Responses to EPA Comments dated June 23, 2017 on
Draft Final Feasibility Study (FFS) (January 4, 2017)
West Lake Landfill, Bridgeton, Missouri
September 1, 2017

General Comments

1. Globally replace the phrase "complete rad removal" with "Full Excavation of RIM," as is used in the abbreviated Remedial Investigation Addendum/Final Feasibility Study (RIA/FFS) work plan dated May 6, 2016.

RESPONSE: The requested changes have been made except where the text refers to the specific alternatives evaluated in the Supplemental Feasibility Study (SFS).

2. Develop and incorporate the third partial excavation alternative based on anticipated future land use into the Final Feasibility Study (FFS). The EPA provided comments to the Respondents on June 2, 2017, ona[sic] their document titled, *Draft Risk to Industrial User of OU1*. In that letter, the EPA proposed a meeting or call with the respondents to discuss criteria for this alternative, after the revisions to the assumptions and calculations in that document were completed and submitted to the EPA. Please contact the EPA at your earliest convenience to discuss this matter further, since this information must be included in the revised FFS.

RESPONSE: An industrial land use alternative is currently being developed for discussion with EPA.

3. Revise the FFS, as necessary, in accordance with all comments on the FFS and previous comments on the Remedial Investigation Addendum (RIA). Please ensure that there is consistency between the two documents when describing items related to the Conceptual Site Model (CSM) and the distribution of radiologically impacted material (RIM).

RESPONSE: The FFS was revised in accordance with this comment. Among other things, Section 2 of the FFS was revised to include similar revisions and similar discussions as those included in the June 16, 2017 revision of the RIA.

4. The Operable Unit 1 (OU1) remedy will not be based on a presumptive remedy for a Resource, Conservation, and Recovery Act (RCRA) Subtitle D Municipal Landfill. Unless RIM is fully excavated, the controlling Applicable or Relevant and Appropriate Requirement (ARAR) for any cap evaluated as a part of a remedial alternative is a cap design that meets the Uranium Mill Tailings Radiation Control Act (UMTRCA) standards, which are performance based. The EPA has carefully considered the appropriateness of using RCRA Subtitle D regulations for RIM in light of suggestions provided by the National Remedy Review Board (NRRB) and other new information since the 2008 ROD. Additional specific comments regarding UMTRCA and RCRA Subtitle C applicability and requirements are provided in Section 3 below. The EPA notes that the cap alternatives should include information about how the Respondents intend to demonstrate that the cap will meet the UMTRCA performance standards, and that a cap design should draw on design elements from RCRA requirements and the associated guidance in order

to be protective over the long term and attain ARARs. The cap must also meet Missouri sanitary landfill rules because municipal solid waste (MSW) is present in OU1.

RESPONSE: For consistency with the ROD, the RIA/FFS SOW and work plan, and the prior evaluations, the ROD-selected remedy was not modified and is still based on the presumptive remedy approach. Instead, to address this comment, an UMTRCA cover alternative that was not based on the presumptive remedy but rather was based on the UMTRCA performance standards was developed, included and evaluated in the revised FFS. In addition, this cover system was included as a component of all of the partial excavation alternatives.

5. Since an acceptable partial excavation alternative based on anticipated future land use was not included in this draft FFS, and because the EPA's previously provided comments on the document, *Estimated Three-Dimensional Extent of RIM*, likely has resulted in changes to the volume estimates for partial and full excavation alternatives, there is insufficient information in this draft for the EPA to provide full and comprehensive comments on the detailed Analysis of Alternatives. These sections will be re-evaluated in the revised FFS.

RESPONSE: Comment noted.

Executive Summary

6. **Page ES-1, Third paragraph** – Revise this paragraph to ensure consistency with the CSM in the revised RIA and primary comment II in the RIA comment letter, dated March 15, 2017.

RESPONSE: The discussion has been revised.

7. **Page ES-2, Second full paragraph** – Add the third partial excavation alternative, which is to be based on reasonably anticipated future land use, and is required in the FFS Statement of Work (SOW) and work plan.

RESPONSE: The discussion has been revised and will be further supplemented following discussions with EPA regarding the proposed alternative.

8. **Page ES-2, Second paragraph** – Add a discussion to this paragraph that provides an explanation for why the on-Site engineered cell is not being evaluated in the Final Feasibility Study. As previously discussed, some of the factors include the time and associated costs with designing and constructing such an on-site landfill in accordance with the applicable state statutes and regulations. Provide any references to relevant documents that include this information.

RESPONSE: This discussion has been revised.

9. **Page ES-3** – Revise the first bullet under number 1 to read, "All of the following remedial alternatives--…"

RESPONSE: The requested change has been made.

10. **Page ES-3** – The last bullet on the page regarding environmental justice (EJ) concerns should be revised to specify any EJ communities identified near the Site and how this information is being utilized in the evaluation of the remedial alternatives.

RESPONSE: This bullet has been revised. The EJ evaluation did not identify any EJ communities near the Site.

11. **Page ES-4** – While radionuclides cannot be fully modified or destroyed by physical, chemical, or thermal processes, treatment has been utilized on these types of materials at other sites to reduce mobility, although not necessarily in similar settings. Furthermore, the fact that the radionuclides present at the Site, as contaminants, are also naturally-occurring is not pertinent to the effectiveness or implementability of treatment. Revise the first bullet under number four by summarizing the findings of the sections in the FFS that discuss treatment.

RESPONSE: The requested change has been made.

12. **Page ES-4, Fifth bullet** – This bullet discusses long-term impact to plants and animals, and should be moved to the Long-Term Effectiveness and Permanence section on Page ES-3. All remedies will cause short-term disruption to plants and animals on OU1.

RESPONSE: The requested change has been made.

13. **Page ES-5, Number 6, Second bullet** – Add the following to (3), "…and landfill waste will be exposed to the environment for a period longer than for the ROD-selected remedy."

RESPONSE: The discussion has been revised.

14. **Table ES-1** – Greenhouse gas emissions and waste excavation volumes should be placed at the top of the short-term risks during cleanup, with a line break between community and on-Site workers. Also, indicate the volume of RIM that would be excavated, in addition to, the volume of waste. Include with these volumes, the percentage of the volume of RIM that each partial excavation alternative would remove compared to the full excavation alternative.

RESPONSE: Table ES-1 has been revised.

15. **Table ES-1** – Clarify in the bullets on Page ES-4, corresponding to short-term effectiveness, why the on-Site annual worker dose reported on Table ES-1 for the full excavation of RIM alternative is significantly lower than either of the partial excavation alternatives.

RESPONSE: The representative radium-226 concentrations (the primary risk for external exposure) expected in the materials to be removed under each alternative were 129, 229 and 241 pCi/g respectively, resulting in a lower external dose for the 7.9 pCi/g Alternative. The lower threshold associated with the 7.9 pCi/g Alternative results in a larger volume of overall material being handled (including a correspondingly larger volume of lower-activity material) and, therefore, a lower annual dose to workers as compared to the other partial excavation alternatives. The overall risk to workers is driven by the time frame for implementation of the alternative, and therefore the overall risk for implementation of the 7.9 pCi/g Alternative was greater (at 2.4E-3) as compared to the other partial excavation alternatives.

The revised FFS calculates external exposure from the upper 95% UCL of COPCs in the volume excavated for worker risk calculations and the upper 95% UCL of COPCs in the remaining volume of soil for future risk calculations.

Section 1

16. **Section 1.1, Page 1** – This section states that the disposal of solid and industrial waste occurred at the Site from approximately the 1950s through 2004, but the second paragraph of the executive summary states that the Site accepted waste from the 1950s through 2005. Resolve this discrepancy in dates.

RESPONSE: This change was inadvertently omitted from the draft recently submitted to EPA, but will be corrected in the next draft. The date in both places should be 2005.

17. **Section 1.1** – The Abbreviated Work Plan for RIA/FFS dated May 6, 2016, stated, "The FFS report will integrate the prior 2006 FS report and the 2011 SFS report as well as include updates…" This FFS report does not currently provide enough pertinent information about the specific evaluations that were conducted therein and the conclusions provided in the 2006 FS and 2011 SFS reports to understand the history of evaluations that lead to the need for this final feasibility study. The EPA requests that you expand Section 1.1 by providing additional historical information regarding previously evaluated alternatives. This section should, at a minimum, explain that the EPA directed respondents to prepare an SFS in January 2010, as a result of public concern after the ROD was published. It should also state the EPA National Remedy Review Board (NRRB) consultation, which occurred as a result of the remedial alternatives costs presented in the SFS being over $25 million, resulted in the additional investigations and studies which then lead to this FFS. Include the timing of the feasibility studies, what alternatives were evaluated in each feasibility study, what decisions were made or changed, and what actions have changed or been modified over time. The EPA suggests that all the alternatives be numbered in a manner that makes it easier to associate them with how they were presented in the prior feasibility studies, in order to easily discuss their status, retained or rejected, and to potentially combine them into a remedial alternative.

RESPONSE: The discussions in Section 5 have been revised in response to this comment and a new table (Table 1-1) presenting the information requested by this comment has been included in the revised FFS.

18. **Section 1.2, Page 3** – The last paragraph on the page states, "Subsequent discussions between Region 7 and OSRTI identified the following performance standards." Revise to state that a memorandum dated May 21, 2009, from the OSRTI Acting Deputy Director identified four additional measures or performance standards to apply to the 2008 selected remedy. Evaluation of those measures has been incorporated into this RIA/FFS process.

