STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF REMEDIATION - DOE OVERSIGHT OFFICE
761 EMORY VALLEY ROAD
OAK RIDGE, TN 37830

March 31, 2016

Mr. John Michael Japp
DOE FFA Project Manager
P.O. Box 2001
Oak Ridge TN 37831-8540

Dear Mr. Japp

RE: Focused Feasibility Study [FFS] for Water Management for the Disposal of CERCLA Waste on the Oak Ridge Reservation, Oak Ridge, Tennessee (DOE/OR/01-2664&D2)

The Tennessee Department of Environment and Conservation (TDEC), Division of Remediation has reviewed the above referenced document pursuant to the Federal Facility Agreement (FFA) for the Oak Ridge Reservation. Based on that review, the state cannot approve the FFS at this time and places this document in informal dispute. TDEC has the following comments on the submittal.

1. The FFS does not convincingly demonstrate that alternative 2, as described, will meet the CERCLA threshold criteria**.** On page 33 in the description of alternative 2, the document states: *"Landfill wastewater initially is discharged to Bear Creek in accordance with current discharge limits (Table 6) and points of compliance. Subsequently, landfill wastewater is treated at LWTS, located at the proposed, adjacent EMDF site prior to discharge to Bear Creek in accordance with revised discharge limits (Table 6)."*

As illustrated in Figure 5 (page 8) and the data presented in the FFS, contact water drains/emerges from solid/hazardous waste and contains contaminants derived from that waste. Consequently, contact water meets the state and federal definitions of leachate cited in the TDEC General Comment 3 and in the FFS at the top of page 8. That is: *"TDEC 0400-11-01 defines leachate as "a liquid that has passed through or emerged from solid waste and contains soluble, suspended, or miscible materials removed from such waste." RCRA (40 CFR 260.10) defines leachate as "any liquid, including any suspended components in the liquid that has percolated through or drained from hazardous waste."* Currently, contact water/leachate is released to drain through an unlined ditch to mix with clean stormwater in the sediment basin, prior to radioactive contaminants being assessed for compliance with the limits in Table 6. The Department of Energy (DOE) has proposed to do the same with leachate collected by the leachate collection system. The practice allows contact water/leachate to be released to the environment and diluted with clean stormwater prior to the compliance evaluation.

TDEC does not agree to the continued use of the outfall from the sediment basin as point of compliance for radiological contaminants in contact water/leachate and has found no formal approval of the current point of compliance in a primary CERCLA or FFA document. The current point of compliance allows mixing of point source wastewater contaminated with radiological constituents with non-point source uncontaminated stormwater runoff prior to meeting the limits for discharge.

Dilution of point source wastewaters with uncontaminated runoff is inconsistent with TDEC permitting practice. The current policy of dilution and discharge without treatment may also conflict with the TDEC prohibition on permitting the discharge of radioactive wastewater in Tennessee Rule 0400-40-05-.04, paragraph (1), subparagraph (b). Compliance limits established post-dilution with non-point source runoff complicate verification, and create a potential for conflicts in operational priorities. The practice of batch discharge during storms enables the release of more contaminated wastewater, but discourages releases between storms that might maximize the use of water storage capabilities.

2. The document fails to establish whether the proposed limits for managed discharge in Table 6 (page 35), or the proposed future discharge limits for radiological contaminants at an on-site wastewater treatment plant, will be protective of human health and the environment. The proposed discharge limits for treated wastewater in Table 6 should meet the Tennessee numeric water quality criteria, as well as narrative criteria and the Anti-degradation Statement, identified in Appendix D of the document as applicable requirements. However, the limits for managed discharge may not be sufficiently stringent to comply with the requirements of the Anti-degradation Statement, should a measurable additional loading of mercury, cadmium, or PCBs in wastewater result from changes in landfill operations.

The assumption of unchanging chemical characteristics in the Environmental Management Waste Management Facility (EMWMF) wastewater was made for the purposes of this document, but should mercury concentrations in landfill wastewater rise, or if the quantity of landfill wastewater discharged to Bear Creek increase, treatment, either onsite or offsite must be provided to remain in compliance with anti-degradation requirements. For comparison purposes, the current loading should be computed using the actual average values of the contaminant concentrations in the wastewater discharge to date, not the current batch discharge limits for the ponds, as in Table K-5 (page K-9) of the document.

3. TDEC generally agrees with the sampling approach that is described briefly in Appendix L of the document. This approach results in a significant reduction in the number of analytes used to determine compliance of landfill wastewater discharged to Bear Creek through either managed discharge or treatment. TDEC also supports the use of process knowledge, use of general water quality parameters as indicators, and use of periodic sampling of more mobile compounds and isotopes to add new key contaminants of concern (COCs) to the list. However,

TDEC will need to evaluate in more detail all potential risks to human health and the environment before concurring with the list given in Table L.1, or with the specific methodology for adding new COCs. These issues should be resolved and details added to this Appendix rather than deferring almost all the specifics to the sampling and analysis plan.

