UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 7
11201 Renner Boulevard
Lenexa, Kansas 66219

Mr. Paul V. Rosasco
Project Coordinator
Engineering Management Support, Inc.
25923 Gateway Drive
Golden, Colorado 80401

Dear Mr. Rosasco:

On July 31, 2023, Parsons submitted the Revised Excavation Plan for the West Lake Landfill Site on behalf of the West Lake Operable Unit 1 Respondents as required to fulfill Section 3.8 of the July 2022 Remedial Design Modified Statement of Work (SOW).

The U.S. Environmental Protection Agency has completed its review and identified deficiencies in the plan that must be addressed prior to approval. Much of the proposed optimized excavation appears to meet the requirements in the Operable Unit 1, 2018 Record of Decision Amendment. However, some of the EPA comments provided in our June 30, 2023 letter for the Estimate of Radioactivity Technical Memorandum were not adequately addressed, so additional information and explanation must be added to the report for the EPA to make a final determination. In addition, the EPA has identified significant inconsistencies in the approach to estimating the extent of RIM greater than 52.9 pCi/g in the southwest corner of the Closed Demolition Landfill, and the corresponding proposed optimized excavation is poorly supported. The EPA has enclosed specific comments with additional details.

Please revise this document in accordance with the enclosed comments. Section 5.6(b) of the SOW requires that the report be revised and re-submitted within 30 days of receipt of this letter. Please feel free to contact me with any questions or concerns by phone at (913) 551-7416 or by email at mahler.tom@epa.gov.

Sincerely,

THOMAS MAHLER Digitally signed by THOMAS MAHLER
Date: 2023.10.05 13:10:16 -05'00'

Tom Mahler
Remedial Project Manager
Remediation Branch
Superfund and Emergency Management Division

Enclosure:

cc: Ryan Seabaugh, Missouri Department of Natural Resources

40618441

Comments on 7/31/23 Design Investigation Evaluation Report

General Comment

The EPA has identified critical comments that must be resolved for the EPA to determine whether the Revised Excavation Plan meets the requirements of the Record of Decision and can be approved for the design of the OU-1 Remedy. Several of these critical comments describe information or additional explanation that must be added to the Revised Excavation Plan to document how the RIM modeling and the evaluations that establish the optimized excavation were performed.

(a) The EPA is particularly concerned with Appendix D of the REP and the proposed optimized excavation of the southwest corner of the Closed Demolition Landfill. Critical issues identified in this appendix include: (1) the use of 5-foot composite samples to estimate the 3D extent of RIM greater than 52.9 pCi/g and calculate the total activity between 0 and 16 feet, and (2) the approach to estimating the outer extent of RIM greater than 52.9 pCi/g. More than one addendum to the OU-1 Design Investigation Field Sampling Plan involved the collection of additional discrete samples from borings with composite samples longer than 2 feet that exceeded or were close to 52.9 pCi/g to ensure adequate data was available to model the RIM in those areas. It is not clear why additional samples from the borings with 5-foot composites were not proposed and collected if that data was intended to be used to estimate the RIM greater than 52.9 pCi/g in this area. In addition, the EPA provided several comments on the draft OU-1 Design Investigation Evaluation Report regarding the estimated extent of RIM greater than 52.9 pCi/g in the southwest corner of the CDL which have not yet been resolved. The draft REP appears to have incorporated this exact extent into Appendix D as a boundary condition for the thiessen polygon extent of RIM rather than using a model to estimate the outer extent of RIM greater than 52.9 pCi/g. The EPA is still reviewing the Confirmation Sampling Plan but may require additional confirmation samples to resolve this issue.

The EPA has also identified other inconsistencies or notable differences in Appendix D with what was done everywhere else at the site. These differences include the size and thickness of the polygons generally being significantly larger than the geostatistical model cell size and the exclusion of all soft (gamma) data from the estimation process and optimization. In particular, the thickness of the individual polygons is generally greater than the actual thickness of the RIM layers at many locations within the site as indicated by the data. This could result in significant overestimates of the RIM volume in polygons with samples that exceed 52.9 pCi/g. At the same time, thinner layers of RIM that may only be identified by a gamma peak could be incorrectly excluded from the estimate. As a result, a limited data set is being utilized to make concentration estimates in relatively large volumes (polygons). The EPA is concerned that the proposed approach unnecessarily increases the uncertainty of the estimations and calls into question the corresponding optimization.

(b) The EPA has also identified borings that have data indicating relatively high concentrations of RIM just below the proposed bottom extent of the optimized excavation, e.g., A1-SB-182 and A1-Th-088. The EPA believes these borings and others like these may provide the opportunity to improve the optimization, e.g., potentially dig less volume of relatively low concentration RIM between 12 and 16 feet within the larger excavation areas and replace by removing a small volume of high concentration RIM slightly deeper than what is proposed in Appendix C. The EPA notes the following text in Section 2 of Appendix C on page 3, "*Assume RIM >52.9 pCi/g at depths of 8 to 12 ft and/or 12 to 16 ft BDID that generally coincides with the 0- to 8-ft BDID*

excavation footprint will be excavated and disposed off-site." Such an assumption for the 12 to 16 ft BDID is allowable under the excavation criteria established in the RODA but may not result in the highest degree of optimization. While the RODA does not require this RIM to be excavated, it does encourage excavation of areas with higher concentrations to potentially reduce the total volume of landfill waste to be excavated. While improvements to the optimization may be possible, the RODA does not require a change to the proposed optimization based on this comment.

