and offsite disposal, and offsite disposal. Below is a summary of these alternatives. These alternatives are more fully described in the RI/FS (DOE 2016a) with support from the Water Management FFS for the Onsite Disposal Alternative (DOE 2016b).

NO ACTION ALTERNATIVE

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

ONSITE DISPOSAL ALTERNATIVES

Description. Under these alternatives, a new onsite, engineered, long-term disposal facility, called EMDF, would be constructed to provide consolidated disposal of most waste resulting from any future CERCLA response actions at the Oak Ridge Site exceeding the capacity of the existing EMWMF. Waste that does not meet the

WAC for safe onsite disposal would be treated to meet the WAC or shipped to licensed and/or permitted offsite treatment and disposal facilities.

Key elements of this alternative are proposed site locations, design and construction, operation, WAC, water management, offsite disposal for waste not meeting EMDF WAC, and closure and post-closure of the facility. Key ARARs are also presented.

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

Design and Construction. The plans for EMDF presented in the RI/FS for the four different onsite disposal alternatives provide disposal capacities of approximately 2.2 to 2.8 million cubic yards. The EMDF facility plans for each location are shown in Figs. 4 through 7. Key elements of the facility include a clean-fill dike to laterally contain the waste, a multilayer base liner system with a double leachate collection/detection system and underlying geologic buffer zone to isolate the waste from groundwater, and a multilayer cover installed over a stable base-contouring layer to reduce infiltration and isolate the waste from human and environmental receptors. Other elements are necessary support facilities (e.g., a landfill wastewater treatment system).

A preliminary cross section of the disposal facility is shown in Fig. 8 while typical, preliminary cross sections of the liner and cover are presented in Fig. 9. These disposal facility features are common to all site locations.

The EMDF would be designed to accept the disposal of RCRA waste, TSCA waste, LLW, and mixed hazardous and LLW.

The EMDF would be constructed in phases, depending on the alternative, only building the capacity needed at that time. The wastewater treatment system and the infrastructure for each landfill would be constructed in the first phase. For the East and West Bear Creek Valley sites, a portion of Bear Creek tributaries would be rerouted to accommodate the landfills with underdrain systems placed under the liners in the original location of the tributaries. The other sites would have lesser reliance on underdrain systems still needed to control water flow from seeps or springs during construction and operation of the landfill. Following closure, reliance on underdrains would stop for these sites. The site in Central Bear Creek Valley would have no long-term reliance on the underdrain system.

Centralized treatment efforts to reduce the volume of waste to be disposed was determined in the RI/FS to be a net expense (i.e., the construction and operation of a volume reduction facility costs more to implement than the savings it would achieve through reducing volume and conserving air space in EMDF). Waste segregation, volume reduction, and recycle would be performed by the cleanup projects and is not included as part of the Onsite Disposal Alternatives.

Operation. The EMDF operation includes activities conducted when waste placement occurs. Initially, it is assumed that both EMWMF and EMDF would be operating with waste being placed in the last EMWMF cell and in the initial EMDF cells. Once EMWMF is filled to capacity, it would be closed.

Some infrastructure systems would be shared between EMWMF and EMDF for those alternatives with landfills located near EMWMF. The Central Bear Creek Valley and West Bear Creek Valley alternatives and eventually the Dual Site alternative would require new infrastructure systems.

Operations at EMDF would include activities such as waste receipt, inspection, WAC attainment verification, and recordkeeping; unloading and placing waste into the disposal cells; compacting waste; covering waste; filling void spaces; surveying incoming and outgoing trucks; dust control; managing landfill water and storm water; and sampling.

Waste Acceptance Criteria. Specific criteria that must be met before waste is accepted for disposal are called WAC. Controlling what waste

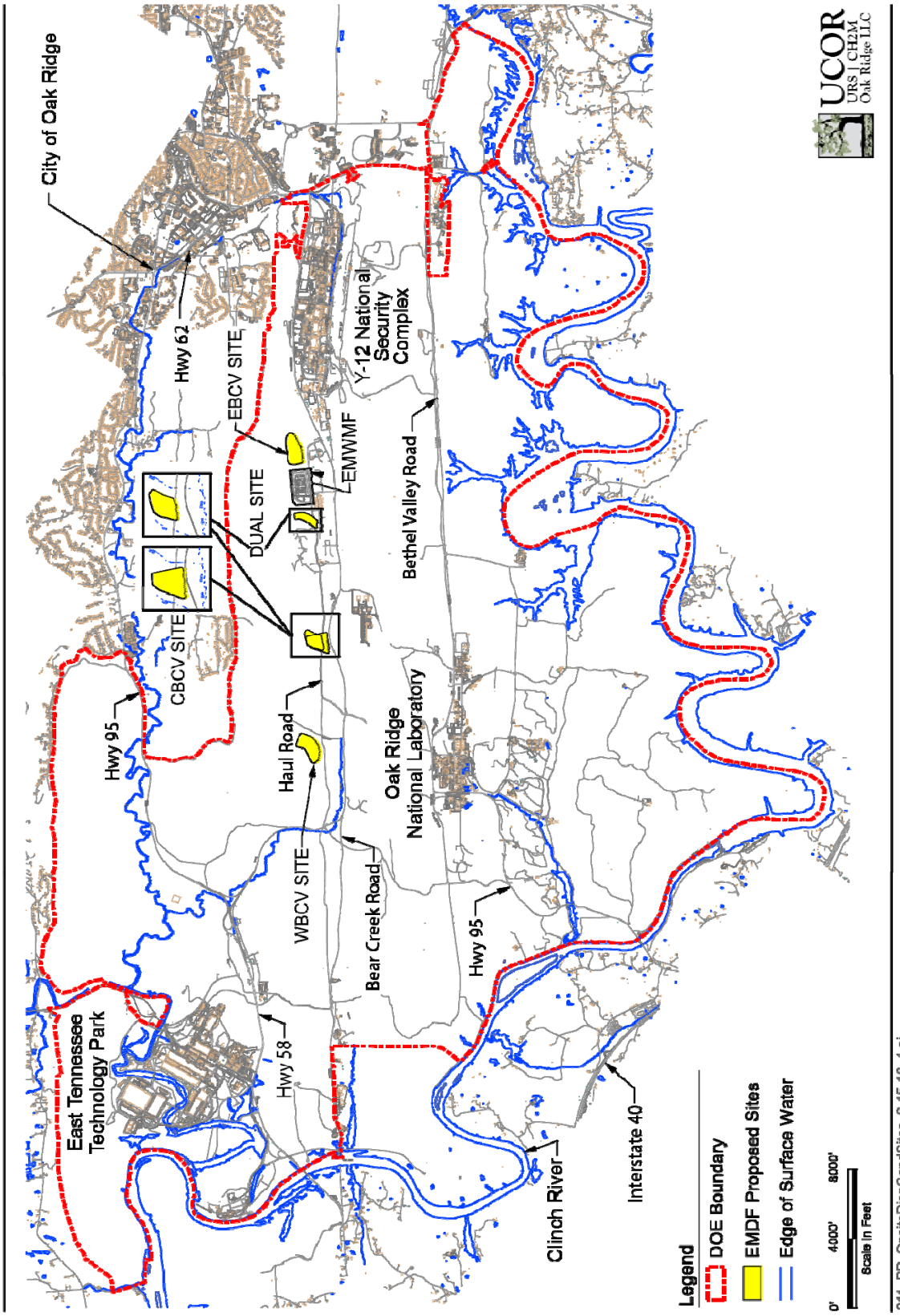

Fig. 3. Proposed sites for the Environmental Management Disposal Facility.

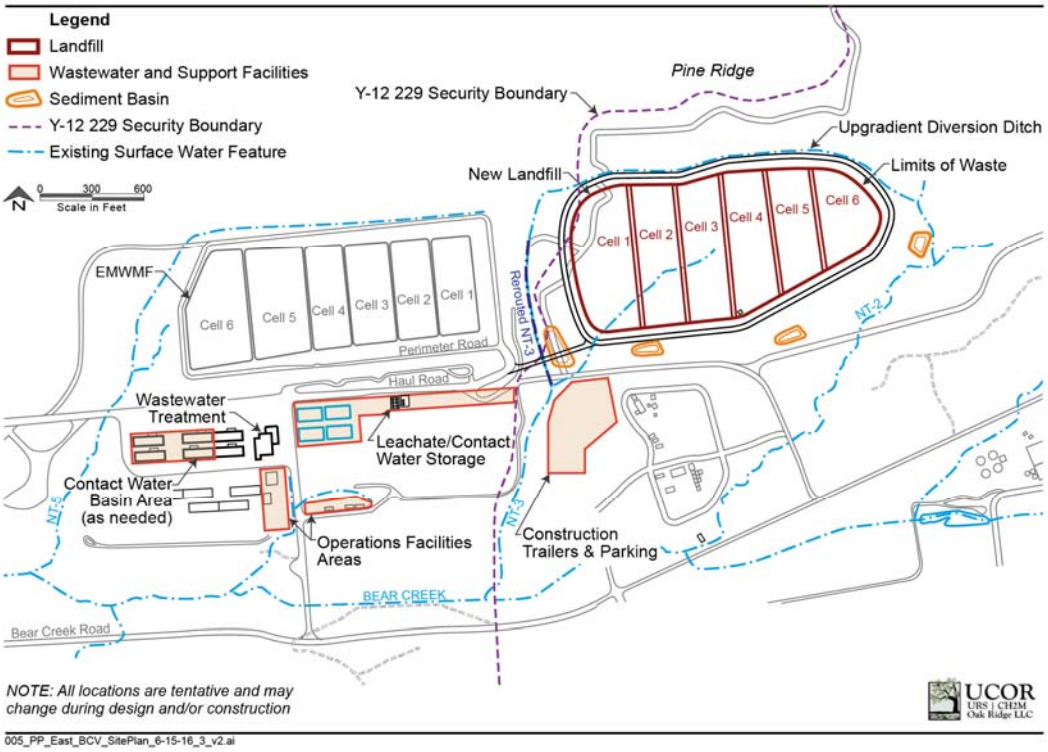

Fig. 4. East Bear Creek Valley Environmental Management Disposal Facility site plan.

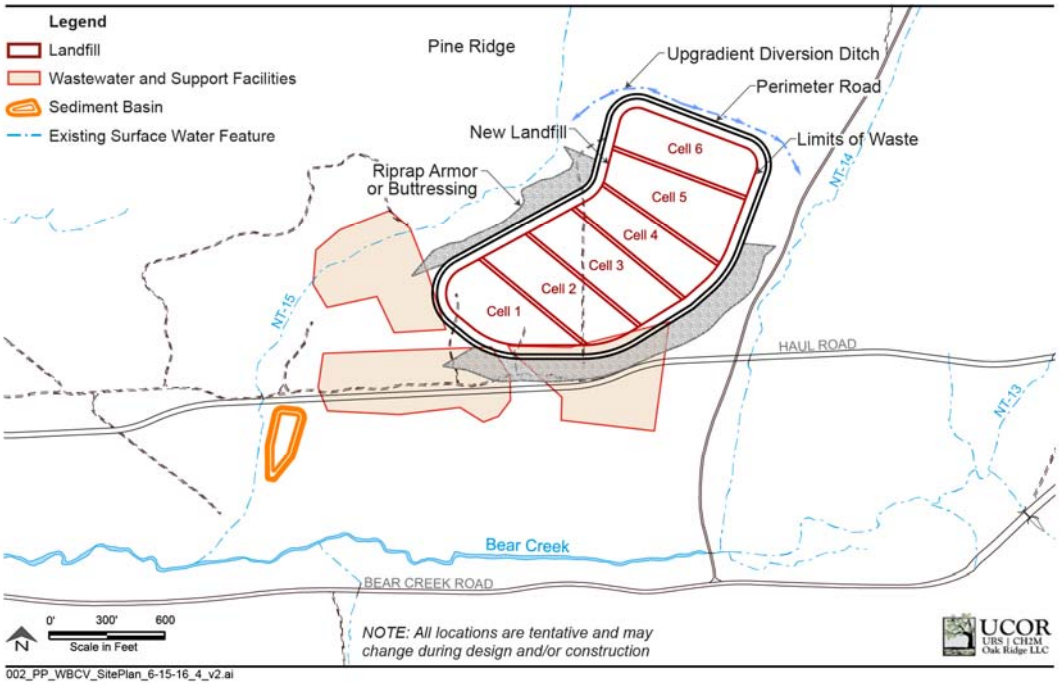

Fig. 5. West Bear Creek Valley Environmental Management Disposal Facility site plan.

