United States Department of Energy
Environmental Management Program
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Proposed Plan for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Waste

September 2018

YOUR OPINION IS INVITED

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

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

This Proposed Plan describes:

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

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

1. Onsite disposal facilitates timely cleanup of the ORR by providing a cost-effective, protective disposal option. An onsite disposal facility within Central Bear Creek Valley protects human health and the environment and achieves or waives all applicable or relevant and appropriate requirements (ARARs), while obtaining the best balance of the remaining CERCLA remedy selection criterion. This Proposed Plan includes a summary explanation of proposed waivers.
2. Onsite disposal optimizes utilization of government funds available for environmental cleanup efforts at the ORR.
3. The proposed site is located well within the DOE reservation in an area not considered for reindustrialization or reuse.
4. Onsite disposal presents the lowest risks to humans through waste transportation.

This document is approved for public release per review by:

UCOR Classification & Information Control Office — Date: 5/3/18

INTRODUCTION..... 2
BACKGROUND 2
SCOPE AND ROLE OF THE DECISION 4
WASTE CHARACTERIZATION AND VOLUME..... 5
BASELINE RISK SUMMARY..... 6
SITE CHARACTERISTICS 6
REMEDIAL ACTION OBJECTIVES..... 8
SUMMARY OF ALTERNATIVES..... 8
EVALUATION OF ALTERNATIVES 17
PREFERRED ALTERNATIVE AND RATIONALE 25
NATURAL RESOURCE DAMAGES..... 26
COMMITMENT TO LONG-TERM STEWARDSHIP 26
COMMUNITY PARTICIPATION 26
REFERENCES..... 27
GLOSSARY 29
ACRONYMS 30
APPENDIX A. SUMMARY OF CERCLA EVALUATION CRITERIA FOR DISPOSAL ALTERNATIVES.....A-1
APPENDIX B. FIELD SAMPLING PLAN B-1

INTRODUCTION

This Proposed Plan presents DOE's preferred alternative for the disposal of waste generated from cleanup actions under CERCLA at the DOE ORR for which additional capacity is necessary beyond the currently approved CERCLA disposal facility (Environmental Management Waste Management Facility [EMWMF]). The Proposed Plan is a document that DOE, as the lead CERCLA agency, is required to issue to fulfill the public participation requirement under CERCLA § 117(a) and the National Contingency Plan (40 *Code of Federal Regulations* [*CFR*] 300.430[f][2]). The Environmental Protection Agency Region 4 (EPA) and the State of Tennessee Department of Environment and Conservation (TDEC) support the issuance of this Proposed Plan as Federal Facility Agreement (FFA) (DOE 1992) parties. The State cannot support DOE's Preferred Alternative, based on information provided to date, until key concerns in the *State Acceptance* Section are addressed.

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

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

BACKGROUND

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

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

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

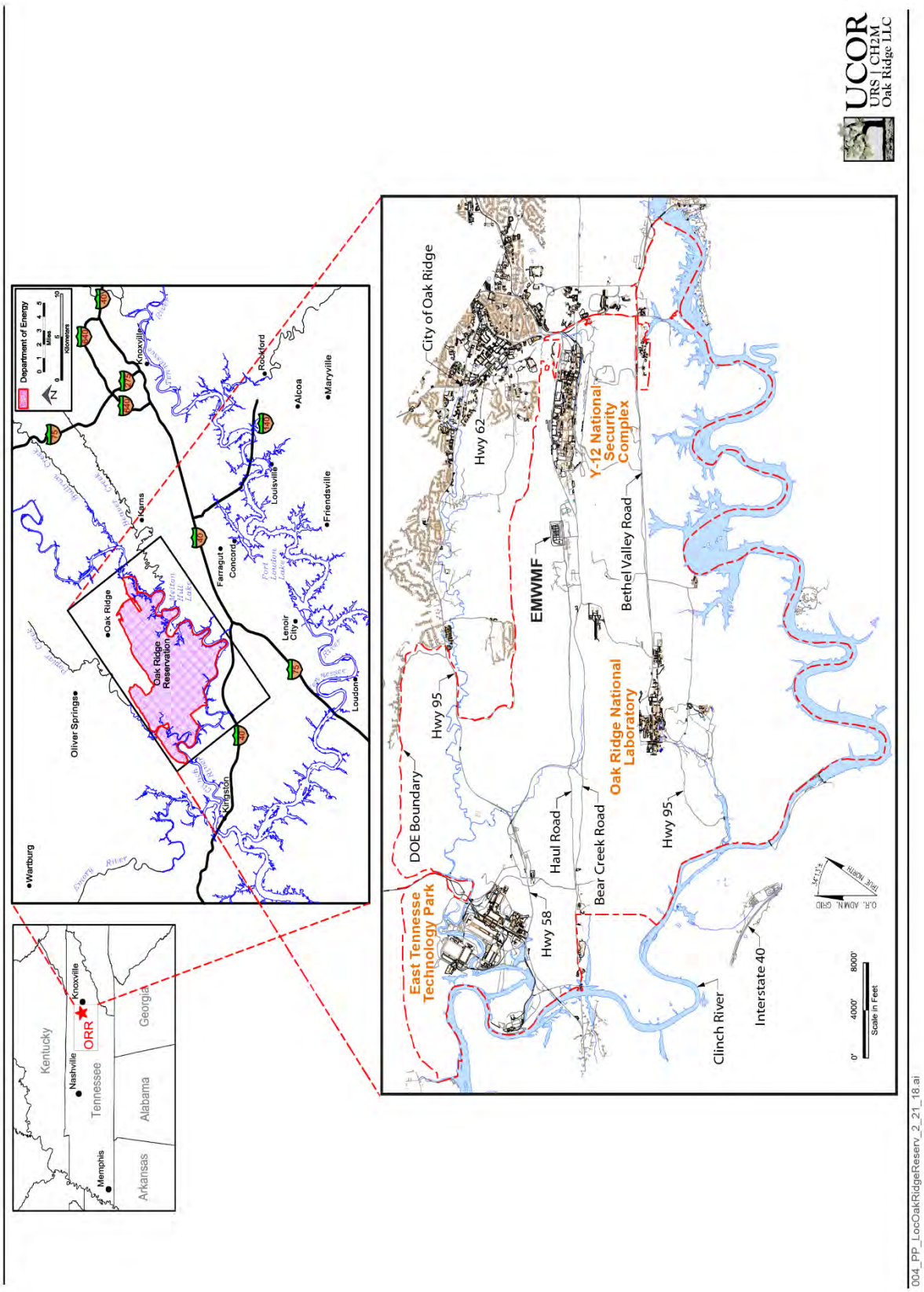

Figure 1. Location of the Oak Ridge Reservation.

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

In 1997, based upon a State recommendation to expand community involvement, DOE sponsored the establishment of the End Use Working Group (EUWG). The group, composed of citizens from diverse stakeholder organizations, was asked to develop recommendations for end uses of contaminated areas on the ORR and community values that could be used to guide the cleanup decision-making process. As documented in the EUWG Stakeholder Report on Stewardship (DOE 1998a), recommendations on the end use of Bear Creek Valley and for siting an onsite CERCLA waste disposal facility were made. The end use recommendation for Bear Creek Valley included the establishment of a restricted waste disposal zone in the area of existing long-term waste disposal areas. The EUWG recommendation stated that any CERCLA waste facility should be located on or adjacent to an area that is already contaminated and used for long-term waste disposal. Consistent with the EUWG recommendation, the current onsite EMWMF is located in East Bear Creek Valley (Figure 2). The EMWMF began operations in 2002 and has been receiving radioactive, hazardous, and mixed wastes from CERCLA cleanup activities on the ORR continuously for the last 16 years. The EMWMF consists of six disposal cells with a total capacity of 2.2 million cubic yards. Approximately 95 percent of the volume of wastes associated with cleanup to date has been disposed onsite, with 5 percent of the volume being disposed offsite. Approximately 15 percent of the radioactive curie content has been disposed at EMWMF, with the remaining 85 percent of the activity disposed offsite. Just over 75 percent of the landfill capacity has been used as of January 2018. There have been over 160,000 waste shipments to EMWMF, primarily on the dedicated (non-public) haul road.