Specific Comments

1. **Main Text, Section 6.0, page 11.** The paragraph in this section states, "*Table 6.1 provides a summary of the estimated excavation volumes of RIM >52.9 pCi/g and overburden/non-RIM material/RIM <52.9 pCi/g. These volumes are slightly different than what was provided in Appendices A, B, and C and in Section 2 of this REP because of the adjustments made during development of the design drawings (e.g., incorporating layers of non-RIM waste material that are less than 2-ft thick and sandwiched between layers of RIM >52.9 pCi/g), as described in Section 5.*" Add additional text to this section and the note under Table 6.1 to clarify that non-RIM and RIM <52.9 pCi/g layers thinner than or equal to 2 feet were added to the RIM volumes and subtracted from the overburden volumes listed in Table 6.1, if that is what was done. In addition, add text explaining why these thin layers were incorporated as RIM volume, e.g., precision of excavation techniques.

2. **Appendix A, Page 5, Executive Summary.** Replace the first sentence of the second paragraph of the section titled, "*2023 Revisions to Incorporate Non-Zero Nugget per USEPA Recommendation and Settlement Revision*" with the following: "*The USEPA then provided feedback on February 21, 2023, via email that neither the updated empirical variograms nor those included in the December 2022 submittal support the selection of zero for the nugget parameter. USEPA's primary concerns include that the selection of a zero nugget is not scientifically defensible based on the data and the use of a zero-nugget value could inaccurately and significantly overestimate the extent of RIM >52.9 pCi/g.*"

   Because of the imprecise nature of drilling in a landfill, there is uncertainty in the exact collection location of sub-surface samples and core gamma, particularly with respect to the elevation. It is therefore reasonable for the actual RIM conditions in the landfill to differ from a given sample result at the estimated location. The selection of a non-zero nugget which is supported by the empirical variograms allows some of this uncertainty to be incorporated into the model predictions. Incorporating uncertainty into the model predictions is one of the primary reasons why indicator kriging was utilized as the model methodology for the design of this excavation. The IK* model with a non-zero nugget provides a systematic process to incorporate data input uncertainty into the estimates of the RIM conditions at each grid cell or node which are based on multiple sampling points in the general vicinity. Manually adjusting the nugget parameter to zero to force the model predictions to exactly agree with the imprecise input data is not scientifically defensible. However, the EPA acknowledges that the modeling output for the IK* model with a zero-nugget parameter can provide information that potentially supports the selection of confirmation sampling locations.

   In addition, for clarity, revise the first sentence of the last paragraph in this section as follows, "*The kriging estimator with a non-zero nugget value is an inexact interpolator in that the model estimates in areas where data are available do not always match the input data points.*"

3. **Appendix A, page 36, Section 4.1.1.1.** Delete the first sentence of the third paragraph in the subsection title, "*Ford Property and RC Samples*". While it may be likely that inclusion of the FP and RC samples in the model data set would not impact the results, this has not been demonstrated nor is such a demonstration relevant because the data is no longer reflective of current conditions as explained in the previous paragraphs.

4. **Appendix A, Section 4.3.1.1, pages 52 and 53.** Several statements and descriptions in this section are unclear.
   - **a.** The first paragraph in the section on page 52 states, "*This section describes the differences between the two variograms as well as specific instances where there is a difference between the model RIM extent and NEP.*" This statement is not clear because both the IK* model with a zero nugget and the IK* model with non-zero nugget provide modeled RIM extents based on Non-Exceedances Probabilities (NEP). It appears based on review of Figures 4.23 through 4.26 that this section is intended to present and discuss two topics. Figures 4.23 and 4.24 appear to be focused on depicting and supporting text discussions of borings with at least one input that correspond to a NEP less than 0.5 but is located outside of the IK* model with a non-zero nugget estimated extent of RIM within 0-20 ft below DI datum (BDID). Figures 4.25 and 4.26 appear to be focused on depicting the differences in the modeled extent of the RIM greater than 52.9 pCi/g between the zero and non-zero nugget variogram models within 0-16 ft. BDID, which is generally consistent with the title of the section. Revise the sentence for clarity. It would also be helpful if the remaining paragraphs of the section would indicate which of the two topics they are related to.
   - **b.** The second paragraph in the section on page 52 states the following with regard to Figures 4.25 and 4.26, "*The minimum NEP value is shown for each input boring location from 0-16 feet BDID for an evaluation of instances where the non-zero nugget model disagrees with the site data.*" This statement is confusing as it implies Figures 4.25 and 4.26 show/list the "*minimum NEP value*" for each input boring. However, based on review of these figures, it appears that the borings are categorized based on whether the minimum NEP value in each input boring is less than 0.5 or greater than 0.5. Revise to clarify.
   - **c.** The third paragraph in the section on page 52 states the following regarding borings/samples with NEPs greater than 0.5 within the IK* (non-zero nugget) model's extent of RIM greater than 52.9 pCi/g from 0-8 ft BDID. "*These locations are surface samples in which the RIM is below the sample therefore these are not actual discrepancies.*" It would have been ideal if a figure specifically showing the extent of RIM greater than 52.9 pCi/g in upper depths, e.g., 0-1 ft BDID, was included to demonstrate that these surface samples are not inconsistent with the modeled extent. However, the EPA will accept a text explanation. Please confirm that the intent of this sentence is to indicate that each instance of an input boring location depicted on figure 4.23a from the map showing 0-8 ft BDID with a minimum NEP greater than or equal to 0.5 but within the modeled extent of RIM is a surface sample with RIM predicted at some depth below it and thus is not an inconsistency. The EPA notes that the map depicting the extent of RIM greater than 52.9 pCi/g 8-12 ft BDID appears to show boring A1-SB-181 as having a minimum NEP greater than 0.5 but located inside the modeled RIM extent. Add text as necessary to acknowledge whether this is an inconsistency.
   - **d.** The first full paragraph on page 53 describes additional discrepancies which are listed in Table 4.8. The description of these discrepancies provided in the paragraph is unclear. Please clarify whether "*analytical sample discrepancies*" are instances of hard sample results which exceed 52.9 pCi/g but the NEP for the model cell where that sample is located is greater than 0.5. Similarly, clarify whether instances of hard sample results which are less than 52.9 pCi/g but