RESPONSE: The requested change has been made.

19. **Section 1.2. Page 4** – Please check that all references to air monitoring reports have been updated to be consistent with current information.

RESPONSE: The requested updates were made for the revised RIA and have been incorporated into the FFS.

20. **Section 1.2, Page 4, Last paragraph** – This paragraph is inaccurate according to Figure 2.9. Delete the portion of the sentence offset by the semi-colon, which starts with, "however, it should be noted" and ends with "outside the Missouri River." See related comment on Section 2.1.6.

RESPONSE: The text has been clarified. Although small parts of the northeastern portions of Areas 1 and 2 are within the floodplain, the areas identified as being within the floodplain are outside of the extent of waste. The approximate extent of waste has been added to Figure 2-9 and shows that all of the waste deposits are located outside of the 0.2% (500-year) floodplain. The approximate extent of waste shown on that figure (Figure 2-9) suggests that the extent of waste in the northern portion of Area 2 may extend into portions of the drainage channel adjacent to St. Charles Rock Road; however, inspection of this area indicates that the waste deposits do not extend into or beneath the drainage channel.

21. **Section 1.2** – Please include a discussion in this section of the suggestions provided by the NRRB.

RESPONSE: A new section 1.3 that summarizes the suggestions provided by the NRRB pursuant to their consultation has been added to the revised FFS.

22. **Section 1.3.2.2, Page 7** – Please revise the second bullet to read, "Acknowledgment of any environmental justice communities in the potentially affected area and modifications, as appropriate, to the evaluation and implementation of remedial alternatives."

RESPONSE: The requested revision has been made.

23. **Section 1.3.2.2, Page 7** – Please replace subsurface smoldering event (SSE) with subsurface smoldering reaction (SSR) in the fifth bullet at the top of the page to be consistent with footnote 2.

RESPONSE: The requested revision has been made.

24. **Section 1.3.2.2, Page 7, Footnote 2** – It is the agencies' understanding that, since 2013, the Bridgeton Landfill facility has implemented considerable measures and upgrades to dewater the waste mass (e.g., installation of shallow sumps, increased the size of header lines, installation of leachate pumps in gas extraction wells, and the intermittent operation of the deep leachate collection system wells in the South Quarry and neck area). These efforts to dewater the waste mass have resulted in the lessoning of pressure related damage to above grade infrastructure and less problems with the on-Site wells ejecting liquids. However, the impacts of subsidence have continued with some of the largest settlement occurring in the last couple of years, while at the same time, the volume of collected leachate has slowed. Given the amount of liquid removal that has occurred over the years, it would seem difficult to argue that only saturated areas have been impacted by the SSE/SSR. To the contrary, the data (i.e. high levels of carbon monoxide in the landfill) and operational efforts tend to make an argument for SSE/SSR activity occurring in a multitude of different moisture levels (saturated and un-saturated). Please revise this footnote to include this information.

RESPONSE: The footnote has been revised to remove the reference to saturated conditions since the purpose of the footnote was to point out the absence of oxygen which led to the understanding of the reaction as a non-combustion event. However we would note that while large areas of the landfill have been impacted by the reaction, there is no evidence that the reaction is occurring outside of the saturated zone (i.e., the area of waste that is wet). Rather, the effects of the reaction – including heated gas and elevated carbon monoxide – migrate away from the area of the reaction itself and can therefore be observed in areas outside the reaction and outside the saturated zone. (In other words, the effects of the SSR can be observed beyond the immediate area where the reaction is occurring.) As EPA notes in its comment, Bridgeton Landfill has invested substantial resources in increased liquid and gas extraction which has allowed for management of the reaction and its effects. But because the landfill is within an unlined quarry, this increased extraction has not resulted in significant decrease in liquid levels as of this date.

25. **Section 1.4, Page 9, First paragraph** – This paragraph lists Remediation Goals for Radioactively Contaminated CERCLA Sites Using the Benchmark Dose Cleanup Criteria in 10 CFR, Part 40, Appendix A, I, Criterion 6(6) (OSWER Directive 9200.4-35P) as one of several pertinent EPA guidance. However, it is unclear how this guidance has been utilized in the FFS, and whether 10 CFR, Part 40, Appendix A, I, Criterion 6(6) regulations were evaluated as ARARs. Clarify how OSWER directive 9200.4-35 has been utilized in the FFS. Evaluate in Section 3 whether 10 CFR, Part 40, Appendix A, I, Criterion 6(6) is an ARAR. If Criterion 6(6) is determined to be an ARAR, conduct the benchmark dose calculations and corresponding evaluations for the relevant radioactive contaminants of concern present at the Site (i.e., such as those radionuclides listed on Page 4 of the guidance, "Radium-226, Radium-228, Thorium-230, Thorium-232, Uranium-234, and/or Uranium-238"). Ensure all the cleanup goals established using Criterion 6(6) of 10 CFR, 40, Appendix A are sufficiently protective under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), (i.e. generally meets the one in ten thousand to one in a million ($10^{-4)}$ to 10^{-6}) risk range, and a hazard index of less than 1). The EPA notes that OSWER directives, 9200.4-18, 9200.4-23, and 9285.6-20, provide additional guidance on how to perform these evaluations, including that the ARAR protectiveness criteria evaluation recommendation of 15 millirem per year (mrem/yr) should be changed to 12 mrem/yr for non-radium/thorium cleanup criteria derivations. Add OSWER directive 9285.6-20 and 9200.4-23 to the list of guidance in this paragraph.

RESPONSE: The referenced text was simply a restatement of the items listed in the RIA/FFS SOW and the RIA/FFS Work Plan. The various regulations and guidance identified in this comment were evaluated as part of the revised evaluation of potential ARARs presented in Section 3 and incorporated into the revised evaluations in Sections 5, 6, and 7 as appropriate.

Section 2

26. **Section 2.1.5, Page 17** – The last sentence of this section states that the Spanish Village neighborhood contains commercial and industrial facilities. Please verify land use, and, if necessary, remove this statement.

RESPONSE: The text has been revised to indicate that the Spanish Village neighborhood consists of single family dwellings but is surrounded by commercial and industrial facilities.

27. **Section 2.1.6, Page 17, Second paragraph** – The concerns with flooding are potentially two-fold: 1) erosion of the cap or cover of the landfill and subsequent exposure of radionuclides and waste, and 2) increased potential for leaching. The topographic land surface of the landfill has been raised over time. Now the majority of it lies above the 500-year flood zone, and significant erosion due to flooding is not anticipated which addresses concern number 1. However, the elevation of the waste and RIM in the landfill has not changed, and flooding could increase the potential for leaching. Add discussion to this section acknowledging this potential for flooding to impact the potential for the RIM to leach under flooding conditions. Also, revise the last sentence of the second paragraph to accurately reflect the information on Figure 2-9, which indicates that the buffer zone vicinity and the north east side of both Area 1 and Area 2 are within the 0.2% annual chance of flooding on the Missouri River Floodplain. Revise the footnote to remove the 0.2% caveat.

RESPONSE: No change has been made. Per subsequent discussions with EPA, it was agreed that flooding would not increase leaching of RIM as flood waters will not elevate the groundwater level into the RIM.

28. **Section 2.2.3, Pages 19 and 20** – Expand this paragraph by including some of the relative discussion from pages 9 and 10 of the SFS Work Plan for OU1. Include the sentence from the SFS work plan that states the EPA determined the level of 50 pCi/g plus background corresponds to risk of less than 2×10^{-5}. Clarify that this risk was determined for exposure scenarios evaluated for the St. Louis Downtown Site (SLDS) Formerly Utilized Sites Remedial Action Program (FUSRAP) Site and not for OU1 of the West Lake Landfill Site. Add the discussion in the last paragraph of the SFS work plan which spans pages 9 and 10. Update this discussion, as necessary, after consideration of the revised updated BRA for OU1. Ensure the discussion demonstrates that the currently established total uranium concentration level associated with the definition of RIM meets the 10^{-4} to 10^{-6} risk range and a hazard index of less than 1.

RESPONSE: The requested revisions have been made.

29. **Section 2.2.3, Page 19** – Remove footnote 4 on Page 19.

RESPONSE: The Respondents believe the footnote (new footnote 5) is factual and is an important consideration and therefore has been retained.

30. **Section 2.2.4, Page 20** – In the paragraph that presents the minimum, average, and maximum identified thickness of the RIM intervals, summarize how the thickness of RIM changes throughout portions of Area 1 and 2. Add at least one example where RIM was determined to be present at multiple depths in a single boring. Clarify whether RIM has been identified to occur generally in a contiguous layer within a specified depth interval, or if some other description better describes the occurrences of RIM in Area 1 and Area 2. Finally, include in this section, a discussion of how the range of depths and changes in thickness where RIM has been identified in Areas 1 and 2 is or is not consistent with these materials being placed as daily cover for landfill operations.

RESPONSE: The text has been expanded and revised to address the items in this comment.

31. **Section 2.2.5, Page 23, First full paragraph** – Expand this discussion by presenting total volume of RIM, as well as, the volume of RIM identified for each partial excavation alternative. The overburden volumes for each excavation alternative should also be presented.