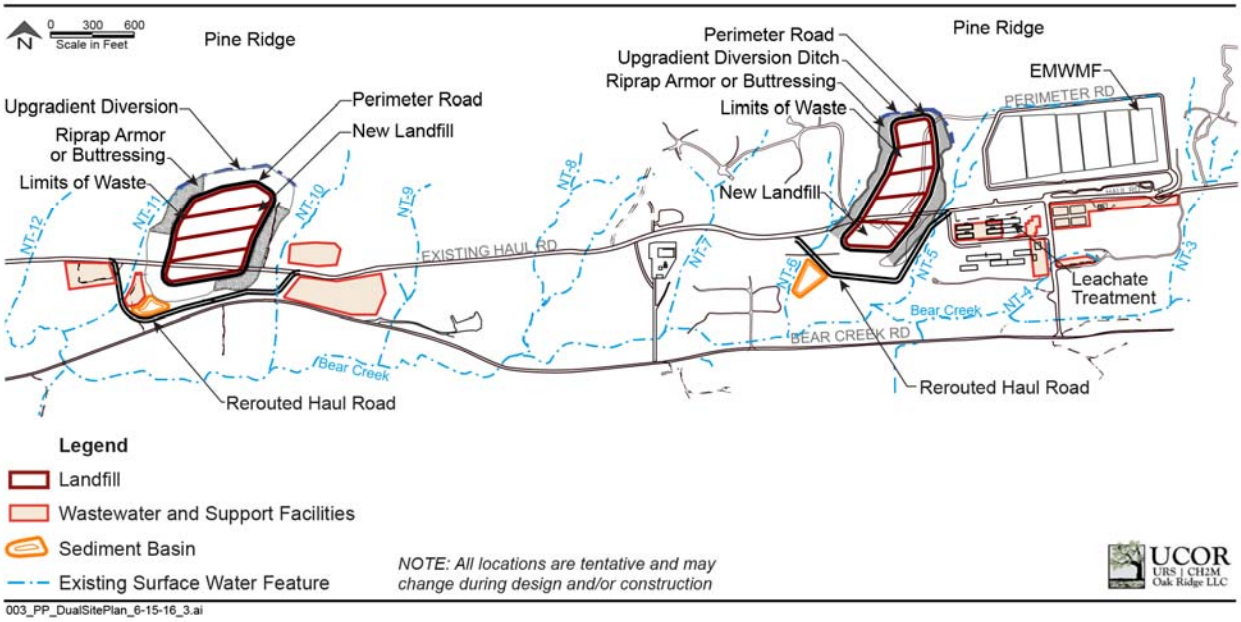

Fig. 6. Dual Site Bear Creek Valley Environmental Management Disposal Facility site plan.

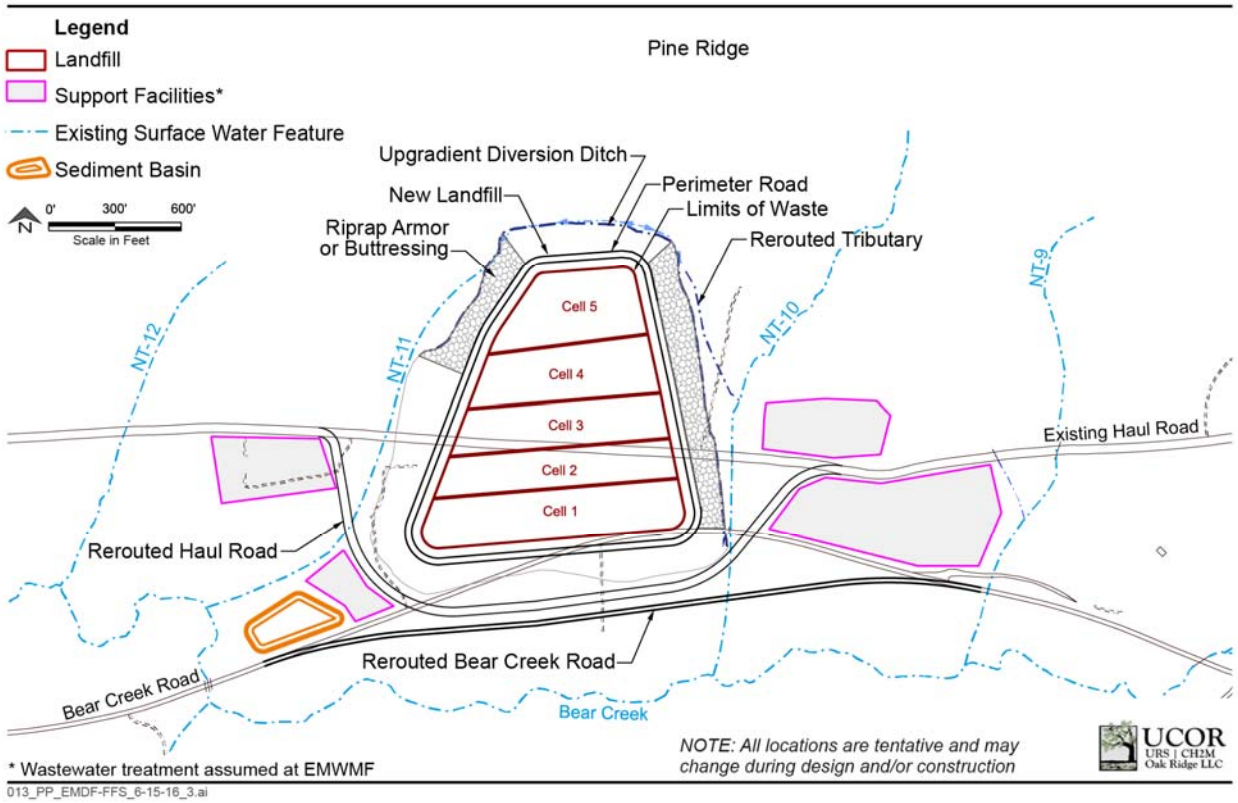

Fig. 7. Central Bear Creek Valley Environmental Management Disposal Facility site plan.

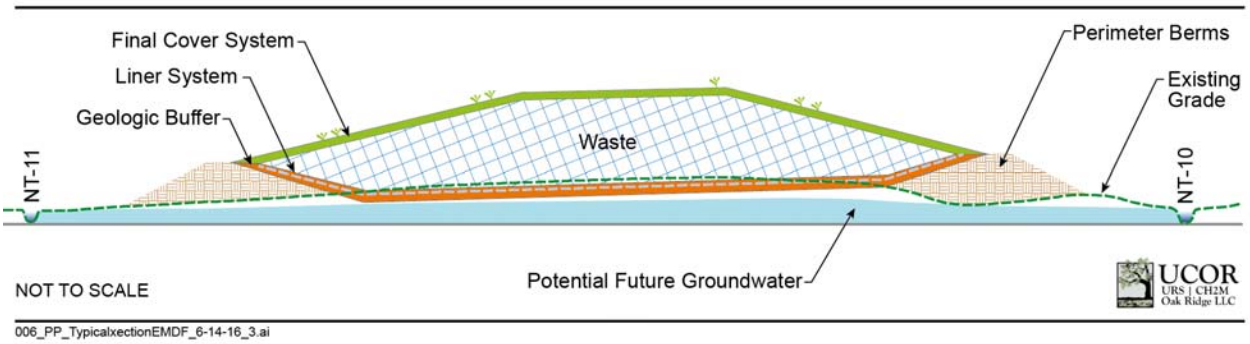

Fig. 8. Typical cross section of EMDF.

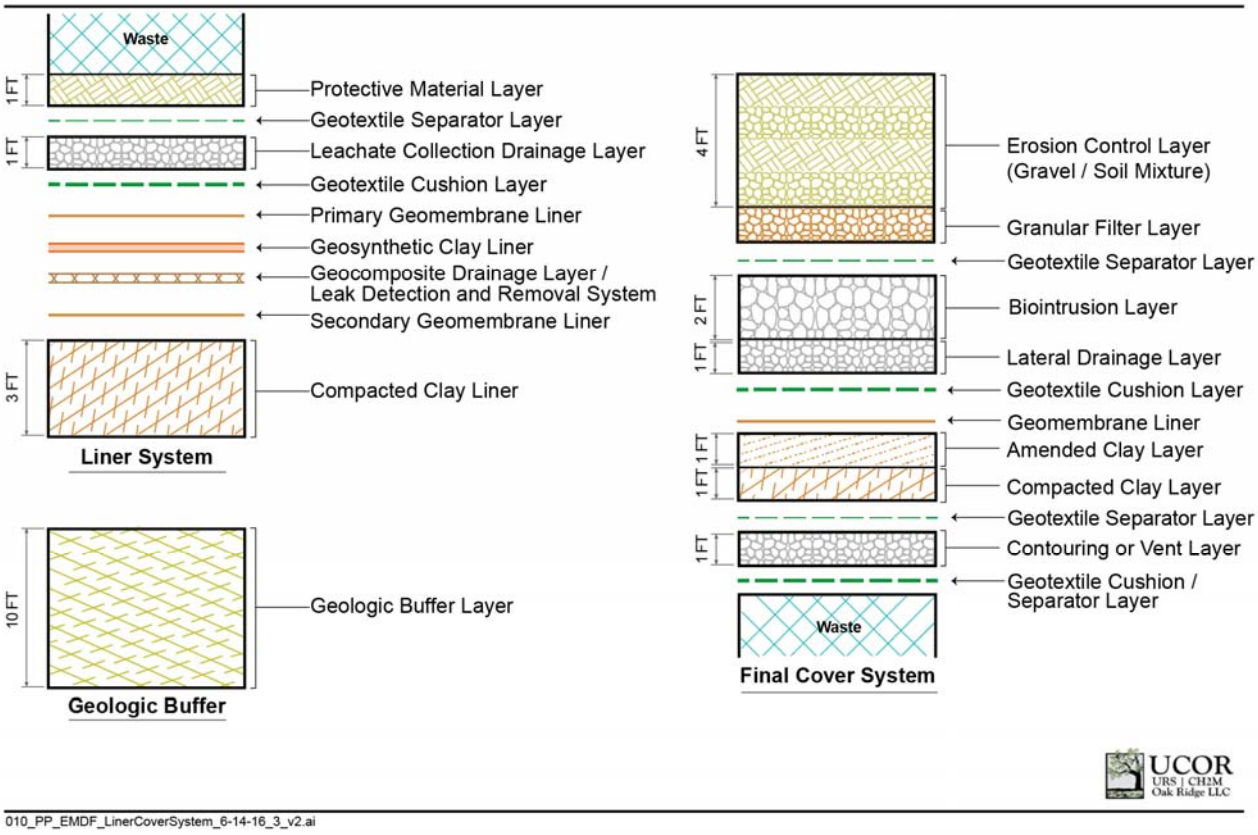

Fig. 9. Preliminary EMDF liner and cover system.

is disposed at EMDF is a key feature to providing long-term protection of human health and the environment and to protecting workers and the public during placement of the waste. By design, EMDF analytic WAC would ensure risk to future receptors, including a resident farmer, would be acceptable. The basis for the EMDF WAC in East Bear Creek Valley is provided in Appendix A. The preliminary analytic WAC (preWAC) identified in the RI/FS and in this appendix are a preliminary set provided to show viability of land disposal at one of the sites. Prior to receipt of waste at EMDF, final WAC would be developed that would also include WAC to protect landfill operators and

to minimize damage to the equipment used for disposal. It is anticipated that similarly calculated preWAC for the other potential EMDF sites would yield similar results as the geologic setting and location of potential receptors are very similar.