the NEP for the model cell where that is located is less than 0.5 would also be examples of these discrepancies. In addition, the following sentence describing an example is unclear, "*For example, an individual sample disagreement may exist in a sample yet the boring for that depth interval is not a disagreement.*" Revise the text to better describe the discrepancies included in table 4.8.

e. Comment 7 from the EPA's June 30th, 2023 letter regarding the Estimate of Radioactivity Technical Memorandum discusses data point disagreements with the model extent. This comment states, "*Ensure that all analytical sample results that exceed 52.9 pCi/g but are outside the 52.9 pCi/g extent of RIM estimated from the IK model are identified so that any significant discrepancies can be considered during the confirmation sampling program.*" Section 4.3.1.1 of Appendix A of the REP lists all the borings with such discrepancies but only provides a small subset of the analytical result discrepancies in Table 4.8. The EPA requests this table be expanded to include all the analytical result discrepancies, or a separate table be added to include the analytical results associated with the boring discrepancies listed in this section.

f. The last paragraph of this section states on page 53, "*… there may be some regions where data that indicate RIM > 52.9 pCi/g are not being estimated as RIM >52.9 by the non-zero nugget model. This is generally acceptable due to the inherent uncertainty associated with individual sample results.*" The text goes on to state that these locations will be used as areas to target during confirmation sampling. The EPA generally agrees with this conclusion. However, borings with analytical results that exceed 52.9 pCi/g within 0-8 ft BDID and that are isolated or separated from larger bodies of RIM greater than 52.9 pCi/g generally must be excavated to comply with the criteria in the OU-1 RODA. However, the EPA acknowledges that there is uncertainty in the elevation of hard samples inherent to the drilling method. As a result, RIM greater than 52.9 pCi/g that is close to but just above 8 ft BDID may be left behind as an isolated pocket with EPA approval. Because these examples are isolated from the larger excavation areas and likely represent very small amounts of activity, the EPA does consider it necessary to incorporate those isolated pockets into the activity balancing for optimization purposes. The EPA has provided additional comments related to these types of discrepancies from 0-8 ft BDID with our Appendix F comments on other excavation areas.

5. **Appendix A, pages 53-55, Section 4.3.1.2.** (a) The first bullet in the section on page 53 conflicts with the last two bullets on this page and the sentence above. Revise the first in the section as follows, "*Areas of elevated overland gamma, particularly above 250 uR/hr, <u>generally</u> spatially correspond with areas of estimates of RIM >52.9 pCi/g with an NEP <0.5 <u>with some exceptions which are identified in this section.</u>*" (b) Revise the second sentence in the paragraph below the first two bullets in Section 4.3.1.2 on page 53 as follows, "*Because incorporating the overland gamma survey data into the model would cause unintended and inaccurate model predictions, this data is being directly compared to the model predictions to identify evidence, if any, of additional shallow RIM greater than 52.9 pCi/g beyond the model predictions.*"

6. **Appendix A, page 57, Section 4.3.3.** (a) The fourth bullet in this section states that the Standard Deviation to Warrant Sampling (SDWS) exceedances were present in an estimated volume of 2.53 cubic yards. Add a statement to this bullet clarifying the percentage of the model domain volume this represents, or conversely add a sentence that states the percentage of the model domain volume that met the SDWS criteria. (b) Because there are locations within the Area 2 thorium model with standard deviations (SDs) between 0.13 and 0.15, add statements to the last two bullets of this page that clarify whether those locations had NEPs that were either less than 0.4 or greater

than 0.6. Further, clarify why the SDWS criteria was met in those areas where the SD exceeds 0.13, e.g., a higher SD threshold was selected and is appropriate for NEPs further from 0.5.

7. **Appendix A, IK Model Figures.** In comment 2.b.ii for the Extent of RIM Technical Memorandum, the EPA stated that figures should be included in the Revised Excavation Plan that depict lateral slices of model predictions that include contours showing two standard deviations around the IK RIM shell or regularly spaced NEPs on either side of the 0.5 NEP line. The EPA acknowledges that attachment 1B to Appendix A of the draft REP includes a response to that comment stating that "*elevation slices of the final model output with standard deviation values and contours of NEP for comparison*" have been included with the REP. However, it is still difficult to compare the uncertainty in the IK model to the OK model which includes figures summarizing extent and uncertainty over all depths. Therefore, some additional IK model uncertainty depictions are necessary. Figures 19 and 20 from Appendix B of the REP related to the activity model are similar to what should be added to the REP.

