



ENERGY AND ENVIRONMENT CABINET

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Leonard K. Peters
Secretary

August 23, 2013

Ms. Rachel Blumenfeld
US Department of Energy
Portsmouth/Paducah Project Site Office
PO Box 1410
Paducah, Kentucky 42002

RE: Conditional Approval of the 100% Remedial Design Report *In Situ* Source Treatment Using Deep Soil Mixing for the Southwest Groundwater Plume Volatile Organic Compound Source at the C-747-C Oil Landfarm (Solid Waste Management Unit 1) (DOE/LX/07-1276&D2)
Paducah Gaseous Diffusion Plant
Paducah, McCracken County, Kentucky
KY8-890-008-982

Ms. Blumenfeld:

The Kentucky Division of Waste Management (Division) received the D2 *100% Remedial Design Report In Situ Source Treatment Using Deep Soil Mixing for the Southwest Groundwater Plume Volatile Organic Compound Source at the C-747-C Oil Landfarm (Solid Waste Management Unit 1)*, dated June 21, 2013. The Division is conditionally approving this document. Conditions are included as an attachment. Please address these conditions in a revised version of the document.

If you have any questions or require additional information, please contact Brian Begley of my staff at (502) 564-6716, or e-mail at brian.begley@ky.gov.

Sincerely,



April J. Webb, P.E., Manager
Hazardous Waste

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DWM File #1160-B; Graybar: ARM20110003 (SW Plume RDR – SWMU 1)

**Kentucky Division of Waste Management Comments Pertaining to the
100% Remedial Design Report *In Situ* Source Treatment Using Deep Soil Mixing for the
Southwest Groundwater Plume Volatile Organic Compound Source at the C-747-C Oil
Landfarm (Solid Waste Management Unit 1)
Paducah Gaseous Diffusion Plant Paducah, Paducah, Kentucky
(DOE/LX/07-1276&D1)**

August 23, 2013

General Conditions:

- 1) The D1 90% RDR KY General Comment # 6 was only partially addressed: “The Division supports the proposal presented during the May 15, 2013 SWMU 1 conference call to allow flexibility in determining step-out criteria that would warrant expanding the currently defined treatment area. The proposed flexibility allows for the interpretation of data so that anomalies and/or discrete zones of elevated VOC concentrations that were identified along the outermost-ring of LDA borings. Also being proposed was the intent to share data as it becomes available in order to discuss, collaborate, and decide if expansion of the treatment zone is warranted.

Specific language pertaining to step-out criteria/contingency borings was not found in the D2 100% RDR. DOE’s Response to the Division’s General Comment #6 stated in part “the project team will discuss the potential need to conduct step-out LDA borings based on the outermost ring results and the specific criteria that will be used for decision making protocol on an as-needed basis.” The Division conducted a ‘find’ search of the entire document for the following words: outermost ring, contingency, step-out, and decision making protocol. No text in the document was identified by the Division that captures the intent of conducting step-out borings, if necessary. The intent of the contingency borings was to expand the treatment area based on data collected from the outermost-ring. Please add text to the appropriate sections in the document to reflect this intent.

- 2) The D1 90% RDR KY General Comment # 10 was only partially addressed. The original comment requested: “For all SWMU 1 figures please add the following features in addition to what is already being depicted: any known underground utilities, MWs, the drainage ditch surrounding the unit, and the approximate boundary of landfarm plots.” None of the revised figures contained the approximate boundary of the landfarm plots. Most of the figures did not include MW 161 and none were labeled. Furthermore, the drainage ditches are also missing from nearly all the figures as well. Please modify at least one figure to include the information originally requested. In addition, please add the WAG27 trenching locations and WAG 23 removal action excavated plots to at least one of the SWMU 1 figures.