RESPONSE: The text of this section has been revised consistent with the results of the updated geostatistical evaluation included as Appendix B to the FFS. This section presents a summary of Site conditions and therefore discussion of the total volume of RIM, similar to that in the RIA. Because the remedial alternatives have not yet been introduced or described in detail, inclusion of volumes for the various excavation alternatives did not seem appropriate for this section. The volumes of RIM associated with each alternative are included in the discussions and tables in Sections 5, 6 and 7 and in the appendix containing the revised report of geostatistical evaluations.

32. **Section 2.2.6, Page 23** – Update the first paragraph to include an accurate number of analyses, consistent with the revised RIA. Also, remove laboratory duplicate analyses from the total number of analyses.

RESPONSE: The text was revised to match the corresponding text in the RIA which included the laboratory duplicates. The text of both documents still need to be revised in a consistent manner to removed the laboratory duplicates. This revision will be made to the next draft of the RIA and carried over to the next draft of the FFS.

33. **Section 2.2.6, Page 23, Footnote 7** – A full explanation of the Cotter data should be included in the RIA, and should be unnecessary in the FFS unless it specifically impacts an alternative being considered. Delete footnote 7.

RESPONSE: The requested change has been made.

34. **Section 2.2.6, Page 24 –** Please update the last sentence of the first paragraph and the entire second paragraph in accordance with previous RIA comments and discussions held on May 10, 2017.

RESPONSE: The discussion has been revised.

35. **Section 2.2.6, Page 24, Last paragraph in section** – The second sentence is unclear; please further describe "relatively close correlation."

RESPONSE: This information was presented in the RIA. Because it was not necessary for the FFS, the discussion was removed.

36. **Sections 2.2.6, General comment**– Appendix B provides details on the significant geostatistical effort to estimate the volume of RIM. There are numerous references in Appendix B noting that these estimates are likely to be biased low, and there are significant assumptions and limitations in these calculations. However, none of the sections in the main text of the FFS make note of these limitations. Please qualify the discussion of RIM material in this section with the limitations and/or cautions noted in Appendix B. This comment also applies to Sections 5.4.1, 5.5.1, 5.6.1, and any other pertinent sections.

RESPONSE: A new discussion regarding the uncertainties of the RIM volume has been added to section 5.5.1 as part of the discussion of the volume of RIM for the full excavation of RIM alternative. This discussion has been referenced as appropriate relative to the discussions of the partial excavation alternatives in Section 5.

37. **Section 2.2.9, Top of page 26** –The volume of RIM located on the former Ford Property represents a conservative estimate of the volume of RIM potentially located on the Buffer Zone/Crossroads property. Expand this discussion to include the likelihood for this to be an overestimate of the volume of RIM present at this portion of the Site and any other uncertainties.

RESPONSE: The discussion has been revised.

38. **Section 2.2.10, Page 28, Second paragraph** – There is no need for an extensive discussion of the "20X rule" in this section. Instead, discuss compounds identified in historical documents and analytical samples that could cause a determination of a characteristic hazardous waste.

RESPONSE: Discussion of the 20 times rule was appropriate since it is the primary basis for determining the applicability of the characteristic hazardous waste regulations to the excavated soils and therefore has been retained.

39. **Section 2.3.1, Page 29-30, Second and third paragraphs of section** – Delete the last sentence from the last full paragraph on page 29 that discusses the average flux for all other portions of Area 2. Also include a discussion of the maximum value measured during the 2016 radon flux monitoring, and compare the results of any new monitoring locations that are near WL-209 and WL-223 to the previous flux measurements collected at those locations.

RESPONSE: The requested changes have been made.

40. **Section 2.3.1, Page 30, First paragraph** – Revise or delete the sentence that compares potential radon exposure to large area activated charcoal cannisters (LAACC) flux measurements. Radon flux is measured in picocuries per meter squared per second ($pCi/m^2/s$), and therefore cannot be used directly to determine exposure risks without determining the corresponding radon air concentration picocuries per liter (pCi/l) of air. Also, add a figure to the FFS showing the air monitoring locations, and reference the figure where appropriate in this section.

RESPONSE: The discussion has been revised. A new figure showing the locations of the air monitoring stations has been added to the revised FFS (Figure 2-16).

41. **Section 2.3.2, Page 31, First full sentence at the top of page** – Revise based on comments to the RIA, including revising the sentence to say, "…does not appear to currently be a significant pathway…"

RESPONSE: The discussion has been revised.

42. **Section 2.3.2, Page 31, First paragraph** – Clarify whether the Site was heavily vegetated prior to 1996, and state the source of the information. Also, revise the second sentence to state whether the levels of radionuclides decreased or were consistent with previous RI sampling.

RESPONSE: The text was revised to indicate that Areas 1 and 2 became heavily vegetated after 1996. We do not believe the results of the continuous perimeter air monitoring performed in 2015 – 2016 are equivalent to the results from the 8-hour samples obtained in 1996 from areas with high levels of radionuclides at the ground surface in Areas 1 and 2. Therefore, the requested comparison has not been made.

43. **Section 2.3.2, Page 31, Third paragraph, Third sentence** – Delete the sentence that begins, "As expected, the isotopic…"

RESPONSE: The sentence has been deleted.

44. **Section 2.3.2, Page 31** – Update footnote 10 after consideration of all the available on-Site air monitoring data. If enough data has been collected to determine the statistical significance of any differences in the results between the two air monitoring programs, include this in the text and consider deleting footnote 10. If enough data has not been collected and evaluated at the time of writing the revised FFS, state in footnote 10 how much data has been collected and how much additional data would be needed to make this determination.

RESPONSE: The footnote has been deleted, and discussion of the comparison of the Site results to the results of the offsite monitoring performed by EPA has been revised.

45. **Section 2.3.2, Page 32, First sentence** – Revise this statement as follows, "The isotopic uranium and thorium results, as well as, the combined radium results obtained from the 13 on-Site stations are less than the results obtained from the EPA's five off-Site stations with some exceptions." List the exceptions in this paragraph and include the station or stations, the radionuclides, and the date range associated with any sample.

RESPONSE: The text has been revised to remove the qualifier and to be consistent with the updated text in the revised RIA report.

46. **Section 2.3.2, Page 32, Top paragraph** – The EPA notes that the 10 CFR, Part 20, Appendix B effluent limits are not risk based limits, and may represent concentrations that would result in exposures that exceed the 10^{-4} to 10^{-6} risk range. Any radionuclides identified to be above background should be evaluated further to determine if the results exceed the CERCLA risk range.

RESPONSE: The reference to 10 CFR Part 20 Appendix B effluent limits has been deleted from the text. The potential risks associated with exposure to fugitive dust were evaluated in the updated Baseline Risk Assessment based on the monitoring results and modeling of potential airborne emissions.

47. **Section 2.4, Page 32** – Update text and Figure 2-15 based on the current draft OU1 storm water monitoring plan and information gained from the recent large precipitation event.

RESPONSE: The requested updates have been made.

48. **Section 2.4, Page 33, Second paragraph, Second to last sentence** – Revise the Maximum Contaminant Level (MCL) for gross alpha to 15 pCi/L.

RESPONSE: The MCL value has been revised.

49. **Section 2.4, Page 33, Third paragraph** – Add a description of any historical sediment sampling for sediment samples, Sed-1 thorough Sed-4.

RESPONSE: The requested addition has been made. A table of the radionuclide results for sediment samples, including those obtained as part of the original RI, has been added to the FFS (Table 2-19).

50. **Section 2.4, Page 33, Fourth paragraph, Second sentence** – Revise this sentence to include the combined thorium level for the SED-4 sample and for the EPA split sample. Explain that these results exceed the definition of RIM. Expand the discussion by clarifying that the individual results for Thorium-230 (14.7 pCi/g and 19.8 pCi/g) were compared to the EPA default preliminary remedial goal (PRG) of 19.7 pCi/g for outdoor workers for a one-in-one million cancer risk without contribution from any daughter products, and was found to be at or near this PRG. Include the date that this PRG was determined using the EPA's PRG Calculator. Discuss whether any of the other radionuclides, in particular Thorium-230 decay products, were detected above the Site-specific background in order to demonstrate whether Thorium-230 was the only contaminant detected.

RESPONSE: The text has been updated as requested, and is similar to the revised discussion in the RIA developed in response to a similar comment on the RIA.

51. **Section 2.4, Page 34** – Update the partial sentence at the top of the page by including the most recent sediment sampling at 400 and 500 feet north of sample SED-4. Also, include a description of the limited gamma scanning that was performed in order to potentially select sample locations.

RESPONSE: The text has been updated to reflect the revised discussion in the RIA developed in response to a similar comment on the RIA.

52. **Section 2.4, Page 34, First paragraph** – Include, in the second sentence, the approximate year that disposal activities in Area 2 ceased, along with, a reference to the source of this information. In the last sentence of this paragraph, include the year that runoff diversion berms were installed, and, if known, the approximate time frame of the natural re-vegetation.

RESPONSE: The text has been updated in response to this comment to the extent possible based on the available information.

53. **Section 2.5** – Revise Section 2.5, as necessary, in accordance with the EPA's comments on the first draft RIA, particularly the use of terms upgradient and downgradient.

RESPONSE: The requested revisions have been made.

54. **Section 2.5, Page 34, First bullet** – State the activity levels that are considered background levels for uranium and thorium, and clarify what is meant by "generally (i.e., state any exceptions to "only background")."

