F.0615.029.0067

DOE-18-0025

I-02033-0351

Department of Energy

Oak Ridge Office of Environmental Management
P.O. Box 2001
Oak Ridge, Tennessee 37831

January 11, 2018

CERTIFIED MAIL

Ms. Constance A. Jones
Superfund Division
U.S. Environmental Protection Agency
Region 4
Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, Georgia 30303-8960

Mr. Randy C. Young
State of Tennessee
Department of Environment and Conservation
Division of Remediation – DOE Oversight Office
761 Emory Valley Road
Oak Ridge, Tennessee 37830-7072

Dear Ms. Jones and Mr. Young:

TRANSMITTAL OF ERRATA PAGES FOR THE *REMEDIAL INVESTIGATION/ FEASIBILITY STUDY FOR COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT, OAK RIDGE RESERVATION WASTE DISPOSAL, OAK RIDGE, TENNESSEE* (DOE/OR/01-2535&D5)

The D5 Remedial Investigation/Feasibility Study for the Comprehensive Environmental Response, Compensation, and Liability Act waste disposal was transmitted to you on February 28, 2017. Per agreements reached in formal dispute during December 2017, four errata pages (pages 6-83 to 6-86) are being issued due to the addition of text (on the first of the four pages) explaining plans to obtain site specific data. As noted in the added text, the data will be placed in the Administrative Record file to support the Proposed Plan where the proposed location has limited existing data. Enclosed are compact disks of the corrected document and hard copies of the replacement pages. Please replace the pages in the document transmitted previously with the enclosed corrected ones.

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(YOUNG 7000 2820 0001 9922 1583)

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TRANSMITTAL OF THE CORRECTED *REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT, OAK RIDGE RESERVATION WASTE DISPOSAL, OAK RIDGE, TENNESSEE* (DOE/OR/01-2535&D5)

If you have any questions or if we can be of further assistance, please contact John Michael Japp at (865) 241-6344 or me at (865) 241-8340.

Sincerely,

Brian T. Henry
Portfolio Federal Project Director

John Michael Japp
Federal Facility Agreement Project Manager

Enclosures:
1. Errata pages
2. Compact Disk

EPA: 1 (Enclosure 1), 2 (Enclosure 2)
TDEC: 2 (Enclosure 1), 1 (Enclosure 2)

cc w/enclosure 1:
SSAB
Rhonda Butler, Value Added Solutions, K-1007, MS-7423, plus 1 copy of Enclosure 2

cc w/o enclosures:
Carl Froede, EPA Region 4
Rich Hill, EPA Region 4
Susan DePaoli, Pro2Serve
Howard Crabtree, TDEC, Oak Ridge
Brad Stephenson, TDEC, Oak Ridge
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6.2.2.6.4 Data Gaps and Uncertainties

Varying extents of data exist for the proposed sites; all sites will require more extensive characterization, if selected. Well and boring data within the EBCV Site are limited to those contained in the Phase I Site Characterization Report (DOE 2017), and areas immediately adjacent to the site have been well characterized. Also documented in the Phase I report is one year of hydrology monitoring in the proposed footprint of the EMDF in EBCV. T&E Species and Stream and Wetland Delineation Surveys were completed for the EBCV Site, although some confirmatory information remains to be collected. The WBCV Site was extensively studied and reported on in 1980 – 1990 timeframe (Golder 1988a/b/c/d, and 1989a/b/c). Some of that information would be applicable to all sites, as they are all located roughly along geologic strike with one another and in areas of generally similar topography. Site 7a (and 7b and 7c) has the least documented characterization; while some data exist for Site 6b, as it is the borrow area for EMWMF.

The conceptual design for the EMDF at each site is based on groundwater, geologic, and geotechnical data obtained in the vicinity of the sites and within footprints if available. These data are sufficient for formulating a conceptual level design for the EMDF at each site and assessing the feasibility of constructing a CERCLA disposal facility. If one of the sites in the On-site Disposal Alternative is selected for implementation, a formal site characterization effort would be conducted as an early action in support of detailed design, building onto the information gained and lessons learned during Phase I characterization at the EBCV Site. The process of collecting, analyzing, and applying site specific data will continue into the final design to ensure that groundwater buffer requirements are met.

For those proposed on-site locations that have been identified in this RI/FS with limited site-specific information (e.g., Site 7a, Site 7b, and Site 7c in Central Bear Creek Valley), additional field investigations will be agreed upon by the triparties, and site-specific data (such as water levels and geotechnical information) will be obtained at those locations. The data collected from these locations will be evaluated by the triparties, and assessed relative to the extensive, existing Bear Creek Valley hydrological and geotechnical data. This characterization data will be captured in a technical memorandum and added to the Administrative Record prior to the public comment period on the Proposed Plan.

6.2.2.7 Process Modifications

Based on future engineering studies and additional data on subsurface conditions, waste types, and volumes, process modifications may be incorporated into the final design. Process modifications or techniques could be used to maximize effectiveness and efficiency of EMDF.

