



STATE OF TENNESSEE
 DEPARTMENT OF ENVIRONMENT AND CONSERVATION
 Division of Remediation - Oak Ridge
 761 Emory Valley Road
 Oak Ridge, Tennessee 37830

February 14, 2018

Mr. John Michael Japp
 DOE FFA Project Manager
 PO Box 2001
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Dear Mr. Japp

TDEC Comment Letter

Strategic Plan for Mercury Remediation at the Y-12 National Security Complex, Oak Ridge, TN

DOE/OR/01-2605&D2/R1

September 2017

The Tennessee Department of Environment and Conservation, Division of Remediation, Oak Ridge Office, has reviewed the above referenced document pursuant to the Federal Facility Agreement for the Oak Ridge Reservation. The following are comments relative to that review.

Specific Comments:

1. **Page 2, Chapter 1.0, Introduction, Paragraph 1, First Sentence:** "...ATSDR...conclusively determined that no adverse human health effects have been suffered due to 'most past and current exposure pathways' of mercury releases (ATSDR 2012)". OREM should clarify this statement. Section 1.B., Overall Conclusions, of the cited report (ATSDR, 2012, p. 4) states:

"Most past and current exposure pathways are not a public health hazard. However, ATSDR identified a few pathways of potential concern.

- *Family members (especially young children) may have inhaled elemental mercury carried from the Y-12 plant by workers into their homes.*
- *Children who swallowed water while playing in East Fork Poplar Creek (EFPC) during some weeks from 1956 to 1958, and adults who incidentally swallowed water during some weeks in 1958, possibly could have been exposed to levels of inorganic mercury that may have increased the risk of developing renal (kidney) health effects.*

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Mr. John Michael Japp

Page 2

February 14, 2018

- *Children who accidentally swallowed soil while playing in two areas along the EFPC floodplain before the removal of mercury-contaminated soil in 1996 and 1997, possibly could have been exposed to inorganic mercury that may have increased the risk of developing renal (kidney) health effects.*
- *Children born to or nursing from women who ate fish from waterways near the ORR may have a small increased risk of developing subtle neurodevelopmental health effects from exposure to organic mercury. For this small increased risk to occur, mothers had to eat fish frequently just before and during pregnancy, or while nursing. Also, children who ate fish from waterways near the ORR may have a small increased risk of developing subtle neurodevelopmental health effects.*

Due to a lack of information, ATSDR cannot determine whether people living off site could have been harmed from breathing elemental mercury from 1950 through 1963, swallowing water containing inorganic mercury from EFPC from 1953 to 1955, and eating fish containing mercury during the 1950s and 1960s." The report includes more than five additional pages of summarized conclusions about potential health effects and uncertainties. Please revise the statement.

2. **Page 7, Section 2.1 Comprehensive Environmental Response, Compensation, and Liability Act, First Paragraph, Last Sentence:** *"Cleanup projects in the Bear Creek Watershed are addressed as part of the overall Y-12 project prioritization and sequencing discussed in Chapter 4; effects of the mercury cleanup on Bear Creek are also examined."*

This sentence should be revised to clarify where effects of the mercury cleanup on Bear Creek are examined. The examination cited in this sentence does not appear in Chapter 4 or elsewhere in the document.

3. **Page 12, Section 2.2.2 Resource Conservation and Recovery Act, Second Paragraph, Last Sentence:** The document should define "mercury-contaminated waste". The document says that Table 2 lists mercury-contaminated wastes that may be encountered during the Y-12 cleanup, but that table focuses on treatment/performance standards for D009 listed mercury-bearing waste.

4. **Page 31, First Paragraph:** *"The proven technologies of retorting and amalgamation have high-energy demand and are not cost effective or practical for the potentially large volumes of waste anticipated during source removal. Several commercial vendors have proven technologies for treating high concentration, mercury-contaminated soils."*

Mr. John Michael Japp

Page 3

February 14, 2018

If the second quoted sentence means that technologies have been proven *in addition to* retorting and amalgamation, please list them. If the retorting and amalgamation are the proven technologies discussed in the second sentence, consider switching the order of the sentences.