- 3) It is uncertain if the “approximate boundary of landfarm plots” accurately represents the area within SWMU 1 where oil landfarming occurred from 1973-1979. It is also uncertain if the current treatment zone encompasses the oil landfarm plots. One aerial photograph was provided to the division during the years of reported landfarm operation. The aerial photograph was dated December 1974 and appears to show a rectangular land scar to the east of where the “approximate boundary of landfarm plots” are depicted in SWMU 1 figures found in various other documents. DOE’s Response to KY General Comment #6 does not address the uncertainty associated with the boundaries of the oil landfarm plots. Absent from the D2 100% RDR figures is the depiction of the “approximate boundary of landfarm plots.” This feature was present in earlier versions of the RDR. The Division’s General Comment #6 (last sentence) stated that “step-out criteria will need to account for the uncertainty associated with the landfarm footprint and lack of analytical data (specifically below 10 ft bgs) northeast of the currently defined treatment zone.” DOE’s response merely stated “the SWMU 1 area has been characterized extensively in the 0-10 ft depth range.” DOE’s response did not mention the extremely high detection limits associated with the 0-10 ft depth range and the overall lack of data greater than 10 ft bgs. There was no mention that the WAG 23 PCB/Dioxin soil removal occurred primarily outside of and to the east of the area defined as the “approximate boundary of landfarm plots,” nor did it discuss the number of existing samples located within the footprint of the 1974 aerial photograph anomaly. DOE has not adequately addressed the 1974 aerial photograph, other than to speculate that the dark area could be a land-scar, a piece of equipment, or drums of oil staged for landfarming. DOE overlooked the fact that depressions were evident in an undated photo, along with a linear depression full of liquid. No historical documentation could be located by the Division, outlining how the oil was applied to the ground surface. It is possible that oil was placed in depressions in the staging area. The existence of the 1974 aerial photograph was unknown by the Division and EPA until one week prior to the submittal of Regulator Comments on the D1 90% RDR. DOE Contractors recently fulfilled the Divisions request to overlay the treatment area with historical WAG 27 trenching and the WAG 23 soil removal action. The newly acquired spatial information provide proof that the oil landfarm plots were larger than originally suspected and they do exist outside of the currently defined treatment area.

The level of uncertainty surrounding the location of landfarm plots and the potential for the existence of additional, and as yet undefined, TCE DNAPL contamination is unacceptable and must be addressed. This uncertainty could be addressed during future Soils Operable Unit RI 2 sampling or in the near term through the placement of several additional UCRS borings within the area depicted on the photo (the land-scar) and near the trenches where landfarming was confirmed. If DOE chooses to defer sampling until Soils Operable Unit RI 2 then the RDR must state that additional investigative work--in addition to sampling the disturbed surface soils--is to be performed to address the remaining uncertainty and that it will be performed as a part of RI 2 sampling. SWMU 1 would then need to be moved

from Soils OU RI 1 to Soils OU RI 2 and would be addressed under the Soils OU RI 2 Feasibility Study. This too would need to be made clear within the text of the RDR. If DOE were to choose to perform some limited UCRS sampling in the near-term to address the remaining uncertainty, then SWMU 1 could remain in Soils OU RI 1 with the disturbed surface soils being addressed as a part of the RI 1 Feasibility Study as currently stated in the RDR. The Division would work with DOE to insure that any near-term sampling could be performed in the most cost-effective manner possible. Please modify the text accordingly.

Specific Conditions:

1) **Page 1, 4th paragraph, last sentence:**

“Existing analytical data from the SWMU 1 source area is included on a CD as Appendix A.” The Division requested (KY General Comment #12 (D1)) that all SWMU 1 data be made available as an excel spreadsheet in the appendix section. After reviewing Appendix A in the D2 version of the document it appears that an abbreviated dataset for SWMU 1 was included. The intent behind the Division’s comment was for DOE to make available all of the soil data associated with SWMU 1. Please provide all relevant soil data for SMWU 1 in Appendix A.

2) **Page 3, 3rd paragraph, 2nd sentence:**

“Discussions on design optimization stemmed from resolution of the estimate of volatile organic contaminant mass and mass distribution,…” The tri-parties (KY, DOE and EPA) did not reach resolution on the estimate of volatile organic contaminant mass and mass distribution at SWMU 1. The Division’s Specific Comment #6 (D1) alludes to the differences in mass estimate calculations associated with SWMU 1. Different mass estimates are due in part to the following: varied field/analytical data sets; modeling software; statistical approach (nearest neighbor, kriging); confidence level; etc. The rationale behind including a mass estimate table (Table 3) was to capture the variables and parameters to support each mass estimate. In this regard it is difficult to see how ‘resolution of the estimate of volatile organic contaminant mass’ was ever reached. Furthermore, resolution on the mass distribution was also not reached. The SWMU 1 tri-party technical group did agree that LDA mixing with steam injection and zero-valent iron injections would address most uncertainties and shortcomings of the data available for delineation of mass distribution. Please reword the sentence. The sentence could be reworded to read as follows: “Discussions on design optimization stemmed from a willingness on the part of the FFA parties to consider alternative estimates of volatile organic contaminant mass and mass distribution.”

