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 March 30, 2020, Parsons submitted draft versions of the Design Investigation Workplan (DIWP), the Field Sampling Plan (FSP), the Quality Assurance Project Plan (QAPP), the Data Management Plan (DMP), the Health and Safety Plan (HASP), and the Radiation Safety Plan (RSP) for the West Lake Landfill Superfund Site Operable Unit 1 to the U.S. Environmental Protection Agency, on behalf of the West Lake OU-1 Respondents. The EPA received the Radiological Control Program Manual (RCM) and implementing Radiological Control Procedures (RCPs), which are considered part of the Radiation Safety Plan and HASP as Confidential Business Information, on April 15, 2020. These documents were prepared and submitted 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 OU-1, West Lake Landfill Superfund Site.

The EPA has completed its review of these documents, except for Appendix F of the DIWP and the HASP, RSP, and RCP. The EPA is disapproving the reviewed portions of the documents as submitted. Please revise these documents in accordance with the enclosed comments and re-submit them within 30 days of receipt of this letter, as required in Section 5.6(b) of the Remedial Design Statement of Work. The EPA will provide comments on Appendix F and the HASP, RSP, RCM and RCPs in the near future.

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 JUMP
Digitally signed by CHRISTINE JUMP
Date: 2020.05.06 16:47:05 -05'00'
Christine R. Jump
Remedial Project Manager
Site Remediation Branch
Superfund and Emergency Management Division

Enclosures

Comments on 3/30/2020 Design Investigation Work Plan

General Comments:

1. The Design Investigation Work Plan (DIWP) and associated documents contains little to no information or proposals for evaluating two of the Remedial Action Objectives (RAOs) summarized as 1) Control and manage leachate that emanates from OU-1 and 2) control and treat landfill gas from OU-1, including radon. The documents also do not discuss how the potential for settlement after the engineered cover is placed in both undisturbed and disturbed portions of Area 1 and Area 2 will be assessed. If the DI will not address these questions, then a rationale must be provided as to how and when information pertaining to these items will be collected so that the design of the remedy can be completed in accordance with the approved schedule. Revise the documents to include discussion of these topics.

2. The EPA's comments on the Preliminary Excavation Plan (PEP) identified several significant issues and concerns with the preliminary excavation design and use of the Remedial Investigation Addendum/Final Feasibility Study (RIA/FFS) geostatistical model for this Remedial Design (RD). The EPA recognizes the effort that has been made to address those issues in the DIWP. Nevertheless, some significant issues with the use of the model remain and are identified and discussed throughout this comment letter.

The Quality Assurance Project Plan (QAPP) presents a simplistic version of the conceptual site model (CSM) and the DI only minimally considers the conceptual site model. The EPA has provided specific, detailed comments later in this comment letter regarding the description of the CSM in the QAPP. Further consideration of the Contamination Concern Map (CCM) must be performed for evaluation and revision of boring locations and samples in response to other comments in this letter

3. The EPA provided specific approval conditions in our February 13, 2020 comments on the PEP aimed at addressing uncertainties and limitations for the geostatistical model being used by the Respondents. Because some of those approval conditions have not been effectively addressed in the DIWP, and in one case not completed, the EPA is unable to determine the effectiveness of the current model for use in this DI. Issues and uncertainties previously pointed out by the EPA that appear not to have been sufficiently addressed for the existing model include:

1. The accuracy of the current RIM extent polygon is unknown and is anticipated to change after the DI is completed. Therefore, proposing a significant number of borings along the current RIM shell may not result in a significant reduction in model uncertainty.

2. The reasonableness of using soft data to predict thorium concentrations is not addressed. An evaluation has not been completed to estimate a detection limit for Ra-

226 and the approximate Th-230 concentration that corresponds to this detection limit.

3. Evaluation and further supporting information related to the development of the cumulative distribution functions (CDFs) including further justification of manual adjustments of the CDFs has not been provided. The EPA acknowledges that the Respondents have proposed to continue evaluating CDF methods through sensitivity testing after the new data is available from the DI to support the revised excavation plan. But this does not support use of the model now to support the DI

4. Additional sensitivity analyses are needed for both geostatistical models depicting changes in extent and relative activities for modeling parameters, e.g. development of the variograms. The EPA acknowledges that the Respondents have proposed to continue this work after the new data is available from the DI to support the revised excavation plan. But this does not address using the model now to support the DI.

Therefore, based on the limited information provided to the EPA in the draft DIWP, the use of the model would need to be limited to a supporting role only in the selection of boring locations and sample intervals. A formal evaluation of the use of soft data to predict thorium concentrations must be completed and presented in the DIWP as required in comments previously provided for the PEP. Only after this evaluation is completed can the EPA determine the extent to which the model should be used to select boring locations.

Even with the issues described above related to the preliminary model, the EPA acknowledges that the proposed borings and additional data collection (soft and hard) would provide some benefit to any geostatistical model. Further, the EPA recognizes that the collection of any additional data serves to move the design of the remedy forward. However, the EPA's primary concern relates to whether the borings and samples proposed for the DI will be sufficient to complete the Revised Excavation Plan and the design of the remedy. Therefore, the EPA strongly recommends applying a process for evaluating and selecting boring locations, similar to the one described in comments 5 and 18 below, in order to reduce model uncertainty. If this is not done, there is an increased potential that additional data will need to be collected after the DI in order to complete the Revised Excavation Plan.

4. The work presented to date has not demonstrated that the model can be used to reasonably predict thorium at concentrations necessary to produce a final excavation plan for the RD. Comment and approval condition 15 in our February 13, 2020 comments on the PEP requested specific actions be performed, including developing an estimation for detection of thorium for each type of soft data, and estimating the corresponding Th-230 concentration for each Ra-226 detection limit with the radium-thorium regression. These detection limits and soft data correlations would inform on the significance of model limitations regarding thorium. Since this work was not presented as requested, the EPA has concerns as to whether the accuracy of the preliminary 52.9 pCi/g RIM shell, which is based substantially on thorium predictions, is sufficient for use as a tool for selecting

boring locations. The extent to which the current model reasonably predicts thorium, and ultimately should be considered for placement of borings, will depend upon results of the radium detection limits and inferred thorium concentrations. Please see below:

1. If the Th-230 concentration inferred from soft data at the Ra-226 detection limit is greater than 52.9 pCi/g, then the preliminary thorium RIM shell is only useful for identifying where Th-230 significantly above 52.9 pCi/g is present but it cannot reliably predict where Th-230 near or below the 52.9 pCi/g is present. In this case, this RIM shell is not expected to result in a reliable excavation boundary. Therefore, the DI should propose borings beyond the existing radium RIM shell. An important piece of information to consider in this scenario in order to propose borings is the radium RIM shell predicted at the Ra-226 detection limit for soft data to compare to other existing model output.

2. If the Th-230 concentration inferred from soft data at the Ra-226 detection limit is near or below 52.9 pCi/g, then the existing preliminary RIM shell may be acceptable for use as purposed in this DI as long as the other comments on the model and its use provided in this letter are addressed, such as comment 2. Ideally, the model would be rerun for radium only at the detection limit for comparison purposes.

The EPA has not determined that the proposed boring locations are unacceptable, but we are unable to substantially evaluate based on what is presented in the DIWP whether the proposed borings will meet all the necessary objectives for the DI. Complete the evaluation described above, include this evaluation in the revised DIWP, and modify the proposed boring locations as appropriate.

5. It appears that the borings proposed to address model uncertainty may not result in significant reduction to this uncertainty as described above. Additional sampling should instead be focused on reducing uncertainty or increasing precision, which is a quantifiable measure of model performance, while considering the representativeness of proposed borings.

One way to increase precision would be to simply collect data where the kriging standard deviation is highest, which is where the model is most uncertain. This is not prudent, however, because some areas with high kriging standard deviation may not be relevant from a decision perspective. For example, suppose the predicted probability of RIM is 0.9. Even with a relatively large kriging standard deviation of 0.15, the lower endpoint of a 95% confidence interval for RIM probability would be about 0.6, and it is classified as RIM regardless of the low precision. Therefore, it is advised to sample with both the predicted probability and the kriging standard deviations in mind.

Included in this comment letter is one approach that could be used which involves analyzing the kriging predictions and standard deviations to select boring locations where the model is most uncertain regarding RIM presence, while controlling for Type I and

Type II error rates. (i.e., false positives and false negatives). See comment 17 for an example of how this could be done.

Section 2.1 states "This DIWP identifies data needs that will support modeling improvements (provided in Appendix E) with the goal of converging on a representation that meets the expected precision for decision making during RD."; however, the DIWP does not define the desired confidence (or conversely, the acceptable decision error). In addition, Appendix E Attachment 1 item 8 states that "quantifying uncertainty may not be possible given the scope of this project." The approach discussed above provides an example of how to propose additional boring locations using a specified error rate can be done relatively easily by framing the decision questions as hypothesis tests.

6. In general, the DIWP does not discuss or acknowledge that step out borings may be needed, e.g. to confirm the boundary of RIM via the perimeter borings. In discussion with the Respondents after this draft DIWP was submitted, the EPA understands that the DI will be sequenced in such a way to attempt to ensure that step out borings will be collected where necessary during this investigation and not require a separate field mobilization in the future. Revise the DIWP with a description of this sequencing and the decision-making process for determining when step out borings are necessary, including how Respondents will share this information with the EPA and the MDNR and consult on the location of step out borings throughout the DI. In addition, the Field Sampling Plan (FSP) must contain additional site-specific detail and documentation of the decision processes so that the people implementing the work in the field can efficiently and effectively collect the necessary data and make in field decisions. The additional documentation must include a description of how field screening data will be used to make decisions regarding location of additional boring and areas within the borings to be sampled.

7. In order to move forward with the investigation, the QAPP must be revised to clearly depict how all data will be of sufficient quality and quantity to meet the objectives of both the DI and the RD.

Specific Comments:

8. **Section 1.0, page 1-1, 2nd paragraph**. Radiological Area 1 is not depicted accurately on Figure 3. Revise to correct.

9. **Section 1.3.1, page 1-3, 2nd paragraph**.

a. Revise the first sentence of the paragraph by deleting the word "*some"* and replacing it with the word *"most" and* adding "*down to 12 feet below the 2005 topographic surface*" to the end of the sentence.

b. Revise the second sentence of the paragraph to read, "*This partial excavation of Rim in combination…"*

10. **Section 1.3.2, page 1-4, 1st sentence**. Add the word "*Presumed*" to the beginning of the first sentence.

11. **Section 2.1, page 2-1, 2nd paragraph.** The paragraph states, "*The purpose of the geostatistical model is to estimate the probability of the presence of RIM >52.9 pCi/g, and the approximate total activity in Areas 1 and 2*." The EPA disagrees with this statement. The purpose of the model is to provide a basis for design of the optimized excavation, which also requires the model calculate RIM activity to 16 feet B2005GS and. In addition, the optimized excavation requires the estimation of RIM activity greater than 52.9 pCi/g with the specific depths listed in the RODA. Revise accordingly.

12. **Section 2.1, page 2-1 and 2-2, third and fourth paragraphs.** The end of this section discusses the content of Appendix E of the DIWP and the work performed since the PEP to further develop and evaluate the preliminary model. However, it is not clear if the borings proposed and depicted in the body of the DIWP utilized the model as presented in the PEP or the updated model described in Appendix E.

    For example, Table E-1 gives variogram parameters that are different from those given in the PEP. The range length for Area 1 appears to have increased from 175 feet in the PEP to 400 feet. The EPA notes that neither this table nor the associated figure includes a unit for the lag distance. It is not clear whether this increase makes conceptual sense. In addition, the radium sill for Area 1 is over an order of magnitude smaller (0.0072) compared to the value given in the PEP (0.08), while the thorium sill for Area 1 is nearly half an order of magnitude smaller (0.01) compared to the value given in the PEP (0.045). Additional effort was placed in estimating the sill compared with the variogram that was used to match the RIA/FFS model, but additional explanation as to how and why the values changed is warranted.

    Ultimately, if the changes to variogram parameters are justified, all the figures and results presented in the document that are used as a basis for selecting borehole locations should be based on the model results calculated using the most up to date variogram model. Revise this section to clarify which model version was used to develop the proposed borings and the associated figures provided in the DIWP.

13. **Section 2.2, pages 2-2 and 2-3.** This section in of the DIWP appears to provide an explanation of the uncertainties associated with the current and various historical topographical surfaces of the site, the depth of historical samples and gamma scanning, and the potential for elevation uncertainty to occur with the sampling during the DI. The section also provides a description of actions that are proposed to be taken in order to address these uncertainties. However, the descriptions of these uncertainties are difficult to understand or do not include consideration of critical information that the DI must attempt to address.

    a. The first sentence of the first paragraph in Section 2.2 is not clear both in terms of how the existing model is "based on the 2005 ground surface" and how this basis for a model is supposedly specified in the RODA. Revise for clarity.

b. The remainder of the first paragraph seems to be related to describing events that have occurred since 2005 that would be the source of uncertainty in the estimated elevations of historical samples. The paragraph mentions installation of the Non-Combustible Cover (NCC) which occurred in 2016. Not described in this paragraph is that this action generally required RIM at or near the surface to be covered with a geotextile fabric and 8 inches of crushed rock/gravel. In addition, a consultant was hired by the Respondents to perform accurate survey measurements of the thickness of this cover to demonstrate the thickness requirement was met. Therefore, this particular action is a source of only very little uncertainty with regard to the current ground surface elevation. The paragraph also mentions the potential for differential settlement to have occurred since 2005. The paragraph fails to consider that a*dditional inert fill materials were placed in Areas 1 and 2 after the 2005 topographic survey.* The portion of Area 1 and Area 2 covered with this inert fill is depicted on Figures 6-12 and 6-13 from the RIA along with the extent of the NCC. The placement of inert fill, along with the presence of the NCC, must be accounted for when determining drilling depths for borings in those portions of Area 1 and Area 2. In addition, differential settlement needs to be considered for borings and samples that were collected previously according to the actual date that they were collected rather than 2005. For example, the soil borings collected for the original remedial investigation (RI) were collected in 1995 and 1997 (see section 4.4.2 and 4.4.3 from the RIA). Nearly all of the additional data collected in Area 1 and Area 2 was obtained between 2013 to 2015 (see section 4.4.5 through 4.4.8 from the RIA). The EPA acknowledges that differential settlement provides a source of uncertainty for the existing data set but this issue is not related to the 2005 surface. Revise the paragraph by including a more complete description of the actions that have resulted in changes to surface elevations since 2005 and clarify the relationship between historical sampling and differential settlement.

c. The second paragraph seems to indicate that "*areas exhibiting poor soil core recovery*" were considered. However, discussion of specific locations where poor soil recovery has been considered do not appear in the DIWP. The EPA acknowledges the poor soil recovery for borings collected from previous investigations do create a source of uncertainty with the elevations of samples and gamma scanning activities collected from those soil cores. However, the DIWP does not present any information about how the DIWP will attempt to address this uncertainty. Revise the paragraph describing the actions that are anticipated as part of the DI to address this uncertainty or provide a reference to where this information will be discussed.

d. The first bullet in this section describes a "sitewide ground surface survey" that will be performed to support the RD. This is further described in Section 3.5 of the DIWP. However, the DIWP does not state when this survey is expected to be performed and whether this information is needed in order to determine the actual drilling depths described in bullet three which are specified to be from the 2005 ground surface. Revise the paragraph by including the timing of the yet to be performed sitewide

ground surface survey and whether this survey will be used during DI drilling and/or sampling.

e. The second bullet is not clear since the elevation/depth associated with historical laboratory and field data have been collected in feet above mean sea level (ft amsl). As an example, the ground surface elevation in ft amsl for the borings placed in Area 1 are provided in table 6-4 of the RIA. Elevations for samples and gamma scanning measurements collected from those borings were measured in feet below the surface and have been assigned an elevation in ft amsl using the elevations measured for each boring. Revise the bullet for clarity.

f. The third bullet describes a method of limiting the core runs to 4 ft to minimize the potential for poor recovery. The EPA agrees that this method will reduce this source of uncertainty. The bullet further specifies that these core runs will be collected based on the 2005 ground surface. However, no information is provided in the DIWP or FSP describing how this will be determined in the field. Revise the bullet for clarity.

g. The final paragraph of the section also states that historical laboratory and field data will be corrected from the 2005 surveyed ground surface to the 2020 surveyed ground surface. As stated above for the second bullet, this is not clear. Revise this paragraph similar to the second bullet.