5. **Page 33, Figure 10. Strategic Schedule for Mercury Cleanup at Y-12:** As stated on Page 7, the strategy only addresses Upper East Fork Poplar Creek (UEFPC) and, to a lesser extent, Lower East Fork Poplar Creek (LEFPC). However, OREM should revise Figure 10 to show the schedule for mercury cleanup in Bear Creek because the strategy assumes that the majority of hazardous waste will be disposed in BCV, where OREM already discharges mercury to Bear Creek and its tributaries, as documented in TDEC's October 25, 2017 letter to OREM (*Explanation of Significant Differences for the Record of Decision for the Disposal of Oak Ridge Reservation Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Waste, Oak Ridge, Tennessee [DOE/OR/01-2322&D1]*).
6. **Page 34, Table 4. Media and Waste Interim and Endstates for Mercury Remediation:** OREM should revise Table 4 to address mercury cleanup in Bear Creek because the strategy assumes that the majority of hazardous waste will be disposed in BCV, where OREM already discharges mercury to Bear Creek and its tributaries.
7. **Page 35, Section 3.3.2.1 Onsite Disposal. First Bullet:** The first bullet states that landfill design (including defining WAC) will allow OREM to dispose mercury-contaminated waste in a protective manner at EMWMF and/or EMDF in BCV. This statement is not supported. For the existing EMWMF landfill: 1) OREM never established protective WAC for mercury, 2) OREM continues to delay treatment of wastewater discharges with mercury concentrations above the 51-ng/L limit and 3) OREM should not dispose mercury-bearing waste at EMWMF before demonstrating that the landfill will not discharge wastewater to Bear Creek with mercury concentrations that exceed 51 ng/L. This TDEC position is discussed further in General Comment 3 and TDEC's letter dated June 13, 2017 (*TDEC Position Regarding the Potential for Further Mercury Impacts In Bear Creek on the Oak Ridge Reservation*). For the proposed EMDF landfill, page 6-85 of OREM's draft (D5) remedial investigation/feasibility study (RI/FS) report (DOE 2017a) defers development of WAC for mercury to an unspecified time in the future.
8. **Page 35, Section 3.3.2.1 Onsite Disposal. Second Bullet:** The second bullet states that OREM will treat mercury-contaminated waste to meet the LDR concentration (0.025 mg/L TCLP), but this level (25,000 ng/L) is a subject of potential concern because it is nearly 500 times higher than the 51-ng/L limit for Bear Creek.

Mr. John Michael Japp

Page 4

February 14, 2018

Although modeling would be required to estimate the mercury contribution to Bear Creek from disposing large volumes of mercury at the LDR concentration, OREM's monitoring data provide direct evidence that at times OREM already discharges untreated EMWMF wastewater to Bear Creek (via a tributary) with mercury concentrations above the 51-ng/L recreational use limit.

9. **Page 35, Section 3.3.2.1 Onsite Disposal, Third Bullet:** The third bullet states that OREM will manage or restrict mercury releases to Bear Creek through treatment of landfill wastewater. However, OREM never established such restrictions at the existing EMWMF landfill and continues to delay treatment of landfill wastewater discharged from EMWMF.
10. **Page 35, Section 3.3.2.1 Onsite Disposal, Fifth Bullet:** The fifth bullet states that OREM will monitor groundwater and deal with "*unexpected deviations*" in a timely manner. TDEC acknowledges OREM's progress toward establishing a defensible groundwater monitoring plan for the existing EMWMF landfill but reiterates the need to replace groundwater monitoring wells that OREM removed to enlarge the facility. OREM is no longer monitoring groundwater southwest of the facility along geologic strike, which is the trend direction for Pine Ridge and BCV. Groundwater on the Oak Ridge Reservation (ORR) flows preferentially in this direction, as noted throughout the Remediation Effectiveness Report (DOE 2017b). That gap in the monitoring network must be corrected to support detection of potential leakage in a timely manner.
11. **Page 36, First Paragraph:** *"Implementation of a future CERCLA disposal facility should include consideration of integrating treatment with disposal for mercury-contaminated debris through application of the RCRA Corrective Action Management Unit (CAMU) regulations found at Title 40, CFR Part 264.552. These regulations allow treatment (in this case macroencapsulation) of mercury-contaminated debris to be completed in-place within the disposal cell. In-cell macroencapsulation provides advantages in terms of safety and cost, and has the potential to minimize the disposal capacity utilized over methods that would complete macroencapsulation outside of the disposal unit. Treatment external to the disposal unit necessitates moving large waste forms from the treatment location to the disposal unit for final placement/disposal, introducing more risk (from a safety perspective as well as containment perspective). A study completed by UCOR (UCOR 2015) considered various options for treatment of mercury-contaminated debris, including in-cell macroencapsulation. The report points out significant benefits afforded by in-cell macroencapsulation both in terms of safety and cost."* The TDEC position regarding mercury disposal in Oak Ridge landfills is presented in our comments on the D3 and D4 drafts of the RI/FS for the proposed EMDF. That position is summarized as follows.

