



**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 September 11, 2020, Parsons submitted revised versions of the Design Investigation Workplan (DIWP), the Field Sampling Plan (FSP), the Quality Assurance Project Plan (QAPP), and the Data Management Plan (DMP). These documents are required pursuant to Sections 3.6(a), 5.7(a), 5.7(d), and 5.7(e) of the May 6, 2019, Remedial Design Statement of Work (SOW) Operable Unit (OU)-1, West Lake Landfill Superfund Site. Implementation of these work plans will provide substantial additional information necessary to design the remedy selected in the September 27, 2018 Record of Decision Amendment.

The U.S. Environmental Protection Agency is approving with modifications the DIWP, FSP and QAPP in accordance with Section 5.6(b) of the Remedial Design Statement of Work, or RD SOW, dated May 6, 2019. The EPA is approving the DMP. Please modify the DIWP, FSP and QAPP as specified in Enclosure A and resubmit to the EPA within 14 days of receipt of this letter.

Appendix E of the DIWP is entitled Updates and Future Geostatistical Processes and Modeling and includes work not directly related to implementation of the design investigation. The EPA has comments on future model development that are included as Enclosure B. It is not necessary to make changes in Appendix E or provide a response to these comments. These comments describe the EPA's expectations with respect to future model development. They are included for your consideration and to facilitate continued coordination as the Respondents move forward with development of the geostatistical models.

Please feel free to contact me with any questions or concerns by phone at (913) 551-7141 or by email at jump.chris@epa.gov.

Sincerely,

Christine R. Jump
Remedial Project Manager
Site Remediation Branch
Superfund and Emergency Management Division



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Enclosures:

A-Modifications to the DIWP, FSP and QAPP

B-Comments on Future Model Development

cc: Ryan Seabaugh, Missouri Department of Natural Resources

Enclosure A
Design Investigation Workplan Modifications

1. **Section 2.2.1, page 2-2, first paragraph of the section.** Modify the third and fourth sentences by replacing with the following, *“There have been changes to the ground surface since the time that past samples were collected which create uncertainty in the accuracy of the previously measured sample depths. In addition, no ground surface survey was performed on OU-1 from the 2005-time frame. The absence of a ground survey further adds uncertainty to the accuracy of the currently assigned hard and soft sample depths in the existing geostatistical model. This DIWP describes procedures that reduce this uncertainty (to the extent practical) through standardizing the depth (and elevations) of all hard and soft data (both existing and new). In order to understand how the standardization will be conducted it is important to detail what changes to the surface have or may have occurred.”*
2. **Section 2.2.1, page 2-2, bullets that follow the first paragraph.** Modify this paragraph by adding the following bullet to this list, *“Because Areas 1 and 2 are landfills, subsidence may have a occurred due to differential settlement as part of the natural breakdown of wastes and/or as a result of the placement of either the inert fill or the NCC described in the bullets above. However, due to the age of the waste in Areas 1 and 2 at the time of installation of the borings, natural subsidence since the borings were installed is not expected to be significant.”*
3. **Section 2.2.1, page 2-2, last paragraph.** Modify the third sentence by replacing the sentence as follows, *“Coring at the Site was previously performed with runs of varying lengths and were often 10-foot or greater. Waste materials preventing representative recovery of soils were sometimes encountered in certain borings that could affect the entire run. As a result, elevation uncertainty is introduced through the entire run for the core collected from these borings.”*
4. **Section 2.2.1, page 2-3, last paragraph.** Modify the first sentence by deleting the words, *“from the 2005 surveyed ground surface to the 2020 surveyed ground surface”*. EPA is not aware of the availability of any 2005 ground surveys. In addition, EPA agrees the results of the DI should be used to determine whether elevation corrections are needed for historical hard and soft data. However, these corrections should be made to the elevations measured at the time of data collection, e.g. from between 1993-1997 and 2013-2015, not to the previous elevation adjustments which were applied to historical data based on an estimate of the 2005 surface.
5. **Section 2.2.1, page 2-3, last paragraph.** Modify the second sentence by deleting the words, *“were measured against historical 2005 surface elevation and”*. Corrections to historical sampling elevations due to settlement, if needed, should be made from the original measured elevation.
6. **Section 2.2.1, page 2-4, first paragraph.** Modify the sentence at the top of page 2-4 by replacing *“...ground surface is used...”* to *“...ground surface was used...”*, and add the following sentence: *“Further evaluation of the modeling methodology will occur during and after the completion of the DI including the selection of datum and model limits.”*