14. **Section 3.0, page 3-1, Item 2.** The language in item 2 must be revised to be consistent with section 3.6 (a) (1) (iii) of the SOW. Revise this item as follows, "Delineate the extent of waste/RIM to confirm the boundaries between OU-1 and OU-2."

15. **Section 3.0, page 3-1, Item 3.** Revise item 3 as follows, "*Further characterize RIM greater than 52.9 pCI/g in order to design an optimized excavation that meets the RODA requirements. (includes sampling objectives to improve the geostatistical model, see GSMOs below)*"

16. **Section 3.0, page 3-1, paragraph after the DI objectives.** The EPA is unable to discern how the Geostatistical Modeling Objectives (GSMOs) as presented are specifically related to or developed from Principal Study Questions (PSQ) 1 and 2 described in the QAPP. In our comments below on the QAPP, the EPA has identified several issues associated with these PSQs. In general, several of the GMSOs are overly broad. In addition, the objectives are sometimes presented as the action that will be performed rather than objectives. The GSMOs are not written in a clear manner such that the specific data necessary for improving the model is identifiable. It is very difficult to understand the rational for the borings proposed on figures 5A through 5F based on the cited GSMOs and the information provided. The GSMOs must be revised to state as clearly as possible the objectives which substantiate data needs. Then additional information can be provided about the how borings were located based on specific GSMOs. (e.g. Borings to achieve GSMO #1 were selected where historical data indicates RIM may be within the targeted gamma count range; however, samples to achieve this

objective may be collected from any boring (or archived cores) which meet the target). EPA notes that the 8 bullets listed after the GSMOs, which are described as "data needs for the geostatistical model", are essentially a re-stating of the GSMOs (without the Kriging standard deviation in GMSO #7), but re-organized and stated in an alternative way. The three lists of objectives or data needs in Section 3.0 should be re-evaluated and potentially reorganized in a manner that is less repetitive and instead clearer about what all the objectives of the DIWP are and how those objectives are proposed to be met, which could then be further expanded on in the sub-sections of Section 3.0.

17. Section 3.0, An Alternative approach to GSMOs 4, 5, and part of 7.

The EPA recommends combining GSMOs 4, 5, and the standard deviation portion of 7 into one GSMO related to increasing precision of the 52.9 pCi/g extent polygon, as estimated by the indicator kriging model for both combined radium and thorium. Understanding and improving upon model deficiencies can only be done by identifying regions of model uncertainty within the decision context. Because the current RIM boundary is likely to change with additional sample collection, we recommend reducing reliance on the currently predicted RIM extent. Rather, additional sampling should be focused in spatial regions with high uncertainty with regard to RIM presence.

To do this, the EPA recommends completing a structured uncertainty analysis to propose boring locations where 1) the model has high kriging standard deviation, and 2) the uncertainty has an impact on excavation decisions. We recommend the Respondents consider the method described below for selecting boring locations in order to optimize the prediction of the 52.9 pCi/g extent polygon from the geostatistical model.

The EPA has guidance (OSWER Directive No. 9285.6-10) that recommends the use of 95% upper confidence limits (UCLs) for estimating exposure point concentrations (EPCs). 9285.6-10) that recommends the use of 95% UCLs for estimating EPCs. This approach is meant to account for uncertainty and protect against underestimation in order to be protective of human health. The primary quantity of interest for the DIWP, while neither an EPC nor a mean over an entire site, is a polygon representing the extent of contamination at the 52.9 pCi/g threshold. Extending the logic of the OSWER guidance is a helpful way to consider uncertainty as it relates to decision making. Considering a 95% UCL for the probability of RIM combines both the predicted probability of RIM and the uncertainty in that prediction.

Described further below is an approach for a sampling plan design using the model that meets the decision objectives while still honoring the basic tenets of reducing uncertainty in measurable quantities. It is recognized that there are multiple logistical constraints, engineering challenges, and other considerations that need to be accounted for in this DI. However, it is still possible to identify quantifiable limits related to the sampling design despite the complexity of the geostatistical model itself. This is both helpful in adhering to the systematic planning in the DQO process and necessary for a robust and defensible design.

In order to increase confidence in the final RIM boundaries, borings/samples must be proposed in areas where the kriging standard deviation is relatively high, and the probability of RIM is close to 0.5. The specific standard deviation that would warrant additional sampling depends on the probability of RIM at that location and can be calculated fairly easily assuming a one-sided, one-sample hypothesis test. To make this example more intuitive, the probabilities provided below are the probabilities of RIM being above the concentration threshold of 52.9 pCi/g. However, this can easily be converted to non-exceedance probabilities. This hypothesis test asks the question, is the probability of RIM above the concentration threshold less than 0.5 with at least 95% confidence? This is selected as the research question of interest, because it is focused towards areas that are not currently predicted to be above the concentration threshold (i.e., the probability of non-exceedance is greater than 0.5), but that could be above the concentration threshold. That is, the probability *could be* less than 0.5 after accounting for model uncertainty. This specific hypothesis test is performed as:

$$z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}}$$

Where z is the test statistic, $\bar{x}$ is the predicted probability of exceeding the concentration threshold, μ_0 is 0.5, and $\sigma/\sqrt{n}$ is the standard error, in this case the kriging standard deviation. The null hypothesis of $\mu \geq \mu_0$ is rejected if $z \leq z_\alpha$, which is 1.645 to achieve 95% confidence. Therefore, we can conclude that we are already sufficiently confident that a specific location, i, is indeed RIM if:

$$\frac{x_i - 0.5}{SD_i} \leq 1.645$$

Where x_i is the predicted probability of RIM at location i, and SD_i is the kriging standard deviation at location i. For example, around the 0.3 RIM shell, a standard deviation less than or equal to 0.12 $\left(\text{or } \frac{0.3-0.5}{1.645}\right)$ is necessary to be 95% confident that those locations are indeed not RIM. If the standard deviation is less than 0.12, additional sampling is unlikely to change the conclusion that those locations are not RIM.

However, decision errors are always possible, and their probabilities in relation to a hypothesis test are easily computed. In the above hypothesis test, a Type I error occurs if we conclude the location is not above the concentration threshold when it is (i.e., less material will be excavated than should be). In this case, the probability of this error is α = 0.05. Given the nature of the requirement in the RODA (minimize excavation volume through optimization), other probabilities for the Type I errors may be considered. The standard deviations listed in the table below are required to achieve 95% confidence that all the RIM above the concentration threshold was able to be identified for excavation.

The goal of the investigation should be to decrease the standard deviations to no more than the values in the table below. Achieving this goal will be directly related to the investigation sample size (number of borings/samples). While not required, this could be

tested by first simulating data at the proposed boring locations, rerunning the model, and evaluating the output. Performance of the simulation would provide some confidence that the proposed sampling design would likely achieve this goal. Note that the values in the table below relate to only sampling outside the current RIM shell to protect against not identifying RIM that should be excavated, but similar calculations should be conducted for probabilities within the current RIM shell if it is important to also protect against excavating material that was incorrectly identified as RIM. This error is referred to as Type II error.

Probabilities of RIM and the corresponding standard deviation needed to reject H_0.

Probability of RIM	SD to warrant sampling	Type I Error (α)	Type II Error (β)
0.45	0.03	0.05	0.50
0.4	0.06	0.05	0.50
0.3	0.12	0.05	0.50
0.2	0.18	0.05	0.50
0.1	0.24	0.05	0.50

A Type II error occurs if we conclude the location is RIM when it is not. The probability of a Type II error is called β and can be computed from α, the predicted probability of RIM above the concentration threshold, and the kriging standard deviation. For the example of the 0.3 RIM shell and a standard deviation of 0.12, the Type II error is 50% when the Type I error is set to 0.05. In other words, if the area in question is not truly above the concentration threshold, we have a 50% chance of concluding that it is above the threshold (and excavating more material than is necessary). The Type II error is high in this case in order to keep Type I error at 5% so that RIM is not left in place that the RODA requires to be excavated. Ideally, this value should be compared to the acceptable Type II error (see QAPP comment on Worksheet #11, step 6), which is commonly set to 20%. However, given that the RODA requires an optimized excavation, acceptable error rates may be different for this project. It is also important to consider and specify the acceptable error rates in order to define the sampling design. The calculation above is provided as an example that could be repeated once each error rate is explicitly defined. Type I error should be controlled in order to ensure the excavation of RIM required by the RODA, but it also desirable to control for Type II error to avoid excavating material unnecessarily which is a tenant of the optimized excavation. A Type II error of 50% indicates that 50% of the excavated material was incorrectly identified as RIM. In order to reduce this error to, for example, 20%, the kriging standard deviation would need to be 0.08 or lower at the 0.3 RIM shell. A data simulation test like what is described above could be implemented by placing boreholes in appropriate locations until the desired standard deviation is achieved.

Ultimately whatever standard deviation is chosen as a goal for each RIM shell can be compared to Figures E-9a-z. The EPA notes again that the probabilities provided above are the probabilities of RIM above the concentration threshold of 52.9 pCi/g, whereas the

contours given in Figures E-9a-z are non-exceedance probabilities. The current figures could be considered as an example of where boreholes could be placed according to the following rules, which use the standard deviations in the table above an example. In this case, additional boreholes in Area 2 are needed around the 0.3 RIM shell for radium where the standard deviations are at least 0.12, around the 0.4 RIM shell for radium where the standard deviations are at least 0.06, and all along the 0.5 RIM shell for radium but especially where standard deviations are relatively greater. The same rules should be applied to the thorium RIM shell with the addition of the areas around the 0.2 RIM shell where the standard deviations are at least 0.18. Note that according to the current figures, the standard deviations in Area 1 are probably not high enough to warrant additional sampling to decrease the standard deviation, under the values given in the table.

Reducing the standard deviations in the model predictions is directly related to the number of samples collected. In other words, the selection of the error rates must be done sin consideration of the number of samples needed to achieve the goal. However, this approach provides a defensible method of selecting additional borehole locations and numbers, according to error rates selected in consideration of the project objectives. By using this approach, the statistical robustness and the efficiency of the design are improved. The EPA notes that performing data simulation as a means to refine and adjust the number of proposed borings would remove some of the guesswork in determining the number of additional samples needed to achieve the desired precision. This would help protect against the possibility of not collecting enough data in the DI for the final model. Regardless of whether data simulation exercises are performed, this approach helps to ensure each boring and sample results in a significant benefit to the design objectives.

18. **Section 3.0 page 3-1, GSMO #1.** The actual objective for GSMO #1 is simply to "improve the correlations between radium, thorium, and gamma using core data." Increasing the sample density in specific gamma count ranges will help to achieve this objective. However, neither the QAPP nor the DIWP provide a rational for how the gamma count range was determined nor how the additional borings proposed were selected. The EPA is therefore uncertain whether this approach will achieve the objective.

An example way to select a gamma count range of interest for this GSMO is provided as follows for your consideration.

Figure 1 shows the relationship between core gamma and combined radium, with log10-transformed axes, and is meant to be similar to Figure E-1 in appendix E of the DIWP, although the data themselves are not identical. A linear model was fit to these data and the confidence bands are shown as dotted red lines.

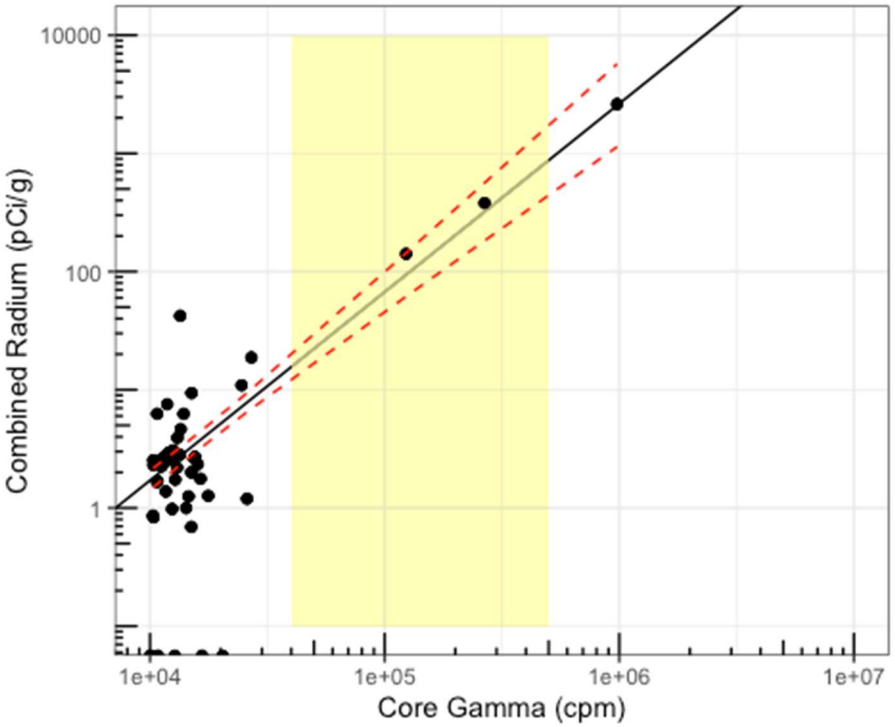

Figure 1. Example regression between core gamma and combined radium.