Wastewater Management. Landfill wastewater from EMDF would be staged and sampled. If the sampling results indicate that the water quality is acceptable for discharge, the water would be directly discharged without treatment to Bear Creek. If the sampling results indicate that the water quality is unacceptable for discharge, the staged water would be treated at a small system. A modular treatment system constructed at either the EMWMF or EMDF site would be used for landfill wastewater treatment if the landfill wastewater exceeds discharge limits. A number of alternatives, including use of existing ORR treatment systems, were evaluated in the Water Management FFS (DOE 2016b). An onsite modular system provides the adaptability required to manage the uncertainty associated with future flow rates and contaminants and, thus, is proposed as a key component of this Onsite Disposal Alternative for use when needed.

Offsite Disposal. Waste that does not meet EMDF WAC and is not found to be effectively treated to meet WAC would be shipped to an approved offsite facility for disposal. If no offsite facility is identified that can accept the waste, the "no path for disposal" waste would be placed in safe and compliant interim storage pending the availability of treatment or disposal capabilities.

Closure and Post-Closure. After completion of waste disposal, EMDF closure activities would include construction of the final cover system as shown in Figs. 8 and 9. Post-closure activities would include collection and, if needed, treatment of landfill wastewater, surveillance and maintenance, environmental monitoring, and land use controls.

Since the Onsite Disposal Alternatives leave hazardous substances in place at levels above unrestricted use, land use controls are required to prevent receptors from encountering the residual hazard. The objectives of land use controls during operation and after closure are to:

- Prevent unauthorized excavation into EMDF
- Restrict access to the EMDF site by unauthorized personnel
- Preclude alternate use of the EMDF site or its groundwater

Table 1 provides the type of controls, purpose of controls, duration, implementation, and affected areas for all of the Onsite Disposal Alternatives. Land use controls would be maintained to ensure long-term protectiveness until they are deemed unnecessary.

The proposed land use controls for EMDF in East Bear Creek Valley are consistent with those already established for Bear Creek Valley under the Bear Creek Valley ROD (DOE 2000) and for EMWMF under that ROD. However, land use controls would need to extend past the point originally envisioned in the Bear Creek Valley ROD if the alternative with EMDF located in Central Bear Creek Valley, West Bear Creek Valley, or the Dual Site alternative is selected. This would require a modification to the Bear Creek Valley ROD. Regardless of the site selected, the implementation of land use controls for Bear Creek Valley, EMWMF, and EMDF would be coordinated and integrated.

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

Action-specific ARARs affect how EMDF would be designed and operated. Key aspects of the RCRA and TSCA regulations are used to determine how to ensure long-term protectiveness of EMDF, both through the design and during operations and closure. There are also ARARs associated with how EMDF will be maintained in the future after closure and how land use controls are required and maintained. The onsite alternative would meet all ARARs, however, two TSCA requirements and one state requirement would require waivers/exemptions from EPA Region 4 and TDEC, respectively for East Bear Creek Valley with the first and the last waiver/exemption needed for all sites. No waivers are being sought under CERCLA.

- TSCA requires that there be no hydraulic connection between the site and standing or flowing surface water and that the bottom of the landfill liner system or natural in-place

Table 1. Land use controls for the Onsite Disposal Alternative

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

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

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

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

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

soil barrier of a chemical waste landfill be at least 50 ft above the historical high water table (40 *CFR* 761.75[b][3]). Construction of a disposal facility anywhere in Bear Creek Valley would not meet this requirement. A waiver of the TSCA hydrologic conditions and 50 ft buffer requirement would be granted under the TSCA regulations on the basis of providing onsite evidence that operation of the landfill will not present an unreasonable risk of injury to health or the environment when the requirement is not met. Likewise, TSCA requires through 40 *CFR* 761.75(b)(5) that the landfill be located in an area of low to moderate relief. The site in East Bear Creek Valley can be engineered to accommodate the steeper slopes at this site, with the engineering calculations and results serving as part of the evidence to grant a waiver for this requirement. (Other sites would not require this waiver.)

- State siting requirements specified in TDEC 0400-20-11-.17(1)(h) require that groundwater does not discharge to the surface in the disposal site. All onsite disposal locations have seeps and springs but, because of the additional engineering provided to address this discharge (geologic buffers, underdrains, etc.), an exemption to this requirement would be provided by TDEC.

HYBRID DISPOSAL ALTERNATIVE

Hybrid disposal refers to significant disposal at both onsite and offsite disposal facilities using elements of both the Onsite Disposal Alternative and Offsite Disposal Alternative. As with the other alternatives, the starting waste volume for the Hybrid Disposal Alternative is the volume of waste created by CERCLA actions on the Oak Ridge Site that could theoretically be disposed onsite. The Hybrid Disposal Alternative proposes consolidated disposal of future-generated CERCLA waste exceeding the capacity of the existing EMWMF in a newly constructed, much smaller capacity landfill on ORR, still referred to as EMDF. Waste volumes that exceed the capacity of the facility, regardless of whether those wastes meet the onsite disposal WAC, would be disposed offsite. A single onsite disposal option is analyzed (one of the two sites included in the Dual Site Option that is located immediately to the west of EMWMF) with components (e.g., buffer, liner, berms, cells, final cover) the same as that discussed under the Onsite Disposal Alternatives.

The onsite portion of the Hybrid Disposal Alternative includes designing and constructing the landfill, support facilities, and roadways;

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

The offsite portion of the alternative includes the same elements that will be discussed in detail for the Offsite Disposal Alternative with the bulk of waste being sent to Energy*Solutions* in Clive, Utah.

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

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

A brief analysis was completed to determine at which volume onsite disposal is no longer cost effective compared to offsite disposal. Offsite disposal cost per cubic yard is constant, ~$800 per cubic yard (see Fig. 10), representing a straight line because offsite disposal costs are independent of volume. It costs the same per cubic yard to dispose of 10,000 cubic yards or 2,000,000 cubic yards. In contrast, the cost per cubic yard for disposal onsite varies, the greater the volume disposed, the lower the cost per cubic yard. Unit costs were evaluated for a series of as-disposed volumes ranging from 440,000 cubic yards to roughly 2,000,000 cubic yards. The resultant cost per cubic yard disposed ranged from roughly $1,262 to $400, respectively. The volume at which the offsite and onsite costs are essentially equivalent, i.e., the breakeven volume, is roughly 750,000 cubic yards.

In summary, for waste volumes less than 750,000 cubic yards, offsite disposal appears to be less expensive per cubic yard disposed. For waste volumes greater than 750,000 cubic yards, onsite disposal appears to be less expensive per cubic yard. As waste volumes approach 2,000,000 cubic yards, the unit rate for onsite disposal is roughly half the cost of offsite disposal.

Based on meeting the first criterion, the onsite landfill should provide in excess of 750,000 cubic yards of capacity. All small footprints examined fulfilled this criterion. The second criterion, to minimize as much as possible hydraulic connections between groundwater and surface water, was best satisfied by the site next to EMWMF. Additionally, it is located in an area dedicated to DOE waste management in the future. Therefore, this site, which provides 850,000 cubic yards of capacity, was selected as the Hybrid Disposal Alternative's onsite location.

As described for the full onsite disposal alternatives, waivers for the TSCA depth-to-groundwater requirement and an exemption to the TDEC siting criteria would be needed.

Volume Reduction. Volume reduction is assumed for the onsite portion of the Hybrid Disposal Alternative. An analysis in the RI/FS demonstrated that the use of a centralized volume reduction system at the Hybrid Disposal Alternative EMDF would provide an additional 145,000 cubic yards of disposal capacity in the onsite facility. This additional capacity results in a reduction in the number of offsite shipments necessary under this alternative, saving costs and reducing the risk of transportation accidents.

Offsite Disposal Location. Energy*Solutions* in Clive, Utah, is the assumed primary location for the offsite disposal portion of the Hybrid Disposal Alternative. It is assumed that classified waste generated while the smaller EMDF is operational would be disposed onsite if the WAC is met. Classified waste generated that does not meet the WAC or is generated once EMDF is closed would be disposed at the Nevada Nuclear Security Site (NNSS) consistent with the description in the Offsite Disposal Alternative. Elements of this option are identical to the Offsite Disposal Alternative.

OFFSITE DISPOSAL ALTERNATIVE

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

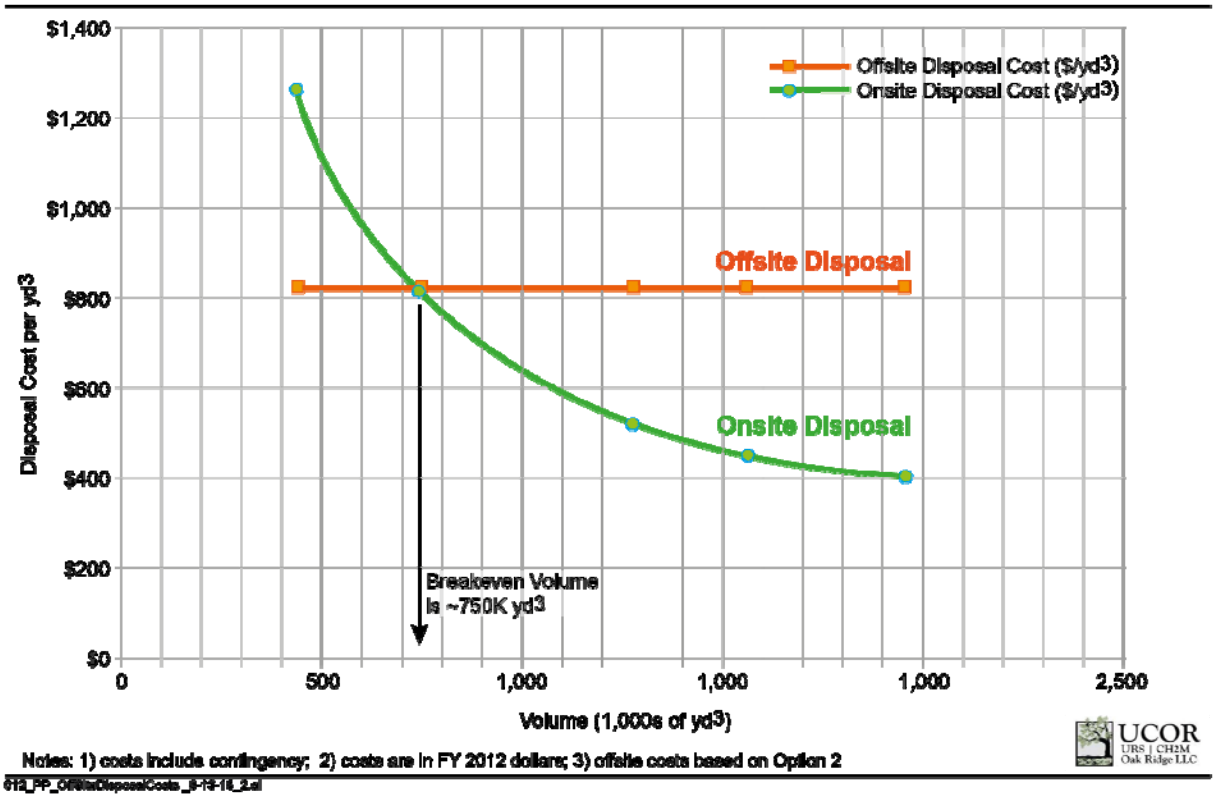

Fig. 10. Estimate of minimum onsite capacity required to reduce $/cy below offsite disposal costs

The generator is responsible for compliance with the WAC. The LLW/RCRA waste is assumed to be shipped by rail to Energy*Solutions* in Clive, Utah, and classified LLW waste would be shipped by truck to NNSS. For the remaining 90 percent of waste, there are two options.