7. **Section 2.2.2.4, page 2-5, item number 4.** Modify item 4 by adding the following words to the end of the item, *“and the elevation data collected at the time of sample collection.”*
8. **Section 3.2.1.1, page 3-7, second paragraph, last sentence:** Modify the sentence by replacing the word *“confirming”* with *“investigating”*.
9. **Section 3.2.1.1, page 3-7, fourth paragraph, last sentence:** Modify the sentence to state, *“...gridded borings, but will be drilled and sampled through the base of waste as per the procedures...”*
10. **Section 3.2.1.1, page 3-8, third paragraph on page, first sentence:** Delete *“per 20 samples”* and replace with *“per boring”*.
11. **Section 3.2.2.1, top of page 3-11:** Modify the partial sentence at the top of p. 3-11 by replacing *“0 to 16 feet B2005GS”* with *“0 to 20 feet B2005GS”*.
12. **Section 3.2.4.2, page 3-14, second paragraph, second sentence:** Delete, *“a subset of these units/samples”*.
13. **Section 3.2.4.2, page 3-15, second paragraph, second sentence:** Delete the sentence that states, *“In the event that “reworking” or the urban land soils results in significant variability or elevated concentrations samples collected from the “urban land” complexes may not be considered during the calculation of a background concentration.”* The statistical process outlined in the QAPP and FSP will be used to make this determination.
14. **Section 3.2.4.2, page 3-15, third full paragraph:** Modify the second sentence of the third full paragraph by replacing the word *“fourteen”* with *“fifteen”* to be consistent with Figure 12 of the DIWP.
15. **Section 3.2.4.2, page 3-15, fourth full paragraph:** Modify the third sentence by changing the number 4 to 3 to be consistent with Figure 12 of the DIWP.

Appendix A – Field Sampling Plan Modifications

16. **Section 2.2.2.2, page 2-11, last sentence:** Modify the sentence by changing the reference from Section 2.4.1.7 to Section 2.4.1.8.
17. **Section 2.4.2.1 and 2.4.2.2, pages 2-23 and 2-24, Tables:** The last two column headings in each table include a (1) designation as if there should be a footnote but there is no note or explanation. Modify these tables by adding the appropriate footnote or removing the (1).
18. **Section 2.4.3.1, page 2-29, Enclosure A borings (“ISL” and “CD” Prefixes):** Modify this section by adding the following paragraph to the end of this subsection:
A duplicate composite sample will be collected from each Enclosure A boring proposed within the waste mass in accordance with Section 2.4.3.5 below. If laboratory analysis of

the duplicate composite exceeds the acceptance criteria (discussed in WS 11 of the QAPP), the Enclosure A boring will be re-logged and sampled in 1-foot intervals.

- 19. Section 2.4.3.1, page 2-29, Perimeter Borings Outside Waste Mass (“PB” Prefix):** Modify the first sentence under this heading to read, *“Borings proposed for the collection of geotechnical data outside the waste extent will be installed to 25 feet BGS. Laboratory analytical samples will be collected from intervals exhibiting an elevated radiological response >20,000 cpm during core scanning.”*
- 20. Section 2.9, page 2-54.** Modify this section by deleting, *“Generally waste will be managed in a manner consistent with historical site operations as described in the Revised Work Plan for Additional Characterization of Extent of Radiologically-Impacted Material in Areas 1 and 2 (EMSI 2015) for solids and consistent with the Core Sampling (Phase 1B, 1C, and 2) Work Plan-Revision 1 (FEI 2014) for liquids.”* and replace with the IDW management language submitted to EPA via email on September 24, 2020.