RESPONSE: This discussion was removed consistent with the approach agreed to during the May 2017 meetings on the RIA relative to groundwater conditions.

55. **Section 2.5, Page 34, Fifth bullet** – Clarify whether radium was only detected in bedrock wells, and revise discussion as appropriate.

RESPONSE: This discussion was removed consistent with the approach agreed to during the May 2017 meetings on the RIA relative to groundwater conditions.

56. **Section 2.5, Page 35** – Revise the last bullet in this section at the top of page 35 to discuss the fact that the results of bench scale tests on radionuclides indicated a potential for the radionuclides to leach, and therefore, the OU3 investigation of groundwater beneath the Site is necessary.

RESPONSE: This discussion was removed consistent with the approach agreed to during the May 2017 meetings on the RIA relative to groundwater conditions.

57. **Section 2.5.2, Pages 35 and 36, First paragraph** – State whether groundwater is in contact with the landfill debris, and if so, discuss where and under what conditions.

RESPONSE: The requested additional discussion has been added to the text.

58. **Section 2.5.2 Page 36** – Define "registered well." Please note that there may be risk associated with direct contact with water from non-potable wells if there are contaminant impacts to those wells.

RESPONSE: The term "registered wells" has been defined. Per the discussions at the July 2017 meeting, no additions have been made to the text relative to the second part of this comment as this item will be addressed as part of the OU-3 RI/FS.

59. **Section 2.5.3, Page 37, Last sentence** – Replace the word "is" with "may be" so that the last sentence reads, "…Areas 1 and 2 may be responsible for these radium occurrences."

RESPONSE: The sentence has been deleted consistent with the other changes made to the groundwater discussion.

60. **Section 2.5.4.2, Page 39, Top paragraph, Last sentence** – Refrain from the use of the term "generally," and state how many samples and which compounds exceeded drinking water standards.

RESPONSE: The sentence has been deleted consistent with the other changes made to the groundwater discussion.

61. **Sections 2.5.4.3.2 and 2.5.4.3.3, Page 39** – The MCLs listed in these sections for iron and manganese, respectively, should be listed as secondary MCLs.

RESPONSE: The discussion has been revised to identify these as secondary drinking water standards.

62. **Section 2.5.5, Page 41, First paragraph** – Replace the words "clearly indicate" with "suggest." Re-write the second paragraph in accordance with the EPA's comments made on the first draft RIA.

RESPONSE: The requested change has been made. The second paragraph of Section 2.5.5 was deleted consistent with the approach taken with the other changes to the groundwater discussion.

63. **Section 2.6** – Develop this section in accordance with the EPA's comments on the first draft of the BLRA.

RESPONSE: The discussion has been revised to reflect the results of the June 2017 revision to the updated BRA.

Section 3

64. **Section 3.1, First paragraph** – The EPA has included a table of ARARs provided by the Missouri Department of Natural Resources (MDNR) as an enclosure to this comment letter. Incorporate any state identified ARARs into the appropriate subsections and Table 3-1, as necessary.

RESPONSE: The additional laws and regulations identified by MDNR have been evaluated to determine which are potentially applicable or relevant and appropriate to the evaluation of alternatives for the OU-1 soil/waste. The prior tables have been updated to summarize the results of this evaluation and are included as part of the revised FFS. Discussions of those ARARs that were identified as being potentially applicable or relevant and appropriate have been added to the revised text of the FFS.

65. **Section 3.1.1.1, Page 43, Second paragraph** – This paragraph states, "The UMTRCA regulations establish specific standards for waste disposal units containing radioactive materials and for land outside of such waste disposal units that has been contaminated with radionuclides as a results of uranium processing or waste disposal activities." Revise this sentence as follows, "The UMTRCA regulations establish specific standards for control of residual radioactive materials at disposal sites and cleanup of land and buildings that have become contaminated with residual radioactive materials from a uranium processing site." The paragraph then states, "Standards associated with the management of a tailing pond or waste disposal unit are evaluated for potential relevance with respect to the solid waste disposal units…" Revise this sentence as follows, "All of these standards are evaluated for relevance with respect to Operable Unit 1 of the Site which includes Areas 1 and 2, as well as, the Buffer Zone/Crossroads property." Include an evaluation in Section 3.1.1.1.2 of the FFS of the relevance and appropriateness of the standards in UMTRCA Subpart B for Areas 1 and 2. The EPA notes that previous evaluations were included in the SFS work plan dated June 4, 2010. The EPA provides further comments on this evaluation in Section 2.

RESPONSE: The discussion has been revised.

66. **Section 3.1.1.1.1, Page 44, Second paragraph** – This paragraph states that additional radon flux monitoring was performed as part of the construction of a non-combustible cover (NCC) over Areas 1 and 2, and demonstrated that the average radon flux from these areas, both individually and collectively, meets the UMTRCA radon emission standard. Please clarify that these radon

flux measurements were not required in the approved work plan for the installation of the NCC dated March 13, 2016; and therefore, were not part of the construction of the cover, but rather they were performed by the Respondents in conjunction with construction of the cover. Further, the radon flux monitoring was performed only after installation of the cover was complete, with the exception of two portions of Area 2 along the outer slope of the landfill cell. The EPA required the installation of the NCC to prevent potential risks posed by the migration of RIM as a result of a surface fire that could cause an exposure to on-Site workers or the public. This cover only serves as a temporary measure to prevent these potential risks until a final remedy is implemented. Therefore, these 2016 flux measurements should not be considered in any evaluation of the performance of a landfill cap or to estimate risks to remedial workers due to radon releasing from any open working surface of Areas 1 and 2 during the implementation of a remedy. In addition, the last sentence of this paragraph references the radon standards and includes "20 pCi/L." Revise this statement by changing the unit referenced to "pCi/m^2/s."

RESPONSE: The text has been revised to state that Respondents performed additional radon flux monitoring following substantial completion of construction of the NCC over Areas 1 and 2. Additionally, the last sentence of the paragraph has been revised to reference the "pCi/m^2/s" unit. The results of the 2016 radon flux measurements are discussed in the FFS but are not used as a basis for calculation of radon flux for evaluation of the performance of a landfill cap or to estimate risks to remedial workers. Instead, these evaluations are based on the radium-226 data and use of the RAECOM model (similar to the approach used in the revised BRA) to estimate radon emissions.

67. **Section 3.1.1.1.1, Page 44, Last paragraph** – The document states that one working level (WL) is equal to approximately 200 pCi/L. The EPA's Radiation Risk Assessment at CERCLA Sites: Q&A (OSWER 9285.6-20) states on Page 18 that, "For purposes of demonstrating compliance with the 0.02 WL Uranium Mill Tailings Radiation Control Act (UMTRCA) regulations as an ARAR, users may assume that either 5 pCi/L of Rn-222, or 7.5 pCi/L of Rn-220 corresponds to 0.02 WL. Therefore 5 pCi/L of Rn-222 or 7.5 pCi/L of Rn-220 may be considered to be the concentration for complying with the UMTRCA indoor radon standard as an ARAR. These values are based on an indoor residential equilibrium fraction of 0.4 (40%) for Rn-222 and 0.02 (2%) for Rn-220." Revise this paragraph by including the Radon-222 concentration specified in the guidance, along with, the equilibrium fraction. Add OSWER directive 9285.6-20 as a "To Be Considered (TBC)." The EPA notes that this guidance may be a TBC for multiple standards being considered in this ARAR evaluation.

RESPONSE: This paragraph has been revised.

68. **Section 3.1.1.1.2, Page 45, First paragraph beneath the indented text, Last sentence** – The definition of a disposal site as described in 40 CFR 192.00 (d) is as follows: "Disposal site means the region within the smallest perimeter of residual radioactive materials (excluding cover materials) following completion of control". Control is further defined in 40 CFR 192.00 (c) as "any remedial action intended to stabilize, inhibit future misuse of, or reduce emissions or effluents from residual radioactive materials." Neither the presence of MSW in OU1 nor the use of OU1 Areas 1 and 2 as solid waste disposal units qualifies these areas as disposal sites, as previously defined. Therefore, 40 CFR 192.12 standards should be evaluated for potential relevance to the Buffer Zone/Crossroad property portion of OU1, as well as, Areas 1 and 2. Because all of OU1 contains RIM, which include Radium-226 and Thorium-230, and because

the concentrations of Thorium-230 are greater, which will cause the Radium-226 concentrations to increase in the future, the EPA has determined that the residual radioactive materials considered in 40 CFR 192.12 are similar to the RIM present in OU1 of the Site. However, the EPA notes that OSWER directive 9200.4-25 states, "The purpose of these standards was to limit the risk from inhalation of radon decay products in houses built on land contaminated with tailings, and to limit gamma radiation exposure of people using contaminated land (see 48 FR 600)." The EPA agrees that the probability of residential land use on Areas 1 and 2 is highly unlikely, and therefore, is not an anticipated future land use. The EPA therefore concludes that the cleanup standards in 40 CFR 192.12 are relevant, but not appropriate for Areas 1 and 2 because the cleanup standards were not developed based on sufficiently similar anticipated land uses. However, these standards are to be considered for any remedial alternative that seeks to remove RIM to the extent necessary in order to eliminate the need for additional engineering and institutional controls due to the presence of radiological contaminants. Revise this section to reflect that the standards in 40 CFR 192.12 are TBCs for Areas 1 and 2, as stated above. In addition, list OSWER directive 9200.4-25 as a TBC because this standard provides guidance on the use of soil cleanup criteria in 40 CFR Part 192 as remediation goals for CERCLA sites.