Figure 2. Environmental Management Waste Management Facility.

SCOPE AND ROLE OF THE DECISION

The scope of the ORR CERCLA cleanup program has significantly increased since the original waste estimates were developed (DOE 1999). *The Remedial Investigation/ Feasibility Study for Comprehensive Environmental Response, Compensation, and Liability Act Oak Ridge Reservation Waste Disposal, Oak Ridge Tennessee* (DOE 2017a)

(herein referred to as the RI/FS) was prepared to evaluate several possible alternatives for disposal of CERCLA waste that would be generated during ongoing and future cleanup of the ORR.

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

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

This Proposed Plan serves the following four primary purposes:

1. Summarizes the volume projections and waste types/characteristics for waste to be generated from future CERCLA cleanup actions on the ORR.

2. Summarizes alternatives and compares them against the CERCLA remedy selection criteria and relevant NEPA values.

3. Identifies and provides the rationale for the preferred alternative.

4. Facilitates public involvement in the remedy selection process.

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

WASTE CHARACTERIZATION AND VOLUME

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

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

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

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

BASELINE RISK SUMMARY

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

SITE CHARACTERISTICS

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

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

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

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

During the months of March and April, DOE collected additional data on the hydrologic conditions underlying the proposed waste onsite disposal site consistent with the approved Field Sampling Plan, and has submitted a “Pre-published Technical Memorandum #1” summarizing the results of that data gathering. Further data collection efforts will be undertaken prior to selection of the remedy to attempt to further characterize the proposed Central Bear Creek Valley Site 7c during both the “wet” and “dry” seasons. This data will be placed in the Administrative Record file. If data indicates that site suitability will require any changes to the EMDF design then, it will be documented consistent with the NCP at 40 CFR 300.430(f)(3), including possible issuance of a revised Proposed Plan.

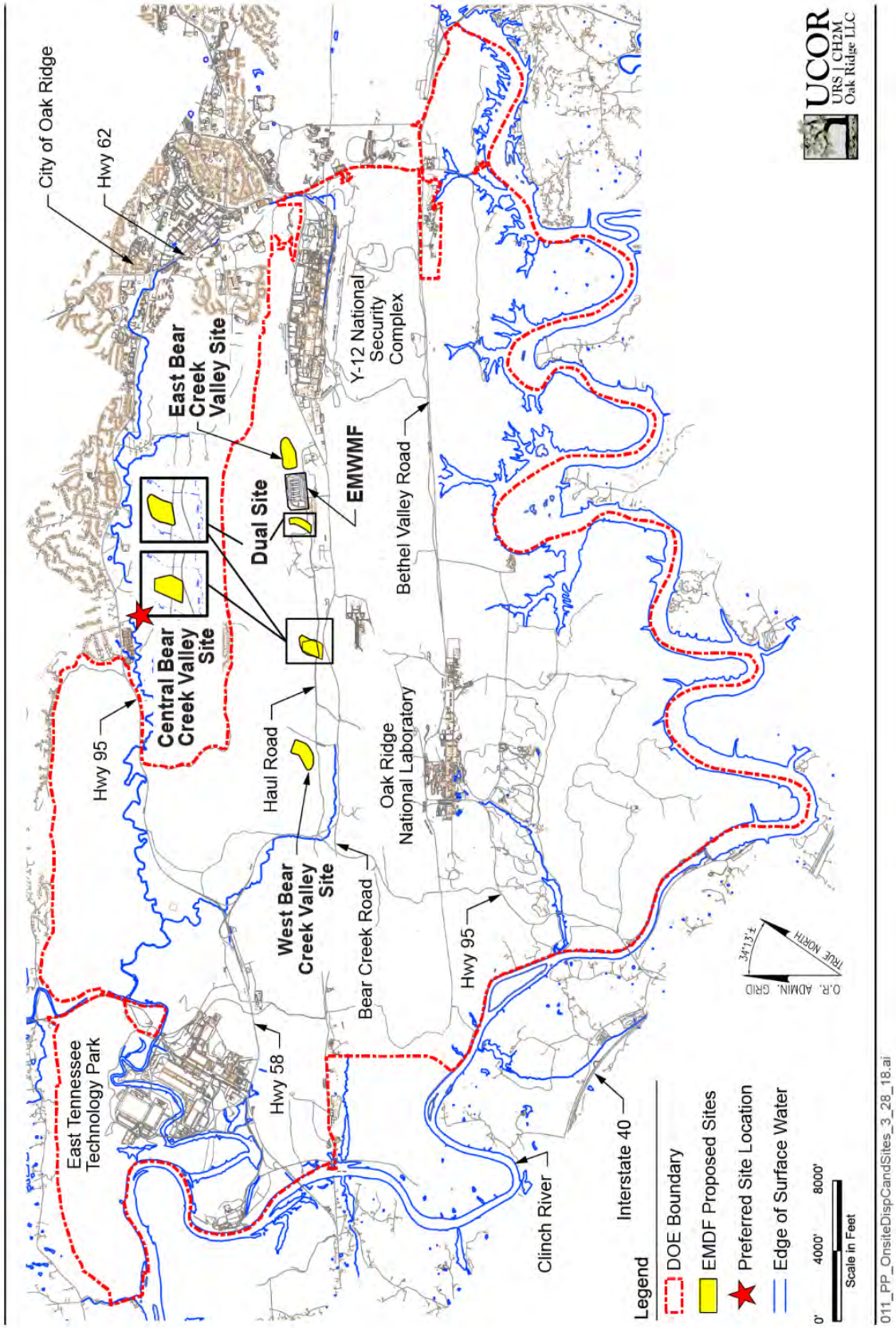

Figure 3. Proposed sites for the Environmental Management Disposal Facility.

REMEDIAL ACTION OBJECTIVES

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

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

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

- Prevent unacceptable exposure to ecological receptors from CERCLA waste contaminants through meeting chemical-, location-, and action-specific ARARs.

SUMMARY OF ALTERNATIVES

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

NO ACTION ALTERNATIVE

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

ONSITE DISPOSAL ALTERNATIVES

The RI/FS that evaluated the alternatives for waste management described in this Proposed Plan was under formal dispute and resolved on December 7, 2017. As part of the Dispute Resolution Agreement, the FFA Parties agreed to publish the Proposed Plan for public comment after the DOE prepared a report documenting the results and analysis of the field investigation in accordance with the Field Sampling Plan, and that the results and analysis would be included in the Administrative Record. Further, the Parties agreed that this field investigation, and EPA/TDEC's review of the results thereof, would be conducted prior to execution of the Record of Decision (ROD) and used in selecting the remedy.

The additional groundwater characterization data was gathered to provide support for the conclusions that the Preferred Alternative in the Proposed Plan (Central Bear Creek Valley Site 7c) was protective of human health and the environment and met ARARs or provided justification for a waiver for landfill siting requirements for disposal of PCBs and radioactive wastes.