Appendix B – Quality Assurance Project Plan Modifications

- 21. QAPP, Worksheet 11, Step 4, page 24, first paragraph after the bullets.** Modify the first paragraph by adding the following sentence at the beginning, *“The boundaries listed above provide the most current estimate of the Area 1 and Area 2 boundaries. The investigation proposed in the DIWP and presented in this QAPP for the perimeter borings will provide data to confirm boundaries for the RD.”* In addition, delete the word “but” from the second sentence.
- 22. QAPP, Worksheet 11, Step 4, page 25, second paragraph in PSQ-2.** Modify the paragraph by deleting the sentence that begins with, *“These units are located on or adjacent to the Bridgeton Landfill property...”* This statement no longer appears to be accurate given that some of the background reference areas are located further from Bridgeton Landfill property.
- 23. QAPP, Worksheet 11, Step 6, page 29, second paragraph.** This paragraph states that for calculation of total activity uncertainty, *“total uncertainty is the summation of individual uncertainties”*. This is only accurate if the uncertainties represent variances and the measurements are independent. However, the first paragraph states that the radionuclide specific uncertainty *“is calculated at the 95% confidence level (1.96-sigma)”* (underlined for emphasis) indicating that the uncertainties will be derived from the standard deviation. In addition, since individual radium isotopes (e.g. Ra-226 and Ra-228) and individual thorium isotopes (e.g. Th-230 and Th-232) may be correlated, the QAPP must consider this in the propagation of uncertainty for combined radium and combined thorium to be considered for making decisions related to PSQ-1 F. Therefore, modify the second to last sentence in this paragraph as follows, *“For the calculation of combined radium, uncertainty will be calculated for the sum of two variables that may not be independent, e.g. $1.96\sqrt{\sigma_x^2 + \sigma_y^2 + \sigma_{xy}}$, where Ra-226 and Ra-228 are represented by x and y, respectively. The covariance term σ_{xy} will be computed given the current data set. The same calculation will be performed for combined thorium (Th-230 and Th-232).”*

- 24. QAPP, Worksheet 11, Step 6, page 29, second paragraph.** Modify the last sentence as follows, *“For comparison against Action Levels and for purposes of Remedy Design and total activity determination, the concentrations of combined radium and combined thorium calculated from individual isotope results from lab samples are accepted as true values when the individual analyses meet the measurement performance criteria specified in Worksheet 12.”*
- 25. QAPP, Worksheet 11, Step 6, pages 29, last paragraph.** Modify the paragraph by deleting the sentence that states, *“The prediction holds for radioactive concentrations above the detection sensitivity of the instrument, which based on Table 6.4 of NUREG-1507 is assumed to be at least as low as 2.8 pCi/g Ra-226.”* EPA acknowledges as stated in Section 4.3 in Appendix E that this value was used as *“the starting point for estimating a reasonable detection limit for thorium”*. However, the specific assumptions, survey procedures, and geometries described in NUREG-1507 that lead to the 2.8 pCi/g detection sensitivity for Ra-226 are not equivalent to the procedures described in the FSP or used previously at the Site. Therefore, EPA cannot approve language that draws site-specific conclusions about gamma detection sensitivity based on information presented in NUREG-1507 without further site-specific demonstration and evaluation.
- 26. QAPP, Worksheet 11, Step 6, page 30, first paragraph.** Modify the first full sentence on this page by adding the words, *“expected to be”* between the words *“instrument”* and *“used”*. This change is needed due to the general nature of this statement and the fact that there are four types of gamma field data that are currently considered for use in the model.
- 27. QAPP, Worksheet 11, Step 6, page 30, item 1.** Modify item 1 by adding the following sentence after the first sentence, *“It is acknowledged that if the standard error of the regression is pragmatically adjusted, then the uncertainty may not be sufficiently accounted for.”*
- 28. QAPP, Worksheet 11, Step 6, page 30, item 2.** Modify item 2 by replacing with the following language, *“A separate model has been proposed to estimate the activity of RIM within locations that are equal to or greater than 52.9 pCi/g for the purposes of the excavation design. The proposed ordinary kriging model estimates a concentration of combined radium and combined thorium, rather than a non-exceedance probability, directly from soft data regressions. As a result, the uncertainty of these regressions will be considered differently than in #1 above. It is expected that this uncertainty may be derived, subject to EPA approval, from the Upper Confidence Limit (UCL) and Lower Confidence Limit (LCL) of these regressions. The final approach to considering the uncertainty of an activity estimate, including the uncertainty from any the soft data used for the estimate, will be included in the Revised Excavation Plan.”*
- 29. QAPP, Worksheet 11, Step 6, page 30, bullets near the bottom of the page.** Modify the first bullet by adding the words, *“has only been used to”* between the words *“model”* and *“provides”* and delete the letter *“s”* from the word *“provides”*. Modify the second bullet by deleting the words, *“is an accounting exercise relating to the optimization of the excavation, and”* then add the words *“estimates are”* after the word *“activity”*. Lastly, delete the sentence that follows

