



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

November 29, 2016

Ms. Tracey Duncan
Federal Facility Agreement Manager
United States Department of Energy
Portsmouth/Paducah Project Site Office
5501 Hobbs Road
Kevil, KY 42053

RE: EPA Comments: Remedial Action Completion Report for *In situ* Source Treatment by Deep Soils Mixing of the Southwest Groundwater Plume Volatile Organic Source at the C-747-C Oil Landfarm (Solid Waste Management Unit 1) at the Paducah Gaseous Diffusion Plant (DOE/LX/07-2405&D1), Primary Document, transmittal dated September 1, 2016 (PPPO-02-3567814-16A); US EPA ID KY8890008982

Dear Ms. Duncan,

The U.S. Environmental Protection Agency (EPA) Region 4 has reviewed the Department of Energy's (DOE) *Remedial Action Completion Report for In situ Source Treatment by Deep Soils Mixing of the Southwest Groundwater Plume Volatile Organic Source at the C-747-C Oil Landfarm (Solid Waste Management Unit 1) at the Paducah Gaseous Diffusion Plant (DOE/LX/07-2405&D1)*. Comments generated as a result of EPA's review are provided as an enclosure to this letter in support of discussion and document revision.

If you have any questions about this correspondence, please do not hesitate to contact me at (404) 562-8547 or via electronic mail at corkran.julie@epa.gov.

Sincerely,

A handwritten signature in blue ink that reads "Julie L. Corkran". The signature is fluid and cursive.

Julie L. Corkran, Ph.D.
Federal Facility Agreement Manager
Superfund Division

Enclosure (as stated)

Ms. Tracey Duncan

EPA Comments: Remedial Action Completion Report for SWMU 1 (DOE/LX/07-2405&D1)

November 29, 2016

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United States Environmental Protection Agency (U.S. EPA) Region 4

Comments on:

Remedial Action Completion Report for *In situ* Source Treatment by Deep Soils Mixing of the Southwest Groundwater Plume Volatile Organic Source at the C-747-C Oil Landfarm (Solid Waste Management Unit 1) at the Paducah Gaseous Diffusion Plant (DOE/LX/07-2405&D1), Primary Document, transmittal dated September 1, 2016 (PPPO-02-3567814-16A)

**McCracken County, KY
U.S. EPA ID KY8890008982**

GENERAL COMMENTS

1. Recording mechanism not clearly presented. It is not clear how the various measurements for parameters were collected during the treatment. For example, it is not clear whether the flow rate measurements were collected digitally or recorded on paper. Similarly, it is not clear whether the flame ionization detector (FID) data were collected electronically or recorded on paper.

For completeness and clarity, revise the draft Remedial Action Completion Report (D1 RACR) to clarify for the reader the recording mechanisms used for each type of data that were collected, and to provide the original data source if collected digitally, or scans if recorded on paper. It is EPA's understanding from the Remedial Action Work Plan that all recordings were digitally collected.

2. Quantity of zero valent iron (ZVI) that was used for each treatment cell not clearly presented. The text indicates that a soil ratio of 1.5 to 2% was used to calculate the mass of ZVI that will be used within the 10,000 micrograms per liter (ug/L) trichloroethylene (TCE) isoconcentration contour. However, it is unclear how much actual ZVI was emplaced within each treatment cell. Additionally, the ZVI dosing concentration used for the soil columns located outside the 10,000 ug/L TCE isoconcentration contour is not discussed in the D1 RACR.

Revise the report to include a brief discussion about the approach for dosing ZVI for all of the soil columns, including those outside the 10,000 ppb TCE isoconcentration contour. Provide the amount of ZVI that was emplaced, preferably in a summary table that also records other pertinent treatment details such as date started, date ended, number of thermal passes, VOC removed, etc., for each of the treatment cells.

3. Contribution of lime stabilization to RAO 3. The text in the second paragraph of Section 1.0 *Introduction* (Page 1) states a lime stabilization process was implemented following soil mixing to address soil stability concerns, but was not an active treatment component of the remedial action (RA). This field change and deviation to the original design is detailed in Section 1.2.3.6 *Lime stabilization of soils* (page 17). It should be noted while the soil stabilization was not an active treatment component of the RA, the stabilization action has most likely reduced the infiltration within the mixing area footprint due to reduced permeability of the soil matrix and potentially contributing to the attainment of RAO 3. For example, the text in Section 1.2.3.6 indicated soil stabilization included mixing quicklime into the unstable treated soil across the soil mixing area to a depth of approximately 6 feet (ft) below ground surface. The text further states lime addition generally continued until the area being treated could support the weight of an excavator. Therefore, the approximately 278,000 pounds (lb) of lime used during the soil stabilization of the

upper few feet of mixed soils is inadvertently serving as a reduced permeability cover over the mixing area footprint. The limited infiltration due to reduced permeability could contribute to the attainment of RAO 3. Revise the report to address this issue by including additional text discussing the potential that the soil stabilization will contribute to the attainment of RAO 3: *Reduce VOC migration from contaminated subsurface soils in the treatment areas at the Oil Landfarm and the C-720 Northeast and Southeast Sites so that contaminants migrating from the treatment areas do not result in the exceedance of MCLs in the underlying RGA groundwater.*