Collection of additional "data" was simulated, and new regression fits were estimated using the following approach which incorporates aspects of the proposed sampling in the DIWP for GSMO #1:

a. Representative core gamma values in the targeted range were sampled from a uniform distribution (lower=40,000 cpm, upper=500,000 cpm). In this case, 22 values were sampled since 11 boreholes are proposed (Figure 5A) and two depths will be sampled at each (FSP Section 2.4.3.1).
b. Combined radium for each value of core gamma was computed as $\hat{y} + \epsilon$, where $\hat{y}$ is the regression fit along the line and ϵ is a random error term drawn from a N(0, RSE), where RSE is the residual standard error. This method assumes that the data collected will follow the existing relationship.
c. The 22 new pairs from steps 1 and 2 are added to the existing data and a new regression line is fit. This fit is shown in Figure 2.

The confidence bands are narrower in Figure 2 compared with Figure 1, and the standard error of the residuals decreased from 0.34 to 0.32, while the standard error of the slope estimate decreased from 0.1 to 0.05. Various combinations of core gamma ranges can be chosen to find the optimal range that provides the largest reduction in the standard errors. Sampling should then be focused in this range. The EPA notes additional samples may result in increased scatter and thus the standard error of the residuals may not decrease.

However, the standard error of the slope estimate *will* decrease as the average value of the core gamma measurements increases. Therefore, it is mathematically optimal to increase the upper end of the range and focus sampling where core gamma is greater than 40,000 cpm.

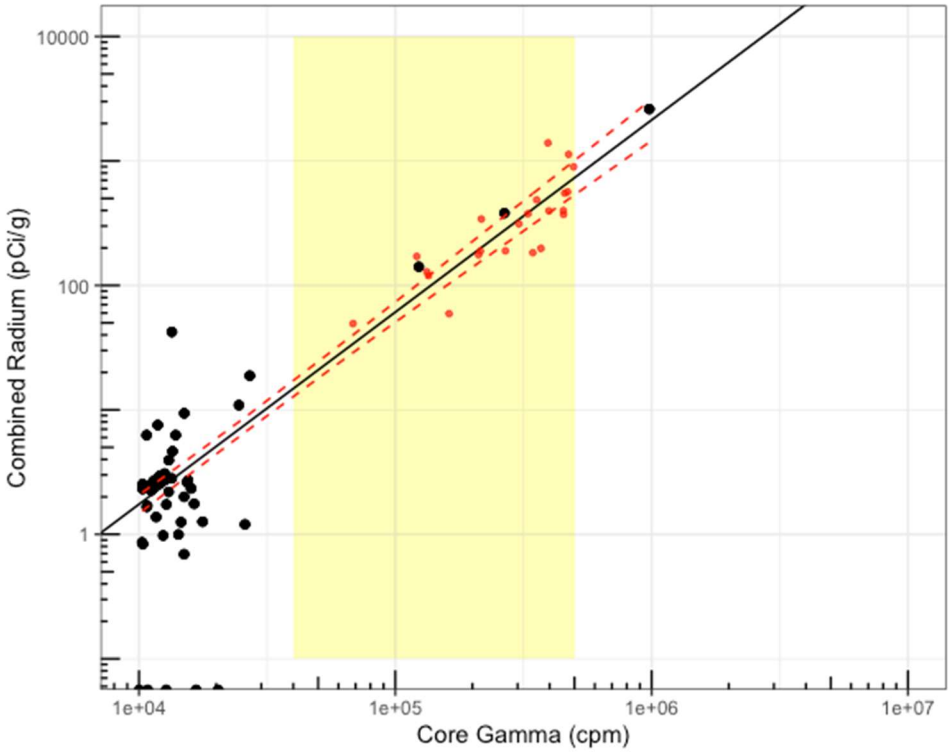

Figure 2. Example regression between core gamma and combined radium.

The DIWP must include additional information on the rationale for how the gamma count ranges chosen for Radium and Thorium were selected. It would also be useful to provide the estimated radium concentrations and the estimated thorium concentrations that correspond to this count range. The DIWP also needs to clarify how improvements to the correlations for both downhole gamma and digitized gamma from the older RI borings are being considered. Lastly, it is not clear how the borings proposed in Figure 5A were selected; however, the EPA acknowledges that samples from targeted ranges of gamma counts can be collected from any borings that contain those count ranges, (new or archived cores). Lastly, the DIWP must include further description of how the borings proposed in Figure 5A were selected.

19. **Section 3.0 page 3-1, GSMO #2.** GSMO #2 as stated, should improve correlation between core scan and downhole gamma of newly collected data by maximizing core recovery in the field but it is not clear how this model objective is being used to select boring locations. GSMO #2 will be accomplished primarily through drilling and sampling techniques (i.e., 4-foot cores) and as written, it appears to be applicable to all new boring locations. Revise the text to clarify how the borings on Figure 5b for GSMO-2 were proposed.

20. Section 3.0 page 3-1, GSMO #3. This GSMO discusses in very general terms improving distribution and spacing of samples and borings, and improving elevation data, particularly as they relate to sample depths and recovery. However, the purpose in creating this specific GSMO is not clear since, as stated, this GSMO would apply to all borings and there are no metrics set for accomplishing this objective. As a geostatistical modeling objective, it should be made clear how the number and location of the proposed borings have been selected to improve the model. In addition, borings should be considered in RIM areas based primarily on original RI borings where differential settlement could be more significant. GSMO #3 should be altered or a separate GMSO created to address the elevation uncertainty related to the potential for differential settlement to have occurred after samples were collected.

21. Section 3.0 page 3-1, GSMO #4. GSMO #4 is to "*increase data density between, and improve correlation of, laboratory and field data along the 52.9 pCi/g RIM boundary*". As discussed in general comments # 3 and #4 above, the EPA has concerns about the reliability of the thorium shell as depicted in the DIWP and recommends decreasing the reliance on the current RIM boundary and instead focusing on areas with a high degree of uncertainty with respect to excavation decisions. GSMO #4 is not written clearly and based on review of Figure 5C it appears there may be other sampling objectives within GSMO #4 that are not explicitly stated but described below:

a. RIM margin areas: Section 3.1.3 references identification of "*area of RIM defined by the total activities of combined thorium and radium between 7.9 pCi/g and 52.9 pCi/g*." These proposed borings are supposedly included in Figure 5C, but it is unclear which borings satisfy this objective. If these borings are distinct from those proposed based on their proximity to the 0.5 RIM shell, they would be better displayed in a separate figure as part of a distinct GSMO. Revise the GSMO#4 for clarity.

b. Overland Gamma Data: Because the existing overland gamma data was not able to be utilized as input for the preliminary model, it can be compared to model prediction to identify model inaccuracies. That is, the model is more likely to be inaccurate where gamma results contradict model results, and this can provide justification for borehole placement. Section 3.1.2 states that "*borings were placed and relocated to provide coverage in areas where elevated counts were observed outside of historical boring/surface sample locations*," yet it is unclear which borings accomplish this goal. Specifically, there are two gamma regions over 250 that are not within the modeled RIM shell. The EPA is assuming the units associated with the Overland Gamma Survey are in microRoentgen per hour (μR/hr) as the data from this survey was reported in the original RI with these units (see figure 4-4 from the RIA). Regardless of the overland gamma survey unit, it is currently unclear if the nearby proposed borings were placed in order to clarify that discrepancy, or if they are proposed due to their proximity to the 0.5 RIM shell. The borings that are meant to resolve areas with elevated counts outside the current RIM shell need to be identified.

22. Section 3.0 page 3-1, GSMO #5. The RIM areas identified in the DIWP from the existing model as being "*predominantly thorium*" are not representative of all the locations the model depicts as being predominately thorium. The DIWP does not provide enough information to identify all the locations or cells predominantly driven by thorium because only two figures (Figure E-8a and E-8b) were utilized to identify these locations. This concept needs to be further evaluated to account for the CSM which includes that Th-230 is elevated above Ra-226 and thus Th-230 is expected to occur beyond where Ra-226 occurs for a given concentration both vertically and laterally. The location of borings proposed for GSMO #5 does not seem to acknowledge the fact that RIM extent is shown to be driven by thorium at the outer lateral boundary nearly throughout the entire model. In addition, no figures or information is provided to depict the vertical difference between thorium and radium predictions in the model. As stated in our comment # 4 above, further understanding of the significance of the limitations of using soft gamma data to predict thorium near the 52.9 pCi/g threshold is necessary to effectively identify borings and collect samples for this GSMO.

The EPA notes that Section 4.1 of Appendix E provides some discussion on how the thorium driven areas were identified. This section states, "*Figures E-8a and E-8b, there are specific areas of the RIM extent that are driven by detection of thorium, meanwhile the radium areas are mostly if not always coincident with the thorium*." (underlined for emphasis) the EPA does not believe that the 2D depictions of the lateral extent of thorium and the lateral extent of radium which are presented side by in the referenced figures, allow for this determination to be made. Mainly because both the lateral and vertical difference in these predictions are pertinent to the final excavation design. The EPA believes that additional differences would be evident if the lateral extent of radium were overlaid by the thorium extent. Include an additional figure that depicts the radium extent and the thorium extent on top of each other.

23. Section 3.0 page 3-1, GSMO #6. GSMO #6 is to "*further define activities of deeper RIM (>12 feet B2005GS and above >52.9 pCi/g)*" and represents a focused objective to improve estimation of activity in the 16-20 foot B2005GS range. It is not clear if this GSMO is meant to focus boring locations and sampling intervals in areas between 12 and 20 feet below the 2005 surface with RIM occurrences significantly above 52.9 pCi/g for purposes of developing the optimized excavation required in the RODA. Revise GSMO 6 for clarity. The EPA notes that all RIM greater than 52.9 pCi/g down to 16 feet B2005GS must be defined and characterized to calculate the amount of activity that must be removed during the RA as well as evaluating high concentrations of RIM for optimization purposes between 12 and 20 feet B2005GS. Revise for clarity.
The EPA also notes that design of the optimized excavation will include identification of isolated pockets of RIM between 8 and 12 feet B2005GS. Therefore, an objective must be added for delineating these isolated pockets and characterizing the activity associated with them. In addition, Section 5.1 of Appendix E argues that "*the process of how activities are calculated becomes 'relative' in that the true accuracy of the estimate is less important than the precision, since the point is to make a comparative estimate of the activities between 0 and 16 feet B2005GS and activity within the volume of RIM identified for removal by the RD*."

a. First, this statement is only true if the bias of the predicted activity in the ordinary kriging model is constant over the entire spatial domain. If this is an assumption made by the geostatistical team, it should be explicitly stated, and the likelihood of it being met should be discussed in detail with respect to the data density and other contributing factors. For example, areas of comparatively low data density could either be either more likely to underestimate activity by missing discrete areas of high activity, or conversely more likely to overestimate activity by interpolating areas of high activity further than they truly exist.

b. Second, the EPA agrees that the precision is important in the context of the excavation decisions in 16-20 feet B2005GS regions, but the uncertainty is not currently appropriately accounted for in the sampling objectives, and the uncertainty of the activity of isolated pockets also needs to be addressed. Sampling under GSMO #6 should focus on reducing uncertainty in each of these estimates of total activity. The goal of improving estimation of total activity of isolated pockets shallower than 12 feet is missing from this GSMO. The estimation of the activity of the potential remain-in-place isolated pockets is equally as important as the deeper activity for balancing and should be targeted within this GSMO or another.

c. Similarly, the sampling objectives should not be focused only on confirming or better characterizing areas that the model currently predicts as isolated pockets or deeper areas to be excavated, but also identifying new areas. Section 4.0 of Appendix E states that "*in areas of deep RIM, 12 to 20 feet B2005GS, borings will be advanced to 20 feet B2005GS*." All the borings within Area 1 and Area 2 should be advanced to at least 20 feet B2005GS. Downhole and core gamma scans should be performed to this depth as well. Higher density sampling should be performed in any RIM area below 12 feet that appears to be significantly above the 52.9 pCi/g threshold, as well as, RIM areas between 8 and 12 feet B2005GS that may be considered isolated pockets.

24. Section 3.0 page 3-1, GSMO #7. GSMO #7 is to "*collect additional laboratory and field data within specific activity ranges, install nested borings at variable spacing to evaluate nugget/short range variance, and collect data in areas of relatively higher kriging standard deviation*". This GSMO appears to describe three separate objectives which are unrelated. For all three concepts listed in this GSMO, no rationale is provided in the DIWP to explain how the borings were proposed in Figure 5F. Additional detail must be added to the DIWP regarding how these concepts were evaluated and the corresponding borings selected.

The first part of the objective related to collecting data "within specific activity ranges" is not clear. The targeted activity ranges that the additional laboratory and field data will be focused on must be listed in the DIWP. It also appears that this may overlap to some degree with GSMO #6. Either separate this objective from GSMO #7 into an additional GSMO or, if appropriate, revise GSMO #6 to incorporate both related concepts.

The DIWP does not appear include any detail to identify the approximate spacing of borings/samples being proposed to evaluate nugget/short range variance and how this spacing was determined. The EPA acknowledges that Section 2.2.1 of appendix ?? contains some additional discussion of short-range variance. However, this discussion in Section 2.2.1 of Appendix ?? doesn't provide the basis for how the number and location of borings depicted in Figure 5F were determined. This information must be included.

The last part of the GSMO#7 states, "*collect data in areas of relatively higher kriging standard deviation* ". This statement describes an action to be taken but not the intended objective. Revise this portion of the GSMO to state the actual objective that is meant to be achieved. The EPA recommends a single GSMO should be reserved for reduction of model uncertainty as discussed in comment 17 for GSMOs #4, #5 and #7.

25. **Section 3.0, paragraph below the GSMO #7 bullet, page 3-2.** The "*data needs*" as presented in the bulleted list on page 3-2 are nearly identical to the GSMO statements. Provide more specific information in the bulleted list about the type and amount of data needed and how it will be collected. This information should also be included in the QAPP to ensure the data collected will be sufficient to meet the objectives.