Mr. John Michael Japp

Page 5

February 14, 2018

- Mercury does not degrade over time. It presents a long-term hazard similar to that of long-lived radionuclides.
- TDEC does not support disposal of a principal threat waste, like debris contaminated with elemental mercury, in a facility that does not meet all the requirements of a RCRA Subtitle C facility.
- OREM has not provided sufficient information to demonstrate that placing mercury in the landfill before treatment (in-cell macroencapsulation) would protect human health and the environment over the long term as required by CERCLA. Protectiveness of the remedy is a threshold criterion of CERCLA that must be satisfied; it cannot be waived like an ARAR [CERCLA 121(d)(1), 42 USC 9621(d)(1)].
- TDEC expects a full evaluation of mercury treatment and disposal options with the FFA parties before mercury waste is introduced to EMDF, which may further impair the Bear Creek watershed.
- OREM should more thoroughly consider the long-term advantages of thermal treatment, macroencapsulation at the point of generation, and off-site disposal for mercury-bearing waste. TDEC recognizes thermal separation and retort as an option for protecting human health and the environment. It is a way to recover and separate mercury from the biosphere. The process also purifies mercury to reduce the chance of it being radiologically contaminated. Active treatment of mercury-bearing waste may cost more in the short term, but it will cost less over the long term by reducing the need for very costly remedial action in BCV.

12. Page 36. Section 3.3.2.2 Offsite Disposal. First Sentence: *"Offsite disposal is available for mercury-contaminated LLW (mixed waste) or hazardous-only waste but is not the preferred method of disposal given the high cost and greater risk as compared with onsite disposal (DOE 2017c)." OREM should refine consideration of off-site disposal options for mercury-bearing waste. If OREM demonstrates that some wastes can be disposed at the proposed EMDF in a manner that protects public health and the environment, wet conditions in Oak Ridge would likely make it necessary to limit the amount, concentration and form of mercury that OREM could dispose there. Also, we believe that OREM could refine its comparisons of long-term risks and costs to the public, as detailed in our comments on various drafts of the RI/FS for the proposed EMDF. More objective evaluations of risks, long-term costs and community acceptance might change OREM's preferred disposal method.*