these two bullets. This sentence is not needed as EPA approval of this QAPP necessarily includes accepting the included performance metrics as acceptable for the design investigation.

- 30. QAPP, Worksheet 11, Step 6, page 31, first paragraph.** Modify the last sentence of this paragraph by deleting the following language, “, as such descriptions rely on professional judgements and other qualitative elements that are beyond the scope of the QAPP as described by Section 5.7 of the SOW (i.e., sample-related analysis and data handling)”.
- 31. QAPP, Worksheet 11, Step 6, page 32, last paragraph.** Modify the last sentence of the paragraph by adding the following, “when the individual analyses meet the measurement performance criteria specified in worksheet 12.”
- 32. QAPP, Worksheet 11, Step 6, page 33, first paragraph.** Modify the paragraph by adding the following sentence to the end, “In addition, the individual analyses must meet the measurement performance criteria specified in worksheet 12.”
- 33. QAPP, Worksheet 11, Step 7, Page 34, first paragraph.** Modify the last sentence as follows, “Consequently, except in the case of PSQ-2, the sampling design for the remaining PSQs is conveyed in other documents associated with the DI as shown in Table 11-4.”
- 34. QAPP, Worksheet 11, Step 7, page 36, first paragraph.** Modify the parenthetical in the first sentence by revising as follows, “(n=14 samples per survey unit)” in order to be consistent with the previous page and figure 11 from the DIWP. In addition, insert a screenshot of the Visual Sampling Plan (VSP) results in this section as Figure 11-2.
- 35. QAPP, Worksheet 12, page 43, second table.**
 - a. Modify the measurement performance criteria for the laboratory control sample duplicates as follows, “If activity < 5 * MDC, then RPD is 100% or less or relative error ratio (RER) < / = 3 (see note below). If activity > 5 * MDC, then RPD is 20% or less.” Similarly, modify the measurement performance criteria for field duplicates as follows, “RPD ≤ 30% (water), 50% (soil) if > 5 * MDC, or relative error ratio (RER) < / = 3 if < 5 * MDC”
 - b. Modify this table by adding performance criteria for matrix spike samples specified in the laboratory SOPs.
- 36. QAPP, Worksheet 37, page 129, step 4.** Modify number 4 as follows, “If both populations to be compared are normally distributed or can be transformed to normal distribution by the same transformation, e.g. logarithmic or other transformation, perform a two-sided t-test comparison of the transformed populations at 95% confidence.” This language provides clarity that both populations must have the same transformation in order to proceed with the normality assumption.