4. Remedy effectiveness and cost effectiveness cannot be fully assessed until LTM is complete.

As noted in the conclusions of the D1 RACR, the deep soil mixing remedial action was successful in accomplishing the RAO to treat and / or remove the principal threat waste and prevent exposure to VOC contamination in the source areas. The treatment train of technologies deployed at SWMU 1 were aggressive and appear to be extremely effective in liberating, extracting, and treating VOCs in the subsurface. The aggressive nature of the treatment technologies reduces the likelihood that additional RAs will be necessary at SWMU1 in relation to VOCs. The quantity and estimated volume of VOCs removed (24 gallons plus or minus 12 gallons) offered by DOE is based upon several uncertainties that were identified with the data collection and analysis. While DOE used statistical analysis to support their calculation, the resulting estimate is still considered a rough order estimate. As seen in Figure 7 *Post-Treatment Soil Borings and Sample Locations* (page 29) total VOCs were recovered from a limited number of large diameter auger (LDA) boring locations within the total mixing area footprint. Therefore, it is not unreasonable to conclude that between 12 and 36 gallons of VOCs were removed from the mixing area given the limited area of recovery relative to the total mixing area footprint and age of the unit.

At the same time, the RA technologies deployed at SWMU 1 were not operated in such a manner to extract all of the VOCs present within a soil column. EPA and KY granted relaxed temperature goal standards for 'low concentration' borings, allowing the physical breaking down of the soil structure via mixing and the application of ZVI to address the VOCs in situ (without achieving the temperature necessary to propel the VOCs to the surface).

EPA notes, therefore, that the true effectiveness of the remediation as captured in RAO number 3 will not be known until LTM is completed to measure the VOCs remaining in the soil and groundwater. Similarly, EPA cautions DOE regarding drawing extended conclusions about the cost effectiveness of this remedy based on dividing the \$13.2 million cost cited in Section 8, *Summary of Project Costs* (page 99) by the estimated volume of VOCs removed in the initial soil mixing phase of this response action (24 gallons plus or minus 12 gallons): such simple calculations would be overestimates of the cost effectiveness and indefensible since (i) the ZVI will continue to address RGA contamination for many years into the future and (ii) the cost effectiveness of the overall response action will not be known until LTM is completed. Further, cost effectiveness is likely better expressed in terms of volume of protected resource restored/remediated, not necessarily in terms of contaminant removed.

Accordingly, this EPA reviewer is concerned about qualitative statements offered by the DOE-Portsmouth Paducah Project Office Manager to EPA Region 4 and EPA Headquarters representatives on November 3, 2016, regarding the *cost-ineffectiveness* of the SWMU 1 remedy and DOE-PPPO recently sharing those messages "on the Hill". Revise the D1 RACR (*Executive Summary* and/or Section 4.5 *Lessons learned/Problems Encountered* and/or Section 8 *Summary of Project Costs*) to

include for the reader statements consistent with this EPA comment regarding conclusions at this time, and in the future, on the cost effectiveness of the SWMU 1 response action.

SPECIFIC COMMENTS

1. **Section 1, Introduction, Page 1**

The general introduction discusses the Southwest Groundwater Plume; however, the location of the plume relative to the C-747-C Oil Landfarm source area is not shown. It would be very helpful to add a figure between Figure 1 - *PGDP Location* and Figure 2 - *C-747-C Oil Landfarm* that shows the location of the Southwest Plume and the relationship of C-747-C Oil Landfarm source area.

2. **Figure 3, SWMU 1 Area to be Soil Mixed, Page 5**

In the "Notes" section, define the abbreviations "Cl" and "SF" for clarity.

3. **Section 4.1.1, Site Preparation, Page 75.**

The first sentence in the first paragraph indicates that monitoring well locations are shown on Figure 7. However, monitoring well locations are shown in Figure 8, *Post-Treatment Well Locations*, page 29. Revise the text accordingly.

4. **Appendix C, Section 2.2, Calculating VOC Mass and Volume Removal, Page 5 of 10 through 7 of 10**

The densities used to calculate the volume for each VOC has not been adjusted per the temperature, and it is uncertain how this may impact the estimated volume of VOCs recovered. Densities of the VOCs have been calculated using density of water at 70 degrees Fahrenheit; however, the operating temperatures were significantly higher (approaching 200 degrees Fahrenheit), and hence the densities would have been lowered as a result. Therefore, the densities of the VOCs need to be adjusted to reflect the operating temperatures. To address this issue, revise the calculations for VOCs removed using appropriate density values reflecting the operating temperatures.

5. **Appendix C, Section 2.4, Conclusions and Recommendations, Page 9 of 10 and 10 of 10**

The total volume for VOC is provided as 24 gallons, but the individual VOC volumes have not been provided. While there is some value in providing a total VOC volume, individual VOC volumes provide more useful data. Also, a molar conversion of cis-1,2-Dichloroethylene and Vinyl Chloride to TCE might also provide a better metric for how equivalent mass of TCE was removed. To address this issue, calculate and present individual volumes for VOCs. It is recommended that consideration be given to the use of a molar conversion of DCE and VC to TCE to calculate an equivalent mass of TCE that was removed.

6. **Section 4.2.2, Volatile Organic Compounds Removed, page 76; and Appendix C, Section 2.2, Page 5 of 10, Section 2.4, Conclusions and Recommendations, Page 9 of 10**

The calculation for VOC mass removal from carbon vessels is described in the conclusions section in Appendix C, but it should instead be provided in a separate section before the conclusions. Additionally, loading concentrations from vapor carbon samples are mentioned but no details regarding these samples, such as when and how these samples were collected, are provided. Also, it is unclear how a single vapor carbon sample is representative of the carbon vessels, especially when they were connected in series (implying that the first vessel will have greater concentrations than the last vessel). Revise the D1 RACR to address this issue by providing additional details regarding the carbon samples.