Data gathering has begun consistent with the approved Field Sampling Plan, and DOE issued a "Pre-published Technical Memorandum #1," summarizing the results of the first round of data gathering. A preliminary review of this Technical Memorandum #1 indicates that the conceptual design of the EMDF as presented in the RI/FS and this Proposed Plan may need to be revised to accommodate the new information on site hydrology and to satisfy the threshold CERCLA criteria. Further, additional data will be collected prior to the ROD, the Administrative Record will be completed consistent with 40 CFR 300.430(f)(3), and provided the FFA parties determine the EMDF can be built, operated and closed in a manner that is protective of human health and the environment and complies with ARARs, then a ROD for the EMDF will be selected consistent with CERCLA and the NCP.

Description. Under these alternatives, a new onsite, engineered, long-term disposal facility

would be constructed to provide consolidated disposal of most waste resulting from any CERCLA response actions at the ORR. Waste that does not meet acceptance criteria for protective onsite disposal would be treated to meet requirements or shipped to authorized offsite treatment and/or disposal facilities.

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

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

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

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

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

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

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

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

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

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

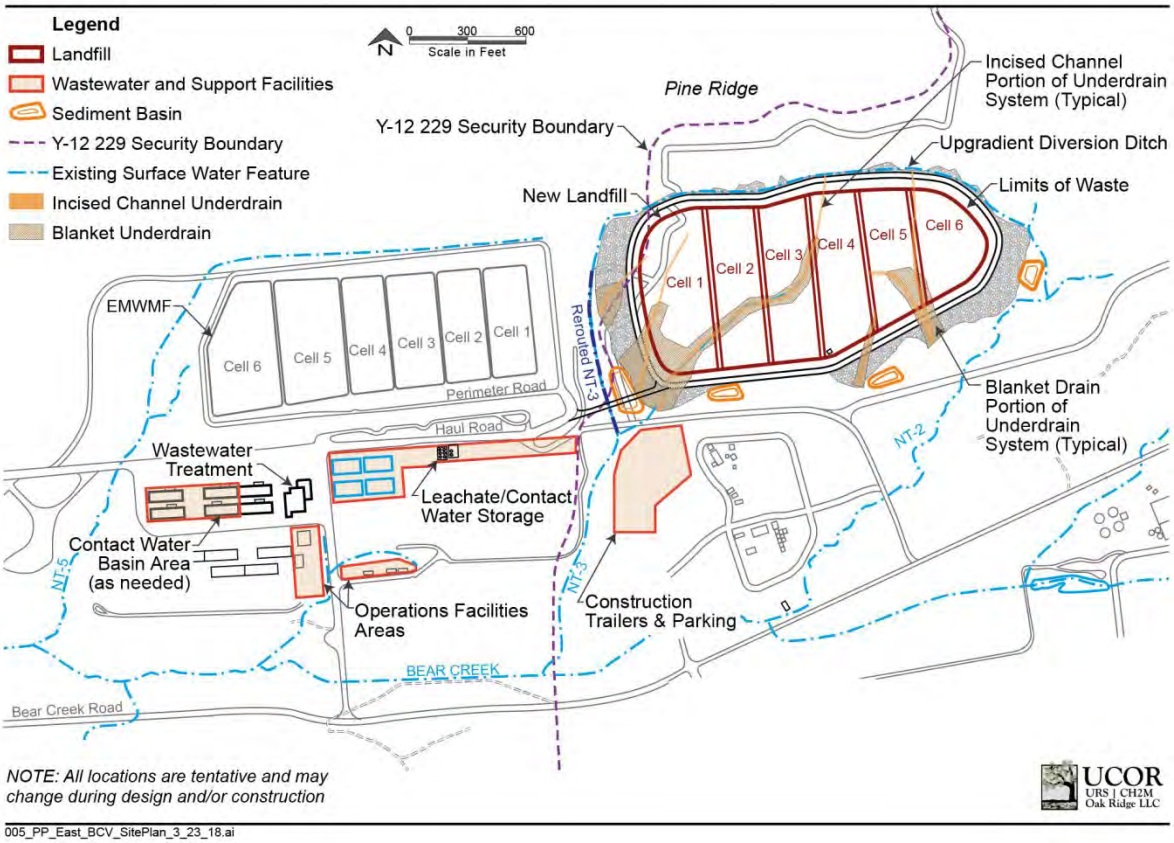

Figure 4. East Bear Creek Valley EMDF site plan.

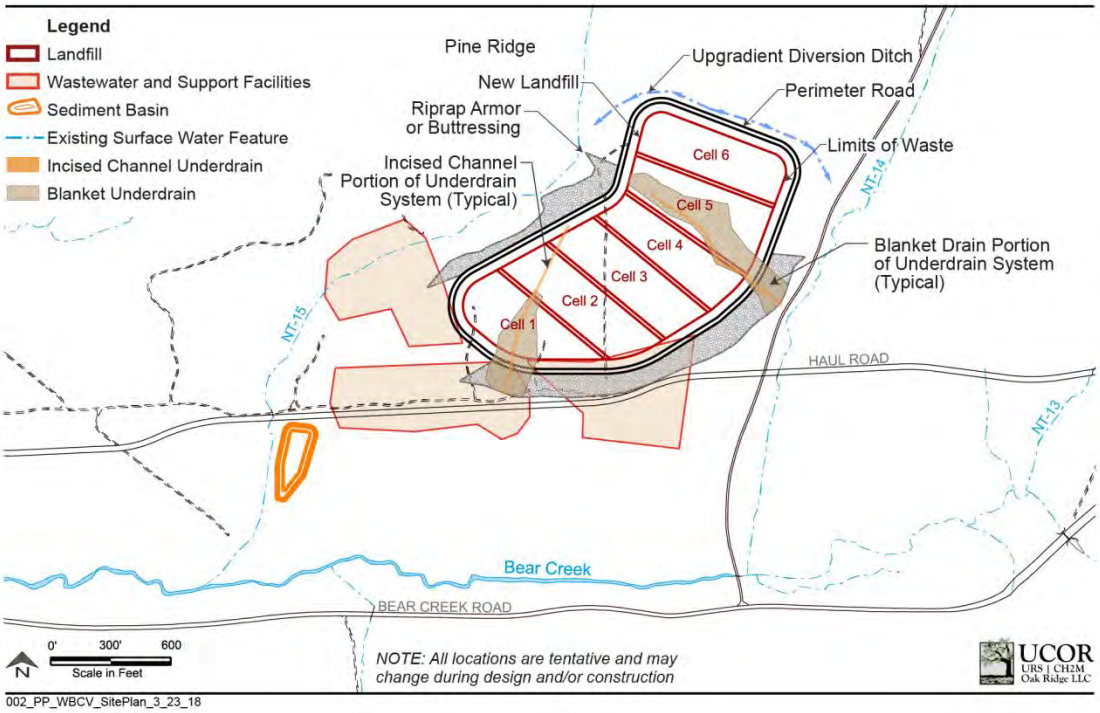

Figure 5. West Bear Creek Valley EMDF site plan.