Appendix E – UPDATED AND FUTURE GEOSTATISTICAL PROCESSES AND MODELING

- 37. Appendix E, Section 1.0, Third Bullet.** Modify the third bullet by replacing “*Appendix G (including Figures G.1 and G.2)*” with “*Appendix F (including Figures F-1 and F-2)*”.
- 38. Appendix E, Section 1.3.4, page E-6, second and third paragraph.** Modify these paragraphs by replacing the text in the remainder of this section beginning with, “*The collection of thorium and radium concentrations, combined with the gamma counts...*” with the following sentence, “As stated above, the data from this background investigation will be considered for an evaluation of the influence of background radiation on soft and hard data if it is demonstrated that this data is representative of Area 1 and Area 2.”
- 39. Appendix E, Section 2.2.1, page E-9, second paragraph.** Modify the last sentence by replacing the word “*replicate*” with “*additional*”.
- 40. Appendix E, Section 2.2.2.1, page E-10, second paragraph.** Modify the last sentence of the paragraph by deleting the words “*excavation cell size and*”. An excavation cell size was not defined or discussed in the Preliminary Excavation Plan (PEP).
- 41. Appendix E, Section 3.1, page E-15, bullets at the end of the section.** Modify the second bullet by deleting the last sentence which states, “*Based on review, duplicates will either be averaged, or the larger value will be selected.*” and delete the entire third bullet. Additional supporting information will be needed before EPA can consider approval of these methodologies related to future development of the geostatistical models.
- 42. Appendix E, Section 4.1, page E-20, second paragraph.** For consistency, modify the sentence that begins with “*Hard data will be collected from these borings...*” by replacing it with the following sentence taken from section 2.4.3.1 of the September 11, 2020 draft of the Field Sampling Plan, “*Laboratory analytical samples will be collected with a frequency of one sample per 4-foot core run for a total of five (5) per boring.*”
- 43. Appendix E, Section 5.0, page E-30, first paragraph.** Modify the sentence that begins with, “*The RODA specified that RIM located between 8 and 12 feet B2005GS can remain...*” by replacing with the following sentences, “*The RODA specifies that a limited number of isolated pockets of RIM located between 8 and 12 feet B2005GS can remain in place as long as the activity left behind is offset by removal of RIM, with preference to areas of higher activity (e.g., 1000 pCi/g) at depths of 12 to 20 feet B2005GS within Area 1 and/or 2. Each isolated pocket identified to remain in place is subject to EPA approval.*”
- 44. Appendix E, Section 5.2, page 3-33, third paragraph.** Modify the third paragraph by adding the words “*will be*” between the words “*and*” and “*fully*” in the last sentence of the paragraph.
- 45. Appendix E, Section 5.2, page E-34, last paragraph.**
- Modify the first sentence by replacing with the following text, “*Given Equation 4 and the remedial objective, when the sum of the RIM activities from the proposed isolated pockets and RIM less than 1000 pCi/g between 12 and 16 feet B2005GS that will remain*

in place is less than or equal to the activity of the RIM between 12 and 20 feet B2005GS that will be excavated, the total activity 0 to 16 feet B2005GS goal is met."

- b. Revise Equation 5.2.2 as follows:

$$A_{IP\ 8-12} + A_{<1000@12-16} \leq A_{>100\ @12-16} + HSA_{>1000@16-z3}$$

46. Appendix E, Section 6.2, page E-35, first paragraph.

- a. Delete, "*, as specified in the RODA (USEPA 2018)*" from the second sentence. The RODA contains no specific requirements for the model; however, it does require that the tool or model used to estimate the activity RIM greater 52.9 pCi/g between the surface and 16 ft B2005GS be the same tool or model that is used to estimate the activity of the optimized excavation.
- b. Modify this paragraph by deleting the third and fourth sentences and replacing them with the following text: *"The 2005 ground surface elevation used in the model and as shown in Figure 5B from the DIWP was determined through aerial photogrammetry. After 2005, fill material was placed over top portions of Areas 1 and 2. Further, due to the fact that Areas 1 and 2 are landfills, there is a greater possibility that subsidence has occurred. Although, due to the age of these landfills, natural subsidence since the borings were installed is expected to be minimal. These two mechanisms, placement of fill and natural subsidence, resulted in changes to the current surface of Areas 1 and 2 making the 2005 surface uncertain. Because a ground survey was not performed in 2005, further uncertainty is introduced."*