26. **Section 3.0 page 3-2, 1st bullet.** The specific goal related to improvement of the regressions needs to be included in the QAPP. See the example in the comment for GSMO #1 above. The DIWP or QAPP should also discuss whether it is important to collect samples throughout the targeted counts per minute (cpm) range and if so how that will be tracked and implemented. This type of detail must be presented in the QAPP to determine if sample collection is of sufficient quality and completeness to meet the objective. And sufficient information must be included in the FSP so that the people in the field know what data to collect.

27. **Section 3.0 page 3-2, 3rd bullet.** See comment #17 above.

28. **Section 3.0 page 3-2, 4th bullet.** The identified data need is to increase data density by reducing the distance between borings, but the bullet does not propose an acceptable average distance between most borings. Revise accordingly.

29. **Section 3.0 page 3-2, 5th bullet.** All borings along OU-1 boundaries should have down hole gamma collected. Revise bullet accordingly.

30. **Section 3.0 page 3-2, 6th bullet**. See comment on GSMO #5 above.

31. **Section 3.0 page 3-2, 7th bullet.** See comment on GSMO #6 above.

32. **Section 3.0 page 3-2, 7th bullet.** See comment to GSMO #7 above.

33. **Section 3.1, page 3-3, 5th paragraph on page**. This section states that these borings are based on historical activities, however, it is not clear which historical activities are being

referred to and whether there are additional historical activities that should be targeted for borings. Revise for clarity and determine if additional borings are appropriate.

34. **Section 3.1, page 3-3, 6th paragraph on page.** This section refers to Figure 7A; however, there are two Figures labeled 7A in this document. This duplication leads to several inaccurate references regarding Figures 7A, 7B, and 7C. Correct figure numbers and references to these figures throughout the Section 3.0 subsections (e.g. Sections 3.1.2.1; 3.1.2.2; 3.1.2.3).

35. **Section 3.1.1, page 3-3 and 3-4**. The subsection title or description should be expanded to make it clear that the discussion is intended to include both Design Investigation Objective (DIO) 1 and the modified version of DIO 2

36. **Section 3.1.1, page 3-3 and 3-4. Perimeter Borings:** Section 3.1.1 states, "*radiological data collected from perimeter borings may be input to the geostatistical model where appropriate*." Perimeter borings would theoretically improve estimation at the boundaries of the geostatistical model. Therefore, the data from these borings must be input into the model.

37. **Section 3.1.1, page 3-3, second paragraph.** This paragraph describes the number of perimeter borings that have been proposed for Area 1 and Area 2 and refers to Figure 5G, Figure 6, and Figure 6A. Figures 6 and 6A include the 1973 aerial. However, the DIWP does not include enough information to explain how the perimeter boring spacing, which is variable, was determined. In addition, staggered borings have been proposed along both sides of the estimated boundaries of Area 2 and the Closed Demo Landfill. The text does not describe how these boring locations were determined. Revise the text by including additional explanation for the variability in the boring spacing particularly along the estimated Area 2 and Inactive Sanitary Landfill Boundary, the Area 2 and Closed Demolition Landfill Boundary, and the Northern Area 1 Boundary.

    In addition, the EPA acknowledges that several additional borings have been located near AC-26A which is in the southeast corner of the estimated Area 2-Inactive Sanitary Landfill boundary. However, given that the location of AC-26A is very close to the current estimated boundary and a sample from this boring from 4-5 feet below the ground surface was determined to have radium-226 and thorium-230 above the definition of RIM (13.4 pCi/g Ra-226 and at 248 pCi/g Th-230), one or more perimeter borings is required to the south of the estimated boundary within the inactive sanitary landfill in order to delineate the extent of RIM related to this area. Samples should be collected from these borings according to all the GSMOs that apply to this area.

    As stated previously, it is not clear why the distance between perimeter borings proposed along the Area 2-Inactive Sanitary Landfill boundary is so much less than the other perimeter borings around Area 2. These perimeter borings should be placed using a rationale like what was proposed for the Area 2-Closed Demolition Landfill boundary which must include staggering borings in locations located on either side of the estimated boundary. These borings must be located within the historical permit boundaries which

are depicted generally in Figure 3-8 of the RIA and more accurately depicted in Drawing Number 2 from the August 29, 2011 Aquaterra-Waste Limits Investigation Summary Report. In addition, these borings should be located within the 1973 historical aerial included as Figure 6 and 6A. In addition, the 1974, 1975, and 1976 aerials should also be considered as they provide some information as to the activities going on in these portions of the Site after the leached barium sulfate residues (LBSR) and topsoil that was reportedly transported from 9200 Latty Avenue in Hazelwood, MO (the Latty Avenue Site or Latty Avenue) to the West Lake Landfill (See section 6.1 of the RIA) but before the 1977 aerial flyover overland gamma survey was performed by EG&G for DOE (See section 4.3.1.1 of the RIA for more details). These additional aerial photographs are included in appendix O of the RIA for May 6, 1974, April 6, 1975, April 12, 1976, and May 9, 1976. In addition, Appendix A-1 from the RIA includes the aerial radiological survey conducted by EG&G. Lastly, for comparison purposes, the estimated boundaries for Area 1 and Area 2 should be overlaid on top of the 1977 aerial radiological survey. Revise these boring locations with consideration of the information referenced above.

38. **Section 3.1.1, 5th paragraph on page 3-4.** The first 2 sentences are identical to the last paragraph on page 3-3. Delete.

39. **Section 3.1.2, page 3-4, second paragraph.** This paragraph states, "*The current lateral extent of 52.9 pCi/g RIM margins are shown on Figures 5A through 5G and have been developed using the geostatistical modeling methods detailed in Appendix E*." Clarify whether this means the 52.9 pCi/g shell was created with the new variogram and revised range and sill lengths discussed in Appendix E. If so, a RIM margin figure comparing these changes and discussing the rationale should be presented in Appendix E.

40. **Section 3.1.2, page 3-5, 1st Paragraph on page.** The second sentence seems to contradict the first sentence. One says the current RIM margins are based on the 50% probability, and the second states the current RIM margins model areas where a probability of 25% non-exceedance indicates a 75% likelihood that RIM is present greater than 52.9 pCi/g has been carried over. Revise to clarify.

41. **Section 3.1.2, page 3-5, 1st Paragraph on page.** Borings should be placed in a transect in a few places across the 25%, 50%, and 75% 52.9 pCi/g probability boundaries to evaluate model predictions. Revise accordingly.

42. **Section 3.1.2.1, page 3-5, second paragraph**. Field data collection methods are not just "*less reliable*", they are currently undefined for the level of thorium that can be detected by gamma scans and are not correlated with radium. Revise this paragraph and section based on the correlations/regressions that are currently being developed.

43. **Section 3.1.2.1, page 3-6, Last paragraph in section.** Revise this section by adding, "*as determined in coordination with the EPA*," after the words, "*and all data collection needs have been satisfied*". Make this same revision in other sections where this language occurs, (e.g. Sections 3.1.2.2; 3.1.2.3; 3.1.3)

44. Section 3.1.2.2, 2nd paragraph, page 3-6. For clarity, revise the second sentence to say, "*RIM in these areas is generally present from 0-12 feet B20005GS in Area 1 and …*"

45. Section 3.1.2.2, 3rd paragraph, page 3-6. All borings should be advanced to 20 feet B2005GS and have down hole gamma scanning performed on them. Revise accordingly.

46. Section 3.1.3, first paragraph, page 3-7. Revise this section to clarify how "*RIM margins greater than 7.9pCi/g*" is being used or defined. Also. the third sentence of the first paragraph states," these *proposed borings will be located outside of the currently expected extent of RIM …*". Clarify whether the "*currently expected extent of RIM*" in this sentence refers to the 52.9 RIM shell or the 7.9 Rim shell.

47. Section 3.1.3, second paragraph, page 3-7. Clarify which borings on Figure 5C are intended to define RIM margins greater than 7.9 pCi/g and differentiate those borings from those associated with GSMO #4. In the text, discuss whether the RIM margins greater than 7.9 pCi/g are meant to be addressed under a specific GSMO or develop a GSMO to address the RIM margins greater than 7.9 pCi/g.

48. Section 3.1.4, page 3-7. Add discussion to this paragraph that more accurately reflects the history of soil disturbance on this property. See Comment 2.4.2 in the FSP.

49. Section 3.1.4.1, pages 3-7 and 3-8. See comment on Section 2.4.2 in the FSP. Surface soil samples associated with the Buffer Zone and Lot 2A2 must be collected and logged to a minimum depth of 12 inches and a contingency must be included in the text that deeper intervals must be scanned and sampled if elevated data results are encountered in the shallow interval. Revise this section to further discuss how the data results (soft and hard) will be evaluated and used from the eight specified survey units for decision making. Revise this section and Section 2.4.2 in the FSP accordingly. Additional comments are provided on this topic in the QAPP on Worksheet 11.

50. Section 3.1.4.2, page 3-8: This section states "*Analytical results from these surface samples will be evaluated to determine a range of used to evaluate these reference areas for comparison to statistically valid background concentrations*."(underlined for emphasis) This sentence is not clear and in addition the statistics to evaluate the background range need to be more specifically described. Also, the EPA does not currently approve the 5 reference areas (4 of which are depicted on Figure 8A). Revise for clarity as well as to provide a description of additional rationale and evaluation necessary to select the reference areas.

51. Section 3.1.5, page 3-8. Add a discussion of the rationale for selecting sediment sample locations, especially with respect to surface water bodies in this section and/or Section 2.4.4 of the FSP. Geologic depositional principles, the CSM and site-specific conditions should be taken into consideration.

52. Section 3.2.3, page 3-11. See comment on Section 2.6.5 of the FSP.

a. Site RAOs require control and management of leachate that emanates from OU-1. Discuss how the need for management will be assessed during the RD. Discuss how the leachate analytes were selected.

b. This section and the FSP state that laboratory samples may be collected and submitted for analyses. It also states field tests may be conducted to evaluate volumes of leachate and evaluate off-site disposal or on-site treatment methods. This work appears to be necessary for RD purposes. Therefore, revise this section and the FSP to state that these tests will be done during the DI and provide the rationale for determining the frequency and timing of these evaluations.

c. Specific discussion of the existing seep in the northwest corner of Area 2 needs to be added to this section or a separate section should be created to discuss it. Inspections and samples will be required for this seep during the DI and the location of the seep should be added to Figure 5G and Figure 6A.

53. Section 3.3, pages 3-11 to 3-13. The EPA is still evaluating this Groundwater Section of the DIWP, especially in light of the work described in the recently received OU-3 Groundwater RI Work Plan and will provide comments on this section and Appendix F in the near future.

54. Table 2. Add a column to Table 2 indicating in each category of boring how many samples will be collected for analytical analysis.

55. Figure 3, Site Features. Some of the boundaries depicted in this figure appear to be inaccurate. Specifically, OU-1 Area 1 and Bridgeton Landfill are not correct. Revise these boundaries to be consistent with Figure 3-5 from the RIA.

56. Figure 5C. Revise this figure to address the following concerns**:**

a. Add units for the Overland Gamma Survey.

b. Revise the text in the box on the lower-left corner of the figure since the RODA does not include specific requirements for the model(s) utilized during RD nor does it specify the non-exceedance probability threshold that an indicator kriging geospatial model must be specified for this particular type of model.

c. Revise the title of the figure and legend since they currently state "*Proposed Area 1 and Area 2 borings (Geostat DQO #4)*"; however, there are no Geostat DQOs described in the DIWP. If this figure is meant to support GSMO #4, it should be listed that way.

57. Figure 6. Revise this figure to address the following concerns:

a. It lists several types of borings which were collected during previous investigations performed on OU-1. It is not clear what set of borings and the associated investigation is being represented by "Soft Data Borings ".

b. Boundaries depicted on the map with thin black lines and slanted green lines are not described in the legend. It is not clear what these boundaries are meant to represent. The EPA suggests they be removed from the figure but if they are pertinent, a label must be added to the legend.

c. The "Waste Boundary" extents depicted in this figure appear to be inaccurate. The approximate edge of refuse is depicted in several figures from the RIA (see Figures 6-8 and 6-9 from the RIA). Replace the "Waste Boundary" with the "Approximate Edge of Refuse" depicted on figures in the RIA. In addition, because this figure is related to evaluating the placement of borings for confirming the boundaries between OU-1 and OU-2, the extent of RIM (< 7.9 pCi/g) should be depicted on these figures rather than the extent of RIM related to designing the excavation. This information can also be taken from Figure 6-8 and 6-9 from the RIA.

58. Figure 6A. Revise figure 6A consistent with the comments provided for Figure 6. In addition, the legend describes a set of borings as "*All visible borings*". This title is not clear and does not appear anywhere else in the DIWP. Revise this description for clarity.

59. Figure 7A. There are two figures with this title. Revise as appropriate.

60. Figure 7A (first). The descriptions next to each of the GSMOs are different than what is described in the text. The text and this figure must be revised for consistency and clarity. The EPA also provided several significant comments on GSMOs. Revise this figure as needed based on revisions to the GSMOs as required by the EPA.

61. Figures 7A and 7B (or Figures 7B and 7C). The color scale on this figure is labeled Non-exceedance Probability, yet the first note states "Color Ramp is probability of 50%-100% probability of RIM exceeding 52.9 pCi/g". This scale, this note, and whether they are related are unclear and must be revised. The cross-section slices include gray shaded areas around the colored portion of the slice. It is not clear if these gray areas are a part of the color scale that is not depicted or if the gray areas are meant to depict something else. Revise the notes for clarity and include a definition of for what the gray areas represent.

62. Figures 7A and 7B. These cross sections should depict probability to a depth of 20 feet. They should also depict where the transects intercept. (i.e. on the B-B' transect show where C-C' intersects). Revise accordingly.

63. Figure 7B. Clarify Note 3 which states, "Color Ramp is along cross-section identified in the plan view map. B-B' shows slight oblique view of C-C' in order to better identify location/depth aspects of RIM. In C-C' only that section is show for simplicity".

64. Drawing 10. As stated above, comments on the groundwater sections and this drawing will be provided in the near future.