3) **Page 4, Remedy Time Frame, 1st sentence:**

There are over ninety words in this sentence. It is too long. Please revise this sentence/section. One suggestion would be to mention the remedy time frame information first and then provide the rationale and support.

4) **Page 4, Remedy Time Frame, 1st sentence:**

“... plus selected targeted boring in areas outside the 1,000 µg/kg contour ...” Please change the word ‘boring’ to ‘borings.’

5) **Page 4, Remedy Time Frame, 1st sentence:**

“... it is anticipated that the leaching of residual TCE for approximately 40 years ...” Please replace the word ‘anticipated’ with a technical description as to how the decrease in time was tabulated, specifically the leaching of residual VOCs impact to RGA groundwater.

6) **Page 5, Large Diameter Auger/Soil Mixing Area, 3rd bullet:**

“Two areas will have targeted borings that are placed in areas that contain apparent uncertainty based on isoconcentration configurations.” The explanation provided for targeting two additional areas does not fully convey the rationale for deploying these additional borings. It is assumed that “isoconcentration configurations” refers to the difference in confidence intervals used to calculate the estimated volume of TCE between 73 µg/kg and 1,000 µg/kg (50% confidence interval) versus the volume of estimated TCE greater than 1,000 µg/kg (90% confidence interval). The rationale for applying two different confidence intervals should be explained within the “Distribution of TCE Contamination in Soil at SWMU 1” section on page 4 (see previous comment). For this bullet, insert text to highlight the lack of control samples (greater than 10 ft bgs) necessary to adequately define the isoconcentration boundaries to the northwest and southeast of the suspected source area. This is the true justification for targeting these areas.

7) **Page 8, Section 1.3 Remedial Design Support Investigation, last paragraph, 3rd sentence:**

The reference to Table 3 containing sample results from borings should refer to Table 2, not Table 3. Please change.

8) **Page 15 thru 18, Table 2:**

Please add the appropriate units to the ‘Depth, ‘bgs’ and ‘Concentration’ columns. Please define the symbols and letters in the ‘Prefix’ and ‘Qual’ columns, respectively. Also define what a blank cell in each column represents.

9) **Page 23, Table 3:**

The following terms appear to be used interchangeably throughout this document: Kriging, nominal kriging, 50% Confidence Interval Kriging? Are all three of these terms meant to be interchangeable? Please clarify within the text what is meant by these various terms.

10) **Page 27, Figure 4, LDA Boring Layout, Notes Section:**

The first note indicates that ‘cross hatching in the LDA borings indicates spacing was manually adjusted in order to provide adequate coverage.’ Figure 4 does not currently contain any cross hatching. Please modify the figure to include cross hatching for the LDA borings that were manually adjusted.

11) **Page 27, Figure 4, LDA Boring Layout:**

It appears that a few borings are not optimally placed. By allowing slight modifications it is possible to reduce the number of overall LDA borings by 2. (1) Consider moving boring #34 to the east and reconfiguring #35 and #257 thru #259. This would allow for the removal of boring #260. (2) Consider moving boring #155 to the east/northeast so there is not so much overlap. Then evaluate the data from boring #'s 133, 154, 177 and 178 to see if the interstitial space warrants a boring or can be left alone. (3) Consider moving boring #245 and # 256 to the southeast and getting rid of #263. (4) Consider adjusting boring #179 to the southwest to reduce the amount of overlap with boring #180. (5) Consider adjusting boring #16 and #17 to the north/northeast and move boring #s 4, 5, and 6 more to the north. The Division understands that the LDA Boring Layout figure is governed by a set of criteria; however, this criterion appears to be creating a few areas where excessive overlap will occur. In these cases, the Division would like to see consideration given to the borings that could be adjusted to minimize excessive overlap in return for a layout that covers more area (see above considerations). If this is impracticable for other reasons then disregard.

12) **Page 31, Section 4.2 Critical Parameters, Percentage of Auger Boring Overlap, all 3 bullets:**

The square footage used to describe the area within each isoconcentration contour is not consistent with other sections and figures presented in the D2 RDR. Please modify as necessary.

13) **Page 33, Figure 5, Hydrogeologic Unit HU4/HU5 Interface:**

This figure is misleading because thirty-one of the soil borings depicted on this map only extend to 10 ft bgs. Since the purpose of this figure is to depict the HU4/HU5 interface, please include on the figure only those soil borings that extended to the HU4/HU5 interface.