Process modifications that may be considered for EMDF include geochemical immobilization technologies designed to retard movement of contaminants; in-cell solid waste treatment to enhance waste stability/reduce leachability, and reduce waste transportation costs while increasing safety considerations; and a modified cap vegetation strategy to enhance cap stability and reduce long-term maintenance costs. The process modifications discussed in this section are not included in the base conceptual design. If these enhancements are deemed to be beneficial and feasible, they could be added to the landfill design or operational procedures, as appropriate, to enhance the implementability, performance, or cost effectiveness of the remedy.

6.2.2.7.1 Geochemical Immobilization

Geochemical immobilization of soluble waste radiological constituents with long half lives or other hazardous contaminants and an innovative waste placement strategy could enhance the performance of the landfill by reducing or limiting long-term migration of contaminants.

Immobilization technologies could be used to reduce solubility of uranium or other constituents in waste. Uranium immobilization technologies include:

- Performing pretreatment of soluble uranium (U^{6+}) to immobilize it as an insoluble mineral.
- Using Apatite II™ and zero-valent iron as reactive barriers or geochemically reactive fill additives in the waste disposal layer.

In terms of hazardous constituents, an example would be mercury. Although not very mobile in most soil environments, mercury immobilization can be improved by adding sulfur or sulfur-containing compounds to fill soil when disposing of mercury-containing materials to promote formation of highly insoluble mercury sulfide or cinnabar. Wastes containing mercury below specific limits and not considered hazardous (e.g., those that *do not* carry the D009 code) would be the target of this type of treatment. Toxicity characteristic wastes contaminated with mercury (D009 waste) must be treated to meet LDRs prior to disposal. Waste to be immobilized could be disposed of in one area in the landfill to reduce the area needed for application of geochemical immobilization technologies. Sustainable immobilization requires compatibility with the regional biogeochemistry.

6.2.2.7.2 On-site Waste Treatment

For some waste streams, it may be advantageous to reduce leachability or meet WAC by implementing some type of stabilization at the EMDF site. In the case of waste treated by grout stabilization (e.g., as is completed at EMWMF for higher activity waste or to provide waste stability), the additional weight of wastes grouted at the generation site greatly increases the costs and risk associated with transporting the treated waste from the generator site to the disposal facility. Mobile processing equipment would be available at EMDF and located adjacent to the active disposal cell to allow for grouting to be carried out within the landfill.

6.2.2.7.3 Cap Vegetation

As an alternative post-closure strategy, the long-term maintenance costs could be reduced and the long-term stability of the EMDF cover system could be enhanced by early establishment of a controlled forest cover. The uppermost layer of the EMDF landfill cover system will be vegetated to protect underlying layers, reduce erosion, enhance evapotranspiration, and reduce infiltration. The mix of vegetation must be appropriate to regional climate and cap soil conditions. Grasses are commonly selected for cover vegetation because they can be rapidly established and grow shallow but dense root systems that stabilize the cap's surface. However, long-term maintenance of a grass cover requires periodic mowing to prevent colonization by shrubs and trees. It is expected that mowing would cease following the active institution control period.

One of the performance requirements for the EMDF cap is that it survive intact for more than 1,000 years with little or no maintenance. Assuming that climate remains temperate and no building occurs on the landfill, it is inevitable that the cap will undergo natural reforestation. It would therefore seem prudent to design the cap with eventual reforestation in mind. Perhaps the best means to do this is to use the expected post-closure maintenance period for the controlled establishment of a forest, so that a healthy stand of climax trees species is present when maintenance ceases. A forest will accomplish the same hydrologic goals of reducing infiltration, promoting run-off, and preventing erosion as well or better than grasses, and has the added benefits of requiring little or no maintenance and better prevention of inadvertent intrusion by making the site less attractive for use/clearing if administrative control is lost.

Objections to the establishment of forests on landfill caps include root penetration and pitting caused by wind-throw (i.e., the holes where the tree's roots have been pulled up). While the tap roots of some eastern forest trees, such as hackberry and certain hickories, can extend more than 3 m (10 ft) into the soil and could thus potentially disrupt cap layers, most common trees, such as oaks, poplar, walnut, most hickories, and cherry, root within the upper 1 m of the soil. These shallow root systems would be beneficial by creating a zone of increased permeability that fosters rapid run-off as storm-flow, yet would not impinge upon the synthetic and engineered cap layers. Further, the dense mat of interwoven roots form an effective barrier to erosion and mass wasting.

Wind-throw of a shallow-rooted forest would create a pit-and-mound micro-topography that influences soil formation and natural plant restoration in a manner that would be beneficial to cap stability. Pit-and-mound topography slows erosion by acting to trap sediments and regenerate soil profiles within the root plate area (Bormann, et al. 1995; Clinton and Baker, 2000; Ulanova 2000; Hancock, et al. 2011). Trapping of sediments and organic matter restores soil productivity and, by providing fertile seeding sites, increases plant diversity. If the cap forestation effort is managed to prevent the establishment of species with deep tap roots, forestation of the cap would appear to be at least as beneficial, and possibly more beneficial, than the typically accepted strategy of long-term protection via native grass/vegetation growth.