   Two figures must be added to the REP, one depicting the IK model uncertainty for Area 1 and the other depicting the IK model uncertainty for Area 2. These figures should reflect 1) uncertainty in the RIM shell related to kriging standard deviation, and 2) uncertainty in the RIM shell related to the NEP used to define RIM. For (1), the EPA recommends computing the minimum NEP over all depths (mNEP), calculating mNEP – 1.96*kriging SD and mNEP + 1.96*kriging SD (where the kriging SD is taken from the depth where the NEP is equal to mNEP), and drawing the 0.5 contour for both sides of the interval. This information is intended to characterize uncertainty in RIM extent related to uncertainty in the kriging predictions. For (2), the EPA recommends drawing both 0.25 and 0.75 contours on the map showing the minimum NEP over all depths. This information is intended to illustrate uncertainty in the RIM extent as it relates to uncertainty in the transformation of soft data to concentrations. As these approaches are recommendations, alternatives may be acceptable if requested and approved prior to resubmission of the REP. Depicting (1) and (2) on a figure for Area 1 and a separate figure depicting the same for Area 2 would satisfy this request. The EPA also recommends adding a third map which combines these two sources of uncertainty. To combine, the EPA recommends contouring the mNEP+1.96*KSD map at the 0.75 level, and the mNEP–1.96*KSD map at the 0.25 level to reflect both sources of uncertainty together. The EPA would like to further discuss this recommended third map with the modeling team.

8. **Appendix A, Figures 3.31 and 3.32.** The EPA previously provided comments that the stepwise nature of the Cumulative Distribution Functions (CDFs) should be depicted in figures as such. The EPA acknowledges that table 3.3 also describes the stepwise nature of the CDFs. Nevertheless, Figures 3.31 and 3.32 must be revised to accurately depict the CDFs as stepwise functions.

9. **Appendix B, OK Model Figures**. Neither Figures 19 and 20 from Appendix B, nor the Enclosure A uncertainty files, appear to show a two standard deviation band around the 52.9 pCi/g extent from the Activity Model. Comment 1.a. from the EPA's June 30, 2023 letter regarding the Estimate of Radioactivity Technical Memorandum discusses the need for additional figures depicting uncertainty information to be added to the Revised Excavation Plan to the extent practicable. Specifically, the comment states figures should be added that include a pair of bands or ribbons with "*contour lines representing where the prediction +/- 2 Kriging Standard Deviations is equivalent to the threshold*". The EPA acknowledges the discussion at the bottom of page 14 of Appendix B that explains why the two sigma bands around the 52.9 pCi/g extent were not included, but this explanation does not indicate adding these bands to the included figures would be impracticable. Therefore, this must be included in the Revised Excavation Plan for

transparency. The EPA notes that uncertainty is expected in all models and should not be seen as a detriment to the model itself. The EPA believes including this information on figures in Appendix B may be informative even if the depicted uncertainty is significantly larger than the 100 and 1,000 pCi/g concentrations.

10. **Appendix B, Section 2.** This section states that "*the bulk density value will have no effect on the optimization process because individual activity calculations will not change relative to each other.*" The EPA does not agree with this statement as written because of the potential for spatial bias in bulk density within the landfill and the corresponding uncertainty. This does not adequately resolve comment 8 from the EPA's comment letter on the Estimate of Activity Technical Memorandum. This sentence must be revised. The EPA would accept the following statement as a replacement, "*Assuming a constant value for bulk density across the site is reasonable, the nominal value used for activity calculations will have no impact on which areas are chosen as isolated pockets and deeper excavation, or how much deeper activity will need to be excavated to compensate for material being left in place.*"

11. **Appendix B, Section 4.2.** Some additional text is needed in this section to clarify how the activity estimates being compared between the IK* and OK models were determined. Further, additional discussion of the observed differences between the two models is also necessary.
    - **a.** Add text that clarifies the source of the IK model activity estimates and how they were determined. This text must clarify whether the IK model activity estimates are the OK model subset to the IK* RIM shell, with activity summed across this domain. If so, this clarification should acknowledge that the estimates are really the activity estimate of the two models combined, since activity cannot be estimated from the IK model alone.
    - **b.** Figures 19 and 20 in Appendix B show that the footprint for RIM greater than 52.9 pCi/g from the OK model is generally larger than the footprint from the IK* model, but the RIM shell in the OK model does not necessarily appear to be 24-25% larger in these figures, as indicated in Section 4.2. Additional text must be added to explain this difference. For example, the difference in extent shown in these figures could be provided to contrast with the difference in volume given in the text. The EPA suggests that text be added to acknowledge that the difference in volume may also be the result of differences between the two models estimated thickness of the RIM layers which cannot be observed on a flat map depicting lateral extent. It would also be useful to demonstrate this with a vertical cross section or at least make note in the text of some examples from the included vertical cross sections that may help demonstrate this.
    - **c.** Additional explanation is needed to justify the large difference in volumes beyond the statements in the first bullet at the top of page 15 and the bullet immediately under the Area 2 bullet on the same page. The EPA agrees that modeling a probability like what was done for the IK* model is not the same as what was done for the OK model and that differences in the two shells should be expected. However, the EPA anticipated that the OK model shell might be smaller in some areas and larger in others. Include text that discusses the potential reasons why the OK model shell tends to be larger more frequently. As described in part b of this comment, please discuss observations in the difference in volumes between the two models that can be observed from the cross-sections.
    - **d.** Please discuss the implications of the statement that the OK model's estimated volume of RIM greater than 52.9 pCi/g is 24-25% larger but only 3-9% greater in activity than the IK* model. For example, do the specific areas included in the OK model 52.9 shell but not the IK* RIM shell tend to show relatively lower concentrations compared to the areas included in both models? If so, please include an explanation stating that the areas of discrepancy between the