14) Page 59, Section 6.2.1 Post-treatment Sampling and Analysis, last sentence:

“The delay is advantageous because contaminant concentrations may remain elevated until the guar carrier for the ZVI degrades, allowing the VOC contamination to be reduced by the ZVI.” The Division was not aware that the guar carrier could bind-up the ZVI for months. After conducting limited research on guar it appears that the concentration of guar is one of the major factors in determining how quickly it will degrade. Is there an industry standard for the application concentration rates for guar? Please consider adding text to describe the target concentration rate for applying guar along with an estimated timeframe for it to break down and expose the ZVI.

15) Page 60, Soil Sampling:

Eleven post-treatment soil sampling locations are proposed to be “representative of both the range of VOC contamination and the areal extent of the treated source zone.” During treatment more characterization data will be available and a more precise understanding of contaminant distribution will be available. The post-treatment soil sampling plan fails to utilize all of the data that will be collected during treatment. The Division would like some post-treatment sample locations to target not only areas where elevated VOCs were identified during the RDSI but also areas identified during soil mixing. Please consider the addition of a few contingency sample borings for this purpose.

16) Page 63, Section 6.2.3 Monitoring Well Construction and Sampling, 3rd sentence:

“Previous sampling and analysis of MW161 documents dissolved TCE levels between 1,000 and 2,000 µg/L since 2005.” A query of PEGASIS, the publicly accessible database for PGDP, revealed that since 2005 the lowest concentration detected in MW161 was 1,100 µg/L and the highest was 2,800 µg/L (collected on 05/14/2012). Please revise.

17) Page 63, Section 6.2.3 Monitoring Well Construction and Sampling:

Four monitoring wells are being proposed to continue the “assessment of future dissolved VOC levels in the area of the treated source.” Based on the proposed configuration of monitoring wells in Figure 9, it does not appear that the area to the west-northwest will be covered downgradient from the suspected source area. Furthermore, given the existence of co-mingled groundwater contamination in the area and the potential for changing gradients (due to plant shut down), it is arguably of limited use to attempt to monitor SWMU 1 using a traditional one up, three down approach. Please add language to this section which allows for greater flexibility for the placement of monitoring wells. Language should indicate that the FFA parties will convene prior to monitoring well installation in order to reach consensus on a well placement strategy.

18) **Page 64, Section 6.2.3 Monitoring Well Construction of RGA Monitoring Wells, 1st paragraph:**

“... until cleanup levels are met in the UCRS soils.” This sentence implies there will not be additional UCRS soil sampling events after the first post-treatment round in an effort to determine the effectiveness of the remedial action. Instead, DOE is proposing to monitor the effectiveness of the UCRS soil remedial action by trending VOC levels in three downgradient monitoring wells. The Division would like for final monitoring well placement to be deferred until analysis of the treatment data is evaluated. It appears to be premature to set monitoring well locations when detailed contaminant spatial information will be collected and made available upon completion of the SWMU 1 treatment. Kentucky believes it to be advantageous to wait for the data generated from treatment before finalizing the monitoring well locations. Furthermore, RGA groundwater flow paths in relation to SWMU 1 should also be considered. Please add text to the document to state finalization of the monitoring wells will occur once data generated from the treatment zone has been collected and following discussions with the Division and U.S. EPA.

**Radiation Health Branch Comments pertaining to the
100% Remedial Design Report *In Situ* Source Treatment Using Deep Soil Mixing for the
Southwest Groundwater Plume Volatile Organic Compound Source at the C-747-C Oil
Landfarm (Solid Waste Management Unit 1)
Paducah Gaseous Diffusion Plant Paducah, Paducah, Kentucky
(DOE/LX/07-1276&D1)**

August 21, 2013

General Conditions:

1. Additional research has revealed that the Remedial Investigation Report for WAG 27 reported significant contamination found in subsurface soils at the site. Most concerning was an area reporting a count rate 180 times the recorded background and excavated material containing nearly 300 pCi/g of enriched uranium. This data does not appear to be adequately addressed by this document. In fact, the document does not mention it at all and instead seems to imply that only oil was landfarmed. Please thoroughly discuss these historical findings and justify the completeness and protectiveness of the current remedial design in light of these findings.
2. In the document it is stated that VOCs/semi-volatiles/radionuclides do not exceed NALs in surface soils, yet surface soils are planned to be removed due to expected PCB contamination. Please add appropriate information concerning contaminants that may be found in the treatment area soils after the initial two-foot soil removal occurs.