65. Appendix E. The EPA is still reviewing Appendix E and determining whether additional comments are warranted; however, the EPA presents the following preliminary comments.

a. Correlations: Appendix E must provide an analysis of the different correlations mentioned and show how collecting targeted field data might improve the correlations. This analysis must include a demonstration of all correlations which depicts the normalized gamma response ranges that will be targeted and how this information will be used to proposed boring and sampling horizon locations.

b. Regressions in the Activity Model: Section 3.1 of Appendix E states that the activity model uses equations C-3 and C-4 from the Geostatistical Report (SSP&A 2017) because "*the additional error matrix analysis performed for these regression equations may more closely represent the true correlation*." While this may be a reasonable justification, it is not clear then why those regressions are not also used for the indicator kriging model since presumably the same justification could be used. This choice should be further justified, or the same regressions should be used for both models.

c. Clustering: Thinning the data as a solution to data clustering is introduced in Appendix E Section 7. While thinning may be easier to implement within the EVS software than the de-clustering weights previously suggested in the PEP comments, the book *Isaaks, E.H. and Srivastava, R.M. 1989. An Introduction to Applied Geostatistics. Oxford University Press, New York, 413* (Isaaks et al. 1989) discusses the loss of information that results from thinning the available data. It is not cost-effective to propose many clustered boreholes if this information will later be lost by data thinning. De-clustering is preferred as it retains all available information and provides a bias correction to the variogram models (Issaks et al. 1989).

d. Duplicates: Treatment of duplicate samples is discussed in Appendix E Section 3.1. The EPA strongly recommends using the average value when duplicates are available. The sample mean is a sufficient statistic and an unbiased, consistent estimator of the true mean, and it is largely backed by statistical theory as the best estimator of the true mean concentration (Casella and Berger 2017). Using the average of duplicates will not introduce bias into the geostatistical model. In addition, whichever method of handling duplicates is chosen, it should be applied to both the activity model and the indicator kriging model for consistency.

66. Appendix F. The EPA is still reviewing the Appendix on DI Groundwater Monitoring and will provide comments on this appendix in the near future.

Comments on 3/30/2020 OU-1 Field Sampling Plan

67. General. The FSP has a lot of non-site-specific statements in it regarding procedures that will or may be performed, (e.g, the monitoring well screen may be screened below

the water table or the monitoring well may be screened across the water table). This document is intended to be a site-specific document that informs workers (and regulators) what and how specific work will be done. Therefore, the specific work to be performed must be clearly documented and/or the decision criteria must be presented in the FSP with references to other documents as necessary.

68. **List of Acronyms, page vi.** Add the following acronyms to the list or include the definition on the specific figure or in the table the acronym is being used: BZ, RU, AC, NWB, SB, PB.

69. **Section 2.1, 2nd paragraph, page 2-1.** Radiation detection equipment should be added to the list of field instrumentation to be used during sampling.

70. **Section 2.1, 3rd paragraph, page 2-1.** Reference should be made to the Attachment Section where the standard forms to be used are located.

71. **Section 2.1.5, 2nd Paragraph, 2nd sentence, page 2-6.** Add statements that the appropriate regulatory entity should also be notified, and regulations followed if a UST system has been encountered.

72. **Section 2.1.5, last 2 sentences of 1st paragraph, page 2-6.** Add statements that the appropriate regulatory entity should also be notified, and regulations followed if a UST system has been encountered.

73. **Section 2.2, 2nd paragraph, 2nd sentence, page 2-6.** Include language indicating that daily briefings will be held with field personnel regarding potential hazards.

74. **Section 2.2.1, Bulleted list, page 2-7.** Revise the first bullet to state that borings fulfilling GSMO #1- 5 and GSMO #7 will be installed to 20 feet Below the 2005 Ground Surface elevation (B2005GS)

75. **Section 2.2, last paragraph, last sentence, page 2-7.** Include reference to 10 CSR 23-4.080 at end of sentence.

76. **Section 2.2.1, last paragraph, last sentence, page 2-7.** Include reference to 10 CSR 23-4.080 (Plugging of Monitoring Wells) to the end of the last sentence of the last paragraph on page.

77. **Section 2.2.1, first paragraph, last sentence, page 2-8.** Include reference to 10 CSR 23-4.080 (Plugging of Monitoring Wells) to the end of the last sentence of the first paragraph on page.

78. **Section 2.2.1.2, 2nd, 5th and 6th paragraphs, pages 2-8 to 2-9.** Add language indicating that any water used in the generation of drilling fluids or during drilling operations will be potable.

79. Section 2.2.2, first paragraph, page 2-9. Abandonment of monitoring wells and borings should be conducted per 10 CSR 23-4.080 regardless of the specific data collection needs of the boring in question. Temporary monitoring wells (including soil borings) 10' deep or greater must be plugged by removing any temporary pipe and filling the well or boring from total depth to 2' from the ground surface with approved grout as defined in 10 CSR 23-4.060 and the remainder of the well or boring filled with compacted uncontaminated native material or grout. Include reference to 10 CSR 23-4.080 at end of the last sentence of the 1st paragraph, Section 2.2.2.

80. Section 2.2.2.1, last sentence in paragraph, page 2-9 Revise last sentence as follows: Grout will consist of a mixture of Portland cement (Type 1) and bentonite in compliance with approved grout defined in 10 CSR 23-4.060, which will be tremied through the drill string as it is being removed and completed in agreement with 10 CSR 23-4.080. Also make this same revision in Section 2.2.2.2, first paragraph in section page 2-9 to 2-10.

81. Section 2.2.2.2, general, page 2-9 to 2-10. Provide additional details regarding installation and time duration of temporary casing needed in borings used for downhole gamma logging, as well as abandonment procedures for the borings when data collection is complete. Installation and abandonment of these type of borings has been a concern in past investigation efforts at the site (2014 Bridgeton Landfill/OU-1 Coring Work Plan and addendums). If a specific procedure has been approved recently in other documentation, please include that reference.

82. Section 2.2.2.2, Last complete sentence on page 2-9. Replace the term "sheeted" with typically used industry term "cased". The sentence should also include a reference to 10 CSR-4.060 which lists the approved casing materials.

83. Section 2.2.2.2, last paragraph in section, page 22-10. Revise sentence as follows, "*Proposed borings that require installation of monitoring well and piezometer will be constructed in accordance with Section 2.5.1 and 10 CSR 23-4.060 and decommissioned as per Section 2.5.3 and 10 CSR 23-4.080*."

a. **Section 2.3.1.3, item 3, page 2-10.** Revise the section to include the following concepts: If drilling fluids are necessary, potable water should be used.

b. Any use of fluids should be minimized to the extent practicable to minimize the potential for spreading contamination.

c. Use of any fluids should be approved ahead of time by project management and appropriate regulatory staff.

84. Section 2.3.2.1, page 2-11. Delete the last sentence in the section that reads, "*In Situ gamma data may not be collected at perimeter borings specifically proposed for geotechnical data collection outside the extent of waste boundaries*" and revise Tables 1 and 2 accordingly. As discussed in comment 36 on Section 3.1.1 of the DIWP, in situ gamma data must be collected for perimeter borings where possible.

85. Section 2.3.2.2, first bullet, page 2-11. Typographical error and incomplete equipment manufacturer listed. Revise to read: Portable ratemeter-scaler: Ludlum Measurements, Inc. (LMI) Model 2221 or equivalent.

86. Section 2.3.2.4, item 1, third sentence, page 2-11. The EPA notes that the example described in this item includes a radiation detector that is smaller than the detector listed for this procedure in section 2.3.2.2, e.g. a Model 44-10. Given that the pipe size will need to be at least large enough for the detector to fit inside it, add the dimensions of the Model 44-10 detector to the bulleted list in section 2.3.2.2.

87. Section 2.3.2.4, item 1, last sentence, page 2-11. The description of borehole details is not site-specific. State the actual size of the borehole and pipe that will be used for this investigation in order to accommodate the instrument cited in Section 2.3.2.2 for use in the DI. Additional details are needed on completion, (including PVC installation), duration of usage, and abandonment of borings used for downhole gamma logging. If a specific procedure has been approved recently in other documentation, please provide that reference. Note that installation of this type of boring for downhole gamma logging may require preapproval and/or a variance from Missouri Geological Survey.

88. Section 2.4.1.1, page 2-12. Add to this list more specific information about the radiation detectors for alpha, beta, and gamma radiation and the photoionization detector (PID) that will be used. Also, add sample labels and containers to this bulleted list, if appropriate.

89. Section 2.4.1.5, page 2-18. Replace the sentence under Screening with the following: "*Samples will be screened with radiation detectors for alpha, beta and gamma radiation and with a photoionization detector (PID) for volatile organic compounds (VOCs)*" and add a reference to the section on field screening/scanning of site samples.

90. Section 2.4.1.6, pages 2-18 and 2-19. There are 2 subsections with the same number, Asbestos Inspection and Field Screening/Scanning of Site Samples. Revise the numbers throughout the document as necessary.

91. Section 2.4.1.6, pages 2-19, Field Screening/Scanning of Site Samples.

a. This section should include more detail regarding the types of field screening that will be done. Discuss the specific equipment to be used for each type of screening/scanning, including for example a PID with a specified eV lamp for VOCs, and the specific radiation detection equipment that will be used to detect alpha, beta, and gamma radiation. Also include a description of the screening/scanning procedures to be used such as where it will be performed, what order it will be performed in, and the approximate speed it will be performed. The EPA notes that if the field screening data is intended to improve soft gamma correlations that were determined from previous investigations, both the equipment and the scanning procedure will need to be as similar as possible for the data to be comparable.

b. Add a reference to the last sentence of this section indicating the location of where information about how the field screening/scanning used to select sample intervals.

92. Section 2.4.1.7, page 2-19. Add an introductory sentence or paragraph that describes how site media consisting of landfill waste will be classified and described using the tables for moisture content and decomposition provided in this section.

93. Section 2.4.2.1, page 2-19 and 2-20. This section discusses a 6" sampling interval because the contamination is "thought to have occurred as a consequence of surface runoff from Area 2…". This justification ignores the fact that the material on Lot 2A2 and the Buffer Zone has been disturbed by human activity several times. Since the nature of the deposition and subsequent anthropogenic movement of the sediments/soil on Lot 2A2 and the Buffer Zone are not fully known, the EPA requires the borings extend to a minimum of 12 inches below the base of the parking surface (gravel, asphalt, fill). Furthermore, Table 4 of the FSP indicates that core scanning will occur from 0-6 inches. Update the table to indicate that radiological core scans are to be performed on the 12-inch core from each boring location. If elevated alpha, beta, or gamma readings are detected at 12", the boring should be advanced in 6" depth intervals until the core scans are no longer elevated. Samples should be collected from 6" below the parking surface, and additional analytical samples must be taken at subsequent 6" depth intervals (e.g. 6-12") if gamma readings are elevated. Also revise Table 4 accordingly. Also add a reference to Section 2.4.1.6, Field Screening/Scanning of Site Samples to this discussion.

94. Section 2.4.2.1, first full paragraph, page 2-20. See comments on Section 3.1.4 - 3.1.4.2 of the DIWP. Selection and description of the proposed background locations should be demonstrated in the text consistent with information in section 2.3 of the EPA's Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites. (EPA 540-R-01-003 OSWER 9285.7-41 September 2002)

95. Section 2.4.2.2, page 2-20. Table 4 from the FSP includes a column that indicates the Buffer Zone and Lot 2A2 samples will have core scan surveys performed on them. Therefore, add appropriate alpha, beta, and gamma radiation scanning instruments to the equipment list in this section.

96. Section 2.4.2.3, page 2-20.

a. Revise this section to indicate Lot 2A2 and Buffer zone samples will have any parking surface material or fill removed prior to loosening the soil to collect the sample to avoid mixing this material into the sample.

b. Add information about when and how the radiation scanning will be performed in each boring and describe the process that will be used to determine if additional samples for laboratory analysis from lower intervals will be collected and submitted.

c. Revise the last sentence of the section by replacing the words "*as necessary*" with "*between each boring and sample*".

97. Section 2.4.3.1, General, pages 2-21 to 2-22.

a. In general, it is difficult to follow the rational for boring locations and to understand how decisions to collect samples in each boring will be made. This section states that, "*Subsurface sampling will be dictated by data needs outlined in the GSMOs and DIOs.*"; however, as discussed in comments on Section 3 of the DIWP above, the GSMOs, as written, are very general and could apply to many borings, not just those specified on the associated figure (Figures 5A-5F). With some exceptions, GSMOs may not be the best or only criteria on which to base soil sampling decisions. Re-evaluate and document the subsurface sampling strategy following revision of the GSMOs as requested.

b. The bulleted list presented in this section is based almost entirely on the GSMOs which are anticipated to be revised based on comments in this letter. Therefore, EPA recommends that this topic be revisited in coordination with EPA, after GSMOs are revised and boring locations have been reevaluated as requested in this comment letter. For example, it may be beneficial to collect a sample above and below an interval with elevated gamma readings in order to give the model hard data to help define vertical RIM intervals and to help delineate potential excavation depths.

c. As indicated in comments on the DIWP, EPA requests that the GSMOs be re-written to more specifically describe the data needed to meet each objective and a description of how the objective will be used to improve the model. A separate boring and sampling plan that is based on meeting the overall DI objectives as well as the GSMOs and fulfilling any data gaps taking into consideration the site conceptual model or historical sampling events, should be developed and used for guiding placement of borings and collection of samples.

d. There is no discussion of how the depth of each boring was determined. In general, the minimum boring depth (except for Lot2A2 and the Buffer Zone) should be 20 ft B2005GS. Since the model makes predictions using nearby data from both horizontal and vertical direction, soft data collected from 16-20 feet will improve the overall model and potentially provide additional information for optimization. The core can be collected and held to provide an option to collect analytical samples from this depth range if the down hole and gamma data suggest it might be useful. Revise this section as indicated.

98. Section 2.4.3.1, first sentence of the section, page 2-21. Add references for where GSMOs and DIOs are defined and discussed or define them in this section.

99. Section 2.4.3.1, first bullet, page 2-21. There is some evaluation of the targeted cpm range for GSMO #1 in Appendix E but little discussion of how this specific range was selected, how it will be implemented and why collection of this data was specified or

limited to the borings identified in Figure 5A This section should be updated after completing the work requested in comment 18 above.

100. **Section 2.4.3.1, 2nd bullet, page 2-21.** This bullet states that for GMSO #2, laboratory analytical samples will be collected from each core run from zero to 16 feet from targeted gamma ranges, and/or peaks observed in alpha scanning. See comments above regarding GSMO #2. It is not clear why specific borings have been selected for this GSMO since improving correlation between core scan and downhole gamma should be a goal for all borings. It is unclear how the borings presented on Figure 5B relate to GSMO #2. The EPA understands that borings may accomplish more than one GSMO, however, it is unclear what selection criteria were used for the boring locations solely proposed for GSMO #2 (borings A1-Th-082, A2-TH-049, A2-TH050, and A2-TH-077). Further discussion should be provided about the sampling rational for GMSO #2 and how it will be used to improve the model.