6.2.3 Waste Acceptance Criteria

A negotiated WAC attainment process was developed for the EMWMF (DOE/OR/01-1909&D3), which involves the designation of four separate categories of WAC requirements (DOE 2001b) to define and limit acceptable wastes. For a future on-site facility, similar tri-party negotiations would result in a WAC attainment or compliance process that will be documented in a primary FFA document, the WAC Attainment (Compliance) Plan. EMWMF WAC include four categories:

- **Auditable Safety Analysis (ASA)-derived WAC:** Derived from facility authorization basis documentation for the EMWMF.
- **Physical WAC:** Derived from operational constraints and contractual agreements for EMWMF operations.
- **Administrative WAC:** Derived from ARARs in the EMWMF ROD (DOE 1999), and from other agreements between DOE, EPA, and TDEC.
- **Analytic WAC:** Derived from the approved risk assessment model in the EMWMF RI/FS and RI/FS Addendum (DOE 1998a, DOE 1998b) for the EMWMF.

Similar categories of WAC are expected to be developed for a future on-site facility. The first two WAC categories are not addressed in this RI/FS, but will be developed during design stages as safety basis documents and operations plans are developed and appropriate waste limits incorporated into the WAC Attainment (Compliance) Plan. The first category, ASA-derived WAC, controls disposal of radionuclides based on a maximum credible release of material that might occur during an extreme wind event at the operating facility. These WAC thus mainly address short-term external exposure risk to workers.

The second category, Physical WAC, address the physical form of acceptable waste items such as length of piping, waste containers size and weight, dimensions of concrete rubble, addresses voids, etc. that are manageable from a facility operations point of view. These WAC limitations are implemented to protect the engineered liner and equipment during operations. It is expected that on-site facility WAC limits/definitions within these two categories will be similar to the EMWMF ASA-derived and physical WAC.

The third WAC category, Administrative WAC, includes excluded waste streams and limits on waste streams as a result of ARARs or other policy issues. For example, the administrative WAC prohibits disposal of transuranic waste, high-level waste, spent nuclear fuel, and Atomic Energy Act of 1954 Section 11e(2) byproduct waste. Figure 6-30 is a flowchart that summarizes exclusions under a preliminary Administrative WAC, for an on-site facility. Excluded waste streams include physical forms (liquid, gas) or defined waste streams (non-CERCLA/non-ORR waste, listed RCRA waste, etc.).

Further waste exclusions based on definitions (e.g., greater than Class C and transuranic waste) have quantitative limits. These preliminary Administrative WAC limits are summarized in Table 6-4. Other Administrative WAC will be added in the development of a WAC Attainment (Compliance) Plan (e.g., possibly mercury depending on treatment method identified), or adjustments to these preliminary Administrative WAC limits may be necessary. Finalization of the Administrative WAC is part of the primary FFA document development.

The third step in the WAC flowsheet (Figure 6-30) introduces the fourth category, analytic WAC limits. Analytic WAC limits are numerical contaminant limits based on contaminant fate and transport analysis for specific receptor exposure scenarios, utilizing site-specific hydrogeologic data and design elements of the EMDF (e.g., cover materials, thicknesses, etc.). Analytic WAC limits provide defense-in depth for facility design to ensure long-term protection of human health and the environment from contaminant releases. Selection of an On-site Disposal Alternative would require development of site-specific, analytic WAC (isotope-specific activity concentration limits) and total facility inventory limits. These limits would be designed to meet RAOs and limit residual risk. Modeling would be performed to calculate the limits and demonstrate compliance with RAOs, as part of developing the WAC Attainment (Compliance) Plan.

This RI/FS presents ranges, low to high, to bound future analytic, site-specific WAC (for individual radioisotopes) rather than developing preliminary analytic WAC as was done for EMWMF at this feasibility stage. The ranges specified herein have been developed using engineering practices and based on a combination of analytic WAC for the current EMWMF, ORR landfill radiological limits, American National Standards Institute (ANSI) free release criteria for radionuclides, and NRC Class A and C limits as well as chemical properties (e.g., mobility and half life).

Appendix H presents a preliminary screening of potential radiological contaminants that would be considered in developing an analytic WAC along with associated properties of those contaminants. That screening resulted in a list of radioisotopes for which analytic WAC ranges are given in Table 6-5. Preliminary inventories of isotopes in waste forecasted for disposal in an on-site facility have been identified based on the Waste Lot data presented in Appendix A, as well as some facility specific characterizations available from ARRA work approximately 3-4 years ago. (ORAU 2013). These predicted, preliminary inventories (at closure) were used to organize the individual isotopes into groups as given in Table 6-5. Within the groups of expected inventories, a ranking by first mobility (based on partition coefficients [Kd]), and secondly on half life helps further indicate which contaminants have the potential to be released from an on-site landfill and would pose a future risk. In addition to analytic WAC, which are limits applied during acceptance of individual waste lots at a facility, total individual isotope inventory limits for the facility as a whole will be determined and documented in a future primary WAC Attainment (Compliance) Plan as noted in the table. Together, these two limits will ensure protection of human health and the environment in the event of future releases.