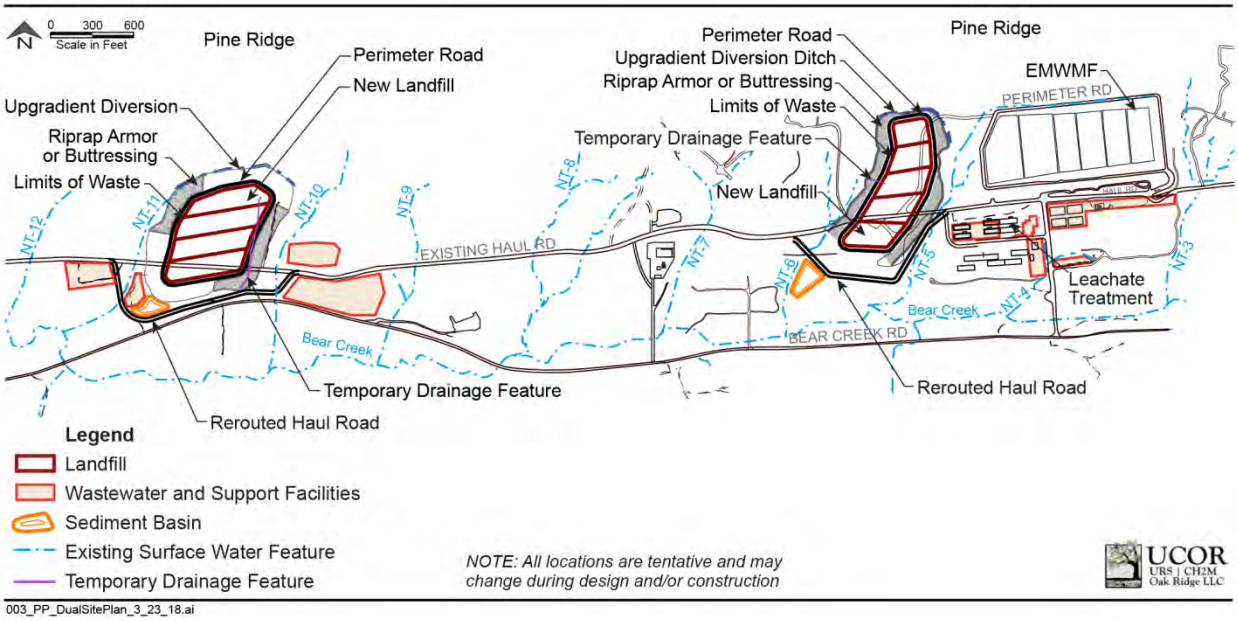

Figure 6. Dual Site Bear Creek Valley EMDF site plan.

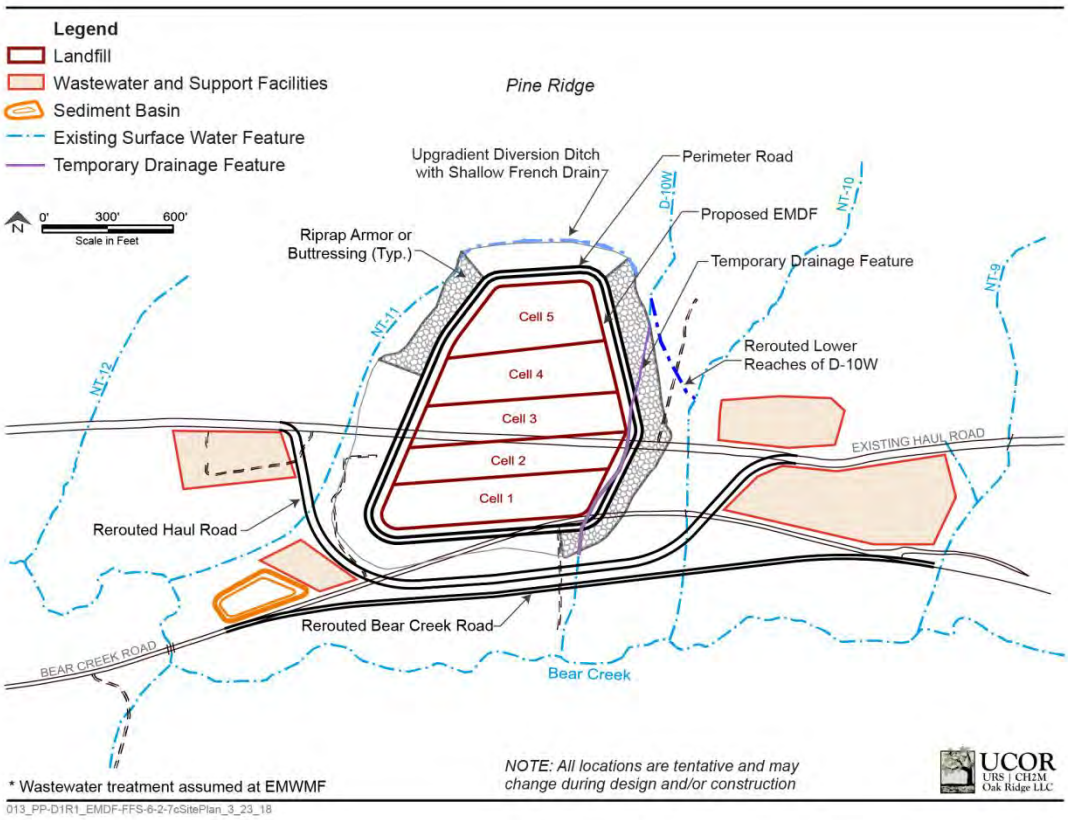

Figure 7. Central Bear Creek Valley EMDF site plan.

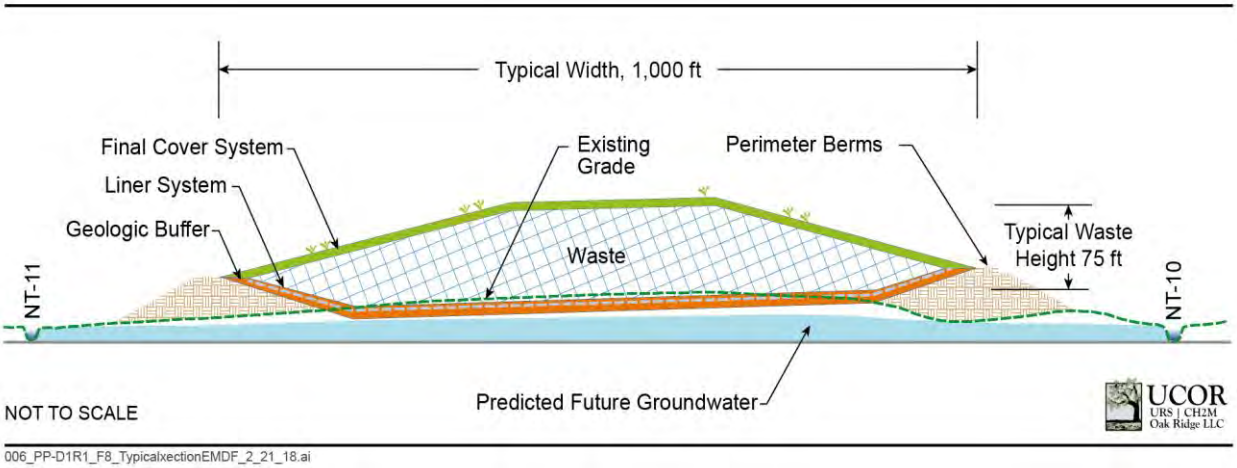

Figure 8. Typical cross section of EMDF.