Mr. John Michael Japp

Page 6

February 14, 2018

- 13. Page 37, Figure 11 Logic Diagram for Treatment of Mercury Waste:** According to the logic diagram, after determining that waste from a mercury area (first rectangle) does not contain elemental mercury (second rectangle), the next step (third rectangle) says "Waste containing mercury". The fourth rectangle says "Characterize: Does it require TCLP Testing?"
- 13a.** The document should summarize the method(s) for determining whether waste contains elemental mercury (second rectangle). This does not warrant changing the diagram, but clarify in a comment response where the document provides this information.
- 13b.** Clarify whether the third rectangle ("Waste containing mercury") is a decision step to determine if the waste contains mercury. If not, consider removing the box or clarifying its role in the process.
- 13c.** If the "20x rule" is used to determine whether the waste requires TCLP testing, that evaluation should be inside the fourth rectangle to support the yes/no decision.
- 14. Page 37, Figure 11 Logic Diagram for Treatment of Mercury Waste:** Under "Media Type" near the center of the diagram, it is not clear what "Other" means. Clarify what "Other" means in a note below the diagram. Also, an arrow appears to be missing from the line connecting "Other" media to the blue decision diamond.
- 15. Page 37, Figure 11 Logic Diagram for Treatment of Mercury Waste:** The document should define "Rad Contaminated" (green decision diamonds). Define "Rad Contaminated" in a note below the diagram or provide a comment response to explain where the document provides this information.
- 16. Page 37, Figure 11 Logic Diagram for Treatment of Mercury Waste:** The pink boxes say "Meet EMWMF WAC and Dispose". OREM never established WAC for mercury at the EMWMF and relies instead on the LDR concentration (0.025 mg/L or 25,000 ng/L TCLP) for mercury. This level (25,000 ng/L) is a subject of potential concern because it is nearly 500 times higher than the 51-ng/L limit for Bear Creek in TDEC Rule 0400-40-03-.03(4). Modeling would be required to estimate the mercury contribution to Bear Creek from disposing large volumes of mercury at the LDR concentration, but OREM's monitoring data provide direct evidence that at times OREM already discharges untreated EMWMF wastewater to Bear Creek (via a tributary) with mercury concentrations above the 51-ng/L recreational use limit.
- 17. Page 38, Fourth Paragraph:** *"The current assumed disposition path for mercury-contaminated debris that meets the threshold for hazardous wastes and may or may not be radiologically contaminated is macroencapsulation (per Title 40, CFR Part 248.45) and disposal in the existing EMWMF. For a future CERCLA disposal facility, the addition of ARARs (in the appropriate decision*

document(s)) designating the facility as a CAMU would allow for macroencapsulation to be completed integral with disposal within the disposal unit. As described in the debris study report (UCOR 2015) this in-cell macroencapsulation would provide additional cost savings over treatment provided prior to disposal under LDRs while also providing a safer alternative to "out-of-cell" treatment." OREM should evaluate all options for the treatment and disposal of mercury-bearing waste more thoroughly. If the proposed EMDF is authorized, the Antidegradation Statement of the Tennessee Water Quality Control Act precludes the authorization of additional mercury loading to Bear Creek. Therefore, it would likely be necessary to limit the amount, concentration and form of mercury that OREM could dispose there.

18. Page 40, Table 5, Endstates for Mercury-Contaminated Waste: This table refers to EMWMF WAC and LDR concentrations. The table should be revised to address how OREM plans to dispose mercury-bearing waste on site while protecting Bear Creek, which is already impaired by mercury and has no additional capacity to receive additional mercury discharges. OREM's monitoring data demonstrate that EMWMF already discharges mercury to Bear Creek (via a tributary) at concentrations above the 51-ng/L recreational use limit.

19. Page 58, Last Bullet, In-cell macroencapsulation: *"Under this scenario, a future CERCLA onsite landfill would have to obtain a CAMU designation in the appropriate documentation through EPA."* OREM should evaluate all options for the treatment and disposal of mercury-bearing waste more thoroughly. If the proposed EMDF is authorized, the Antidegradation Statement of the Tennessee Water Quality Control Act precludes the authorization of additional mercury loading to Bear Creek. Therefore, it would likely be necessary to limit the amount, concentration and form of mercury that OREM could dispose there and/or treat landfill wastewater discharges in perpetuity.

General Comments:

1. TDEC comments regarding the Oak Ridge Office of Environmental Management (OREM) Y-12 mercury remediation strategy are based in part on the following understanding.
 - The 90% upper confidence limit (UCL) for Toxicity Characteristic Leaching Procedure (TCLP) mercury concentrations exceeds the Resource Conservation and Recovery Act (RCRA) *"threshold value of 0.2 mg/L for all sampled structural media"* (Birchfield and Albrecht, 2012, p. 12).
 - Mercury contamination in soil has not been delineated, but the volume *"may be excessive"* (Wilkerson et al., 2013, p. 10).