- Option 1 – The remaining waste would be shipped to NNSS in Nye County, Nevada, by rail transport from ETTP to a transfer facility in Kingman, Arizona. Intermodal containers would then be transferred to trucks for the final leg of the shipment to NNSS.

- Option 2 – This same waste would be shipped by rail to Energy*Solutions* for disposal.

Waste Control Specialists in Andrews, Texas, was also considered for mixed LLW/RCRA waste, but it does not have the capacity to take all of the planned waste. Option 2 was found to be the more cost effective of the two full options evaluated, with a lower cost and lower transportation risk. Therefore, this option is used to evaluate the Offsite Disposal Alternative. Other key elements of this alternative are packaging requirements, onsite support facilities, and transportation.

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

- The proposed receiving facility must be operated in compliance with all applicable state, and local regulations; there must be no relevant violations at or affecting the receiving facility.

- There must be no releases from the receiving unit and contamination from prior releases at the receiving facility must be addressed, as appropriate.

- For mixed LLW/RCRA material, offsite treatment, storage, or disposal facilities must

have an approved Nuclear Regulatory Commission license and RCRA Part B permit.

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

Other disposal locations meeting these requirements such as Waste Control Specialists could be considered during the design and implementation phase if this alternative is selected.

Packaging Requirements. Packaging requirements for waste originating at each generator site would be determined based on waste form (e.g., treated or untreated soil, debris, miscellaneous solids, personal protective equipment/trash, sediment/sludge), waste type (e.g., LLW, mixed waste), transportation mode, destination, and other considerations. Generators would be responsible for waste packaging to reach the ETTP transloading station. Packages such as intermodals or supergondolas were assumed to be dedicated to one or more generator sites and would be recycled throughout the waste disposal process, unless used for classified LLW waste disposal at NNSS. Classified waste shipped to NNSS is assumed to be disposed in non-returnable containers.

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

- Transload facility – Rail transportation of waste is assumed for all waste (except classified) being shipped for offsite disposal. The existing transload facility at ETTP would facilitate the transfer and staging of waste containers from trucks to railcars. Waste delivered by truck from generator sites would be staged at an existing docking area for rail shipment. Packages with waste such as intermodals would be loaded onto articulated bulk container railcars or the waste may be placed directly in supergondolas. When ready for shipment, one or more railcars would be transferred from the rail spur to the railroad system.

- Size reduction facility – A size reduction facility could be constructed and operated in close proximity to the ETTP transload station. Waste targeted for size reduction would be transported by dump truck to ETTP and unloaded into the size-reduction unit feed systems for processing. Processed material would be loaded by conveyor or excavator into intermodals that would be staged for loading onto railcars. Size reduction was found to be cost effective when Option 1, disposal of most waste at NNSS was considered. However, it was not feasible for Option 2, as the transportation method was weight-limited and reductions in volume did not affect the number of transportation trips. Size reduction could be reconsidered if offsite disposal were selected.

Transportation. All waste containers would be loaded onto a truck at the generator site. Local transportation would be the responsibility of the generator and is not part of the Offsite Disposal Alternative.

Most bulk LLW and mixed LLW/TSCA/RCRA waste would be shipped to Energy*Solutions* by rail and classified LLW waste would be transported to NNSS by truck.

EVALUATION OF ALTERNATIVES

All remediation alternatives must be evaluated against the nine CERCLA evaluation criteria. The first two criteria (overall protection of human health and the environment and compliance with ARARs) must be met by any alternative considered for selection in the ROD. The next five criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost) are the primary balancing criteria that form the basis for the detailed analysis. The last two criteria (state and community acceptance) are considered modifying criteria as the remedy may be modified as a result of input from the state and the community. The evaluation against the first eight criteria results in the identification of the preferred alternative for the disposal of waste generated from cleanup actions under CERCLA at the DOE Oak Ridge Site. Community acceptance will be evaluated after review and consideration of comments received on this Proposed Plan.

DOE also evaluated the alternatives against NEPA values in consideration of the DOE Secretarial Policy Statement on the National Environmental Policy Act of 1969 (DOE 1994).

The comparative analyses of alternatives are summarized in Table 2 and are discussed below.

Table 2. Comparative analysis of alternatives

Evaluation criteria	No Action	Onsite disposal	Hybrid disposal	Offsite disposal
Overall protection of human health and the environment	Least protective. If more waste were managed in place, protection would depend on long-term land use controls at multiple sites.	Protective because waste disposed in a landfill designed for long-term containment considering the site-specific conditions, including weather. More protective in the short term because of decreased transportation risks.	Protective because waste disposed in a landfill designed for long-term containment considering site-specific conditions, including weather. Less protective in the short term because of increased transportation risks.	Protective because waste disposed in a landfill designed for long-term containment considering site-specific conditions, including weather. Less protective in the short term because of increased transportation risks.
Compliance with ARARs	No ARARs. ARARs for remedial actions, including waste disposal at individual sites, are specified in separate CERCLA documents.	Meets all chemical and location-specific ARARs. But EPA Region 4 will need to grant a waiver from certain TSCA requirements and TDEC will need to grant an exemption from a TDEC siting requirement associated with groundwater. Additionally, the East Bear Creek Valley site will also require an additional TSCA waiver from low-to moderate topography.	Meets all chemical and location-specific ARARs. But EPA Region 4 will need to grant a waiver from TSCA requirements and TDEC will need to grant a waiver from TDEC requirements associated with groundwater.	Meets all ARARs although there are few because most activities occur offsite. Receiving facility compliance with licenses and permits would be determined prior to transport.
Long-term effectiveness and permanence	Would be protective because required under future CERCLA decisions, but multiple future waste disposal decisions may not result in an overall effective solution.	Provides effective long-term protectiveness because of landfill design and use of risk-based WAC. Potential non-acute residual hazards may be greater than for offsite disposal because of higher regional population, wetter climatic conditions, and shallower depth to groundwater. Most sites rely on an underdrain system to move underlying groundwater away from the landfill. The only full size site that does not rely on an underdrain under the waste over the long term is the Central Bear Creek Valley site.	Provides effective long-term protectiveness for waste through onsite landfill design and through meeting offsite facility WAC.	Provides effective long-term protectiveness for waste meeting the facility WAC. The offsite facilities are typically in arid environments that reduce the likelihood of contaminant migration, and fewer receptors exist in the vicinity of Energy*Solutions* and NNSS than near the Oak Ridge Site.
Reduction of toxicity, mobility, or volume through treatment	None.	Any reduction through treatment would be the responsibility of the generator. Some minor reduction in toxicity would occur through wastewater treatment.	Any reduction through treatment would be the responsibility of the generator. Some volume reduction would occur during this alternative and some minor reduction in toxicity through wastewater treatment.	Any reduction through treatment would be the responsibility of the generator.
Short-term effectiveness	No short-term impacts.	Some adverse environmental effects would result from construction and operation of EMDF, but would be controlled or mitigated per regulatory requirements and engineering practice. The Onsite Disposal Alternative is more protective in the short term because of lower transportation risks.	Has greater transportation risks than the Onsite Disposal Alternative, but less than the Offsite Disposal Alternative.	There are limited environmental impacts from offsite disposal although a transportation accident could cause a small release of contamination. Transportation risks are significantly greater than for the Onsite Disposal Alternative.

Table 2. Comparative analysis of alternatives (cont.)

Evaluation criteria	No Action	Onsite disposal	Hybrid disposal	Offsite disposal
Implementability	No implementation required.	Technically and administratively feasible. Services and materials required for design, construction, and operation are readily available as are qualified personnel, specialists, and vendors. Construction would involve the use of standard construction equipment, trades, and materials and no new technology development is required. Provides a greater level of certainty than offsite disposal that long-term disposal capacity would be available. East Bear Creek Valley site is the most difficult to implement due to steep slopes and the presence of other Y-12 activities in the area.	Technically and administratively feasible. Onsite services and materials are available. Standard construction. Some reliance on offsite disposal capacity but less reliance than the offsite disposal alternative.	Technically and administratively feasible. Offsite disposal of waste relies on the continued availability of offsite disposal capacity. Future changes in the states' acceptance of waste transport and disposal are not likely, but could challenge implementation.
Cost	None. However, efficiencies of waste management consolidation and economies of scale would not be realized.	Cost per cubic yard of as-generated waste disposed is $278-$347 (present worth 2016 dollars). Cheapest is Central Bear Creek Valley site at $278/cubic yard and most expensive is the Dual Site Alternative at $347/cubic yard.	Cost per cubic yard of as-generated waste disposed is $587 (present worth 2016 dollars).	Cost per cubic yard of as-generated waste disposed is $675 (present worth 2016 dollars).
NEPA	By making several waste disposal decisions, cumulative impacts cannot be assessed.	Permanent loss of land for alternate future uses, however, for the East Bear Creek Valley site this loss is in an area already dedicated to waste management. Would be irretrievable and irreversible use of resources such as gravel, soil, and fuel. The construction and operation would increase the number of jobs locally.	Minimal loss of land for alternate future uses. Fuel use would be irreversible and significant. More local jobs that the full offsite disposal alternative but fewer than the onsite disposal alternatives.	No permanent loss of land as land at offsite disposal facilities is already dedicated to waste disposal. Fuel use would be irreversible and significant. Fewer local jobs would be created.

ARAR = applicable or relevant and appropriate
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
EMDF = Environmental Management Disposal Facility
EPA = U.S. Environmental Protection Agency
NNSS = Nevada Nuclear Security Site
TDEC = Tennessee Department of Environment and Conservation
TSCA = Toxic Substances Control Act of 1976
WAC = waste acceptance criteria
Y-12 = Y-12 National Security Complex

EXPLANATION OF NINE CERCLA EVALUATION CRITERIA

1. **Overall Protection of Human Health and the Environment** addresses whether a remedial action provides overall protection of human health and the environment. This criterion must be met for a remedial alternative to be eligible for selection.

2. **Compliance with Applicable or Relevant and Appropriate Requirements** addresses whether a remedial action meets all of the applicable or relevant and appropriate Federal and state environmental requirements, or provides grounds for invoking a waiver of the requirements. This criterion must be met for a remedial alternative to be eligible for selection.

3. **Long-term Effectiveness and Permanence** considers the ability of an alternative to protect human health and the environment over time.

4. **Reduction of Toxicity, Mobility, or Volume Through Treatment** evaluates an alternative's use of treatment to reduce harmful effects of contaminants, their ability to move in the environment, and the amount of contamination present.

5. **Short-term Effectiveness** refers to potential adverse effects on workers, human health, and the environment during the construction and implementation phases of a remedial action.

6. **Implementability** refers to the technical and administrative feasibility of a remedial action alternative, including the availability of materials and services needed to implement the alternative.

7. **Cost** refers to an evaluation of the capital, operation and maintenance, and monitoring costs for each alternative, including present-worth costs.

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

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

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

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

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

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

COMPLIANCE WITH ARARS

The No Action Alternative has no ARARs. The Offsite Disposal Alternative and the offsite disposal element of the Hybrid Disposal Alternative meet the required chemical-, location-, and action-specific ARARs, and no waivers are requested. Compliance of the disposal facilities in the Hybrid and Offsite Disposal Alternatives with their licenses and permits would be determined prior to transport in accordance with the CERCLA Offsite Rule.

The onsite disposal element of the Hybrid and the Onsite Disposal Alternatives would be designed to meet all the ARARs under CERCLA. One TSCA and one TDEC technical

requirement concerning how groundwater interacts with the site would not be met by any of the onsite disposal locations. However, waivers/exemptions are being sought because the design will consider the need to keep groundwater out of the geologic buffer, the liner system, and the waste. Additionally, for the East Bear Creek Valley site alternative, the requirement that the landfill be located in an area of low to moderate relief as stated in 40 *CFR* 761.75(B)(5) is not met. Appendix G of the RI/FS provides the details concerning how the facility engineering and type of waste being disposed is the basis for waiving or exempting these requirements. These ARARs are not being waived under CERCLA.