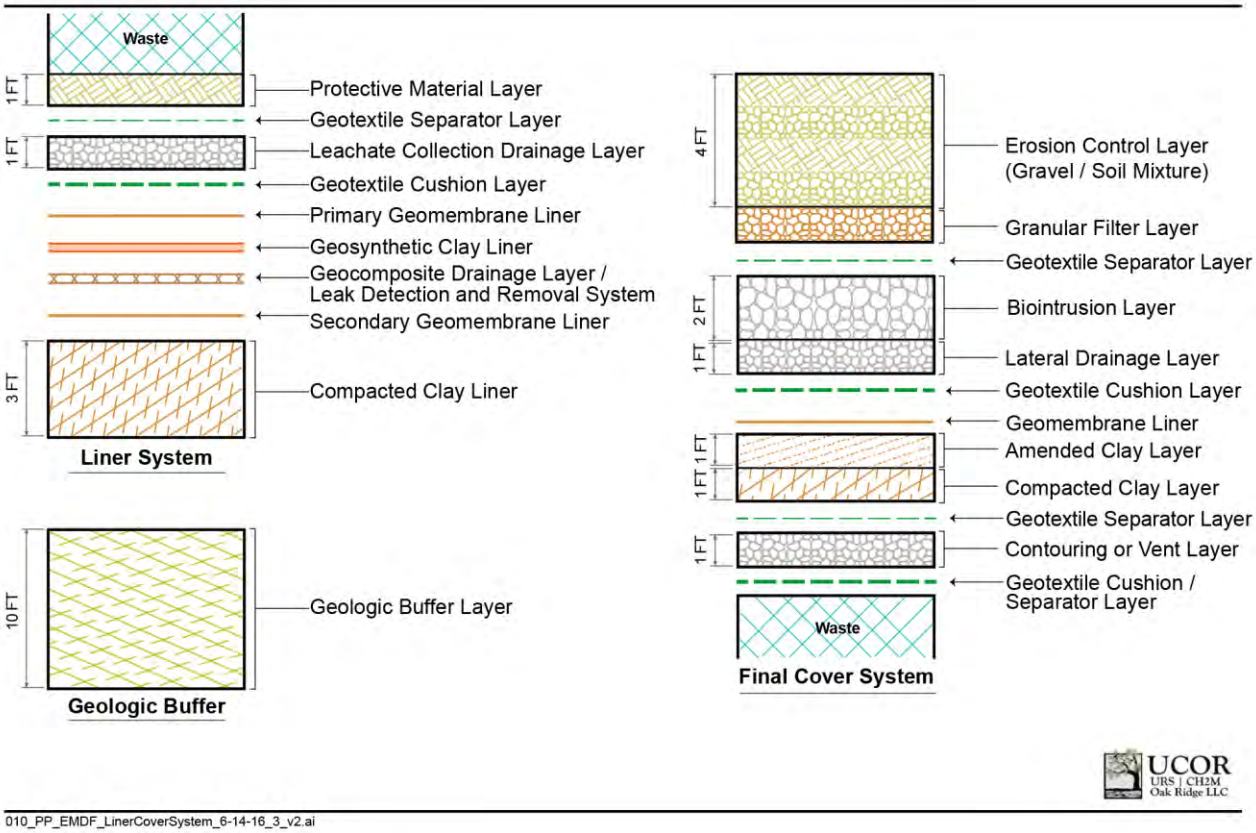

Figure 9. Preliminary EMDF liner and cover system.

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

The purpose of WAC is to allow the disposal of only those wastes that could be protectively managed within the facility and ensure protection of human health and the environment. Wastes that do not meet the WAC will require offsite disposal or receive treatment. The final WAC will be attached to the ROD prior to signature and will be one of many factors used by DOE to assure protection of

human health and the environment. A process – to be reviewed and approved by DOE, EPA, and TDEC that ensures the wastes generated by CERCLA response action projects meets the EMDF WAC – will be developed before operation of the facility begins.

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

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

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

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

Wastewater Management. The operation of the onsite disposal alternative at the Central Bear Creek Valley Site 7c will generate wastewaters in the form of leachate and other landfill wastewater (waters that come into contact with the waste) that will likely require treatment prior discharge into surface water. After the landfill is closed, leachate is the only wastewater that is anticipated to be generated at the onsite disposal alternative. Management of these wastewaters is a component of this remedial action and, therefore, must be protective of human health and the environment and comply with ARAR requirements, consistent with the FFA, CERCLA, and the NCP.

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

The Administrative Record for the management and discharge of this wastewater is not yet complete, and the evaluation of alternatives to address wastewater management in a D2 Focused Feasibility Study is currently under dispute between the Agencies. The ROD will describe CERCLA and NCP-compliant discharge requirements for wastewaters from the EMDF.

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

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

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

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

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

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

Action-specific ARARs affect how EMDF will be designed and operated. Key aspects of the RCRA, TSCA, and state radioactive waste regulations are used to determine how to ensure long-term protectiveness of EMDF, both through the design and during operations and closure. There also are ARARs associated with how EMDF would be maintained in the future after closure and how land use controls are required and maintained. The onsite alternatives require CERCLA ARAR waivers and/or regulatory exemptions. An exemption under the state radioactive waste disposal rules and a waiver under TSCA will be requested as part of the CERCLA remedy selection process as described further below. The basis of the waivers or exemptions to be requested for onsite locations will be included in the ROD if an Onsite Disposal Alternative is selected.

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

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

HYBRID DISPOSAL ALTERNATIVE

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

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

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

- Minimum capacity that allows onsite disposal to be more cost effective than offsite disposal (see Figure 10)

Table 1. Land use controls for all Onsite Disposal Alternatives

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

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

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

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

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

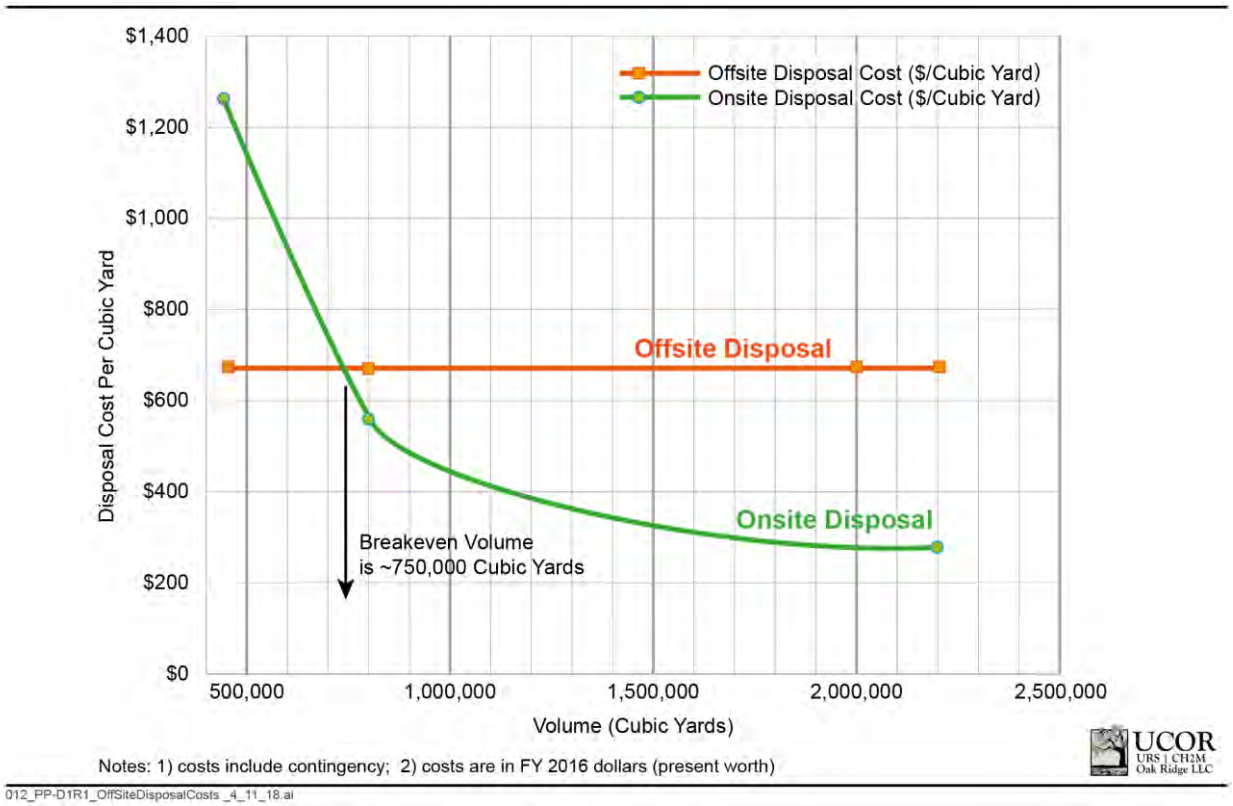

Figure 10. Estimate of minimum onsite capacity required to reduce unit cost of onsite disposal below offsite disposal.