101. **Section 2.4.3.1, 3rd bullet, page 2-21.**

a. **1st sub-bullet.** See general comment on Section 2.4.3.1 above**.**

b. **2nd, 3rd and 4th sub-bullets.** Revise these bullets to include language that indicates if soft data readings are elevated enough to suggest RIM may be present, additional samples may be required to characterize and delineate the RIM in that boring and step-out borings and samples will be required if RIM is identified in perimeter or boundary confirmation borings.

102. **Section 2.4.3.1, 4th bullet, page 2-21.** A2-TH-092 should be added to the sub-bullet along with TH-125 and TH-127 to serve the same purpose on the south side of Area 2 (although it should be installed to approximately 60 feet).

103. **Section 2.4.3.4, item 3, page 2-23**. Remove the word "*or*" from the second sentience. The core should be scanned with a PID.

104. **Section 2.4.3.4, item 7, page 2-23.** All borings should have core scanning and downhole gamma logging (if the installation method allows for downhole gamma logging), including perimeter borings. Delete, "*or abandon the borehole with bentonite/cement grout, depending on the location*" from this item.

105. **Section 2.4.4, page 2-23.** Discuss the rationale for selecting sediment sample locations here or in Section 3.1.5 of the DIWP. The geologic principles of deposition as well as site specific information should be considered.

106. **Section 2.4.4.1, Second to last paragraph in section, page 2-24.** Since offsite migration may have occurred 40+ years ago, the depth of deposition for site related sediments is unknown. Revise this section to state that borings in the drainage area and Northern Surface water body will be proposed to the depth necessary to evaluate the depositional history of these areas and determine an appropriate sediment sampling depth. At a minimum all sediment samples must be collected to a minimum depth of 24

inches below the current surface and potentially deeper based on the evaluation borings required above. This two foot sediment interval (or greater) will be logged and radiologically scanned. A minimum of two analytical samples will be collected from each sediment boring, one from the zero to six inch interval, and a second from the interval with the most elevated radiological response. If necessary, a third sample should be collected at the deepest interval with an elevated response to delineate potential impacts.

107. **Section 2.4.5, pages 2-27 to 2-28.** Add references to the QAPP as appropriate in this section.

108. **Section 2.4.5.1, pages 2-27.** The QAPP indicates that Th-228 will also be analyzed. Add Th-228 to this table for consistency with the QAPP and list the type of radioanalytical test that will be used for each parameter. Explain the rationale for any differences in radionuclide analytes between the various sampling media and revise as appropriate. Consistency with historical analyses is not necessarily appropriate justification.

109. **Section 2.4.5.2, page 2-28**. Include the type of radioanalytical test that will be used for each parameter in this table.

110. **Section 2.4.5.3, page 2-28.** Include the analytical method for each analyte in this section or reference where that information is presented in the QAPP. The analytes for sediment and the analytes for surface soil are different; however, since both are evaluating to background (See Section 2.4.4 of the FSP) both media should evaluate the same analytes.

111. **Section 2.4.7, page 2-29.** State how the waste acceptance criteria analytes were selected and if they could change based on the disposal facility chosen. Include the analytical method for each analyte.

112. **Section 2.5, page 2-29 and 2-30**. This monitoring well section is overly generalized and should be revised to contain appropriate site-specific detail.

113. **Section 2.5.1, page 2-30.**

a. **2nd paragraph, page 2-30**. Specify whether the wells installed in the waste mass will be screened above or below the water table and state the length of screen that will be used in these wells.

b. **3rd paragraph, page 2-30.** This paragraph states that monitoring wells will be "*installed to a depth to be determined in the field based upon observations of waste thickness and moisture content*"; however, it does not specify how those parameters will be used to determine the depth and construction of the well. Revise this paragraph by adding site-specific detail regarding decision points for well construction (i.e. well will be installed to the base of the waste mass, or screen will be set below the waste but screened across the water table…)

c. **3rd paragraph, page 2-30**. State the diameter of the borehole the well will be constructed in or revise the well cross section to represent the dimensions of wells that will be installed at this site.

d. **4th paragraph, page 2-30**. Bentonite has a natural radioactivity that is typically about 2x background of other clays. The EPA recommends surveying all bentonite grout for radioactivity before use and documenting the levels.

e. **First paragraph on page 2-31**. Delete the *"/or*" from the first sentence.

f. **First paragraph on page 2-31.** Add the specific monitoring equipment that will be used at this site during drilling of monitoring wells.

114. **Section 2.5.3.2, Item 5, page 2-33.** Cuttings extracted during creation of a temporary boring or temporary piezometer may not be used to backfill the boring for the reasons below. Revise item 5 accordingly.

a. Pursuant to 10 CSR 23-4.080: Temporary monitoring wells 10' or greater in depth must be plugged by removing any casing and filling the well from TD surface with approved grout (10 CSR 23-04060).

b. Cuttings should not be used to backfill borings or wells regardless of depth due to the various contaminants present at the landfill that may not be detected visually or with the available field screening equipment.

c. Backfilling the borings with cuttings would also create a potential conduit for vertical migration of contamination.

115. **Section 2.6.1.2, first paragraph, page 2-34.** Add reference to Section 2.9 (Collection and Disposal of IDW) to address the collection and disposal of purge water accumulated during sampling. And a reference to Attachment 9, the form used to record field data during ground water sampling.

116. **Section 2.6.1.2, Item 3 on both page 2-34 and 2-35.** Include the frequency that parameters will be collected and measured for both types of wells (< 25' deep and >25 feet deep). Parameters are typically measured every 3 minutes until stabilization criteria for water quality parameters have been met.

117. **Section 2.6.2, page 2-35.** Add a reference to Attachment 11, the form used to record field data during surface water sampling.

118. **Section 2.6.2.2, 4th bullet, page 2-36**.

a. Discuss the frequency for leachate sample collection. (see comment on Section 3.2.3 of the DIWP)

b. Add that water quality parameters will be taken from the water body before sample collection if it can be done without disturbing the water quality.

119. **Section 2.6.3, page 2-37**. Add discussion to this section (or a new section) regarding the seep located in Area 2 southeast of the Buffer Zone. Include an inspection frequency to establish baseline conditions and a sampling method and protocol.

120. **Section 2.6.4.1, page 2-37**. Include on this list the specific field parameters to be collected.

121. **Section 2.6.4.2, page 2-37.** State how the leachate analytes were selected and include whether treatment and disposal options were considered when choosing them**.** See comments on Section 3.2.3 of the DIWP.

122. **Section 2.6.5, page 2-38.** This sections states wells "*may*" be tested to measure hydraulic conductivity. Replace "*may*" with "*will*" or discuss the decision criteria and rationale that will be used to make that decision. Discuss here or in 3.2.3 of the DIWP whether the need for leachate management as stated in the RAOs will be evaluated with these wells.

123. **Section 2.6.5.2, page 2-38**. Revise to include site specific language.

124. **Section 2.7 through 2.7.3, pages 2-39 to 2-40**. Section 2.7 states that equipment will be calibrated according to the manufacturers recommended guidelines or per Ameriphysics Radiation Control Plan (RCP). Identify the location where these guidelines will be accessible to workers or provide the necessary details in this document or the QAPP.

125. **Section 2.8.1.1, page 2-40.** In the first sentence of this section replace "*Area-1*" with "*OU-1*".

126. **Section 2.8.1.2, page 2-40**. Define, or state how and when, ambient background for scanning purposes will be determined.

127. **Section 2.9, page 2-42.** Specific details for IDW management for each waste media that may be generated must be provided in this section. It is not acceptable to reference historical documents for this information or to say that "*evaluation of site-derived waste management procedures will be ongoing.*" Soil cores generated during the DI may be temporarily archived for use during the RD; however, their ultimate disposal must be addressed.

128. **Section 3.1.2, page 3-1 to 3-2.** Groundwater sample naming conventions must be made consistent with OU-3 sample naming conventions. An additional designation should be added to identify that the sample is being collected for the OU-1 baseline groundwater monitoring program.

129. **Section 3.2.3.2, item 7, page 3-4**. It is recommended that the COC form be placed in a sealable plastic bag prior to being placed in the cooler.

130. **Tables 2 and 3.**

a. Revise these tables to reflect responses to the EPA's comments on sampling strategy throughout FSP and DIWP.

b. Clarify on the tables whether the waste acceptance criteria sample will be from one of the intervals sampled for other analytical purposes.

131. **Table 4.** Revise the sampling interval column and the core scan column of Table 4 to reflect comments on Section 2.4.2.1.

132. **Figures 1 and 2.** It is recommended that the size of the boring symbols or text labels be reduced to make identification of boring clearer.

133. **Figure 6.** Provide a larger scale figure of sediment sample locations so the actual locations with regards to current conditions on the ground are visible. Add labels to the figures identifying the North Surface Water body and the Earth City Flood Channel and discuss the rationale for locating sediment samples here or in the DIWP. Sample locations should be based on where sedimentation was most likely to occur.

134. **Attachment 3. Core log**. The core log should be modified for site-specific conditions by adding columns for PID and radiation field screening data. The specific name of the driller and contractor should be removed unless they are accurate for this field investigation.

135. **Attachment 11, Surface water/seep sampling record**. Measurement units for each field test parameter should be added to the form.

136. **Attachment 13, Surface Soil Sampling Record**. The field test parameters on this form should be updated to reflect site-specific needs for this site.

Comments on 3/30/2020 OU-1 Quality Assurance Project Plan (QAPP)

137. **General Comment.** The QAPP is not sufficiently developed to identify all the DIs that rely on collection of data, determine questions that will be answered from this data, and determine how this data will address data gaps and design objectives. Revise the QAPP to include objectives for all the data that will be collected for decision making or estimating purposes so that appropriate data quality criteria can be developed.

138. **General Comment.** Information pertaining to the quality of data collected during the various activities throughout the entire DI (such as field measurements, sample collection, GPS, and required consumables) must be included in the QAPP. In general,

information regarding specific procedures for sample collection and operation, maintenance, and documentation for field equipment may be included in the FSP, with references to FSP sections made in the QAPP. These items must be addressed in the QAPP to demonstrate that the data are of acceptable quality for the intended purpose.

139. **General Comment.** The location of specific individuals responsible for maintaining the official copy of the QAPP, and a statement of how all individuals specified will receive the most current copy of the QAPP when modified need to be added. This information must be specified in the QAPP (See EPA QA/G-5, Example Checklist, C-6, A-9 item 5).

140. **General Comment.** Laboratory Standard Operating Procedures (SOP) were provided but it is not clear what analytical method is being followed for each analyte. In addition, no field collection sampling SOPs were found or referenced including sample geolocation, sample depth measurement, physical sampling methods such as auger or drill. This information must be included in the QAPP (See EPA QA/G-5, Example Checklist, C-7 to C-9, B2).

141. **General Comment.** Sampling SOPs must specifically detail whether and how sampling equipment should be decontaminated and how by-products will be disposed of. (See EPA QA/G-5, Example Checklist, C-9, B2 Item 8).

142. **General Comment.** Discussion of Inspection/Acceptance for Field and Lab Supplies and Consumables was not found, nor was identification of individual(s) responsible for this work provided. This information must be included in the QAPP. (See EPA QA/G-5, Example Checklist, C-12, D8).

143. Additional comments on the QAPP from EPA Region 7's QA Office are included as an enclosure to the comment letter.

144. **Worksheet #10, Page 10 of 140, General Comment.** The first paragraph of this worksheet contains the following statement, "*The concise summary below focuses on elements of the CSM that are important to an understanding of data gaps to be resolved as a means of informing DQO development.*" The EPA does not agree that the four paragraphs that follow this statement contain sufficient detail to understand the data gaps and associated uncertainties that are proposed to be resolved through the DI and the associated data quality objectives. Further, several critical aspects of the CSM are missing from the discussion. This includes the following: (1) Further description of the assumed landfilling activities associated with the leached barium sulfate residues and soil mixture which were brought to the Site in 1973 (daily, intermediate, and final cover); (2) A description of the land area, estimated volume of RIM, and estimated volume wastes contained in OU-1; (3) General description of the surface of the landfill and how that has changed from the early 1970s to the present day; (4) Further description of the prior investigations at the site and the dates of those investigations; (5) Description of the radiological content associated with RIM (Primarily U-238 radionuclides that are not in equilibrium with Th-230 as the most prevalent); and (6) General description of the

remedy including the optimized excavation. The EPA notes that information pertaining to all of these items except number 6 are included in the RIA.

Each of these topics helps inform and characterize the current data gaps and significant uncertainties that need to be addressed through the DIWP so that an acceptable final design for the remedy can be completed. These data gaps and uncertainties include: (1) The location and volume of RIM greater than 52.9 pCi/g generally between the current surface and a depth of 20 feet below the 2005 ground surface sufficient to reasonably determine an optimized excavation; (2) The specific locations of RIM significantly above 52.9 pCi/g between 12 feet and 20 feet below the 2005 surface to reasonably determine an optimized excavation; (3) The specific locations of RIM that appear to be isolated from larger occurrences of RIM between 8 feet and 12 feet below the ground surface sufficient to be accounted for in the optimized excavation; (4) The specific vertical intervals of RIM that have been estimated from prior borings; (5) The preliminary model predictions; (6) Soft and hard data correlations/thorium detection capability; (6) Boundaries of Area 1 and Area 2 related either to the extent of waste or in some cases the extent of RIM; and (7) Radionuclides occurrences in sediments located below the current surface (below the top 6 inches) of drainage areas surrounding OU-1. Additional uncertainties are acknowledged in the section already, such as, the current location of RIM on the Buffer Zone and Lot 2A2 and representative background concentrations for those two portions of OU-1.

This worksheet contains the only formal discussion of the CSM related to the DIWP deliverables and must be revised to provide a reasonable understanding of the data gaps and uncertainties that the DI is intended to address. This will also allow DQOs to be developed that ensure data quality is sufficient to address necessary aspects of these data gaps.

145. Worksheet #10, second and third paragraph, page 10 of 140. The discussion presented in these paragraphs of the CSM have very little relevance to the design of the remedy and provides very little insight into the nature of RIM and its placement at the Site. Include in these introductory paragraphs a description of the nature of RIM and in particular the prevalence of Th-230. This description should also include an acknowledgement of the relative difficulty to detect this radionuclide compared to other radionuclides associated with RIM.