LONG-TERM EFFECTIVENESS AND PERMANENCE

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

The WAC would restrict what waste could be placed in the landfill. This criteria would be set assuming some failure of the manmade components of the underlying liner system and would be set to ensure that even under these conditions, the release of contamination from the landfill would not harm human health or the environment. The WAC would be set to protect a future resident farmer in the area even though a farmer would not be allowed to reside in Bear Creek Valley near EMDF due to land use controls required under this decision and under the previous Bear Creek Valley ROD decision.

A difference in the Hybrid and the Onsite Disposal Alternatives' long-term effectiveness is the WAC that would have to be developed for each site to provide the same degree of protection. For the sites located nearest the groundwater table and nearest to the surface water bodies, a lower WAC would be needed to obtain the same degree of protection. The site in East Bear Creek Valley has the greatest distance to the groundwater table, which may allow a higher WAC to be set at that site for the same degree of protection.

The major difference would be the long-term land use changes among the sites. The sites in Central and West Bear Creek Valley are currently undisturbed forest and both are identified to remain uncontaminated under the Bear Creek Valley ROD. Use of these sites would have the greatest land use change as the forest would be removed and the land use would be changed to waste management use. The Dual Site Disposal Alternative would also have a notable land area that would also become unforested and need to be a future waste management area where none is currently planned.

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

The Offsite Disposal Alternative and offsite disposal element of the Hybrid Disposal Alternative also rely on engineering and land use controls at the offsite disposal facilities to prevent inadvertent intrusion, including engineered barriers to intrusion and waste migration. Offsite disposal of waste at Energy*Solutions*, Waste Control Specialists, and NNSS in the long-term may be considered more reliable at preventing exposure than onsite disposal on the ORR. Energy*Solutions*, Waste Control Specialists, and NNSS are in arid environments that reduce the likelihood of contaminant migration or exposure via groundwater or surface water pathways. While the climate in Tennessee is wetter and could be considered less protective, this factor is

considered both in determining what waste can be safely placed in a disposal cell to ensure long-term protection and in determining how a cell would be constructed.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

The No Action Alternative does not reduce toxicity, mobility, or volume through treatment. Except for treatment as necessary to meet the EMDF WAC and minor wastewater treatment as needed, the Onsite Disposal Alternatives do not include treatment as a major element of the alternative. Waste generators would be required to treat wastes as needed to meet the EMDF WAC before onsite disposal, which could reduce the toxicity, mobility, or volume of waste depending on the waste characteristics and treatment applied.

For waste disposed offsite, treatment would similarly be applied as needed before shipment or at the receiving facilities and is the responsibility of the generator. The Hybrid Disposal Alternatives may also reduce the volume of contaminants prior to offsite shipment through various volume reduction methods.

SHORT-TERM EFFECTIVENESS

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

For the action alternatives, risk to human health is the most differentiating element. Under both disposal alternatives evaluated, risks to workers and the community from actions at the disposal facilities would be controlled to acceptable levels through compliance with regulatory requirements and health and safety plans. The activities are very similar between alternatives as even for offsite disposal, additional capacity would need to be built to accommodate the large volumes received, if not immediately, at some time in the future for other wastes.

The most significant risk of death or injury would result from waste transportation over long distances. Offsite transportation carries a much higher risk to human health than does onsite transportation due to the public roads/railroads travelled and the long distances involved. For the offsite alternative, assuming most of the waste travels by rail to Energy*Solutions*, injuries related to transportation accidents would be four times those associated with the onsite alternatives and fatalities would be estimated at over 2 compared to negligible chance under the Onsite Disposal Alternative. To date, there have been roughly 150,000 shipments made to the onsite EMWMF without an accident.

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

Environmental effects could result from a spill during transport and handling for the Offsite Disposal Alternative, but there is a low risk of a spill and only minor adverse effects are likely to result.

IMPLEMENTABILITY

Implementability for the No Action Alternative is not applicable, but all disposal alternatives are administratively and technically feasible. Currently, services and materials needed for pre-construction investigations, construction, and operation of the Onsite Disposal Alternatives and transportation and disposal capacity for the Offsite Disposal Alternative are available. No impediments to future operation of the Onsite Disposal Alternatives are likely to arise. The onsite EMDF of both the Onsite Disposal Alternatives and the Hybrid Disposal Alternative is more complex to implement than shipping waste offsite. However, the technology is well proven and onsite disposal capacity has already been constructed at ORR. Use of both onsite and offsite disposal as in the Hybrid Disposal Alternative does

introduce operational complexity as decisions about what is disposed onsite versus offsite would be needed. The East Bear Creek Valley site has the most notable implementation issues of the Onsite Disposal Alternatives as it is the steepest of the sites and has little room for infrastructure. Many other Y-12 facilities and operations are close to the site.

Reliance on offsite disposal facilities introduces an element of uncertainty into the continued availability of offsite disposal during the anticipated operational period. Offsite disposal introduces risks of interruptions caused by events outside of the control of DOE such as impacts on transportation routes (accidents by other generators) and offsite facilities. Because CERCLA waste generation on the Oak Ridge Site is projected to continue through 2043, onsite disposal would provide much greater certainty that sufficient disposal capacity is actually available at the time the wastes are generated.

COST

There are no costs associated with the No Action Alternative, but there are no opportunities for economy of scale from multiple waste disposal decisions.

The projected cost for the Offsite Disposal Alternative is approximately two times that of the Onsite Disposal Alternatives. The estimated total project costs correlate to an estimated $278 per cubic yard of waste (present worth 2016 dollars at Central Bear Creek Valley site) for the Onsite Disposal Alternative and an estimated $675 per cubic yard of waste (present worth) for the Offsite Disposal Alternative, Option 2 (lower priced option). Both costs have the same assumed uncertainty of 25 percent in waste volumes and cost contingency. Selection of two smaller sites (the Dual Site Disposal Alternative) would raise the unit present worth costs to $347 per cubic yard. The Hybrid Disposal Alternative has unit costs between the other alternatives at $587 per cubic yard.

STATE ACCEPTANCE

The State of Tennessee has expressed their concern for the East Bear Creek Valley site and any other site that relies in the long-term on underdrains to control groundwater under the waste, including the site in West Bear Creek Valley. They have expressed support for the Central Bear Creek Valley site because any reliance on underdrains would be solely during construction and operations or under support areas not directly underlying the waste. With the proposal of Central Bear Creek Valley as the preferred site, the state supports the use of onsite disposal. Through approval of this Proposed Plan, the State of Tennessee accepts the presented preferred alternative.

NEPA VALUES

There are no NEPA values to evaluate for the No Action Alternative as the future waste disposal decisions are unknown. However, there would be no cumulative impact evaluation possible with multiple future decisions.

There are many NEPA values to be evaluated for the disposal alternatives. Those associated with sensitive resources were discussed in the RI/FS under Compliance with ARARs or Short-term Effectiveness and are not key differentiating values. Because these decisions are a cumulative decision for all remaining waste disposal, much of the CERCLA evaluation has focused on cumulative impacts. A draft composite analysis has been completed for the Onsite Disposal Alternative that demonstrates the impacts the added radiological contamination into the area would have on receptors in Bear Creek Valley. This study showed that there is no additional radiological impact to potential public receptors from increasing waste disposal in Bear Creek Valley.

The remaining NEPA evaluation focuses on land use, use of irreversible and irretrievable resources, and socioeconomic values.

Land use within the permanent institutional control boundary of all disposal locations, both onsite and offsite, would be restricted. Support areas used during construction and operations of disposal facilities could be released for other uses after facility closure. The Onsite Disposal Alternatives would cause a permanent loss of land for alternate uses of up to 110 acres (for the Dual Site Disposal Alternative).

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

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

Onsite disposal would have the greatest effect on local socioeconomic factors. From design and engineering to construction and 20 plus years of operation, and then to closure and many years of post-closure care, many local jobs would be created. A study was completed by the University of Tennessee to evaluate the economic impacts of implementing an Onsite Disposal Alternative. The study concluded that $695 million from additional wages and subsequent spending would be spent in the tri-county area around and including Oak Ridge as a result of the additional jobs afforded by this alternative. A summary of the study can be found in the administrative record file (University of Tennessee 2015).

The East Bear Creek Valley location adjacent to existing waste disposal sites minimizes the potential impact of the presence of a new facility on future development nearby in Oak Ridge or on the ORR. There would be increased potential negative perception as the site is moved down the valley towards West Bear Creek in areas originally deemed to be uncontaminated. Regardless of the site, there may be some negative perception locally of additional waste being disposed in Oak Ridge, but much like the potential negative perception of additional transportation through the community, the impacts are likely to be small.

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

The immediate areas surrounding all of the proposed EMDF sites are currently unpopulated. The nearest residential areas are approximately 0.8 mile (Country Club Estates) from the Dual Site or Central Bear Creek Valley alternatives. The Scarboro Community, located a little further north of the East Bear Creek Valley site, is the only formally identified environmental justice community near the ORR and would not be impacted by the construction, operation, or closure of EMDF. All nearby communities are located over the ridge from the proposed EMDF sites and surface water and groundwater from the disposal areas move in directions away from (as opposed toward) these areas. The mile plus distance, plus Pine Ridge, provides a visual and sound barrier between the residents and the waste disposal construction and operation activities. The communities are not located on any access roads to ORR, so there would be no increased traffic in the area from construction. Waste is shipped to the disposal facilities on dedicated haul roads operated on the ORR, so there is no interaction between the public and the transport trucks.

PREFERRED ALTERNATIVE AND RATIONALE

Based on all of the considerations and the information currently available, an Onsite Disposal Alternative is the preferred alternative to manage wastes (after EMWMF capacity is reached) from the Oak Ridge Site CERCLA actions. The preferred alternative meets the required threshold criteria and provides the best balance of all other criteria. The DOE has determined that the preferred alternative satisfies the legal requirements of CERCLA 121(b) to (1) be protective of human health and the environment, (2) to appropriately comply with ARARs based on obtaining two waivers, (3) be cost effective, and (4) use permanent solutions and resource recovery technologies to the extent practicable. The fifth CERCLA 121(b) criterion, to satisfy the preference for treatment as a principal element of the remedy would be addressed by treatment required of individual waste generators, as needed, to meet the EMDF WAC before onsite disposal.

As part of the identification of the onsite disposal alternative as the preferred alternative, a site is also being proposed. The site in Central Bear Creek Valley is proposed for the following reasons:

- The site is not far from the area designated as a future waste management area.
- There is no long-term reliance on underdrains systems to control groundwater under the waste.

- The site is easy to secure and there would be no easy public access to the area.
- The site is not steep and there is room for infrastructure installation as there are no other activities nearby.
- There is sufficient capacity for a single landfill to be constructed, keeping costs lower.

The preferred alternative can change in response to public comments on this Proposed Plan or if new information is provided to the agencies. New information from future design characterization efforts may also impact the preferred location of EMDF.

The Onsite Disposal Alternative sited at Central Bear Creek Valley is proposed for the following reasons:

1. Facilitates timely cleanup of the Oak Ridge Site by being a cost-effective, safe disposal option and by providing an onsite disposal facility within Bear Creek Valley at a location that is easiest to justify necessary ARAR waivers or exemptions. Having an onsite disposal option increases the amount of limited government funds available to be directed to the environmental cleanup efforts.
2. Meets all regulatory requirements or provides a sound basis for waiving the regulation.
3. Is protective of human health and the environment, including existing residents, workers, and future hypothetical residents in Bear Creek Valley.
4. Is located in an area well within the DOE reservation in an area not considered for reindustrialization or reuse.
5. Has the lowest short-term risks to humans through transportation or industrial accidents.