- OREM's strategy is to maximize the extent to which *"the remaining equipment and the facility can be combined into a single high volume, low SOF EMWMF waste profile"* (Birchfield and Albrecht, 2012).
2. The OREM strategy described in the document under review assumes that most mercury waste will be disposed in Bear Creek Valley (BCV) at the existing Environmental Management Waste Management Facility (EMWMF) or a proposed future facility, the Environmental Management Disposal Facility (EMDF), provided facility waste acceptance criteria (WAC) are met. Bear Creek is already impaired by mercury. OREM never established WAC for mercury at the EMWMF and relies instead on the land disposal restriction (LDR) concentration of 0.025 mg/L (25,000 ng/L) by the TCLP. This level (25,000 ng/L) is a subject of potential concern because the LDR concentration is nearly 500 times higher than the 51-ng/L limit for Bear Creek in TDEC Rule 0400-40-03-.03(4). Although modeling would be required to estimate the mercury contribution to Bear Creek from disposing large volumes of mercury at the LDR concentration, OREM's monitoring data provide direct evidence that at times OREM already discharges untreated EMWMF wastewater to Bear Creek (via a tributary) with mercury concentrations above the 51-ng/L recreational use limit.
3. TDEC concerns about management of Y-12 mercury waste are informed in part by recent experience. On June 13, 2016 TDEC notified OREM that before disposing mercury-bearing waste at the landfill, OREM must provide assurance that EMWMF will not discharge landfill wastewater to Bear Creek with mercury concentrations that exceed the 51-ng/L limit. Instead of providing assurance, OREM disposed 235 truckloads (about 2.5 million pounds) of mercury-bearing waste from the Y-12 National Security Complex (Y-12) West End Mercury Area (WEMA) from August 2016 through December 2017. TDEC completed an audit (TDEC 2017) to determine whether OREM managed the disposal of mercury-bearing waste in accordance with the expectation expressed in TDEC's June 13, 2016 letter (*TDEC Position Regarding the Potential for Further Mercury Impacts in Bear Creek on the Oak Ridge Reservation*). The audit found the following:
- OREM did not comply with an official letter from the TDEC-DoR Director, nor did OREM initiate any review of waste characterization and disposal processes.
 - OREM did not make the project team, WAC attainment team or EMWMF operations staff aware of TDEC's expectations.
 - OREM continued mercury waste disposal at the EMWMF without providing requested assurances to TDEC.

Mr. John Michael Japp

Page 9

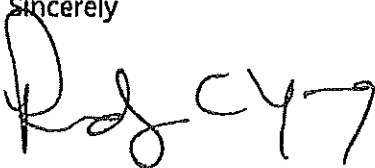
February 14, 2018

During February 2017, OREM planned to develop a procedure for notifying TDEC when mercury waste might be disposed at EMWMF. OREM cancelled that plan in July 2017, quoting a strategy that has not been demonstrated to protect the public: *"Mercury contaminated waste that passes TCLP, meets LDR prior to treatment, and is not listed waste is not considered a hazardous waste and can be disposed of at permitted industrial landfills or EMWMF. Any waste that is characteristically hazardous due to mercury contamination and requires treatment to meet LDRs will require regulatory approval prior to onsite disposal through the Waste Handling Plan."* Instead, OREM deferred the issue to be addressed in the strategic plan reviewed in this letter. As noted in Specific Comments 8 and 16 and General Comment 2, the LDR concentration (0.025 mg/L or 25,000 ng/L TCLP) is not likely protective because it is nearly 500 times higher than the 51-ng/L limit for Bear Creek.

4. DOE should take into account the biogeochemical cycle of mercury and that atmospheric mercury is more than likely being deposited onto the ORR; this mercury, while not originating on the reservation, becomes part of the mercury flux and should be accounted for in models as well as the mercury strategy for remediation. Biogeochemical inputs of mercury are important to consider as the deposition of atmospheric mercury may be contributing to methylation in the UEFPC. While it is probably not as significant as the amount of mercury in the environment on the ORR, it could help to explain why the concentrations in fish tissues are not decreasing. Has the biogeochemical cycle been evaluated to determine if it is a significant input of mercury?

Questions or comments concerning the contents of this letter should be directed to Curt Myers at the above address or by phone at (865)220-6565.

Sincerely



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