two models are likely attributable to lower concentrations of RIM. In the event that there are a small number of relative high activity concentrations included in the OK model but located outside of the IK* RIM shell, these should be identified so they can potentially be considered during confirmation sampling.

e. This section also includes a discussion of areas with high OK model uncertainty. The specific areas listed should be compared to sub-areas A through M and W through Z. At a minimum, add text that indicates whether the sub-areas overlap with any of the areas of high OK model uncertainty. This text could alternatively be added to Appendix C.

12. Appendix B, Section 4.3, page 16, Table 4.1. Comment 14 in the EPA's June 30, 2023 letter regarding the Estimate of Radioactivity Technical Memorandum discusses the importance of the inclusion of uncertainty estimates from kriging standard deviation for the activities listed in Table 4.1 in the Revised Excavation Plan. Specifically, this comment states, "*Expand the presentation of activity estimates in the Revised Excavation Plan by including uncertainty metrics.*" The response to this comment included in Attachment A of Appendix B states that additional figures and shapes were included in Enclosure A to improve the evaluation of uncertainty. However, this does not address the comment, and no uncertainty metrics for the activities listed in Table 4.1 were included. While these uncertainty metrics were important to evaluate whether the amount of uncertainty changes significantly with depth, it is even more important to evaluate the uncertainty associated with the optimized excavation areas (deeper excavations of relatively high activity RIM and isolated pockets that will remain in place) which are primarily being defined by the OK model rather than the IK* model. The EPA also provided a comment related to developing uncertainty metrics for those areas in our June 30, 2023 letter but provide additional feedback on that issue in our comments for Appendix C below. Therefore, the EPA is not requiring the previously requested uncertainty metrics for Table 4.1 be included in the revised REP, but is requiring the uncertainty metrics related to the optimized excavation areas be included per our comments on Appendix C.

13. Appendix C, Section 2.2, page 6, fifth bullet. The EPA has reviewed the boring log for A2-PB-145 associated with sub-area L and M. The EPA notes that a sample from 5-5.5 feet indicates combined thorium at 69.4 pCi/g, and the previously collected composite sample from 5-10 feet BDID indicates combined thorium at 74.8 pCi/g. Combined thorium is also present in this boring at 346 pCi/g from 10-10.5 feet BDID. The EPA acknowledges that the IK* model with a non-zero nugget did not identify any RIM greater than 52.9 pCi/g between 0-8 feet BDID. However, because the boring and samples indicate otherwise, the EPA does not consider this particular area an isolated pocket that would meet the criteria described in the RODA. Given that this appears to be an isolated area, it may be acceptable to add this to Appendix F as an "Other Excavation Area" and collect additional samples as part of confirmation sampling to finalize the estimated extent of RIM in this location like what has been proposed in other locations.

14. Appendix C, Figures. The figures that depict the individual sub-areas with RIM greater than 52.9 pCi/g that will either be left in place or excavated to offset activity that will remain between 8 and 16 feet BDID include a table with the estimated activity associated with each sub-area. Comment 12 from the EPA's June 30, 2023 letter discusses the need for additional uncertainty analysis using kriging standard deviation informed by the optimization. Specifically, the comment states, "*Since the purpose of the OK model is primarily to support the optimization process which will involve evaluating potential isolated pockets of RIM between 8 and 12 feet below the 2005 ground surface and higher activity areas within larger excavations between 12 and 20 feet below the 2005 ground surface, uncertainty should be specifically evaluated for these areas.*" The comment goes on to provide an example of information that would support such an evaluation which states, "...

showing the uncertainty around the activity estimates with these areas of interest for optimization would also be useful." The response to this comment included in Attachment A of Appendix B indicates that additional information was included with the Enclosure A files. However, none of this information provides uncertainty analysis of the individual sub-areas presented in Appendix C of the REP using kriging standard deviation. Therefore, activity uncertainty must be added or depicted in some way on these figures in the Revised Excavation Plan. For example, a column for total uncertainty in the activity estimate could be added to the tables provided in Figures 2.2d, 2.3a, 2.3b, 2.6e, 2.7a, and 2.7b. One method to describe this total uncertainty would be to list the activity interval defined by calculating the lower and upper endpoints of concentration within each model cell using the predicted activity +/- 1.96*KSD_A and sum concentration endpoints multiplied by grid cell volume over the grid cells in the sub-area. Alternatively, or in addition, provide a table that includes concentration and kriging standard deviation for each of the sub-areas A through M and W through Z on a cell-by-cell basis. The table will need to separate cells by sub-area or provide some identification of the sub-area that each cell is within.