NATURAL RESOURCE DAMAGES

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

COMMITMENT TO LONG-TERM STEWARDSHIP

This proposed remedy would result in leaving hazardous material at the EMDF site that may remain hazardous for a long time. The DOE is committed to long-term stewardship to protect future users of the site.

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

COMMUNITY PARTICIPATION

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

Community involvement is critical to the CERCLA process. A public meeting has been scheduled by DOE to discuss cleanup alternatives and address questions and concerns the public may have about all alternatives. The DOE has established a 45-day public comment period, which allows the public time to review the document and submit comments on the preferred and other alternatives. DOE will document, evaluate, and respond to comments as part of the subsequent ROD. Comments may be addressed to John Michael Japp, FFA Project Manager, Oak Ridge Environmental Management, DOE Oak Ridge Operations, Post Office Box 2001, Oak Ridge, Tennessee 37831.

The preferred alternative identified in this Proposed Plan represents the recommended alternative for the disposal of future waste generated from cleanup actions under CERCLA at the DOE Oak Ridge Site. This Proposed Plan provides stakeholders the information necessary

to determine if action is warranted and provide comments on the potential alternatives. The DOE may modify the preferred alternative or select a different alternative in response to public input. Therefore, the public is encouraged to review and comment on all information in this Proposed Plan. After considering public comments, DOE will prepare a ROD that presents the selected remedy. Following the approval of the ROD, DOE will prepare plans and implement the selected action.

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GLOSSARY

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

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

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

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

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

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

Present Worth – Present worth costs reflect the quantity of money that would need to be placed in a bank today at a set interest rate, termed the discount rate, to pay for the remedial action over the life of the project. The present worth approach for cleanup decision making and comparison of alternatives is recommended by EPA in its cost estimating guidance for Superfund sites (EPA 540-R-00-002, *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study*, July 2000).

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

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

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

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

ACRONYMS

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

Proposed Plan for the Disposal of Future Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste
Public Comment Sheet

DOE is interested in your comments on the alternatives being considered in the *Proposed Plan for the Disposal of Future Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste,* including the preferred alternative. The mailing address is preprinted on the back of this form. You may use this form to submit your comments. We must receive your comments on or before the close of the public comment period. If you have questions, please contact Mr. John Michael Japp, FFA Project Manager; Oak Ridge Environmental Management; DOE Oak Ridge Operations; P.O. Box 2001, Oak Ridge, TN 37831; (865) 576-6344.

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Name: _____

Address: _____

City: _____ State/Zip: _____

Phone: _____

MAILING LIST ADDITIONS:

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

Place stamp here

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

APPENDIX A. BASIS FOR PRELIMINARY ONSITE DISPOSAL FACILITY WASTE ACCEPTANCE CRITERIA

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BASIS FOR PRELIMINARY ONSITE DISPOSAL FACILITY WASTE ACCEPTANCE CRITERIA

The Onsite Disposal Alternatives and the Hybrid Disposal Alternative include the design, construction, operation, and closure of a waste disposal facility called the Environmental Management Disposal Facility (EMDF). There are several alternatives presented in the remedial investigation/feasibility study (RI/FS) for onsite disposal, each disposing of waste in a different location or a different amount in Bear Creek Valley. Waste from the Oak Ridge Site destined for EMDF must meet waste acceptance criteria (WAC) to be accepted for long-term management within the facility. The WAC are limits placed on waste that ensure the short-term and long-term protection of human health and the environment. These limits include legally binding requirements (called administrative WAC), safe operations-based requirements (called auditable safety analysis-derived WAC), safe handling requirements (called physical WAC), and concentration requirements (called analytic WAC). Following is a brief summary of each of the WAC for an onsite waste disposal facility at any location:

1. Administrative WAC: Requirements from state and federal laws that are applicable or relevant and appropriate (ARAR) to the action that are codified in a Record of Decision (ROD), and from other agreements between the Federal Facility Agreement (FFA) parties, U.S. Department of Energy (DOE), U.S. Environmental Protection Agency, and the Tennessee Department of Environment and Conservation.

2. Safety-basis WAC: Requirements from facility authorization basis documentation required by 10 *Code of Federal Regulations* Part 830, Subpart B that ensure operations or activities associated with nuclear materials can be conducted safely.

3. Physical WAC: Requirements placed on waste forms to ensure safe waste handling for workers and to prevent damage of operations equipment and facilities.

4. Analytic WAC: Concentration limits placed on radiological and chemical constituents derived from fate and transport and risk assessment models to ensure long-term protection of human health and the environment in the event of future migration out of the facility.

ADMINISTRATIVE WAC

Administrative WAC include limits on disposal of radiological and chemical waste set by the state and federal government to ensure long-term protectiveness of disposal facilities. As an example of administrative WAC for radiological waste, concentrations of specific radionuclides must not exceed concentrations defined by the U.S. Nuclear Regulatory Commission as acceptable for near surface disposal. These limits restrict radiological waste such that waste greater than Class C waste (i.e., transuranic waste, high-level waste, spent nuclear fuel, or Atomic Energy Act of 1954 Sect. 11e(2) byproduct waste) from being disposed in an onsite waste disposal facility. As an example for chemically contaminated waste, specifically waste classified by the Resource Conservation and Recovery Act of 1976 (RCRA) as hazardous waste, the administrative WAC limits waste to that which complies with land disposal restrictions (LDRs) as defined in RCRA. Administrative WAC also allow the FFA parties to set limits, when necessary, when other WAC do not fully address protectiveness concerns.

SAFETY-BASIS WAC

Safety-basis WAC place limits on disposal of radionuclides based on a maximum credible release of material to nearby surrounding areas that would occur during an extreme wind event during operations at the facility (e.g., during such time that radionuclides at the surface of the facility are moved by high winds). Because of where EMDF is located within the Oak Ridge Reservation, this WAC mainly addresses short-term external exposure risk to nearby workers.

PHYSICAL WAC

Physical WAC address the physical form of acceptable waste items that may be safely managed at EMDF to protect workers, waste handling equipment, and the facility. Such WAC include limitations on the length of piping, the size and weight of waste containers or other large solid items, the dimensions of concrete rubble or other solid items, and the void volumes within containers or pieces of equipment.

ANALYTIC WAC

Analytic WAC establish concentration limits for both radionuclides and chemicals anticipated to be present in waste to be disposed. These limits are derived from contaminant fate and transport models and risk assessment models that consider a specific nearby receptor and exposure pathways associated with that receptor (ingestion, inhalation, etc.). The modeling effort considers fate and transport characteristics of the waste and the landfill that influence the potential migration of radionuclides and chemicals from the waste, through the engineered structures of the EMDF, through the underlying soil and rock between the facility and the receptor to groundwater and surface water used by a potential receptor. Only waste in which radionuclides and chemicals are below the analytic WAC are candidate waste streams for disposal. These WAC ensure long-term protection of human health and the environment, meaning that should radiological or chemical constituents leach from the facility and ultimately migrate to the receptor location, the resultant exposure will not be unacceptable as defined by state and federal regulations.

The first three WAC are still under development as they depend to some extent on a more detailed design and operational plans for EMDF. Development of the fourth WAC, analytic WAC, is the focus of the rest of this appendix. The process discussed in this appendix has resulted in preliminary limits at this point that were developed to demonstrate that protective, yet not excessively binding, analytic WAC can be developed for EMDF. For the purposes of the evaluation, analytic WAC were only developed for EMDF at the East Bear Creek Valley site. Should another site be selected as the preferred alternative, WAC will be developed in an equivalent manner for that site. Fundamentally because all sites are located in very similar geologic conditions and use the same basic facility design, it is anticipated that differences in the analytic WAC limits between the sites will be minimal.

This appendix is provided to allow the public to review the process by which analytical WAC are determined. These WAC are called preliminary analytic WAC (preWAC) because further evaluations will be conducted as more information becomes available and after receipt of public comments to allow preWAC to be finalized before the EMDF becomes operational.

BASIS FOR PREWAC

The derivation of preWAC is based on the following elements:

- Hydrogeologic characteristics of the proposed site
- EMDF liner and cover
- Characteristics of a nearby future hypothetical receptor

Site Location Characteristics

The EMDF site for which preWAC were calculated is located in East Bear Creek Valley within an area where current and former waste disposal sites are located. This East Bear Creek Valley site lies on the southern slopes of Pine Ridge between Bear Creek Northern Tributary (NT)-2 and NT-3. Bear Creek is roughly 1100 ft south of the site at the nearest point. Fig. A.1 shows the EMDF location used in the preWAC development, which is just east of the current Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) waste disposal facility, the Environmental

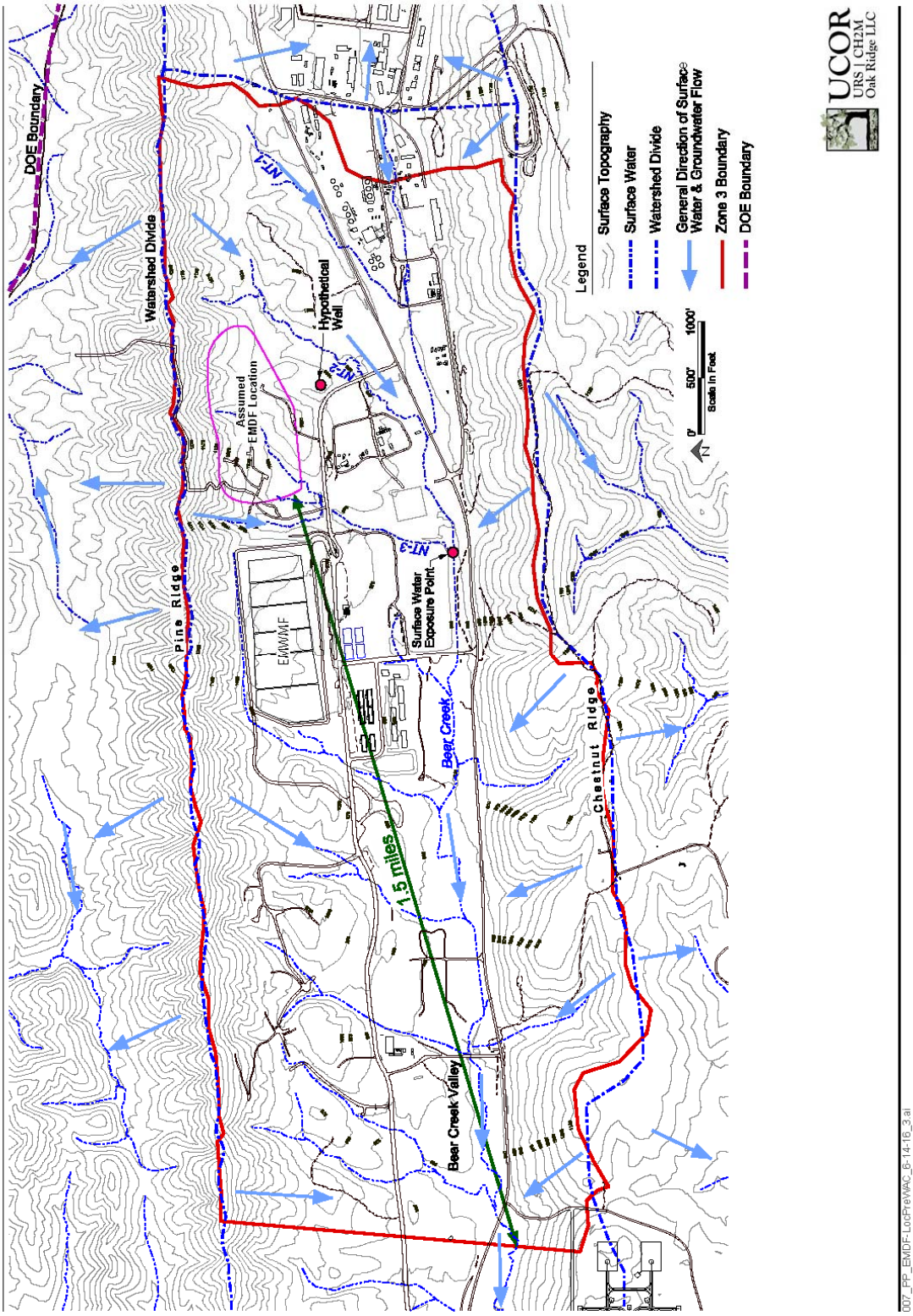

Fig. A.1. EMDF location for preWAC development and Zone 3 (DOE-controlled industrial use) boundaries.