RESPONSE: This section has been revised.

69. **Section 3.1.1.1.2, Pages 45 and 46, Last paragraph, Fourth sentence** – Revise to state that residential exposures are not expected because there are no current residential land uses within Areas 1 and 2, nor is it reasonably anticipated in the future. Please also clarify in the remainder of the paragraph that, while the landfill is currently subject to institutional controls restricting residential use, the determination of reasonably anticipated future use does not rely on the existence of institutional controls.

RESPONSE: The discussion has been revised.

70. **Section 3.1.1.1.2, Page 46** – Add to this section a paragraph discussing cleanup goals for uranium in consideration of comments provided previously in sections 1.4 and 2.2.3. Include any necessary calculations and evaluations in order to demonstrate whether the definition of RIM, which includes a total uranium concentration of 50 pCi/g plus background, could be established as a cleanup goal that meets the 10^{-4} to10^{-6} risk range and a hazard index of less than 1 for the Site. Determine whether 10 CFR, Part 40, Appendix A, I, Criterion 6(6) is an ARAR or TBC, and include OSWER Directives 9200.4-18, 9200.4-23, and 9285.6-20 as TBCs if necessary. When evaluating the non-carcinogenic risks posed by uranium, use the toxicity value of 0.0002 mg/kg-day as recommended in the December 21, 2016, EPA memo titled, "Considering a Noncancer Oral Reference Dose for Uranium for Superfund Human Health Risk Assessments." In particular, page 4 of the memo states, "OSRTI, therefore, recommends the use of the ATSDR intermediate MRL for soluble uranium <u>without</u> further adjustment, in lieu of the RfD currently published in IRIS, for assessment of chronic exposures also." Include this memorandum as a TBC in this section.

RESPONSE: The text has been revised to include an assessment of the protectiveness of the uranium cleanup standard, as requested.

71. **Section 3.1.1.1.3, Page 47, First paragraph** – Delete all of this paragraph, with the exception of the first sentence, and delete the following two paragraphs. The results of past groundwater investigations do not provide useful information for determining whether the groundwater protection standards of 40 CFR 192 Subparts A and B are either relevant or appropriate. Combine the remaining sentence of the first paragraph with the fourth paragraph. Revise the first sentence of the fourth paragraph as follows, "Based on the presence of radioactive and other hazardous substances at OU1, and the potential for leaching to groundwater, the groundwater protection standards in 40 CFR 192.02(c)(3) and (4)) and monitoring requirements (40 CFR 192.03) of the UMTRCA regulations are potentially relevant and appropriate to any remedy that will result in RIM remaining on Site."

RESPONSE: The discussion has been revised.

72. **Section 3.1.1.1.3, Page 47** – Add to this section, a discussion of OSWER Directive 9283.1-14, which addresses the use of uranium drinking water standards under 40 CFR 131 and 40 CFR 192 as Remediation Goals for Groundwater at CERCLA sites. This discussion should specify that both the uranium MCL (40 CFR 141) and the UMTRCA standards (40 CFR 192) are potentially relevant and appropriate. In addition, this discussion should include a comparison of the groundwater point of compliance standard in 40 CFR 192.02 (c)(4) to the CERCLA approach for conducting groundwater responses. As stated on page 6 of the OSWER directive, "For example, the CERCLA approach for complying with the MCL throughout the plume is more stringent than the UMTRCA approach of complying with the groundwater standard only in the uppermost aquifer." Add OSWER Directive 9283.1-14 as a TBC, and incorporate accordingly.

RESPONSE: Groundwater is being addressed as a separate OU, and accordingly the revision sought in this comment exceeds the scope of the revised draft FFS. Nevertheless, discussion of OSWER Directive 9283.1-14 has been included in Section 3.

73. **Section 3.1.1.2** – Add a fourth bullet to this section as follows: 40 CFR 61 Subpart I - National Emission Standards for Radionuclide Emissions From Federal Facilities Other Than Nuclear Regulatory Commission Licensees and Not Covered by Subpart H. Add a corresponding section under section 3.1.1.2 that discusses the relevance and appropriateness of the standards in 40 CFR 61.102 during remediation which would limit the effective dose equivalent to any member of the public to 10 mrem/yr. The EPA notes that these regulations are discussed in OSWER directive 9200.4-18 in attachment A: Likely Federal Radiation Applicable or Relevant and Appropriate Requirements (ARARs).

RESPONSE: The requested revision has been made.

74. **Section 3.1.1.2.1, First paragraph** – Add to this paragraph, the compliance procedures specified in 40 CFR 61.223 which state that flux testing must be done after the uranium mill tailings pile is covered, but prior to long-term stabilization or in any case to demonstrate conditions have been met for disposal. In addition, add 40 CFR 61.223 (a) which specifies that flux measurements should be conducted according to 40 CFR 61, Appendix B, method 115, or other procedures with prior EPA approval.

RESPONSE: The discussion has been revised.

75. **Section 3.1.1.2.2, Page 49** – Include in this section, a discussion of OSWER directives 9200.4-18 and 9285.6-20. Of particular importance, these directives specify an ARAR protectiveness criteria evaluation recommendation of 12 mrem/yr. Add these directives as TBCs in this section, and ensure that the necessary evaluations of any dose-based ARARs are conducted to demonstrate sufficient protectiveness under CERCLA.

RESPONSE: The requested evaluations have been included.

76. **Section 3.1.1.2.3, Page 49, Second paragraph** – Sentence three and four of the paragraph appear to be partially redundant. Revise these sentences to ensure that 10 CSR Division 60 Chapter 4 regulations are stated to be potentially relevant and appropriate, and remove any redundancy.

RESPONSE: The requested revisions have been made.

77. **Section 3.1.2.9, Last paragraph** – This paragraph states the St. Louis Lambert Airport Authority (STLAA) has indicated any excavation alternative will violate the Federal Aviation Administration (FAA) ROD and the Restrictive Covenant. Per page 181 of Appendix A, The City of St. Louis, Missouri Negative Easement and Declaration of Restrictive Covenants Agreement, #4: "The term of this Agreement shall begin on the Effective Date and shall end only if and when St. Louis choses in its sole and absolute discretion to abandon its negative easement granted herein by terminating or canceling the Agreement in writing and recording such writing with St. Louis County's Recorder of Deeds." Since the excavation alternatives are dependent upon removing soils and waste from areas 1 and 2 and replacing the non-RIM waste in the landfill, please include a description of the most recent discussions, communications, or agreements between Bridgeton Landfill, LLC and the city of St. Louis regarding bird mitigation efforts that will need to be considered in evaluating the implementability of the excavation alternatives.

RESPONSE: The text has been updated to reflect the most recent communications.

78. **Section 3.1.3.1, Page 58, Third paragraph** – Revise the third and fourth sentences to state, "The fact that the RIM materials account for the majority of the risk posed by the Site, which include exposure to gamma radiation and radon, as well as, the potential for RIM to leach, indicate the cap design should focus on the performance standards of UMTRCA. Additional measures as specified by any RCRA closure criteria should supplement the design of the capping system to ensure it is protective for all materials present at the Site."

RESPONSE: The discussion has been revised.

79. **Section 3.1.3.1, Page 58, Third paragraph, Fifth sentence** – The ROD-selected remedy did not consider in the design of the cap the potential for RIM to leach. Add to this paragraph, a summary of the evaluation of alternate capping designs, and specifically the use of a geosynthetic clay liner (GCL). Include a comparison of the permeability of a compacted clay layer (CCL) and a GCL.

RESPONSE: The first part of the comment is incorrect; the remedy selected by the ROD did address leaching. For example, the ROD states on p. 22 *"However, radionuclide and nonradionuclide contamination is present in the landfill units; the potential for leaching to groundwater and offsite migration is a pathway that should be addressed as part of the remedy for the Site."* On p. 30, the ROD identifies the remedial action objectives (RAOs) for Areas 1 and 2 including *"Minimize infiltration and resulting contaminant leaching to groundwater."* On p. 49 the ROD states *"The multi-layer cover will also be designed to prevent infiltration of surface water that might cause leaching of contaminants to the groundwater."* Regardless, a discussion of alternative capping designs was added to Section 4.3.2.1.

80. **Section 3.1.3.3, Page 60, Fifth paragraph** – As stated above, any cap design that addresses RIM remaining on-Site should primarily focus on achieving the UMTRCA performance standards. Please revise this paragraph to more fully evaluate the RCRA Subtitle C requirements, including the landfill cover performance criteria at 40 CFR 264.111(a) – (c) and landfill cover design requirements at 40 CFR 264.310(a)(1)–(5), as potentially relevant and appropriate requirements. Consider the EPA's comments to the draft RIA regarding the solubility and mobility of RIM and the analysis of new data collected from OU1, as well as, the toxicity of RIM in comparison to the MSW contained in the landfill. An additional consideration is the June 26, 2000, letter from the EPA's Office of Air and Radiation and Office of Solid Waste and Emergency Response to the Idaho State Senate Minority Leader, Clint Stennett, responding to questions regarding the unregulated disposal of radioactive byproduct material generated before 1978. Further, the EPA also notes that statements regarding the disposal of non-radiological industrial wastes contained in historical reports (i.e. 1982 and 1988 NRC reports) may also inform whether certain provisions of RCRA Subtitle C are relevant and appropriate requirements. Lastly, please include in your evaluation whether the EPA Technical Guidance Documents – Final Covers on Hazardous Waste Landfills and Surface Impoundments, the EPA OSWER 530 – SW –89 –047, (July 1989) and (Draft) Technical Guidance For RCRA/CERCLA Final Covers, the EPA OSWER 540-R-04-007, (April 2004) – should be included as TBCs to inform the evaluation of cap designs that are intended to meet the UMTRCA performance standards.