15. **Appendix C, 3D model depictions.** The EPA expected based on the comments provided in our June 30, 2023 comment letter for the Estimate of Radioactivity Technical Memorandum that 3D information depicting the locations of importance for the optimized excavation, e.g., the sub-areas presented in Appendix C, would have been added to at least one 3D file provided with the REP. The EPA is able to estimate the general location of some of these sub-areas in the existing 3D files, which is helpful to view the overburden volume specific to the sub-areas. However, in the case of sub-area B, it does not appear to be feasible to readily identify that excavation area with the 3D files provided. Therefore, the EPA recommends a file similar to "Encl 1 C.1 - Geostatistical model.ctws" provided with Appendix A be included with the Revised REP. The EPA believes it is more important to develop the uncertainty metrics described in the previous comment and is not requiring this file to be included with the revised REP. However, such a file must be submitted with the 90% RD for documentation purposes and to increase transparency. In addition, the existing webscene uncertainty files have layers labeled 'min' and 'max' which are misleading considering the layers appear to represent only +/- 1 or 2 SDs. The EPA recommends revising these layer titles to 'lower' and 'upper' or something equivalent. At a minimum, the associated pdf/readme file must address this issue if no changes are made to the layer labels.

16. **Appendix D, Section 1.1, page 1, placeholder.** This paragraph states, "*This evaluation assumes that the RODA excavation requirements for Areas 1 and 2 also apply to the Closed Demolition Landfill (CDL).*" The RODA applies to any portion of the site with RIM, and the EPA agrees the excavation requirements must be applied here.

17. **Appendix D, Section 1.3, page 2, second paragraph.** This paragraph states, "*... the 52.9 pCi/g boundary was placed between borings with RIM >52.9 pCi/g and borings without RIM exceeding 52.9 pCi/g at depths less than 20 ft below DI datum.*" The EPA has previously provided comments on similar statements made in the draft DIER. This statement is inaccurate and does not reasonably describe how the lateral extent of RIM >52.9 pCi/g was defined for this excavation area. For example, there is no boring between CD-EA-199-C and CD-EA-199-B to justify the proposed extents of RIM between these borings. Similarly, there are no borings between CD-EA-200-D and CD-EA-176 to justify the proposed extent between those borings. In addition, the estimated extent of RIM greater than 52.9 pCi/g was placed in many instances very close to borings that had RIM greater than 52.9 pCi/g, e.g., CD-EA-175-A and CD-EA-208. The EPA acknowledges that this paragraph also states confirmation borings will be performed in this area to further refine the lateral extent of RIM >52.9 pCi/g of the excavation. The EPA expects a higher number of samples

and/or closer spacings between confirmation borings may be necessary in this area. However, the inaccurate statement listed above must be revised to include a summary of the basis for the extent of RIM included with Appendix D. It is the EPA's understanding that this extent was estimated based on a combination of factors including the development of a specific conceptual site model for this excavation area, a historical aerial photo analysis, and evaluation of available data. Also, ensure that the revisions to this paragraph will be consistent with revisions made to the DIER on this same topic in response to the EPA's previous comments.

18. **Appendix D, Section 1.5, page 3, first bullet.** The bullet states, "*for CD-EA-200-A, recovery was only 20% for the 12 to 16 ft sample, and the grab sample in that interval was less than 7.9 pCi/g for combined radium and combined thorium; however, the result for the 16 to 20 ft sample was >52.9 pCi/g.*" However, Figure 3.17 depicts the polygon represented by CD-EA-200-A as having RIM in both 12-16 and 16-20. This discrepancy should be explained and/or figure 3.17 should be corrected.

19. **Appendix D, Section 1.5, page 3, last paragraph.** (a) This paragraph states, "*These layer thicknesses were developed based on considerations such as quantity of data available and potential excavation depths within the CDL.*" This statement is not clear in particular with regard to a potential relationship between the excavation depths within the CDL and selected layer thickness. The EPA is not aware of any such considerations for the development of the cell size for the geostatistical models used everywhere else at the site. In addition, while the paragraph does not provide any description of how the quantity of data available impacted the selection of the layer thickness, the EPA is concerned that the downhole and core gamma data were excluded from Appendix D and the optimized excavation in this area. This statement must either be revised to explain how the available data and excavation depths in the CDL were used to select the layer thickness or be deleted. (b) This paragraph also states, "*To adequately represent potentially excavatable materials, a 2-ft thickness was assigned to each layer within the top 20 ft of the DI datum. This 2-ft thickness is also appropriate given the excavation requirements discussed in Section 1.2.*" The EPA believes the 2-ft thickness selected for development of the optimized excavation in this area could lead to significant overestimates of RIM volumes and activities in individual polygons determined to have RIM greater than 52.9 pCi/g or completely miss layers of RIM that are relatively thin and/or may only be identifiable via gamma data. In addition, no explanation or justification is provided to support the appropriateness of the 2-ft thickness with regard to the excavation requirements in the RODA. The layer thickness must be reduced to 0.5 feet unless sufficient data is not available, in which case the EPA would accept a 1-foot thickness.