Management Waste Management Facility (EMWMF). The figure also illustrates the distance between the waste disposal site and the nearest future public access to surface water via Bear Creek, which is defined by the "Zone 3" boundaries. The Zone 3 boundary is defined in the Bear Creek Valley ROD as DOE-Controlled Industrial Use, indicating the future use of this area is for industrial purposes only, and that it will remain under DOE control.

As stated in the RI/FS, East Tennessee is not ideally suited for land disposal of wastes because of the high annual rainfall (over 50 in. per year on average) and complex subsurface geologic and groundwater flow conditions. However, the proposed sites and facility design provide layers of defense to protect human health and the environment. Performance of the EMDF relies upon the durability of engineered systems and native materials for waste containment. Limiting the waste allowed to be disposed is another defense layer. As required by CERCLA, the site will be closely monitored into the future until it no longer presents a hazard to health and the environment. The groundwater model used to evaluate the fate and transport of potential waste contaminants migrating from EMDF in the future provides information to determine the concentration limits that ensure long-term protection. A detailed description of site geology is provided in Appendix E of the RI/FS.

Cap and Cover

The EMDF plans (Fig. A.2) include the following elements from the top of the facility to the bottom of the facility (more detail is provided below):

- A cap consisting of both natural soil with a specified low hydraulic permeability and manmade materials to prevent rainwater from entering the cap and flowing through the waste

- A base liner consisting of both natural soil with a specified low hydraulic permeability and manmade materials with layers that allow for water collection and removal from the disposal cells during operations and isolation of waste from the underlying soils in the long term

- Geologic buffer consisting of natural soil with a specified low hydraulic permeability to prevent and reduce any movement of water up into the liner or waste and provide isolation of waste from the underlying soils and groundwater in the long term

The total cap thickness assumed in the WAC calculations is 11 ft, including a 4-ft vegetation layer (a soil/rock matrix) on its top slope, underlain by a 1-ft filter layer (graded natural materials such as sand and gravel) and a 2-ft biointrusion layer (larger rocks and boulders), which is followed by a 1-ft lateral drainage layer. The biointrusion layer would inhibit unintentional access to the waste by humans, burrowing animals, and plants. The upper portion of the cover further prevents long-term erosion and protects the underlying clay barrier layers from the degrading effects of drying and freezing.

This cap is also assumed to have a composite barrier layer of a 40-mil-thick density polyethylene geomembrane layer over a 2-ft-thick low permeability clay layer. The barrier layer prevents water infiltration. The predicted combined effects of evapotranspiration in the vegetated layer, lateral drainage of water, and the presence of the barrier layers result in negligible infiltration of rainwater into the wastes.

Underneath the waste, the liner system, made up of eight layers, includes a system to collect and remove any leachate generated during waste disposal operations, any water that may infiltrate the waste before final cover construction is completed, and remaining drainage that occurs shortly after the disposal cell is capped and closed. The liner also includes a secondary leachate detection system to confirm that the cell liner system is functioning properly and to collect leachate if the primary system fails. The liner design has a composite layer consisting of a geomembrane overlaying a geosynthetic clay liner layer, a composite layer consisting of a geomembrane overlaying a 3-ft low permeability clay layer, and a 10-ft geologic buffer layer. These layers present a barrier to contaminant leaching downward out of a cell and also help prevent water from intruding into the waste from beneath the cell.

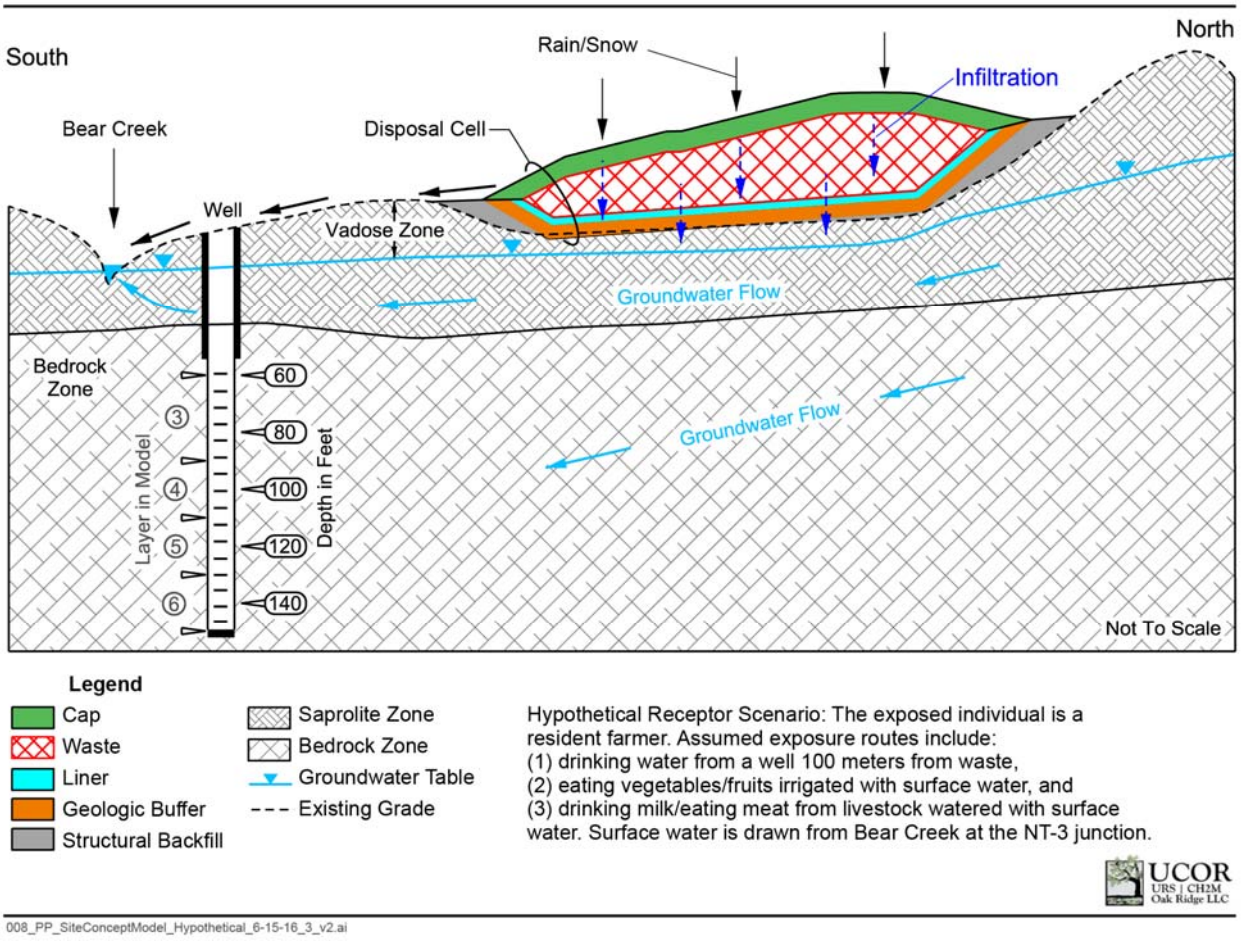

Fig. A.2. Conceptual site model and hypothetical receptor scenario.

Characteristics of Nearby Receptor

In the development of the preWAC, a hypothetical resident farmer receptor is assumed as the nearby receptor even though this land will never be released for residential use by DOE. The receptor scenario involves a family of four using groundwater from a well, located between the facility and Bear Creek, roughly 100 meters from the edge of the waste for domestic needs, including drinking water, and surface water from Bear Creek for agricultural purposes. Figure A.1 indicates the location of the well used by the receptor relative to the site as well as the surface water exposure location. An average of 240 gal per day is pumped from the well, based on domestic needs of a family of four, while surface water is used to cultivate vegetables and water livestock. The exposure pathways associated with this receptor includes the following:

- Ingestion of groundwater from a domestic well
- Consumption of home-grown vegetables/fruits irrigated with surface water
- Consumption of milk and meat from livestock drinking surface water and fed with vegetation irrigated using surface water

PREWAC CALCULATIONS

Analytic preWAC for individual radiological and chemical constituents are maximum concentrations in waste such that, should migration occur to the receptor location, protective goals are not exceeded. These limits correspond to the maximum permissible concentration of each constituent that could be placed in the facility if the waste containing that single constituent were to occupy the entire disposal cell volume in a soil like matrix.

The contaminant leaching/transport analysis and exposure scenario includes the following processes:

- Infiltration of (rain/snow) water into the waste cell
- Leaching of contaminants from the waste into the underlying subsurface
- Transport of contaminants from the site to the receptor well as well as discharge to surface water bodies
- Uptake by the hypothetical receptor through use of groundwater and surface water

The conceptual site model indicating the models used in the calculation of preWAC is shown in Fig. A.3. Models used in this evaluation include the following:

- Hydrogeologic evaluation of landfill performance (HELP) model
- Groundwater transport and flow models MODFLOW/MODPATH and MT3D
- Contaminant uptake and risk model PATHRAE-HAZ and PATHWAY-RAD

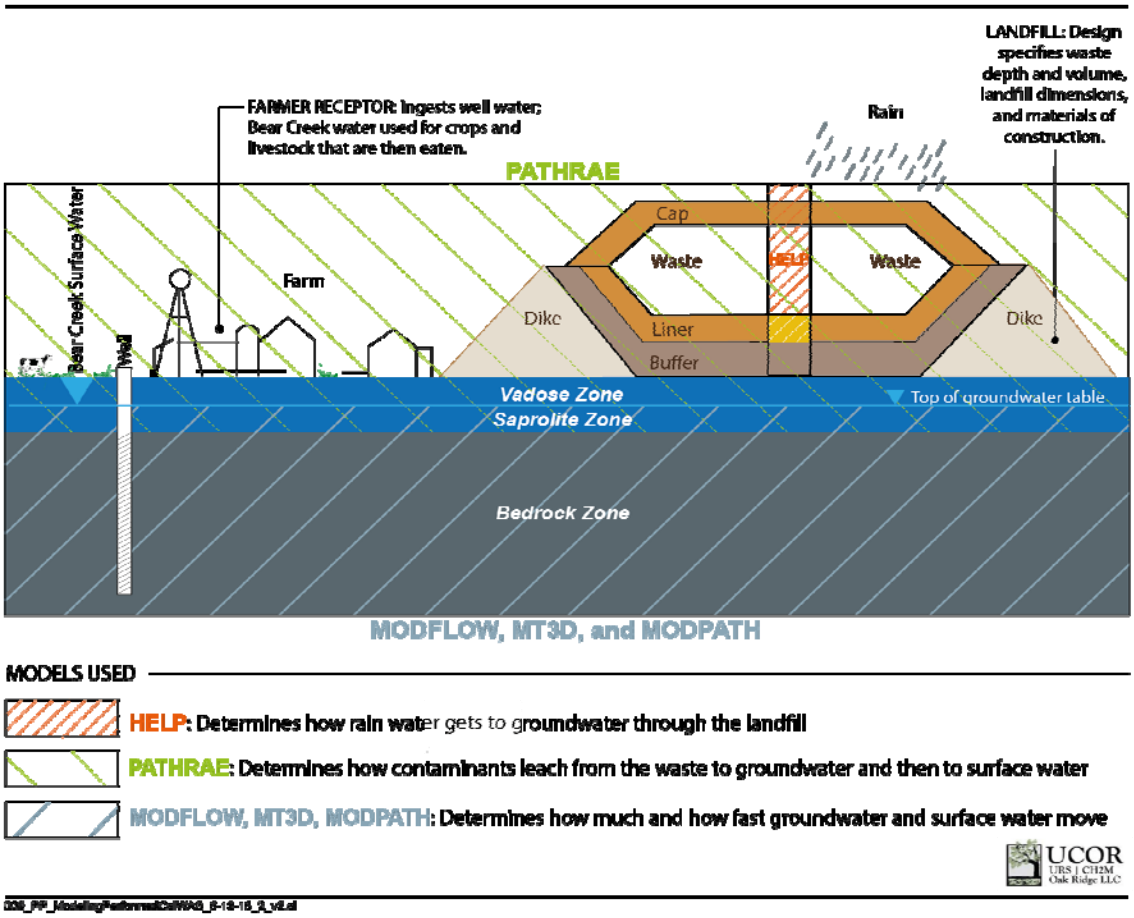

Fig. A.3. How models were used to estimate potential future contaminant conditions.