RESPONSE: Section 3.1.3.3 of the FSS reviews RCRA Subtitle C requirements, including final cover requirements (as well as the two referenced guidance documents), to determine if they are applicable or relevant and appropriate to West Lake Landfill OU-1, or otherwise to be considered.

During the RD phase, we will prepare waste acceptance profiles, which we will use to obtain confirmation that the wastes are disposed of off-site at an appropriate facility, able to accept the particular wastes at issue. We will provide that confirmation to EPA upon receipt.

81. **Section 3.1.3.3, Page 61, First paragraph** – This paragraph contains redundant statements regarding the applicability of RCRA Subtitle C regulations at MSW landfills. In addition, the statements assert that the EPA has indicated that RCRA covers are generally not appropriate for large municipal landfills. Revise this statement by deleting any redundancy, and clarifying that while RCRA Subtitle C covers are generally not appropriate for municipal landfills with lower toxicity waste, this is not the case at the West Lake Landfill due to the presence of higher toxicity RIM.

RESPONSE: Section 3.1.3.3 of the FSS reviews RCRA Subtitle C requirements, including final cover requirements, to determine if they are applicable or relevant and appropriate to West Lake Landfill OU-1.

82. **Section 3.1.3.3, Page 61, Last paragraph in section** – Revise this section to reflect the analytical confirmation as presented in the RIA of the potential for RIM to leach to groundwater. The EPA notes that there is currently uncertainty as to whether RIM has leached to groundwater, and if so, to what extent. However, based on the potential for RIM to leach, the ingrowth of radium over long periods of time associated with the RIM, and the solubility of radium compared to thorium, the EPA can conclude that the RIM poses a potential future threat to groundwater. Therefore, if RIM remains on-Site, the final landfill cover must be designed to meet the groundwater protection standards under UMTRCA, and consider any RCRA Subtitle C standards determined to be ARARs and guidance documents determined to be TBCs.

RESPONSE: The paragraph was deleted consistent with the other changes made to the groundwater discussion.

83. **Section 3.1.4** – This section and subsequent subsections discuss waste acceptance criteria (WAC) for various facilities; however, there is no discussion on whether the materials present at OU1 of the Site fall within those criteria. Add to this section, a preliminary determination on whether or not the materials present at OU1 of the Site could be disposed of at each of the facilities presented. Since waste acceptance criteria at facilities commonly can change until contracts are put in place, this preliminary evaluation should include the date any WAC information was obtained.

RESPONSE: This section of the FFS is only intended to evaluate ARARs, in this case, WAC. Evaluation of the ability of each alternative to comply with ARARs, including WAC, is presented in Section 6 as part of the detailed analyses of alternatives. The dates of the WAC information have been added to the text.

84. **Section 3.2, Pages 67 and 68 –** Please revise the Remedial Action Objectives (RAO's) to more specifically address the OU1 contaminants and media of concern, potential exposure pathways, and remediation goals in accordance with the EPA's comments on this FFS. While the EPA expects to have further discussion with the parties regarding RAO's, the EPA has revised the OU1 RAOs as follows:

a. Prevent direct contact to contaminated media (including waste material, fill, and leachate) located on or emanating from OU1.

b. Prevent exposure by inhalation and external radiation from contaminated media (including waste material, fill, leachate, and gas emissions) located on or emanating from OU1 that exceed the more stringent of a 10^{-4} to 10^{-6} risk (or a Hazard Index of 1 for noncarcinogenic risk) or other health-based standards identified in the ARARs.

c. Minimize infiltration to prevent contaminants from leaching to groundwater in excess of MCLs, or if there is no MCL, other standards identified by the ARARs.

d. Control and manage leachate that emanates from OU1.

e. Control and treat landfill gas from OU1, including radon in accordance with standards identified in the ARARs.

f. Control surface water runoff, and minimize erosion associated with OU1 in accordance with standards identified in the ARARs.

g. Additional RAO for the Buffer Zone/Crossroads Property - Remediate soils to the extent necessary to allow for unrestricted land use.

RESPONSE: The discussion has been revised.

85. **Section 3.2, Page 68, Paragraph beneath bullet 5** – While the potential need for groundwater remediation is being investigated under OU3, RAO's requiring groundwater protection are necessary for OU1 to ensure that the OU1 remedy is protective and compliant with ARARs. Therefore, remove all but the last sentence of this paragraph.

RESPONSE: The discussion has been revised.

86. **Section 3.2.1.1, Page 68, First paragraph, First sentence** – Revise this sentence to account for the Buffer Zone/Crossroads property, and state that cleanup levels were determined to be relevant and appropriate for this portion of the Site.

RESPONSE: The discussion has been revised.

87. **Section 3.2.1.1, Page 68, First paragraph, Second sentence** – The cap should extend, as necessary, to contain and control both RIM and solid waste. Revise this paragraph to specify that the extent of the engineered landfill cover that would be installed must be sufficient to ensure that the performance standards in 40 CFR 192.02 can be met while also covering any wastes that are present.

RESPONSE: The discussion has been revised. All RIM and solid waste will be covered with an engineered landfill cover and the performance standards of 40 CFR 192.02 will be met. We would like to discuss with EPA the coordination of cover requirements applicable to the different landfill units in achieving these performance standards.

88. **Section 3.2.1.2, Page 68, First paragraph** – Revise this paragraph to ensure consistency with Section 3.1.1.1.2 and the comments provided related to the relevance of the standards in 40 CFR 192.12 to Areas 1 and 2. Revise the last sentence to explain that the engineered landfill cover and corresponding institutional controls would not have the same requirements if the RIM were removed to the level specified for this remedial alternative.

RESPONSE: The discussion has been revised.

89. **Section 3.2.1.2, Page 69, First paragraph** – Revise this paragraph to ensure consistency with comments provided in sections 1.4, 2.2.3, and 3.1.1.1.2 that relate to the definition of RIM and the establishment of a protective cleanup goal for uranium.

RESPONSE: The discussion has been revised.

90. **Section 3.2.1.2, Page 72, First paragraph** – This paragraph states, "These cleanup values were used to identify the Site soils that would be included with the scope of the "complete rad removal" alternative, and that would otherwise be used to define the extent of any hybrid landfill cover…" Revise this statement to ensure consistency with comments provided for Section 3.2.1.1 above related to the required extent of any cap on OU1.

RESPONSE: The discussion has been revised.

91. **Section 3.2.1.2, Page 72, Second paragraph** – Update the non-carcinogenic soil screening levels for uranium for commercial/industrial and residential uses using the toxicity value of 0.0002 mg/kg-day as recommended in the December 21, 2016, EPA memo titled, "Considering a Noncancer Oral Reference Dose for Uranium for Superfund Human Health Risk Assessments," as specified in related comments to section 3.1.1.1.2. Revise this paragraph, as necessary, to ensure consistency with prior EPA comments on establishing uranium cleanup goals.

RESPONSE: As discussed in section 3.3.2 of the FFS, the non-carcinogenic screening level for elemental uranium for commercial/industrial land uses is 230 mg/kg according to the June 2017 Regional Screening Levels generic tables. Since the mass-concentration of the uranium remediation goal is less than EPA's current non-carcinogenic screening levels (71 mg/kg < 230 mg/kg), the uranium remediation goal of 71 mg/kg (50 pCi/g) represents a more conservative cleanup target than EPA's current non-carcinogenic screening level for elemental uranium and residual uranium concentrations equal to or less than 50 pCi/g plus background (54.5 pCi/g) will not pose any non-carcinogenic risks. EPA's radionuclide preliminary remediation goal (PRG) calculator was used to evaluate risks to a composite worker exposed to 50 pCi/g of elemental uranium using calculator default parameters including the toxicity value of 0.0002 mg/kg-day. The risk was approximately 4.3 x10E-6, which is in the lower region of the CERCLA acceptable risk range of 10E-6 to 10E-4, supporting the observation that the proposed cleanup level of 54.5 pCi/g will be protective of both carcinogenic and non-carcinogenic risks.

92. **Section 3.2.1.3, Page 72, First sentence** – Change the word "directed" to "specified."

RESPONSE: The requested change has been made.

93. **Section 3.2.1.3, Page 72, Second to last paragraph, First sentence** – Add to this paragraph, additional information about the origin of the 1000 pCi/g cleanup goal. The EPA notes that page 2 of OSWER Directive 9200.4-25 states, "The criterion for subsurface soil was derived as a tool for use in locating and remediating discrete deposits of high activity tailings (typically 300-1000 pCi/g) in subsurface locations at mill sites or at vicinity properties." Also of note, is the Final Environmental Impact Statement (FEIS, 1983) for Standards for the Control of Byproduct Materials from Uranium Ore Processing (40 CFR 192) Volume I. The FEIS states on pages 3-4, "The ore grade at the different mills typically varies from 0.15 percent to 0.3 percent uranium, and the radium concentration (and presumably other radionuclides in the Uranium-238 decay series) varies from 200 pCi/g to 900 pCi/g." Also provided in the FEIS, is tables 3-1 and 3-3, which show radium concentrations at licensed mills up to 850 pCi/g, and average concentrations of radium in inactive uranium mill tailings up to 1000 parts per trillion. As presented in the draft updated BLRA for OU1, the future exposure point concentrations (EPC) for Radium-226 and Thorium-230 are expected to exceed 1000 pCi/g; Table 22 in the draft updated BRA presents EPCs for Area 2 up to 6,373 pCi/g for Radium-226 and up to 14,629 pCi/g for Thorium-230.