- Minimize hydraulic connections between groundwater and surface water (e.g., minimize dependency on underdrains)

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

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

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

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

OFFSITE DISPOSAL ALTERNATIVE

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

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

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

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

- For mixed LLW/RCRA material, offsite commercial treatment, storage, or disposal facilities must have an approved Nuclear Regulatory Commission license and RCRA Part B permit.

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

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

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

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

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

- Size-reduction facility – A size-reduction facility would be constructed and operated near the ETTP trans-load station. Waste targeted for size reduction would be transported by dump truck to ETTP and unloaded into the size-reduction unit feed system for processing. Processed material would be loaded by conveyor or excavator into intermodals that would be staged for loading onto railcars. Size reduction was found to be cost effective where packaging/transport methods are not weight limited and reductions in volume affect the number of transportation trips.

EVALUATION OF ALTERNATIVES

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

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

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

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

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

EXPLANATION OF NINE CERCLA EVALUATION CRITERIA

-THRESHOLD CRITERIA-

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

-BALANCING CRITERIA-

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

-MODIFYING CRITERIA-

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

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

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

COMPLIANCE WITH ARARS

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

It is important to note that both a TSCA waiver and a Tennessee Department of Radiological Health (TDRH) exemption would be requested for the selected Onsite Disposal Alternative. The parts of TSCA and TDRH that will need to be waived are as follows:

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

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

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

LONG-TERM EFFECTIVENESS AND PERMANENCE

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

the landfill liner and leachate systems, the bottom of the landfill would contain any contaminants from future unacceptable releases to the environment. During operation when landfill wastewater is generated, that wastewater would be treated as required for removal of contaminants above discharge limits. Upon closure, when the landfill cover is placed, landfill wastewater generation would cease.

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

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

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

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

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

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

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

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

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

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

SHORT-TERM EFFECTIVENESS

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

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

Offsite transportation carries a much higher risk to human health than onsite transportation

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

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

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

IMPLEMENTABILITY

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

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

COST

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

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

Table 2. Estimated costs for disposal alternatives

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

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

STATE ACCEPTANCE

The State of Tennessee recognizes the importance of selecting a waste disposal option to support environmental cleanup and building demolition on the Oak Ridge Reservation (ORR) by the U.S. Department of Energy. The State also supports identification of Central Bear Creek Valley Site 7c as the most promising disposal location on the ORR. A key reason the State supports evaluation of Site 7c is its potential to provide a reasonable disposal capacity without relying on underdrains for collecting and discharging groundwater under the facility. DOE is collecting information at the site to evaluate this assumption.

To be clear, the State would not support a disposal facility that has a drainage feature (underdrain) to suppress the water table. In addition, current information about conditions at the site indicates the proposed landfill would need limits on the types and volumes of waste to protect human health and the environment. Waste exceeding onsite disposal limits would need to be disposed of offsite.

The State did not approve the remedial investigation/feasibility study report that serves as the primary basis for this Proposed Plan. The State documented concerns about protecting human health and the environment throughout the CERCLA process leading to this Proposed Plan. On May 22, 2017, DOE initiated a formal dispute under the *Federal Facility Agreement for the Oak Ridge Reservation* to move the CERCLA process forward to this Proposed Plan. The State, EPA and DOE signed a Dispute Resolution Agreement on December 7, 2017. As part of the Dispute Resolution Agreement, the three parties agreed to give their best efforts to work jointly to issue this Proposed Plan identifying Central Bear Creek Valley Site 7c as the preferred location for EMDF. The Dispute Resolution Agreement outlines a general path for meeting CERCLA requirements.

It is the State's opinion that outstanding issues should be resolved before a ROD selects onsite disposal as the preferred alternative. Until then, the State is unable to approve the preferred alternative. To be clear, a preferred *alternative* is not the same as a preferred *location*. The preferred alternative presented in this Proposed Plan includes assumptions about the volumes and types of waste, as well as natural conditions at Central Bear Creek Valley Site 7c.

The following discussion summarizes the State's key concerns.

1) Site characterization (detailed description) – During March and April, 2018, DOE collected data on hydrologic conditions underlying the proposed Central Bear Creek Valley Site 7c disposal site during the "wet" season (winter/spring), consistent with the attached Field Sampling Plan. DOE submitted a "Pre-published Technical Memorandum #1" summarizing the data. Preliminary review of Technical Memorandum #1 indicates the conceptual design of the EMDF presented in the draft RI/FS reports and this Proposed Plan may need revision to accommodate the new information on site hydrology.

   DOE will collect additional data before the ROD to characterize conditions during the "dry" season (summer/fall). DOE will place the data in the Administrative Record. If this information changes understanding of the site's suitability, the new information would be documented consistent with the NCP at 40 CFR 300.430(f)(3)(ii), including possible

issuance of a revised Proposed Plan. Provided the FFA parties determine the EMDF can be built, operated, and closed in a manner that is protective of human health and the environment and complies with ARARs, a ROD for the EMDF would be signed consistent with CERCLA and the NCP.

2) ARAR identification – CERCLA requires the ROD to include a final list of ARARs. It is the State's position that, at a minimum, ARARs will include State and Federal statutes, rules, and regulations identified in RI/FS Appendix G attached to the Dispute Resolution Agreement. As stated in this Proposed Plan, DOE may request CERCLA waivers and/or exemptions under the State radioactive waste disposal rules and waivers under the Toxic Substances Control Act (TSCA) for the following requirements, as allowed by the regulations.

   - The hydrogeologic unit used for disposal shall not discharge ground water to the surface within the disposal site. [TDEC 0400-20-11-.17(1)(h)]

   - The landfill site shall be located in an area of low to moderate relief to minimize erosion and to help prevent landslides or slumping. [TSCA 40 CFR 761.75(b)(5)]

   - The bottom of the landfill shall be above the historical high groundwater…. There shall be no hydraulic connection between the site and standing or flowing surface water…. The bottom of the landfill liner system or natural in-place soil barrier shall be at least fifty feet from the historical high water table. [TSCA 40 CFR 761.75(b)(3)]

   The State intends to review exemption and waiver requests pursuant to statutory and regulatory requirements and the State's site-specific understanding, including characterization data, projections of waste proposed for disposal (i.e., volumes, types, and characteristics), and the conceptual dimensions for a waste disposal unit at Central Bear Creek Valley Site 7c.

3) Waste acceptance criteria –TDEC wants to make sure that the proposed landfill would be sufficiently protective for Tennessee residents. One way to protect human health over the long term is to limit what may be placed in the landfill. Limits are determined through modeling various scenarios that represent where and how people may be exposed to materials released from the landfill in the future. Even though the landfill would be engineered and constructed to specific standards, it would still be affected by natural processes such as erosion, settling, and root penetration over time. Given that some radionuclides to be placed in the landfill would remain dangerous for thousands of years and longer, analytical WAC will be developed to limit what can go into the landfill.