146. Worksheet #10, fourth paragraph, page 10 of 140. This paragraph attempts to provide a description of the existing data set, the resulting description of RIM based on this data, and rationale for why additional data is needed. This description fails to fully consider the CSM and existing data/model when describing the estimated occurrences of RIM, and specifically final cover application. It also fails to provide any context as to the adequacy or lack thereof of the existing data set. In order to provide some context related to the sentence that states the number of radium and thorium analyses that have been performed for OU-1, sentences should be added describing the land surface (e.g. acreage) associated with Area 1 and Area 2, the number of borings placed in Area 1, as well as, the estimated volumes of RIM and waste material contained in Area 1 and Area 2 which

are contained in the RIA. This information can be used to describe an average acreage represented by each boring and an average volume represented by each sample. Lastly, the sentence stating that judgement-based sampling programs create bias and uncertainty is unclear. The paragraph must be revised to provide a more complete consideration of the CSM and the current estimated occurrences of RIM, provide a general description of the need for additional data to support the design of the remedy, and the data gaps/uncertainties associated with the existing data set significant to completing the design of the remedy.

147. Worksheet #10, last paragraph, page 10 of 140. The last paragraph describes the uncertainty related to the occurrences of COCs in the Buffer Zone and Lot 2A2 portions of OU-1, as well as, the need for the determination of representative background concentrations of these COCs. However, the worksheet does not adequately discuss PSQ #4 and PSQ #5. Revise this paragraph by including a CSM discussion and associated description of data gaps related to groundwater and sediment sampling.

148. Worksheet #11, Step 1, page 12 of 140. Revise the first sentence as follows, "*The term "isolated pockets" is used in the Remedy to describe certain infrequent occurrences of RIM between 8- and 12-feet that may be left in place to reduce the volume of the excavation provided the estimated activity associated with such pockets is removed from deeper locations elsewhere, with a preference for high activity areas.*" In addition, delete the following from the second sentence, "*, and*".

149. Worksheet #11, Step 1, first paragraph, page 13 of 140. This paragraph appears to be the only one in the section that states the specific problem to be solved through the collection of data for this DI. While the section generally describes the complexity of designing a remedy that requires characterization of a large subsurface contaminant source, it does not include an adequate description of the problem that is to be solved with the DI. This problem description should include an acknowledgement that there are some uncertainties and limitations associated with the existing data set that impact the existing geostatistical model's ability to accurately predict occurrences of RIM sufficient to design the optimized excavation portion of the remedy. The section must be revised to include at a minimum a description of the problems that are to be addressed through data collection during the DI including but not limited to: (1) Estimating/determining the depth to drill each boring and the depth to collect samples from within each boring; (2) Improving correlations/regressions between concentrations of radionuclides and gamma scanning surveys; (3) Reducing model uncertainty (see comment for the DIWP concerning "An Alternative approach to GSMOs 4, 5, and part of 7**"**); and (4) Any other decision points, e.g., deciding to perform a step out boring that will be based on either soft or hard data.

150. Worksheet #11, Step #2, Table 11-1, Page 14 of 140. Several issues exist with how PSQ #1 and the alternative actions are presented in the QAPP. The first is that it restricts the primary focus of the study question related to improving the CCM to the 52.9 pCi/g portion of the boundary of the excavation design. The CCM needs to be capable of reasonably predicting all occurrences of RIM greater than 52.9 pCi/g between the current

surface and 16 feet below the 2005 topographical surface (B2005GS) regardless of whether these occurrences are part of the excavation. This is necessary in order (1)to estimate the activity of all the RIM greater than 52.9 pCi/g between the current surface and 16 feet below the 2005 surface and (2) to select, delineate, and estimate the volume and activity associated with isolated pockets between 8 and 12 feet below the 2005 surface that will not be excavated. Both examples describe locations within OU-1 that need to be characterized for optimization purposes but are not part of the excavation boundary.

The CCM also needs to be capable of being queried to select, delineate, and estimate the activity associated with higher activity occurrences of RIM (significantly above 52.9 pCi/g) between 12 feet and 20 feet below the 2005 ground surface. Lastly, the CCM must be capable of reasonably predicting the lateral extent of all RIM (combined thorium and combined radium greater than 7.9 pCi/g) for the purposes of determining the placement of the OU-1 landfill cover. If the respondents intend to have one PSQ related to deciding the adequacy of the CCM in the QAPP for this DI, then the study question must be expanded to ensure all the purposes of the CCM for this design are addressed. The EPA recommends that a separate PSQ be developed specifically related to the ability of the CCM to reasonable estimate activity as required in the RODA.

151. Worksheet #11, Step 2, Table 11-1, Page 14 of 140. PSQ #2 appears to be outside the scope of the DI. The final proposed optimized excavation will be presented in the revised excavation plan after incorporation of the data into a CCM that has been further evaluated and determined to be suitable for the RD. The EPA is uncertain how subsequent steps of the DQO process could be developed to ensure the data collection activities associated with the DI provide a definitive answer as to whether an excavation plan based in part on this data, but which has not yet been developed, meets the requirements of the RODA. The EPA suggests this study question be removed from the QAPP or substantially revised to pertain to specific data collection activities geared towards characterizing isolated pockets of RIM between 8 and 12 feet B2005GS and higher activity occurrences of RIM between 12 and 20 B2005GS.

152. Worksheet #11, Step 2, Table 11-1, Page 14 of 140. PSQ #3 appears to be written for a remedial action rather than an RD. Data collection must first occur to characterize the occurrences of RIM on the Buffer Zone and Lot 2A2 to determine where or whether remediation is needed according to the requirements in the RODA. Revise PSQ #3 accordingly.

153. Worksheet #11, Step 2, Table 11-1, page 14 of 140. It is not clear why groundwater monitoring and leachate characterization are being combined into one PSQ as they are being investigated for two distinctly different reasons. The EPA recommends that more specific study questions be developed for each of these media. The alternative actions do not seem appropriate because they can only be taken after the PSQ is answered.

154. Worksheet #11, Step 2, Table 11-1, page 14 of 140. PSQ #5 is so broadly written that it is not clear what must be estimated in order to determine impacts nor is it clear how the determination will be made as to whether an impact has occurred. The PSQ must be revised so that there is consistency between it, the alternative actions, and the estimation/decision statements presented in Table 11-1. If a decision-based approach is chosen, define historical impacts so that it is clear how the need for correction action will be determined. If an estimation-based approach is chosen, the PSQ should be clearly directed towards estimating the concentrations of radionuclides in subsurface sediments based on the potential for historical migration of RIM. EPA notes that Section 2.4.4 of the FSP states, "*Sediment samples will be collected from locations in and adjacent to the Northern Surface Water Body and Earth City Flood Control Channel, as shown on Figure 6, in order to evaluate the presence of radionuclides above background, if any, in these areas*." The QAPP and the FSP must be consistent.

155. Worksheet #11, Step, Table 11-1, pages 14 and 15 of 140. The PSQs do not include questions related to certain critical aspects of the design and/or data gaps. These items need to be addressed in the DI so that the design of the remedy can be completed in accordance with the approved schedule. See general comment 1 above and revise the PSQs as necessary. In addition, no PSQ is included related to DI objectives 1 and 2 listed on page 3-1 of the DIWP for confirming the boundaries between OU-1 and OU-2 (see comment for PSQ #1). The QAPP also needs to address the data quality associated with samples and scanning performed for these borings.

156. Worksheet #11, Step 2, Figure 11-1, page 16 of 140. This figure appears to try to present a combination of remediation steps involving both the optimization aspects of the excavation of Area 1 and Area 2 required by the RODA, as well as, the potential excavation that may be required for the Buffer Zone and Lot 2A2. Similar to PSQ #2, this seems to be outside the scope of the DI and goes beyond specifically discussing the decisions and estimates associated with the data collection activities. Such a diagram would be useful in the revised excavation plan and either the 30%, 90%, or final design submittals. However, the figure as currently presented is unclear and the EPA is concerned that it may not be consistent with the requirements of the RODA. The EPA believes that a diagram that visually depicts the steps/decisions that are specific to the DI would be useful. Revise this figure after updating the statement of the problem and PSQs according to the prior comments. Then include in the diagram steps for locating the depth of samples within specific borings, the approach to making decisions to collect an additional step out boring, and any other decisions or estimates that will be made specifically related to the DI.

157. Worksheet #11, Step 3, second paragraph, page 17 of 140. The first sentence of this paragraph states, "*For PSQ-1, PSQ-2, and PSQ-5, <u>spatially-correlated</u> concentrations of total radium and total thorium in pCi/g are needed, where the former is informed by the radioisotopes <u>Ra-266</u> and Ra-228 and the latter by the radioisotopes Th-230 and Th-232*." (underlined for emphasis) It is not clear what is meant by "spatially-correlated" in this sentence. If the intent is to require samples from individual locations to be analyzed for both total radium and total thorium, then revise the sentence to simply

state what analyses are required for samples collected for PSQs #1, #2, and #5. In addition, "*Ra-266*" should be changed to "*Ra-226*".

158. Worksheet #11, Step 3, page 17 of 240. Revise where necessary descriptions of the inputs to the decision for PSQ #5 to ensure consistency between the QAPP and the FSP. (See comment on PSQ 5 for details).

159. Worksheet #11, Step 3, page 18 of 240, first paragraph. In the first sentence of this paragraph, the passage "*Thus, Ra-226, Ra-228, Th-230, and Th-230 are…*" apparently should be "*Thus, Ra-226, Ra-228, Th-230, and Th-232 are…*".

160. Worksheet #11, Step 3, page 19 of 240. Included on this page is the following statement, "*While considered qualitative due to reasons identified, the geostatistical processes use the gamma data by inclusion in the cumulative distribution function as part of the indictor assignment for indicator kriging at multiple thresholds. In doing so, the gamma measurements are essentially weighted such that they can be used in support of identification of RIM, but with less influence than the laboratory measurements.*" As described in these statements, qualitative data is being used to quantify specific concentrations of radionuclides. The use of gamma data in the manner described in the statement above requires the development of one or more DQOs. Revised the QAPP to include DQOs for all types of gamma data that are based on the intended use of this soft data and/or improvements to correlations to laboratory data.

161. Worksheet #11, Step 4, page 20 of 240, first paragraph. The description of the site boundaries and their relationship to existing fencing is overly simplistic and is not consistent with other aspects of the DI. For example, Section 3.1.1 of the DI work plan states, "*Seventeen (17) borings are proposed along the perimeter of Area 1, and 39 borings are proposed along the perimeter of Area 2, to evaluate (a) whether RIM is present and (b) evaluate the extent of waste as it pertains to cap design.*" In addition, section 3.1 of the DI work plan states, "*Additional perimeter borings were placed in areas where historical filling operations were observed to supplement historical data collected and better define RIM distribution in these areas.*" A substantial amount of additional data collection has been proposed to improve the accuracy of the extent of RIM greater than 7.9 pCI/g and/or waste material. Even though the perimeter boring program is not currently addressed in this QAPP, the description of the Area 1 and Area 2 boundaries must be revised to acknowledge that additional investigation has been proposed.

162. Worksheet #11, Step 4, page 20 of 240, second paragraph. The description of where RIM is expected to be located on the Buffer Zone and Lot 2A2 is overly simplistic. This discussion should be expanded to acknowledge that the "*soil surface*", as differentiated from "*ground surface*", of these areas was disturbed after it was discovered that RIM material had migrated from Area 2 but before they were "*covered by gravel and other gravel-like material*". A summary of the previous investigations and regrading activities that occurred on these two properties is described in Section 6.7 of the RIA. Revise this paragraph by including a summary of significant details related to the spatial

boundaries of the Buffer Zone and Lot 2A2. In addition, the note added at the end of this paragraph is not clear with regard to "*the presence of average surface radioactivity*" and "*the new 15 cm surface*". While it doesn't seem necessary to describe the circumstances under which remediation of the Buffer Zone or Lot 2A2 would be necessary in "*Step 4. Define the Boundaries of the Study*" of the DQO process, the sentence must be revised for clarity or removed. Lastly, this paragraph must be revised to note that survey units (i.e., decision units) related to PSQ #3 have been established in the DIWP and provide a reference for that document.

163. Worksheet #11, Step 4, page 20 of 240, third paragraph. This paragraph discusses the boundaries of the background investigation associated with PSQ #3. This discussion is not consistent with similar discussions in Section 3.1.4.2 on page 3-8 of the DIWP and Section 2.4.2.1 on page 2-20 of the FSP. This inconsistency primarily relates to the following statement in the QAPP, "*One distal location is also investigated.*" The sections referenced from the DIWP and FSP state that this location, "*will be identified and included in the background study.*" The paragraph must be revised to make clear when and how this distal background location will be selected and the evaluation criteria that will be used to select it. If this information is going to be described in one of the referenced sections of the DIWP or FSP, then a reference to this information can suffice. The EPA has provided additional comments on this topic in both Section 3.1.4.2 of the Design Investigation and Section 2.4.2.1 of the FSP. The EPA has provided additional comments on this topic in both Section 3.1.4.2 of the DI and Section 2.4.2.1 of the FSP. This worksheet will need to be revised consistent with any changes made to the FSP and DIWP sections based on the EPA comments. The EPA suggests that all the discussions related to the selection of the background locations be consolidated into one of these three documents and referenced in the other two. Lastly, the reference to a figure depicting the four currently selected background locations needs to be corrected to either Figure 8A of the DIWP or Figure 5 in the FSP.

164. Worksheet #11, Step 4, page 20 of 240, fourth paragraph.

a. The paragraph states, "…*the uncovered background reference area that can be scanned with field instruments to make an a priori assessment of how representative a sample will be…*" It does not appear that such surficial gamma scans have been proposed for the background reference areas based on review of the DIWP. Revise the section to clarify whether a surficial gamma scan will be conducted on the proposed background locations and how this scan will be used to assess the representativeness of individual background samples.

b. The paragraph also states, "…*subsurface sampling…presents a number of worker health and safety challenges*." The EPA is not aware of any health and safety challenges for workers conducting typical subsurface sampling as this work is done commonly for many Superfund sites. Include in this paragraph further description of the health and safety challenges being referred to in this sentence or delete this item.

c. Lastly, the paragraph states, "*Because it is impossible to sample every inch of a survey area, at some point professional judgement is used to decide upon a frequency or spacing at which samples are presumed to be representative when scanning is not possible.*" This statement is overly simplistic and needs to be revised based on the following information. The EPA's 1996 Soil Screening Guidance provides examples and recommended approaches to developing soil sampling strategies that do not rely on the use of surface scans to estimate mean concentrations in an exposure area. This is done in part by systematically determining the number and location of samples within an exposure area based on expected variation of the contaminants within the exposure area and predetermined decision error rates. In addition to this guidance, the EPA previously provided a comment to Section 5.2 of the Design Criteria Report discussing this same topic and provided additional guidance documents (see comment 59 from the EPA's September 13, 2019 letter).