47. Appendix E, Section 6.2, page E-35. Modify the section by adding the following paragraph between the first and second paragraphs, *"In addition to the uncertainty in the estimate of the 2005 surface, the potential for natural subsidence to have occurred since the time of sample collection adds a level of uncertainty to the measured sample depth. This uncertainty is greater for the oldest samples, such as those collected during the original RI (1993-1997)."*

48. Appendix E, Section 6.2, page E-36, last paragraph. Modify the first sentence by deleting the words, *"from the 2005 surveyed ground surface to the 2020 surveyed ground surface"* for consistency with the modification to the same sentence in Section 2.2.1 of the DIWP.

49. Appendix E, Figure E-11a. Modify Figure E-11a by adding a legend for the standard deviation color coding consistent with the other E-11 figures.

Enclosure B

EPA comments on future modeling development related to discussion in Appendix E

1. **General Summary.** In the past several weeks during meetings and working sessions, EPA and the Respondents came to agreement on additional evaluations, and in some cases, changes to the modeling approach. EPA expects these evaluations will be completed and any changes made to the modeling approach will be described in the Revised Excavation Plan. Among the simpler agreements reached was that histograms will be checked before assuming distributional form. It was also agreed, as discussed in Section 3.1 of Appendix E, that the same regressions will be used for both the IK* model (extent model) and the OK model (activity model). EPA also suggested that all data be included in graphical presentations of the regressions. EPA acknowledged that regressions can be built on truncated datasets, but that the data set should be truncated at the value of the predictor. Other future modeling related suggestions not related to the performance of the DI mentioned previously but not discussed in detail are included in the comments below.
2. **Separation of regressions.** Developing regressions separately for various types of soft data has been discussed in multiple meetings between the Respondents and EPA. The effect of data type on the relationship to activity must be accounted for in future model iterations. EPA expects at a minimum that separate regressions for downhole and core gamma will be developed and compared. EPA recommends that separate CDFs be developed for each soft data type if there appears to be differences between the regressions. EPA also recommends the existing regression for the older digitized gamma be graphically compared to the final downhole regression to determine if there are differences. EPA believes this information will be important to determine the appropriate use of the various soft data types as inputs for the final model.
3. **GCPT Soft Data.** EPA believes the way the GCPT data are utilized in the current extent model introduces unquantifiable uncertainty due to the lack of co-located hard data for which to develop a regression. EPA acknowledges that GCPT data was only collected in Area 1. In the previous model, the regression determined from the other soft data types was used for the GCPT data even though the type and size of the detector, as well as, the data collection procedures were different. EPA is concerned that this uncertainty may be significant for design of the remedy. Given the large influx of data the proposed design investigation will result in, EPA recommends the Respondents consider excluding all GCPT data in future model iterations and avoiding this uncertainty altogether. If GCPT data are included in the final model, the impacts on both the extent model results and the activity model results must be evaluated in detail and would be subject to EPA approval for use in the Final Excavation Plan.
4. **CDF development.** As mentioned in comment 35 from EPA's 7/13/20 letter regarding the first revision of the QAPP dated 6/5/2020, EPA recommends development of a "low count" CDF for count ranges below which the gamma-thorium regression is weak or nonexistent. This "low count" CDF should be calculated across all the data below the gamma threshold that the gamma/thorium regression is truncated at as the proportion of samples with activity above 52.9 pCi/g. In addition, this same process should be completed for radium, assuming the gamma/radium regression used for CDF development will be truncated.