   The Dispute Resolution Agreement provides for the State's independent verification of DOE modeling. State acceptance of the preferred alternative relies heavily on the State's ability to complete the independent verification based on information provided by DOE. The State will consider site-specific data, assumptions, and exposure scenarios in evaluating whether the WAC support an onsite disposal alternative that meets CERCLA requirements, remedial action objectives in this Proposed Plan, and performance objectives in Tennessee radiological health rule 0400-20-11-.16. The State will evaluate potential toxic effects of uranium in addition to potential cancer risk.

4) DOE assessments – DOE Orders require an assessment of the performance of the proposed disposal facility for radionuclides. This includes the Performance Assessment (PA), Composite Analysis (CA), and Preliminary Disposal Authorization Statement (PDAS). The State contends these DOE documents should be in the Administrative Record because the State will rely on them when evaluating the protectiveness of the preferred alternative during remedy selection under CERCLA.

5) Mercury disposal – Mercury contamination at the Y-12 National Security Complex (Y-12) is currently the greatest known environmental risk on the ORR (DOE 2017b). DOE plans to demolish parts of Y-12, including the West End Mercury Area (WEMA) buildings. The State is concerned about disposal of mercury-containing waste from that effort because of its potential release into Bear Creek and threat to people who eat fish caught downstream.

Fish in Bear Creek and downstream in East Fork Poplar Creek already contain mercury. Both streams are posted by the State to prevent fish consumption. The State is concerned that disposal of large volumes of mercury-contaminated waste in EMDF could further degrade Bear Creek, East Fork Poplar Creek, Poplar Creek and the Clinch River. Therefore, the State expects that DOE will limit or manage mercury disposal to provide reasonable assurance that the amount of mercury released in the future will not violate the intent of the Tennessee Water Quality Control Act (TWQA) or adversely impact people fishing and eating fish downstream.

6) Use of underdrains – Tennessee operational practice does not allow drainage features to permanently suppress the water table to mitigate springs or streams at proposed landfill sites. This is consistent with Tennessee rules [for example, TDEC Rules 0400-11-01-.04(3), 0400-11-01-.04(4)(a)(2), 0400-20-11-.16(5), and 0400-20-11-.17(1)(h)]. It is the State's position that selecting a disposal alternative that requires an underdrain would require (1) exemptions or waivers from Tennessee Division of Radiological Health and TSCA requirements and (2) a convincing demonstration that use of underdrain(s) would protect human health and the environment.

7) Discharge limits – Consistent with the Dispute Resolution Agreement, it is the State's position that discharge limits for disposal of facility wastewater should be consistent with CERCLA and established in the ROD. The State considers it important for a future onsite disposal facility to protect downstream surface water users who eat fish and comply with the Tennessee Water Quality Control Act and regulations.

CERCLA requires DOE, as the lead agency, to provide an opportunity for local governments and members of the public to offer input to help ensure selection of the most acceptable alternative. CERCLA also requires DOE to incorporate meaningful citizen input into making the decision. After DOE collects additional data, the State may request another public meeting if evaluation of the data changes the State's understanding of conditions at the Central Bear Creek Valley Site 7c.

DOE as the lead agency has provided responses to these key concerns and issues, as contemplated by the CERLCA process, below.

U.S. DEPARTMENTOF ENERGY RESPONSE TO STATE ACCEPTANCE

The DOE believes that the Central Bear Creek Valley site can be used for construction of a fully protective disposal facility of sufficient size to support completion of planned Oak Ridge Reservation cleanup activities. DOE believes site characterization activities completed to date indicate that with proper site development and facility design, the proposed facility can safely isolate disposed wastes from the environment.

DOE agrees with the State that remediation of mercury residuals remaining at the Y-12 site is a priority for the Oak Ridge cleanup program. While the vast majority of the mercury retrieved during site remediation will be isolated and stored for off-site disposal, some residual levels of mercury associated with building rubble, soils and drained equipment are proposed for onsite disposal. It is important to recognize this contamination is currently proximate to ground and surface water resources, and in a largely uncontrolled setting. The objective of the onsite disposal proposal is to remove contamination from this setting and place it in an engineered facility that eliminates ongoing environmental impacts.

The need for underdrains at the proposed facility will be evaluated further during design activities, should a decision be made to proceed with facility design and construction. Based on available data, DOE predicts no permanent underdrain should be required; however, it is possible that a temporary drainage feature may be required under lateral earthen berms associated with the facility. If needed, these drainage features would not be located under areas of waste placement. Use of underdrains at disposal facilities is an engineering approach employed by multiple disposal facilities in the East Tennessee region as a means of enhancing landfill stability and performance.

NEPA VALUES

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

NEPA values were evaluated for the disposal alternatives. Those values associated

with sensitive resources were discussed in the RI/FS (DOE 2017a) under compliance with ARARs or Short-term Effectiveness and are not key differentiating values.

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

Table 3. NEPA considerations for Onsite Alternatives

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

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

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

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

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

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

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

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

The areas immediately surrounding the proposed EMDF sites are currently unpopulated DOE-controlled property. The nearest residential area is approximately 0.8 mile (Country Club Estates) from the Dual Site or Central Bear Creek Valley sites and approximately 1 mile from the West Bear Creek Valley site. The Scarboro Community, located approximately 1.5 miles northeast of the East Bear Creek Valley site would not be impacted by the construction, operation, or closure of EMDF. All nearby communities are separated by a large ridge (Pine Ridge) from the proposed EMDF sites. Additionally, surface water and groundwater originating in the proposed disposal areas in Bear Creek Valley move away from these residential areas. The mile plus distance, and Pine Ridge, provide a visual and sound barrier between the residents and the waste disposal construction and operational activities. The surrounding communities would not be affected by

construction traffic since access to Bear Creek Valley is restricted by ORR security. Waste is shipped to the disposal facilities on dedicated haul roads operated on the ORR, so there is no interaction between the public and the transport trucks. These dedicated haul roads also would minimize public interaction with trucks transporting waste to the trans-load facility for offsite disposal.

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

PREFERRED ALTERNATIVE AND RATIONALE

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

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

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

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

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

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

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

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

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

The site offers distinct advantages in relation to the management of technical challenges related to surface water and groundwater in Bear Creek Valley. As part of the evaluation of the suitability of this particular location, EPA, TDEC, and DOE agreed that collection and analyses of additional field data would be important to inform this Proposed Plan and ultimately the selection of the preferred alternative for future remediation waste management at the ORR (see Appendix B). The additional data supplements data contained in the RI/FS (available as part of the Administrative Record). The additional field data focuses on the Central Bear Creek Valley site to help define the location-specific hydrologic properties (both surface and subsurface) and support the determination in the ROD whether key ARARs (identified in previous *Key ARARs*

section) can be complied with or whether regulatory exemptions/waivers will be required as part of the remedy selection documented in the ROD. The additional data also will be used to evaluate the ability of the remedy to meet CERCLA statutory requirements. Attached to this Proposed Plan (Appendix B) is an approved copy of the Field Sampling Plan used in the data collection effort that occurred between the conclusion of the RI/FS and this Proposed Plan. The results of the Field Sampling Plan activities are contained in Technical Memorandum #1 (discussed in the Field Sampling Plan) which provides DOE's analysis of the data in relation to the hydrologic properties of Central Bear Creek Valley. Technical Memorandum #1 is available in the Administrative Record.

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

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

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

NATURAL RESOURCE DAMAGES

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

COMMITMENT TO LONG-TERM STEWARDSHIP

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

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

COMMUNITY PARTICIPATION

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

Community involvement is critical to the CERCLA process. A public meeting has been scheduled by DOE to discuss cleanup alternatives and address questions and concerns the public may have about all alternatives. DOE

has established a 30-day public comment period, which allows the public time to review the document and submit comments on the preferred and other alternatives. DOE will document, evaluate, and respond to comments as part of the subsequent ROD. Upon request, DOE will engage the public in additional public outreach efforts. Comments may be addressed to John Michael Japp, FFA Project Manager, Oak Ridge Environmental Management, DOE Oak Ridge Operations, Post Office Box 2001, Oak Ridge, Tennessee 37831.