Transport and an individual's uptake of constituents that may be present in future waste, including both radionuclides and chemicals, were modeled. Because of subsurface conditions and the characteristics of each constituent, not all constituents will move from the waste to a potential future receptor at the same rate. Those that might reach a receptor earlier are of more concern because there is less uncertainty in the fate of a constituent in the first 1000 years than afterwards. The DOE requires that WAC be set for at least 1000 years to protect human health and the environment, but the WAC for the proposed EMDF goes beyond 1000 years.

The WAC were set to ensure that the following risk-based and ARAR-based objectives were met within the first 2000 years by waste disposed in the proposed EMDF:

- For the first 1000 years, the risk to humans would be less than or equal to 1 in 100,000 additional cancer incidents or an overall toxicity factor of less than 1. In addition, the underlying groundwater would need to meet drinking water standards and the adjacent surface water in Bear Creek would need to meet ambient water quality criteria, which are limits established to be protective of ecological species and human health.

- After 1000 years, the risk to humans would be less than or equal to 1 in 10,000 additional cancer incidents for radioactive constituents. It is assumed at that point that meeting LDRs will provide the necessary levels of human health and ecological protection from hazardous, nonradioactive constituents.

PreWAC for radionuclides predicted to peak after 2000 years were based on 500 mrem/year radiological dose criterion, a criterion set by U.S. Nuclear Regulatory Commission exposure limit guidelines that uses a risk-informed approach. The assumptions underlying this calculation are exactly the same as those made for calculating risk-based preWAC for constituents estimated to reach the receptor before 2000 years. As with the time frame of 1000-2000 years, it is assumed that meeting LDRs will provide the necessary levels of human health and ecological protection from hazardous, nonradioactive constituents. A total of 62 isotopes and numerous organic and inorganic constituents were modeled. Data pertinent to each constituent (e.g., physical/chemical parameters, slope factors, specific activities, reference doses, etc.) required by the models are presented in Appendix H of the RI/FS.

PREWAC RESULTS

Appendix H of the RI/FS provides the results of fate and transport and exposure/risk analysis, which demonstrate that analytic preWAC can be developed for the proposed EMDF that would meet applicable risk and dose criteria, be protective, and yet allow much of the future cleanup waste from the Oak Ridge Site to be disposed onsite. The analysis provides the basis for demonstrating that waste generated by remedial actions after EMWMF reaches capacity could be disposed in a potential new disposal facility that would be protective and, thus, is a viable disposal option for most of the CERCLA waste expected from the cleanup of the Oak Ridge Site. If onsite disposal is the selected remedy as determined by the CERCLA process, final WAC, which may include those calculated in a similar manner, but for a different facility location, would be approved for the new facility by FFA parties prior to waste receipt and documented in an approved plan.

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Comment Resolution Form

Document Number: DOE/OR/01-2695&D0	**Document Title:** Proposed Plan for the Disposal of Future Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste		
Name of Reviewer: Susan DePaoli and Brian Henry	**Organization:** Professional Project Services and Department of Energy, Oak Ridge	**Date Comments are Due:**	**Date Comments Transmitted:** 7/20/15

Comment Codes:	C = Clarification or additional information needed; response may be in summary of comment responses and/or next version of document D = Deficiency of some type; cite applicable regulation(s) E = Editorial comments will be noted and corrected, but dropped from the summary of comment responses

Comment No.	Sect/ Page	Comment		Response	Accept/ Reject
		Code			
1.	Pg 1, Item 1		Suggest "allowing limited available government funds to be directed to environmental cleanup." First time I read this I had a different interpretation, that this was limiting funds spent on cleanup!	Revised to read "Having an on-site disposal option increases the amount of limited government funds available to be directed to the environmental cleanup efforts."	
2.	Pg 1, Item 3		Remove the word "even."	Change made as suggested.	
3.	Pg 4, 1st para		Need to define "cy."	"cy" spelled out in each instance since this is a public document.	
4.	Pg 6, 1st partial para		1.6M CY is as-generated volume. Correctly stated within the parenthesis; however, it calls this volume the "as-disposed" volume (these statements contradict each other). Remove the word "as-disposed" will solve this.	Modified as requested.	
5.	Pg 6, Risk Summary, 1st para		Need to also state the goal is to protect human health and environment ("safely address" doesn't seem strong enough).	The phrase "while protecting human health and the environment" has been added to the paragraph.	
6.	Pg 6, Risk Summary, 2nd para		"Sites indicates" needs rewording.	The first part of the paragraph has been reworded as follows: "There are numerous sites across the Oak Ridge Site in which action has been determined to be required under CERCLA that will generate waste that must be managed efficiently and in a protective manner."	
7.	Pg 8, 1st partial para		First occurrence of "WAC"… define.	WAC has been defined.	

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8.	Pg 8, Design and Construction, 1st para, 3rd sentence		My first read of this was that support facilities were part of the cap! Look at rewording a bit. Might want to just leave out the support facilities since the next sentence also talks about the "cell design" only.	This text has been reworded as follows: "…, and a multilayer cover installed over a stable base-contouring layer to reduce infiltration and isolate the waste from human and environmental receptors. Other elements are necessary support facilities for example, a landfill wastewater treatment system."	
9.	Pg 8, Design and Construction, 3rd para		Because NT3 is mentioned here, it appears to me that mention of the underdrain and accommodation of NT3 under the landfill is being avoided. Either don't bring up reroute of NT3 around the landfill here (do it later?) or also mention the underdrain/crossing NT3.	Text to add in the underdrain system has been added to this paragraph.	
10.	Pg 11, Waste Acceptance Criteria		While WAC may be necessary to protect equipment, just doesn't sound right....perhaps say "to protect landfill operators and secure the equipment used...."	Text reworded to say "WAC to protect landfill operators and to minimize damage to the equipment used for disposal."	
11.	Pg 11, Water Management, 1st sentence		Suggest stopping with "staged and sampled." then go on to say "If the sampling results indicate that the water quality is acceptable for discharge, ..." etc....	Change made as suggested.	
12.	Pg 11, Water Management, 6th sentence		On-ORR is too odd. Suggest using just "ORR" or "on-site ORR".	Used "ORR" as suggested.	
13.	Pg 12, Table 1, #5, Affected Areas column		Might want to say "EMDF landfill and EMDF site"	Used "EMDF landfill and site" for all applicable entries.	
14.	Pg 13, top partial para		Should "alternative 2" be the "on-site alternative" or "EMDF?" This is the only use of the numbered alternative, although the section is titled Alternative 2.	Used "on-site alternative" as suggested.	
15.	Pg 13, 1st bullet		Discussion needed. The RI/FS writers took a different approach regarding the "hydraulic connection", based on the writing of the TSCA regulation, this connection is interpreted as a requirement of the developed site, not the undeveloped site. Therefore, no waiver is needed for this portion of the regulation.	The latest discussions by the RI/FS team indicate that the waiver is being granted under TSCA and no CERCLA waiver needed. This text has been revised to reflect this thinking and reviewed by P2S for consistency with the D5 version of the RI/FS.	
16.	Pg 13, 2nd bullet		From conversations with Jeff Crane, appears EPA will comment on RI/FS that this waiver not being granted - instead ask for CAMU designation.	This text has been modified with input from P2S to be consistent with the D5 RI/FS.	

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17.	Pg 14, On-site Support Facilities, 1st bullet		Either define CSX system or just be more generic?	"CSX" replaced with "railroad" as suggested.	
18.	Pg 15, Compliance with ARARs, 2nd para		Only mentioning the 50 ft buffer, not hydraulic connection (this is consistent w/RI/FS, but not how the PP has stated this waiver previously).	Reference to the hydraulic connection with surface water has been added.	
19.	Pg 18, Short-term Effectiveness, 2nd para, 3rd sentence		Add "for" between "even off site."	Change made as suggested.	
20.	Pg 19, NEPA Values, 2nd para,		… there is essentially "no additional"... If I am a public person reading this, I would balk at this statement! Add onto the end "to a public receptor" or some such criteria that would bound this statement.	The qualifier "to potential public receptors" has been added to the sentence.	
21.	Pg 20, Preferred Alternative and Rationale, #1		See comment on first page.	Changes made as suggested in Comments 1 and 2.	
22.	Pg 2, Introduction, last part of 1st para		Unclear what this is saying.	The idea of "associated sites" has been deleted as there are none currently identified.	
23.	Pg 2, Background, 5th sentence		Add "hosted" to sentence: "ORNL has historically hosted and …"	Change made as suggested.	
24.	Pg 2, Background, 6th sentence		Rewrite sentence to read: "…weapons disassembly, and has a continuing mission in some of these areas."	Change made as suggested.	
25.	Pg 4, Scope and Role of the Decision, 3rd para		Rewrite sentence to read: "If needed, future CERCLA wastes from ETTP or other sites found on the ORR or outside the ORR, but within OREM's area of responsibility, could be disposed of at the EMDF."	Based on comments received in the last review, this sentence was removed from the document.	
26.	Pg 5, 1st partial para after figure		Rewrite sentence to read: "…the initial post-closure period." FFS only addresses short term post closure.	Based on comments received in the last review, this statement has been removed from the document.	

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27.	Pg 5, Item 2		Didn't the RI/FS do that?	Text changed to read "Summarizes alternatives and compares them against the CERCLA remedy selection criteria and relevant NEPA values."	
28.	Pg 6, 1st partial para		Sue has asked that we stop giving a specific year for this [when EMWMF reached capacity].	The discussion that included dates has been removed from the document.	
29.	Pg 6, 2nd para		I think the DOE definition of mixed waste only includes RCRA and LLW. I think TSCA and LLW is a separate category.	A third type of waste, rad/TSCA waste has been added to the sentence and the definition for mixed waste clarified.	
30.	Pg 6, 4th full para		Should we not mention that all waste with mercury as a contaminant is required to meet LDRs	Only mercury containing waste that is listed or exceeds TCLP will need to meet LDRs. Other mercury-contaminated waste is not considered to be RCRA. No change has been made.	
31.	Pg 6, Risk Summary, 2nd para, 3rd sentence		Rewrite sentence to read: "…individually, a coordinated waste disposal strategy is more practical and cost effective."	Change made as suggested.	
32.	Pg 6, Risk Summary, 2nd para, 4th sentence		"consolidated waste management effort." Not sure what this means?	"consolidated" has been changed to "coordinated" to be consistent with earlier sentence.	
33.	Pg 7, 1st bullet		I believe we are changing this to only an HI of 1 and limiting it to 1000 years.	Agree. This change has been made.	
34.	Pg 7, 2nd bullet		Same comment as above. Also applies to footnote b.	Agree. This change has been made.	
35.	Pg 7, 4th bullet		I think we are changing the wording of this one in the RI/FS also.	The final RAOs from the RI/FS have been incorporated into the document.	
36.	Pg 7, Summary of Alternatives		One comment for this and the rest of the document is that it will have to be updated based on the changes to the RI/FS.	The text has been updated to be consistent with the D5 RI/FS.	