5. **Additional indicators.** The previous revision of the QAPP dated June 5, 2020 stated, “*an additional indicator will be developed between 52.9 and 500 pCi/g to down-weight the values in this range*” (p. 29 of 156). EPA believes the word “*indicator*” in this sentence refers to the activity thresholds used to develop the indicators (i.e., the cut-points 7.9, 52.9, 500, and 1000 pCi/g used in CDF development). The limited number of cut-points is a serious deficiency in the preliminary RD model. Current probabilities at these cut-points are very close to either 0 or 1 (greater than 0.85 or less than 0.15). Given project goals and the classification of RIM at the 0.5 probability, it is important to differentiate between 0.5 and 0.6 probabilities in the kriging process. Therefore, since the computations are relatively simple, EPA recommends adding activity thresholds that correspond to non-exceedance probabilities of 0.1 through 0.9 at a resolution of 0.1. In any case, EPA expects that additional activity thresholds will be developed.
6. **Manual calibration.** EPA acknowledges that the data-driven model inputs such as the variograms, regressions, and CDFs may not necessarily produce the most accurate model results, and that the geostatistical models could potentially benefit from manual adjustments to the various sub-models as a calibration technique. If the Respondents believe manual adjustments may be warranted for future versions of the geostatistical model(s), EPA recommends exploring the effects of adjusting the variograms rather than the CDFs. While the data collected may not represent the true spatial relationships present at the site, once that spatial relationship is established, the model results follow from this. EPA notes that while comparison for the current adjustments are shown in the DIWP, the explanation of why the results better align with the CSM were not provided. Whatever manual adjustments are made must be justified by comparing the pre-adjustment and post-adjustment results and fully explaining why the post-adjustment results better align with the CSM.
7. **Variograms/anisotropy.** Having separate horizontal and vertical variograms makes sense due to the nature of contamination within the landfill. Different relationships horizontally and vertically may be expected due to the placement of waste. It has not been made clear how distinct spatial relationships in each direction, which might have different range lengths, sills, nuggets, and possibly different variogram models, could be combined into a single three-dimensional variogram with only one additional parameter (anisotropy) without some assumptions. If the modeling software (EVS) does include assumptions, these assumptions must be acknowledged, evaluated, and the results presented in the Revised Excavation Plan.
8. **Nugget.** Short-range variance is identified as a sampling objective, and EPA expects the data will be adequate to estimate a nugget effect. When analyzing the data for a nugget effect, however, it is important to keep in mind that the samples proposed specifically for the nugget effect analysis were collected vertically. The scale of “short-range” may differ vertically versus laterally (i.e., it may be up to 10 or 20 feet laterally, but only one foot vertically). With that in mind, all data should be considered in the nugget effect evaluation as part of the variogram fitting process. A zero-nugget assumption is likely not appropriate due to the heterogeneous nature of the landfill. Therefore, EPA recommends assuming a non-zero nugget and using the new data to estimate the appropriate nugget effect, rather than simply evaluating the existing assumption. By evaluating an existing assumption there is the potential to overlook data if the nugget is small and doesn't appear to be visually different from zero.

9. **Grid cell size.** As stated in comment 89 from EPA's July 13, 2020 letter to the revised DIWP deliverables, the appropriate grid cell size should be determined by the level of heterogeneity at the site that is expected to influence excavation decisions. EPA expects that the cell size will be evaluated, and potentially decreased to gain better resolution in the model results, after other modeling decisions are made such as establishing the regressions, CDFs, and variograms.
10. **Uncertainty analysis.** One of the major deficiencies of the Preliminary Excavation Plan (Parsons 2020) was the lack of uncertainty analysis presented for both the extent model and the activity model. Much of the revised DIWP focused on the uncertainty in the extent model to inform sampling and included limited analysis on the uncertainty in the activity model. EPA expects that uncertainty analysis will be performed on the revised models, in order to determine if the data are adequate to support the design of an optimized excavation plan that meets the requirements of the RODA. For the extent model, the standard deviation field should be mapped by elevation slices for comparison to the SDWS. For areas of significant size with respect to the excavation with standard deviations exceeding the SDWS, it should be acknowledged that the desired confidence of inclusion in the RIM shell was not obtained, and the implications of this should be discussed with respect to the design. For the activity model, EPA recommends calculating confidence intervals for each area where the activity impacts the excavation (i.e., total activity between 0 and 16 feet, activity in isolated pockets, activity in deeper excavation areas). The width of these confidence intervals would then be considered in the revised excavation plan.