4. TDEC has conducted a preliminary assessment of risks incurred through a fish ingestion pathway by a recreational user in the reach of Bear Creek including Bear Creek Kilometer (BCK) 9.2. Based on dilution with a stream discharge corresponding to the 30Q5 at BCK 9.2 as calculated with USGS regression equations or from data and default values for the exposure scenario and bioaccumulation factors for radionuclides, more restrictive limits on at least some of the seven radioactive isotopes evaluated by DOE in this FFS may be necessary to ensure protection of human health and the environment. TDEC considered additional radionuclides present in landfill wastewater in our analysis, including carbon-14, chlorine-36, and radium isotopes. Computed risks suggest that more restrictive limits than those proposed in this FFS may be appropriate for a number of these additional isotopes. A more thorough description of TDEC's analysis of discharge limits that might be imposed by risk due to fish ingestion, including permissible loading of radionuclide releases to Bear Creek, is given below.

1) Appendix K derives "Revised Discharge Limits for Landfill Wastewater." We agree that discharge limits are needed for radiological constituents and that promulgated Tennessee Water Quality Criteria are Applicable or Relative and Appropriate Requirements for the EMWMF/EMDF water treatment system, including, and not limited to, recreational use criteria.

2) Figure K-1 (page K-4) indicates that the land use downstream of BCK 9.2 is classified over the short term for recreational use and long term for unrestricted use. Recreational use includes the capture and subsequent consumption of fish and shellfish. Page 4-47 of the 2015 Remediation Effectiveness Report (RER) states that "*the lower stretches of Bear Creek are often impounded due to beaver dams which create the deeper pools suitable for rock bass habitat...*" The RER also states that "*the upper stretches of Bear Creek are less suitable for rock bass, and the sunfish species most often encountered in the stretch of Bear Creek between BCK 4.6 and BCK 9.9 is the redbreast sunfish...*" TDEC is preparing to post Bear Creek for fish consumption due to levels of mercury and PCBs in fish. Appendix K, Page K-16 speculates that it is plausible that fish caught at alternate locations may be consumed. With sunfish in upstream Bear Creek areas and rock bass in downstream Bear Creek areas, it is also plausible that fish from upper and lower Bear Creek are all that would be consumed. TDEC's analysis utilized default assumptions for resident fish consumption from EPA's Preliminary Remedial Goals for Radionuclides (PRG) website and values from the "Resident Fish Table."

3) TDEC's analysis of recreational use and fish consumption utilizes bioaccumulation factors (BAF) available from Argonne National Laboratory's RESRAD Offsite documentation. These bioaccumulation factors do not always agree with BAFs given in Table K-11. For example, Table K-11 lists the BAF for strontium-90 of 2.9 L/kg and uranium-238 of 0.96 L/kg. RESRAD Offsite documentation lists BAFs for strontium isotopes of 60 L/kg and uranium isotopes of 10 L/kg. These differences in BAFs will result in at least an order of magnitude difference in discharge criteria. The source for BAFs used in Appendix K is not clear.

4) TDEC rule 0400-40-03-.03(4) specifies that when determining levels appropriate for recreational use, a "10-5 risk level is used for all carcinogenic pollutants."

5) Table K.12 titled "Total recreational risk-based discharge limits" contains 7 radioisotopes plus uranium as a soluble salt. Table H-13 for the "*Remedial Investigation/Feasibility Study for Comprehensive Environmental Response, Compensation, and Liability Act; Oak Ridge Reservation Waste Disposal; Oak Ridge, Tennessee*" (Waste Disposal RI/FS) dated 3/11/2016 includes about 62 radionuclides in the waste stream. Bioaccumulation factors are available for all but one or two of these radionuclides. Waste Disposal RI/FS, Appendix H, Attachment A, Table 2-2 also includes a number of additional radionuclides that were considered and not modeled for the Waste Disposal RI/FS. Discharge limits based on capture and subsequent consumption of fish (reactional use) should be derived for all constituents in the proposed waste stream that bioaccumulate or bioconcentrate in the fish and that may pose greater than a 10-6 excess cancer risk.

6) Po-210 is in the U-238 decay chain and previous RESRAD modeling indicated Po-210, if present, may pose a threat from fish consumption at extremely low levels. A discharge level for Po-210 should be developed.