The EPA notes that the BLRA is being revised in response to comments the EPA previously provided, and that these values are subject to change. Because concentrations of Radium-226 and Thorium-230 significantly exceed 1000 pCi/g, ensure the information presented in this comment is considered in this section.

RESPONSE: The information presented in this comment has been considered and the discussion revised as appropriate.

94. **Section 3.2.1.3, Page 72, Last paragraph** – Revise the last sentence on the page to explain that all the partial excavation alternatives were discussed during a meeting in September 2014 between the EPA, the Respondents, and the MDNR. As stated in Section 2.2.8, Principal Threat Wastes, "…it is conservatively assumed that principal threat wastes may be present within OU1." According to the EPA's guide to Principal Threat and Low Level Threat Wastes, OSWER Directive 9380.3-06FS, November 1991, "Principal threat wastes are those source materials considered to be highly toxic or highly mobile that general cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. They include liquids and other highly mobile materials (e.g., solvents) or materials having high concentrations of toxic compounds. No 'threshold level' of toxicity/risk has been established to equate to 'principal threat.' However, where toxicity and mobility of source materials combine to pose a potential risk of 10^{-3} or greater, generally treatment alternatives should be evaluated." The EPA notes that the draft updated BLRA presents a total risk to a future grounds keeper for Area 2 at $2.08x10^{-03}$. Further stated on Page 110 of the FFS in footnote 19, "In all cases evaluated in the Baseline Risk Assessment, Th-230 and Ra-226 (plus decay products) accounted for more than 95% of the risk to the target receptors." The EPA also notes that the BLRA is currently being revised in response to the EPA comments. While the standards in 40 CFR 192.12(a) and OSWER Directive 9200.4-25 provide guidance on establishing cleanup goals at 5 pCi/g of combined radium and 5 pCi/g of combined thorium plus background based on unrestricted use at sites where 40 CFR 192.12(a) is an ARAR or TBC, residential site use is not a reasonably anticipated use at this Site, as was discussed in prior comments. Selecting a cleanup goal that is one order of magnitude greater than 5 pCi/g or 50 pCi/g plus background, would reduce the total risks to the maximally exposed individual in the future to less than 10^{-3}. Therefore, a cleanup goal of 52.9 pCi/g combined radium and combined thorium is to be considered for any remedial alternative that seeks to remove contaminates at the landfill to the extent necessary to reduce risks posed by RIM to less than 10^{-3}.

RESPONSE: As discussed in section 3.3.3 of the FFS, the second partial excavation alternative uses a cleanup level of 52.9 pCi/g (excavation of all soil/waste containing radium or combined thorium with activity levels greater than 52.9 pCi/g down to a depth of 16 feet beneath the topographic surface). We would also note that the subject meeting actually occurred on September 24, 2013, not 2014.

95. **Section 3.2.1.3, Page 72, Last paragraph –** The 16-foot depth alternative was previously identified based on a qualitative determination, conducted prior to the additional characterization investigation, that a large proportion of the RIM was present above this depth, and materials could be excavated to this depth utilizing common excavation practices. Excavation of RIM that exceeds 52.9 pCi/g of combined radium and combined thorium to a depth of 16 feet also eliminates any future exposures that would result in a risk greater than 10^{-3}, assuming that sufficient fill or other non-RIM materials are placed back on the surface of the landfill. The

Abbreviated RI/FFS Work Plan indicated in a footnote that the Respondents have the ability to propose a different depth interval, reflective of all the available site data for this alternative, which would be identified during the evaluation of the data in preparation of the RIA and FFS reports. Footnote Number 20 on Page 110 of this FFS document is identical to the footnote that appeared in the work plan, and states, in part, that "it is premature to propose an alternative depth at this time." It goes on to indicate that if one is identified during the RIA/FFS process, Respondents will seek concurrence from the EPA. The statement in footnote 20 is no longer current, and should be deleted. The text of the FFS should be updated to reflect the Respondents' proposal with regard to an alternative depth consideration. The EPA recommends a meeting or call to discuss evaluating depth alternatives at the same time we discuss an alternative based on the anticipated future user.

RESPONSE: The basis for the 52.9 pCi/g threshold (originally presented as a 79 pCi/g threshold at the 9-24-13 meeting) and the 16-foot depth criterion were only recently described by EPA to the Respondents so there was previously no basis for consideration of alternative criteria. The 52.9 Alternative and other partial excavation alternatives are discussed in sections 3.3.3, 5, 6 and 7 of the FFS.

Section 4

96. **Section 4, Page 74, Last paragraph on page** – Delete the sentence beginning with, "Because the EPA has eliminated the complete RAD removal ..."

RESPONSE: This paragraph has been revised. In addition, per the discussions at the July meeting, additional text has been added to Section 4.3.2.2 relative to the issues associated with a potential on-site disposal cell. Specifically, text presented in the prior SFS regarding the limitations and issues associated with an on-site disposal cell was added to this section.

97. **Section 4.3.2.1, Page 80** – This section indicates that discussion of capping and covers were included in the FS; however, this discussion must be updated in the FFS to discuss UMTRCA standards rather than RCRA Subtitle D landfill cap/cover systems. The second paragraph also discusses a GCL as an example of a geosynthetic layer that can be added to provide a lower permeability layer to further reduce radon emissions and further restrict precipitation infiltration. GCLs are installed dry, and only have low permeability properties when hydrated. If dry, GCLs would not provide reliable performance in reducing radon emissions, and consistent hydration levels are not assured. Therefore, remove "further reduce radon emissions" from the last sentence of this paragraph. A flexible membrane liner could potentially reduce radon emissions, but may not meet longevity requirements.

RESPONSE: The discussions in Section 4.3.2.1 of the FFS have been updated per this comment.

98. **Section 4.3.2.2, Page 80, Second paragraph** – Add a discussion to this paragraph that provides an explanation for why the on-Site engineered cell is not being evaluated in the FFS. As previously discussed, some of the factors include the time and associated costs with designing and constructing such an on-Site landfill in accordance with state ARARs. Provide any references to relevant documents that include this information.

RESPONSE: The requested discussion has been added.

99. **Section 4.3.2.4.3, Page 82, Second paragraph** – Expand this discussion to support statements made in this paragraph. Consider the use of sheet pile cutoff walls in certain areas of the Site where it may be beneficial and could provide a cost savings, such as excavation in the vicinity of the transfer station. For the excavation scenarios, evaluation of overburden mass removal, schedule impacts, cost variances, etc., should be further considered.

RESPONSE: The discussion has been revised. The evaluation of the sheet pile walls for excavation stability presented in the SFS was reviewed and updated and incorporated into Appendix D of the revised FFS. In addition, the potential use of sheet piling or other shoring techniques to brace the transfer station foundation during removal of RIM near that structure has also been included in this appendix.

100. **Section 4.3.5.2.3, Page 92, Last paragraph, Third sentence** – "Experience gained through investigations (EMSI, 2016b) and the non-combustible cover removal actions indicate that Th-230 is the dominant and most widespread radionuclide at the Site." Expand this discussion to indicate that identification and removal of the gamma emitting Radium could potentially inadvertently leave behind undetected concentrations of Thorium that would be subject to future ingrowth and increasing risk.

RESPONSE: The discussion has been revised.

101. **Section 4.4.1.1, Pages 103-104, First three paragraphs** – These paragraphs provide subjective statements regarding the drawbacks of using temporary structures (e.g., need for provision of proper ventilation, explosion proof fixtures, structure durability if necessary to move, and prohibitive costs) without providing references or information to support the statements. Delete these paragraphs, or revise them to add appropriate supporting information.

RESPONSE: Additional evaluation of the potential use of temporary structures for excavation areas has been developed and included in Appendix D.

102. **Section 4.4.1.2** – This section states in several places that the effectiveness of a technology for separating RIM from solid wastes could not be determined without a full pilot study. The need for a pilot test should not be the sole reason for ruling out a technology. Additional information and clarification is needed before ruling out technologies.

RESPONSE: The text has been expanded but the point still remains valid. We have been unable to locate any information regarding the potential application of physical segregation/separation of radiologically-impacted soil from solid wastes. The available case studies and technical literature were insufficient to determine if this technology could be effective, but conversely, it did not provide any basis to indicate it would not be effective. It has simply never been applied or otherwise demonstrated for use in separating radiologically-impacted soil from MSW.

103. **Section 4.4.1.2, Page 106, Last paragraph of section, Second sentence** – Revise this sentence to indicate that an evaluation of cost, schedule impacts, and volume removed is necessary to determine whether this technology would be beneficial for the 1000 pCi/g partial excavation.

RESPONSE: The discussion has been revised.