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

REFERENCES

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Office of Solid Waste and Emergency Response, Washington, D.C., October.

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

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

GLOSSARY

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

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

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

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

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

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

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

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

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

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

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

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

ACRONYMS

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

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

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

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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.
SUMMARY OF CERCLA EVALUATION CRITERIA FOR DISPOSAL ALTERNATIVES

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APPENDIX A. SUMMARY OF CERCLA EVALUATION CRITERIA FOR DISPOSAL ALTERNATIVES

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

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

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

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

Evaluation Criterion	No Action Alternative	Onsite Alternatives				Offsite Alternative	Hybrid Disposal Alternative
		East Bear Creek Valley	Central Bear Creek Valley	West Bear Creek Valley	Dual Site		
Reduction of toxicity, mobility, or volume through treatment		• Landfill wastewater treatment would reduce contaminants to levels required for discharge.				• Reduction in volume provided for disposal at NNSS.	• Reduction of volume is provided through mechanical volume minimization.
Implementability		• Implementation is technically feasible; landfill design and construction of the type presented in this conceptual design is commonly carried out. • Services and materials required for design, construction, and operation of the landfill are readily available, as are qualified personnel, specialists, and vendors. Construction would involve the use of standard construction equipment, trades, and materials; no new technology development is required.				• Administrative and technical requirements are implementable as demonstrated by the current offsite shipment effort from ORR. • However, disposal of waste at commercial and DOE facilities relies on continued availability of offsite disposal capacity. Future changes in the states' acceptance of waste transport and disposal could challenge implementation of the alternative. Travel through multiple states could raise challenges.	• Implementation of the onsite disposal portion is technically feasible; landfill design and construction of the type presented in this conceptual design is commonly carried out. • Less new construction is required. The landfill is smaller and much of the existing infrastructure at EMWMF may be usable. • Services and materials required for design, construction, and operation of the landfill are readily available, as are qualified personnel, specialists, and vendors. Construction would involve the use of standard construction equipment, trades, and materials; no new technology development is required.
		• Greater use of underdrain system required at this site. • Construction on steeper slopes. • Some new construction is required including support facilities.	• Reliance on drainage systems expected to be required only during construction. • No reliance on underdrains beneath waste footprint required. • Slopes less pronounced than those at East Bear Creek Valley, so construction easier. • New construction is required, including support facilities.	• Greater use of underdrain system required at this site. • Slopes less pronounced than those at East Bear Creek Valley, so construction easier. • New construction is required, including support facilities.	• Reliance on drainage systems expected to be required only during construction. • No reliance on underdrains beneath waste footprint required. • Slopes less pronounced than those at East Bear Creek Valley, so construction easier. • Some new construction is required for support facilities and through construction of two landfills.		
Cost		• Cost per cubic yard of as-generated waste disposed is $276 (present worth 2016 dollars). • Total cost $538.3M (present worth 2016 dollars).	• Cost per cubic yard of as-generated waste disposed is $276 (present worth 2016 dollars). • Total cost $537.2M (present worth 2016 dollars).	• Cost per cubic yard of as-generated waste disposed is $284 (present worth 2016 dollars). • Total cost $553.3M (present worth 2016 dollars).	• Cost per cubic yard of as-generated waste disposed is $343 (present worth 2016 dollars). • Total cost $667.4M (present worth 2016 dollars).	• Cost per cubic yard of as-generated waste disposed of is $675–$767 (present worth 2016 dollars). • Total cost is $1,315–$1,494M (present worth 2016 dollars).	• Cost per cubic yard of as-generated waste disposed is $587 (present worth 2016 dollars). • Total cost is $1,145M (present worth 2016 dollars).
State Acceptance	• The State recognizes DOE concerns that the no action alternative would require each cleanup project to select a disposal option for its waste.	State acceptance of the onsite disposal alternatives depends on the following: • Evaluation of information DOE is collecting on streams, springs and groundwater (e.g., depth of the historical high water table) that would affect the ability to contain the waste and protect humans and the environment (including the degree and duration of reliance on underdrains to discharge groundwater or surface water during facility operation or after closure); • Agreement on a final list of protective requirements (ARARs), including how site characterization data and projections of waste to be disposed will inform how DOE justifies any ARAR waiver or exemption requests; • Evaluation of realistic information on the amounts and types of waste to be disposed, including WAC; • Independent verification that the proposed WAC comply with the law and protect human health and the environment over the long term; • The amounts of hazardous and radioactive constituents that DOE may discharge into Bear Creek will be consistent with CERCLA and agreed to in the ROD; • Independent verification of DOE's assessments, to the extent that they inform the State's CERCLA decisions, including evaluation of potential long-term risks associated with hazardous contaminants like mercury and the toxic effects of uranium;				• The State would support the offsite disposal alternative, because the offsite facilities have approved permits that comply with applicable regulations and are located in relatively flat, dry, unpopulated locations with deep water tables—factors that make them more protective over the long term than sites on the ORR. • Offsite disposal of mercury-contaminated waste would also remove significant amounts of mercury from the Clinch River watershed, reducing potential future mercury releases to streams where people fish.	• The State would support the hybrid disposal alternative because the offsite facilities have already been permitted in relatively flat, dry, unpopulated locations with deep water tables—factors that make them more protective over the long term than sites on the ORR. However, DOE would need to provide additional information about the onsite location(s). • A hybrid alternative that uses offsite disposal of mercury would remove significant amounts of mercury from the Clinch River watershed, reducing potential future mercury releases to streams where people fish.

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

Evaluation Criterion	No Action Alternative	Onsite Alternatives				Offsite Alternative	Hybrid Disposal Alternative
		East Bear Creek Valley	Central Bear Creek Valley	West Bear Creek Valley	Dual Site		
		• DOE limiting or managing mercury disposal to provide reasonable assurance that the amount of mercury released in the future will not violate the intent of the Tennessee Water Quality Control Act (TWQA) or adversely impact people fishing and eating fish downstream. • Timely inclusion in the Administrative Record of all documents that form the basis for remedy selection, including the PA, CA and PDAS; and • Community feedback and DOE's evaluation and inclusion of public input.					• An important reason the State would support this alternative is its potential to meet DOE's estimated disposal capacity needs with a combination of onsite and offsite disposal without relying on underdrains to discharge groundwater or surface water during operation of the onsite facility or after closure.
		• The EBCV alternative is not acceptable to the State because meeting DOE's capacity needs would require building the facility over existing streams and springs that would require underdrains. • Long-term protectiveness and justifications for ARAR waivers and exemptions have not been established.	• The State supports identification of Central Bear Creek Valley Site 7c as the most promising disposal location on the ORR. DOE is collecting information at the site to evaluate these assumptions.	• The WBCV alternative is not acceptable to the State, because meeting DOE's capacity needs would require building the facility over existing streams and springs that would require underdrains. • Long-term protectiveness and justifications for ARAR waivers and exemptions have not been established.	• The State would support the dual-site alternative as a promising disposal option on the ORR, although DOE would need to collect and provide additional information about the sites. • An important reason the State would support this alternative is its potential to meet DOE's estimated disposal capacity needs without relying on underdrains to discharge groundwater or surface water during operation of the facility or after closure.		
Public Acceptance	To be determined upon submittal of the Proposed Plan						

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