165. Worksheet #11, Step 4, last paragraph. The description provided in this paragraph does not adequately describe the spatial and temporal boundaries for PSQ #5. The spatial boundary described in this paragraph is more limited than the discussion and figure in the DIWP. No discussion is included related to the temporal boundary. This description will inform the relationship between the depth of sediments and the timeframe which these sediments were potentially deposited in drainage areas. Revise this description accordingly.

166. Worksheet #11, Step 5, Table 11-3, pages 22 and 23 of 140. The decision rules must be revised for PSQ #1 and PSQ #2 according to comments provided for Step #2 of Worksheet 11. As part of Step 5, the geostatistical model should be mentioned with respect to PSQs #1 and #2, and the other specific statistical methods should be discussed with respect to the other PSQs. For PSQ #3, it appears that a two-sample t-test will probably be performed based on the discussion of Visual Sampling Plan software (VSP), but this needs to be explicitly stated. Assumptions of the stated statistical method(s) should also be mentioned here or as part of Worksheet 37 (Step 3 of a data usability assessment), as well as what plans exist to evaluate them (e.g., a histogram to assess normality). The plans for what software will be used for the analysis should also be stated.

167. Worksheet #11, Step 6. Acceptable decision errors should be specified in Worksheet 11 Step 6 rather than in the final excavation design. Acceptable decision error should be used to evaluate the appropriate number and placement of samples since the data are available to do so. This is the purpose of specifying the acceptable decision error upfront. Appendix E of the DIWP (Introduction) states that the model should "*meet the expected precision for decision making*," but this precision has not even been identified. An example of how acceptable error rates should be used is discussed in the comment to the DIWP that relates to "An Alternative approach to GSMOs 4, 5, and part of 7".

168. Worksheet #11, Step 7. Additional detail on the selection of specific sampling locations for the Buffer Zone and Lot 2A2 is needed as part of Step 7 in Worksheet 11.

The VSP software is mentioned with regards to the sample size calculation, but it is unclear how the locations in each of the survey units in Figure 8 of the DIWP were selected beyond the random start. For example, specify that sample locations 10 meters due north, south, east, and west of the random start were selected at intervals until the survey unit boundary was reached.

169. Worksheet #12, pages 30 through 38 of 140. There does not appear to be discussion of any Measurement Performance Criteria for GPS measurements and boring/sampling measurements that will be performed for samples discussed in this section. Nor is this provided in Worksheet #14 related to Secondary Data Uses and Limitations. Revise worksheet #12 by including Measurement Performance Criteria for these items.

170. Worksheet #13, page 39 of 140. The table provided on this page mentions "*1982 sampling depth inaccuracies*" as a factor affecting reliability of data related to the "*OU-1 Subsurface Soil Radiological Lab Data*" and "*OU-1 Subsurface Soil Field Screening Data*". However, no mention of potential depth inaccuracies is mentioned in the 1995 investigations for which differential settlement may provide a source of uncertainty for data collected 25 years ago. Revise the table by more thoroughly considering uncertainties of the existing data and provide a complete list of factors affecting the reliability of the data.

171. Worksheet #13, page 40 of 140. It is not clear why the last 6 data types listed in this table have no information in the column related to the use of these data types relative to the current project. This information must be added, or these data types should be deleted from the table.

172. Worksheet #17, pages 58 through 60 of 140. Several comments have been provided in the DIWP and FSP that relate to the sampling design and rationale currently proposed in this worksheet. This worksheet should be revised as necessary in consideration of other comments provided in the QAPP and related comments provided in the DIWP and FSP.

173. Worksheet #18, pages 61 through 85 of 140. Table 18-1 provides the estimated total boring depth in (feet B2005GS) that is expected for each boring as well as an Easting and Northing coordinate for each boring. However, no discussion appears to be included in the DIWP, FSP, or QAPP related to how the depth of each boring will be related to the current ground surface so that each boring can be drilled to the appropriate depth. Revise the table by including a column listing the corresponding depth from the current surface or include a description of how and when this will be determined.

174. Worksheet #22, page 93 of 140. Neither geolocation equipment nor any equipment related to making depth measurements is included in this worksheet. If field equipment will be used for these activities, they must be added to this table.

175. **Worksheet #36.** Worksheet 36 must specify the circumstances under which data will be rejected as a result of not meeting QC criteria. The corrective actions section (Worksheet 28) only says to correct the problem and re-analyze the sample. Worksheet 36 identifies the "R" qualifier as rejected data that are unusable "*due to serious deficiencies in meeting QC criteria*," but it is never specified what qualifies as a serious deficiency.

176. **Worksheet #36.** This worksheet specifies data validation procedures for the analytical group/method of "*All Chemical Analyses*." The QAPP is unclear as to whether these specifications also apply to radiological analyses. This worksheet should be revised to clarify what data validation procedures apply to data from radiological analyses.

177. **Worksheet #37.** It appears, based on the description provided in the first paragraph, that Steps 3-5 given in Worksheet 37 for a data usability assessment are meant to be performed during, rather than prior to, data analysis and after the data collection activities are concluded. Step 5, *document data usability and draw conclusions*, must include an evaluation to determine whether there is enough confidence to use the data to answer the study questions following statistical analysis (step 4, "*implement the statistical method*"). This process must be completed for each of the PSQs. For example, PSQ #3 is described in Step 7 of Worksheet 11 with the following, "*PSQ-3 asks, "Are radionuclide concentrations in the Buffer Zone and Lot 2A2 reduced to background?" This question is answered by 1) determining statistically valid mean background concentrations of ROCs, 2) determining mean concentrations of ROCs in DUs, and 3) comparing the means.*" For this example, the evaluation described in Worksheet #37 will be related to the statistical metrics chosen for item 1 and item 2, any associated limits on type I and type II error rates, and the statistical test that will be conducted for item 3.

Comments on 3/30/2020 Data Management Plan (DMP)

178. **General Comment: Specification and Data Management Procedures Regarding the Access Soft Database.** The DMP identifies two primary stores of data: the EQuIS database and the Access Soft Database. Descriptions of the data management systems and data management procedures included in the DMP primarily regard the EQuIS database, while descriptions of and management procedures related to the Access Soft Database lack specificity. Revise the DMP to provide additional specification and procedures related to the Access Soft Database. These specifications and procedure should address:

a. Use of existing software tools to enforce referential integrity of the database (e.g., the EPA's Scribe software or EQuIS Data Processor); if no such software will be used, a description of how referential integrity will be maintained and verified within the database;
b. Establishment of a uniform naming system for identifying locations associated with soft data types;
c. Integration of background count rates;
d. Integration of calculated parameters (e.g., net count rates);

e. Integration of or reference to spatial survey data (Figure 4.1 indicates that spatial data will be stored in the EQuIS database); and
f. Referential integration with the EQuIS database (e.g., cross referencing common borings or boring groups).

SPECIFIC COMMENTS

179. Section 4.0 – Data Types and Procedures. This section describes various data types (e.g., laboratory analytical data, field measurement data, etc.) and references a Data Flow Model depicted on Figure 4.1. The EPA requests specification of an additional data type in Section 4.0 that addresses frequently used parameters calculated from other data types. These calculated parameters should include but not necessarily be limited to:

a. Combined thorium: sum of Th-230 and Th-232 concentrations in a sample in picoCuries per gram (pCi/g);
b. Combined radium: sum of radium-226 and radium-228 concentrations in a sample in pCi/g;

c. RIM activity: sum of total thorium and total radium concentrations in a sample in pCi/g; and

d. Sample depths referenced to the 2005 topographic surface in feet (i.e., depths in "B2005GS" as described in the FSP of the Draft DIWP).

Section 4.0 should be revised to include specification of this additional data type, and Figure 4.1 should be revised to depict processing and storage of calculated parameters. The calculated parameters to be processed and stored in database(s), including those listed above, should be identified in the DMP, and the procedures for calculating the parameters should be included in the DMP or in another document of the DIWP.

Section 5.2.2.2 – Data Validation. This section includes the procedure for updating laboratory-provided data with changes identified during data validation. The EPA requests storage of the laboratory-provided data qualifiers in the EQuIS database along with data qualifiers as modified by the data validation process. This section should be revised to include this specification.

180. Section 6.2 – Quality Assurance and Control, Paragraph 4, Sentence 1. The passage "*Data will be batched for analytical preparation…*" apparently should be "*Samples will be batched for analytical preparation….*" This sentence should be revised as necessary.

Comments on 3/30/2020 Health and Safety Plan and Radiological Control plan

181. The EPA does not specifically approve these plans, and any comments on them will be provided under a separate cover**.**

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

Apr 29, 2020

MEMORANDUM

SUBJECT: Quality Assurance Project Plan West Lake Landfill Superfund Site Operable Unit 1; Bridgeton, Missouri – Reviewed

FROM: Diane Harris,
Regional Quality Assurance Manager
Laboratory Services and Applied Science Division

DIANE HARRIS Digitally signed by DIANE HARRIS Date: 2020.04.29 12:53:15 -05'00'

TO: Christine Jump
EPA Project Manager
Superfund and Emergency Management Division

The review of the subject document prepared by Parsons and dated March 2020 has been completed according to "Uniform Federal Policy for Quality Assurance Project Plans - Optimized UFP-QAPP Worksheets," March 2012.

Because the document was unsigned, it was reviewed as a draft and the comments are outlined below. Critical comments identify issues which need to be addressed before the document can be approved. General comments identify opportunities for strengthening the document but do not affect approval.

Critical Comments

1. § 1.2 Signatures, page 2. Once the QAPP is ready for final approval, it will need to be submitted with the appropriate signatures. See also QAPP Worksheet #4, 7 & 8.

2. QAPP Worksheet #3 & 5: Project Organization and QAPP Distribution, page 3.

    a. Tom Hansen is shown as the QA Officer for Ameriphysics on the organization chart but as the Health Physicist on the signature page (see also worksheet #4). Which is correct? Is he performing both roles and does this allow him the needed independence as the OA Officer? If not, should there be another QA signature on the signature page for Ameriphysics?

    b. Are the lines shown on the organization chart represent lines of authority and/or lines of communication?

3. QAPP Worksheet #6: Communication Pathways, page 6. Although some assumptions could be made, communication pathways related to unexpected events, emergencies, field non-conformances, and QAPP changes during work do not appear to be specifically addressed here.

4. QAPP Worksheet #11: Project/Data Quality Objectives, page 11. For landfill gas and radon monitoring, this section generally refers to ARARs. Where are these ARARs defined?

5. Figure 11-1 Decisions and Relationships, page 16. The top of this figure refers to areas impacted by RIM > 7.9 pCi/g. Is this correct? All other references to RIM impacts refer to 52.9 pCi/g.

6. QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times, page 88. Is any laboratory accreditation required? If so, the accreditation expiration date needs to be noted on this worksheet.

7. QAPP Worksheet #31, 32 & 33: Assessments and Corrective Action, page 135. This worksheet appears to focus on assessments of reports and other documentation. Are there any field and/or laboratory audits planned? If so, they need to be addressed here including the type, frequency, responsible person(s), estimated date, required deliverables, and deliverables due date. Worksheet #35 does refer to verifying planned audits were conducted which implies some type of field and/or laboratory audits will be performed.

8. 2.4.2.1 Laboratory Analytical Sample Collection Strategy, page 2-20 in FSP. A fifth reference area farther away from the project site will be selected. Other than being farther away, are there any other characteristics or observations that will be used to determine an appropriate fifth reference area?

9. § 2.6.2 Surface Water Sampling, page 2-36 in Field Sampling Plan (FSP). Surface water samples may be collected during heavy precipitation events if deemed necessary by the Parsons Project Manager subject to USEPA approval. How might the collection of surface water samples as described here be deemed necessary?

General Comments

10. § 1.2 Signatures, page 2.

    a. As with previous West Lake QAPPs, it is assumed the signature page includes the appropriate representatives for the Respondent and no separate Respondent signature is needed.

    b. If there are any plans and reports from previous investigations relevant to this project, they should be listed here.

11. QAPP Worksheet #4, 7 & 8: Personnel Qualifications and Sign-off Sheet, page 4. If there are any personnel specialized/non-routine training, certifications, or clearances needed, they should be noted on this worksheet.

12. QAPP Worksheet #9: Project Planning Session Summary, page 8. Please note the paragraph immediately before the table appears incomplete because it ends with the phrase “dependent upon.” It is recommended that any missing information be added.

13. QAPP Worksheet #10: Conceptual Site Model, page 10. Because the information expected on this worksheet related to pertinent site condition, physical objects present, site maps, aerial photographs, and GIS information can be found in the FSP, a reference to the FSP for this information would be useful.

14. QAPP Worksheet #14 and 16: Project Tasks & Schedule, page 41. This worksheet simply refers to responsibilities falling to the Respondents or USEPA; however, the person/persons responsible for tasks should be identified.

15. QAPP Worksheet #18: Sampling Locations and Methods, page 61. Because this worksheet ideally should address field and QC samples, a reference to Worksheet #20 would be helpful.

16. QAPP Worksheet #31, 32 & 33: Assessments and Corrective Action, page 135. If there are any assessment checklists to be used, they should be referenced here or included.

17. QAPP Worksheet #36: Data Validation Procedures, page 140. If there are any validation checklists to be used, they should be referenced here or included.

18. QAPP Worksheet #37: Data Usability Assessment, page 142. This worksheet generally refers to Parsons and Ameriphysics for performing the data usability assessments; however, the personnel involved should be identified by organization and position/title.

19. 2.4.6.1 Geotechnical Analyses in Non-Waste Areas, page 2-28 in FSP. The method should be verified and updated accordingly for organic content. Currently the FSP refers to ASTM D2984, however, this appears to be a withdrawn method for "Validation of Results of Process Vapor Pressure Analyzer." See § 2.4.6.2 which refers to ASTM D2974.

20. § 2.7 Field Meter Calibration, page 2-39. If there are separate SOPs that will be followed for the use of field instrumentation (alpha, beta, gamma detectors, PID, water quality meters, GPS, etc.) they should be referenced. In some instances, the operator's instructions are referenced but not for all.

If you have any questions, please contact me at x7258.

R7QAO Document Number: 2020094