20. **Appendix D, Section 2.2, page 4, last paragraph.** This paragraph states that discrete and composite samples were assigned to one or more layers based on depths and that if a sample fell with multiple layers, the sample was assigned to each of those layers. Specifically, the paragraph states, "*a composite sample from 0 to 5 ft would be assigned to Layers 1, 2, and 3*". The use of 4 or 5 ft. composites to delineate RIM greater than 52.9 pCi/g in layers proposed in Appendix D that are half that thickness is not appropriate. Section 3.2.4 of Appendix A of the REP states, "*The procedure for samples with intervals >2 feet included combining aliquots samples from different intervals within a core run. This methodology includes potential for dilution of material of high activity concentration with material of lower activity.*" For this and other reasons, composite samples with intervals greater than 2 ft. were eliminated as inputs to the geostatistical models and replaced with either additional grab samples or gamma data. In addition, the method of assignment of composite samples to individual layers is inconsistent with how composites (with sampling intervals less than 2 ft.) were utilized as inputs for the geostatistical models. Composites with

sampling intervals greater than 2 ft. must be removed as inputs for developing the optimized excavation in Appendix D. In general, gamma data should be used in place of composites. However, composite samples with sampling intervals less than or equal to 2 ft. may be utilized if the depth assignment of the concentration is consistent with what was done for composite samples utilized in the geostatistical models.

21. **Appendix D, Section 2.3, page 5, General Comment.** For increased clarity, specify whether the sample depth interval established for grab samples was used to establish the 'sample length' (e.g., grab sample CD-EA-191-A-0.5-1 would be assigned a sample length of 0.5 feet). In addition, please clarify whether any samples included in this calculation applied to overlapping intervals (e.g., a grab sample within the same depth interval as a composite). If so, it appears an adjustment to the weights is necessary to ensure the weights do not sum to greater than one (e.g., divide by the sum of the weights) since this would overestimate the LWA.

22. **Appendix D, Section 2.3, page 5, last paragraph.** This paragraph states that three borings had areas of no recovery within the top 16 ft of the DI datum which resulted in no or limited (composite only) available data in particular layers. It further states that since no elevated downhole gamma peaks existed in the missing intervals, the analytical concentrations from above and below the area of no recover were averaged, and the calculated average concentration values were assigned to the missing interval. The EPA has multiple concerns with this approach. One of the primary reasons for conducting modeling for the optimized excavation was to provide a systematic method to predict the concentrations of RIM between data points and to avoid arbitrary assignments of RIM concentrations between known data points. The EPA acknowledges that estimating concentrations within data gaps by averaging samples immediately above and below is a systematic process, but one which is significantly less sophisticated than what was conducted everywhere else at the site. Further, because the data collection process for the borings being utilized in this excavation area was established without this specific use of the data being known, samples were not regularly spaced or standardized so that the vertical span of these averages could be controlled or minimized. In addition, "*elevated downhole gamma peaks*" have not been defined in this section, so it is not clear whether this statement supports the decision for certain layers in CD-EA-175-A, CD-EA-200-A, and CD-EA-200-C. Regardless, to avoid creating a new method for evaluating gamma data with respect to concentrations of combined radium and combined thorium and to significantly increase the data available to design the optimized excavation in this area, available core gamma and downhole gamma data should be converted to radium and thorium concentrations using the regressions established for the ordinary kriging model. These soft data inputs should be utilized in a manner generally consistent with the data prioritizations established for the geostatistical models. The EPA is willing to consider alternative data prioritizations specific to this area with supporting justification.

23. **Appendix D, Section 4.1, page 16, second paragraph.** Revise this paragraph to be consistent with text changes made to Section 2 of Appendix B related to EPA comments on the statements that describe the effect of bulk density on the optimized excavation.

24. **Appendix D, Section 4.3, page 16, general comment.** This section appears to describe the equations that will be used to determine whether the optimized excavation will meet the RODA requirements rather than the approach to optimization as the title of the section indicates. The EPA notes that Section 2 of Appendix C of the REP provides this type of information for the optimized excavation elsewhere at the site. This section must be expanded to include additional information regarding any assumptions and/or descriptions of the actual approaches to selecting areas between

8 and 16 ft BDID to leave in place and areas between 16 and 20 ft BDID to excavate to make up that activity.

25. **Appendix D, Section 5.0, General Comment.** Given the significance of the other comments the EPA has provided on this appendix, the optimization of the excavation must be reevaluated after implementing any required changes to the approach to estimating the extent of RIM greater than 52.9 pCi/g. The EPA expects this section to be updated with the revised Appendix D consistent with the new optimized excavation in this area.

26. **Appendix D, Figure 1.2.** No description is included in the text to explain how the extent of RIM was estimated around CD-EA-199-B, why a circular area was chosen and how the radius of the circle was established. Add this information to the appropriate section of Appendix D.

27. **Appendix E, general comment.** More discussion on bulk density uncertainty is warranted. Based on the range of bulk density measurements presented in Appendix E, the activity estimate for any single cell could vary by up to +/- 30%. If a spatial relationship exists, it is possible that bulk density could be systematically larger or smaller in isolated pockets, in which case the optimized excavation based on the activity balancing could result in the removal of insufficient activity or result in a larger than necessary excavation volume. A similar uncertainty exists for the areas of deeper excavation of higher activity RIM. This source of uncertainty must be acknowledged in the text.