7) For determining allowable releases of radionuclides to Bear Creek for recreational use, Tennessee Rule 0400-40-03-.05(4) requires that the basis of stream flows is equal to or exceeding the 30 day minimum 5 year recurrence interval. BCK 9.2 is located near the location where land use is designated as recreational and is in the reach the 2015 RER documents fish. Using USGS stream stats and USGS site 03538270 (BCK 4.55) scaled for watershed size (watershed at BCK 9.2 is 0.38 the size of the watershed at BCK 4.55), a 30 day five year flow on the order of 238 to 272 liters per minute is estimated. Minimum 30 day flow measured by DOE at BCK 9.2 in the past 10 years was 311 liters per minute in October 2007.

8) Radionuclides are already present in Bear Creek surface water. For example, the average concentration measured at BCK 9.2 October 2006 through September 2015 and presented in RER data for U-238 is 17 (95% UCL of 17.5) pCi/L; U-235/236 is 0.77 (95% UCL of 0.8); and U-233/234 is 8 (95% UCL of 8.2) pCi/L. The mass of radionuclides already in the stream has to be taken into account when determining discharge criteria.

9) We have not identified radionuclide sampling and analysis at BCK 9.2 for many of the radionuclides that may be in the EMWMF/EMDF waste stream. If there are insufficient sampling and analysis of radiological constituents in Bear Creek surface water to determine concentrations present in Bear Creek water without the wastewater treatment plant discharge, a sampling and analysis plan should be performed to determine existing levels of radionuclides in Bear Creek surface water. Until this is performed, the discharge concentration should be the concentration that causes a 10-5 target risk. For example, until strontium-90 data is obtained for BCK 9.2, the interim discharge limit for strontium-90 should be on the order of 5 pCi/liter. Once current conditions are determined, remaining capacity and resulting discharge limits may be calculated.

10) The following table incorporates the above comments into table for a few radionuclides. This assumes a 30 day minimum 5 year recurrence interval flow of 311 liters per minute and a discharge rate of 113 liters per minute (30 gpm).

Nuclide COPC	Fish BCF (pCi/kg) /(pCi/L) RESRAD Offsite	Ingestion of Fish TR=1E-5 (pCi/kg)	pCi/L to cause TR 1E-5 from fish ingestion	BCK 9.2 flow	Average and 95%UCL Concentration (pCi/L) at BCK 9.2 (Oct 2010-Sept 2015 - RER data)	Average pCi/minute load/flux measured at BCK9.2 October 2006 through September 2015	BCK9.2 pCi/min load to cause TR=1E-5	Remaining capacity at BCK9.2 in pCi/min	Assuming 30 gpm (113 L/min) discharge rate, discharge limit in pCi/L based on downstream fish consumption
C-14	5.00E+04	1.00E+04	0.2	311	Not Analyzed		62.2		0.2
Cl-36	1.00E+03	4.60E+03	4.6	311	Not Analyzed		1430.6		4.6
Co-60	3.00E+02	9.10E+02	3.0	311	Not Analyzed		943.4		3.0
Cs-135	2.00E+03	2.60E+03	1.3	311	Not Analyzed		404.3		1.3
Cs-137	2.00E+03	5.40E+02	0.3	311	Not Analyzed		84.0		0.3
H-3	1.00E+00	3.10E+05	310000.0	311	Not Analyzed		9.64E+07		3.1E+05
I-129	4.00E+01	1.00E+02	2.5	311	Not Analyzed		777.5		2.5
K-40	1.00E+03	6.00E+02	0.6	311	Not Analyzed		186.6		0.6
Ra-226	5.00E+01	4.00E+01	0.8	311	Not Analyzed		248.8		0.8
Ra-228	5.00E+01	1.40E+01	0.3	311	Not Analyzed		87.1		0.3
Sr-90	6.00E+01	3.00E+02	5.0	311	Not Analyzed		1555.0		5.0
Tc-99	2.00E+01	5.10E+03	255.0	311	Not Analyzed		79305.0		255.0
Th-229	1.00E+02	7.00E+01	0.7	311	Not Analyzed		217.7		0.7
Th-230	1.00E+02	1.70E+02	1.7	311	Not Analyzed		528.7		1.7
Th-232	1.00E+02	1.50E+02	1.5	311	Not Analyzed		466.5		1.5
U-233/234	1.00E+01	2.10E+02	21.0	311	8 (95%UCL=8.2)	2488	6531.0	4,043	36
U-235/236	1.00E+01	2.20E+02	22.0	311	0.77 (95% UCL=0.8)	239.47	6842.0	6,603	58
U-238	1.00E+01	2.40E+02	24.0	311	17 (95%UCL=17.5)	5287	7464.0	2,177	19
Po 210	1.00E+02	9.00E+00	0.1	311	Not Analyzed		28.0		0.1

Questions or comments concerning the contents of this letter should be directed to Howard Crabtree at the above address or by phone at (865) 220-6571.

Sincerely

Randy Young, FFA Manager
Environmental Restoration Program

xc Patricia Halsey, DOE
Jeff Crane, EPA
Brian Henry, DOE