28. **Appendix E, page 1, first paragraph.** Revise the second sentence as follows, "*This evaluation demonstrates that the estimated **average** dry bulk density of waste **and soil material** at the West Lake Landfill Superfund Site is 1.47 grams per cubic centimeter (g/cm^3) (91.9 pounds per cubic foot [pcf]).*" The bolded words identify the changes to the statement.

29. **Appendix F and/or Section 4 of the main text, General Comment.**
    a. Appendix F must include additional information on the methods used to compute the numeric values in Table 1. Appendix F does not include any text other than what is included in Table 1 and the associated figures. The EPA acknowledges that Section 4 of the REP main text states: *"The depth and lateral extents of RIM >52.9 pCi/g at each boring location were estimated by identifying deeper samples and surrounding borings where RIM >52.9 pCi/g was not identified. Appendix F includes a summary table of delineation assumptions and thicknesses and volumes of both overburden and RIM > 52.9 pCi/g."* Neither this text nor the table in Appendix F provide enough information to document how the other excavation area extents were estimated. This information is particularly important for the four out of seven other excavation areas for which Table 1 states, "*Additional sampling to be performed to complete delineation of RIM > 52.9 pCi/g*".

    b. The lists of borings in Table 1 that were used to partially estimate the extent of the other excavation areas do not include any depth information. The EPA acknowledges that the figures depicting the individual excavation areas do identify the depths where RIM greater than 52.9 pCi/g was identified in the boring that triggers the need for excavation. However, no information is provided with regard to the depth of available samples in bounding borings. This information is necessary to document that sufficient data is available in those borings to delineate the extent of RIM greater than 52.9 pCi/g. Text must also be added to clarify how the excavation extents for RIM greater than 52.9 pCi/g in CDL-1, Lot-2A1, and Lot-2A2 will be

finalized given that the figures indicate the proposed boundaries are "*approximate*" but no additional sampling is being proposed to delineate those areas.

c. Missing from Section 4 and Appendix F is any explanation about why the IK* and OK models were not used to delineate the extent of RIM greater than 52.9 pCi/g in these locations given that all of these areas were within the model domain and the corresponding borings/samples were used as inputs to the model. It appears based on review of model output figures included in Appendix A and B of the REP that several of these areas were not identified as likely to exceed 52.9 pCi/g even though at least one sample in that area does contain RIM greater than 52.9 pCi/g. The EPA also notes, as expected, that the IK* model output with a zero nugget parameter does identify these areas as likely exceeding 52.9 pCi/g with the possible exception of CDL-1. Add an explanation to either Section 4 or Appendix F about why the modeling tools could not be or were not used to estimate the 52.9 pCi/g excavation extents in these areas.

d. The EPA recommends that the IK* modeling output with a zero-nugget parameter be utilized, where appropriate, to help explain and document the proposed excavation extents for the RIM greater than 52.9 pCi/g of the other excavation areas and why existing data rather than modeling was used to define those locations. In any case, the EPA expects the future proposals for additional sampling to finish the delineation of those areas will include consideration of the IK* model with a zero nugget as a tool to help guide additional sampling locations.

e. The EPA identified additional borings that have analytical results showing RIM greater than 52.9 pCi/g between 0-8 feet BDID that are outside the IK* RIM shell, as discussed in comments above for Section 4.3.1.1 of Appendix A. For example, boring A1-SB-066 has a combined thorium result of 378 pCi/g from 4.3 to 4.8 BDID and A2-TH-117 has a combined thorium result of 339 pCi/g from 0.3 to 0.8 feet BDID. The EPA expects the response to comments provided for Section 4.3.1.1 of Appendix A will result in a table that can be used to identify borings which have RIM that exceeds 52.9 pCi/g between 0-8 feet BDID that are outside the IK* model RIM shell. The borings on this list that are isolated and generally outside the larger excavation areas should be added as "other excavation areas" to Appendix F to comply with the excavation requirements in the RODA unless an acceptable justification can be made as to why this RIM should remain in place. As described in part d of this comment, the non-zero nugget model may be a useful tool for estimating the extent of RIM in these locations.

f. The last sentence in the second paragraph of Section 4 is not acceptable as written. The EPA agrees that occurrence of RIM greater than 52.9 pCi/g that is less than 8 ft below the DI datum will not affect the optimization of the excavation. However, RIM greater than 52.9 pCi/g which has been identified from Design Investigation data or that modeling indicates is outside of the previously estimated Area 1 and Area 2 boundaries is subject to the same optimization requirements as the RIM greater than 52.9 pCi/g inside the previously estimated Area 1 and Area 2 boundaries, with the exception of the portions of the Buffer zone that are not utilized to build the Area 2 cover and Lot 2A2. It is appropriate for the REP to acknowledge that the RIM greater than 52.9 pCi/g less than 8 ft below the DI datum will not affect the optimization. However, RIM which is outside of the Buffer Zone and Lot 2A2 and is between 8 and 16 ft below the DI datum must be incorporated into the optimization unless it can be demonstrated that these areas are so small and represent such a small portion of the total activity that they collectively would have no significant impact on the optimization of the excavation. The EPA

notes that the RIM greater than 52.9 pCi/g in the southwest corner of the CDL must include optimization and would not be considered insignificant.