Section 5

104. **Section 5, Page 107** – The EPA requested three partial excavation alternatives, including one based on risk to a future industrial worker. A preliminary evaluation was conducted which indicated that the industrial risk alternative would be equivalent to the 1000 pCi/g alternative. That evaluation is referenced, but not included in the FFS. The EPA reviewed that document, and provided comments to the Respondents on June 2, 2017. Revise that evaluation in accordance with the EPA's comments, and present the revised evaluation and an industrial risk alternative in Section 5 of the FFS. The EPA recommends a meeting or call between the Respondents and the EPA to discuss the scenario to be presented in the FFS, prior to submitting the revised document.

RESPONSE: A partial excavation alternative that would be protective of future industrial land use of Areas 1 and 2 is being developed for discussion with EPA.

105. **Section 5.1.1.1, Page 108** – The paragraph below the alternatives states that the EPA determined all the FS alternatives, except No Action (L1), would be protective. Add language to state that, based on the additional investigation, the EPA no longer considers Alternatives L2 and L3 protective (in addition to not meeting state regulations) due to radionuclide activity identified at the surface of the landfill, and due to the new understanding of the potential for RIM to leach to groundwater.

RESPONSE: A footnote has been added to reflect EPA's statement in this comment.

106. **Section 5.1.1, Page 108** – Add the word "presumed" before "historic erosion" in the first sentence of the second paragraph following the list of alternatives.

RESPONSE: The requested change has been made.

107. **Section 5.1.3, Page 110, Footnote 19** – Revise "Thorium-226" in the last sentence of the footnote to "Thorium-230."

RESPONSE: The requested change has been made.

108. **Section 5.1.3, Page 110** – Delete Footnote #20, and see comment 3.2.1.3 above on page 72.

RESPONSE: The requested change has been made.

109. **Section 5.1.3, Page 110** – Footnote #21 refers to Alternatives No. 2 and 4, but it appears that it should refer to No. 3 and 5. Revise as appropriate.

RESPONSE: Agreed that it should have referred to No. 3 and 5; however, the footnote was deleted because the text was revised to reflect a revised approach to development of an industrial land use alternative per EPA direction.

110. **Section 5.3** – This section should be revised in accordance with the EPA's general comment number 4 and comments on section 3.

RESPONSE: Consistent with the response to general comment no. 4, the discussion of the ROD-selected remedy was not revised. Instead, a separate UMTRCA cover alternative that is based on the UMTRCA performance standards (and not based on the presumptive remedy) was developed, included and evaluated in the revised FFS.

111. **Section 5.3, Page 111** – Revise the bullet on page 111 to reflect changes requested in previous comments regarding the use of UMTRCA as the primary standard for the capping alternative.

RESPONSE: Per the response to prior comments, a new alternative that includes an UMTRCA cover system has been added to the FFS to address this and other similar comments. This section of the text is describing the major components of the ROD-selected remedy as described in the ROD. Therefore, revision of the bullet is inconsistent with the language presented in the ROD.

112. **Section 5.3, Pages 112-114** – Evaluate the ROD requirements with respect to the UMTRCA Subpart A performance standards.

RESPONSE: The discussion has been revised with the intent being to describe the requirements of UMTRCA as part of the description of the UMTRCA cover alternative. Evaluation of the ability of this or any of the alternatives to meet UMTRCA or other ARARs has been added to the detailed analysis of alternatives in Section 6.

113. **Section 5.3, Page 113, Footnote 24** – Delete this footnote, and if appropriate, revise text.

RESPONSE: The requested changes have been made.

114. **Section 5.3.1.2, Pages 116-117** – Where cut and fill operations involve the excavation of RIM, please also include the evaluation of off-Site disposal of RIM.

RESPONSE: Per the discussions at the July 2017 meeting, the text has been expanded to explain why off-site disposal is not included as part of the ROD-selected remedy.

115. **Section 5.3.1.3** – This section should include an explanation why off-Site disposal of the RIM removed from the Buffer Zone/Crossroads Property is not being further considered.

RESPONSE: Per the discussions at the July 2017 meeting, the text has been expanded to explain why off-site disposal is not included as part of the ROD-selected remedy.

116. **Section 5.3.1.3, Page 117** – UMTRCA Subpart A, 40 CFR 192.12 (a) specifies that "the concentration of Radium-226 in land averaged over any area of 100 square meters shall not..." Revise this section to state that the design-phase investigation of the Buffer Zone/Crossroads Property will be designed based on the guidance in MARSSIM, and in compliance with any ARARs, such as, 40 CFR 191 Subpart B.

RESPONSE: The text was revised as requested. In subsequent discussions, EPA indicated that this comment was intended to refer to 40 CFR 192 Subpart B, not 40 CFR 191 Subpart B.

117. **Section 5.3.1.4, Page 118** – The second paragraph indicates that the thickness of the landfill cover layers is based on the requirements of Missouri solid waste rules. Revise this statement

and the design criteria, as needed, to base them on meeting the UMTRCA standards. Due to the updated understanding of the potential for RIM materials to leach, a higher coefficient of permeability (> 1 x 10-5 cm/sec) should be considered for the hydraulic barrier layer. A cover system, including a composite barrier layer and a drainage layer, may be one way of meeting these standards.

RESPONSE: This discussion relates to the ROD-selected remedy which was based on the Missouri solid waste rules with enhancements as necessary to meet the UMTRCA standard. The text has been revised to indicate that although the design was based on the solid waste standards, it was also evaluated to confirm that it would meet the UMTRCA standards, specifically with regard to gamma radiation exposures and radon emissions, both currently and after 1,000 years of radium ingrowth from thorium decay.

118. **Section 5.3.1.4, Page 119, First paragraph** – Revise and clarify the first sentence on page 119 to indicate that the statement regarding measured radon flux values less than 10% of the regulatory limit is only accurate after construction of the NCC. In a letter dated May 18, 2016, the EPA clearly stated that the NCC could not be considered for future potential exposure scenarios in the baseline risk assessment, and that also applies to evaluating future radon emissions for cap proposals. Revise this paragraph using the pre-NCC flux measurements, and calculate cap elements needed to meet the UMTRCA standards.

RESPONSE: The text has been revised to remove references to the flux measurements and to reflect the approach (RAECOM model) used in the BRA.

119. **Section 5.3.1.4, Page 119, Fourth paragraph** – Add a statement that all earthen material used in constructing a final cover system must meet design specifications to be determined in the Remedial Design process.

RESPONSE: The discussion has been revised as requested.

120. **Section 5.3.1.4, Page 119** – Delete the first sentence of the second paragraph on page 119, and calculate the cap thickness necessary to meet UMTRCA standards for gamma exposures. Re-write the second and third paragraphs on page 119 with regards to meeting UMTRCA standards.

RESPONSE: The referenced sentence has been deleted/revised and paragraphs have been revised per this comment.

121. **Section 5.3.1.4, Page 119, Third paragraph** – There is insufficient information presented at this time to determine the accuracy of the first sentence. Revise this paragraph after addressing the other comments in this section.

RESPONSE: The evaluations that support this statement are included in Appendix F (and were included in the prior draft of the FFS and the prior SFS). Therefore, the statement has been retained.

122. **Section 5.3.1.6, Page 121, Last paragraph** – Removal of Potassium-40 in this paragraph is recommended, since it is a naturally occurring isotope rather than a contaminant of concern (COC).

RESPONSE: The reference to Potassium-40 has been removed.

123. **Section 5.3.2.2, Page 128.** – The partial sentence at the bottom of the page should be revised to replace "completion of the Record of Decision" with "initiation of the Remedial Action."

RESPONSE: The statement has been revised.

124. **Section 5.4.1, Page 130** – Include the estimated volume of RIM in the Buffer Zone/Crossroads Property in the "Total RIM" volume calculations to be used in the partial and full excavation alternatives.

RESPONSE: The estimated volume of soil on the Buffer Zone/Lot 2A2 that may contain radionuclides is included in the total volume of RIM to be disposed offsite under the full excavation of RIM alternative (see p. 16 of Appendix K-1 and line 186 on p. 8 of 27 of Appendix K-4). This soil volume was not included in the volume of material to be disposed under the partial excavation alternatives as the available data indicate that activity levels in this soil are below the threshold levels specified for the partial excavation alternatives, therefore, it was assumed this soil would be consolidated in Area 1 or 2 as part of the regrading activities.

125. **Section 5.4.1, page 131** – The third paragraph discusses "feasibility-study level of accuracy" for the volume estimates of RIM and overburden and the high degree of uncertainty for these values. It goes on to state that the intent of prior investigations was not to accurately define the 3-dimensional extent of RIM for quantity estimates. The EPA recognizes that there is a degree of uncertainty in soil investigations; however, in a letter from Alyse Stoy to William Beck, Esq., dated April 20, 2015, the EPA addressed the issue of uncertainty. Specifically, the EPA stated "[w]ith this additional data, EPA believes the parties will be in a position to mitigate the large degree of uncertainty in determining the extent of RIM and associated volume calculations that could negatively impact or bias the evaluation of the partial excavation alternative. EPA believes this additional data will establish a higher level of confidence in the volume calculations in a way that is consistent with the existing sample methodology and fully incorporate data sets previously collected." Please revise this paragraph to better reflect the level of investigation that has been performed at the Site.

RESPONSE: Although additional data were collected consistent with EPA's 2015 directive, uncertainty still remains regarding the configuration and volume of RIM subject to the partial and full excavation alternatives. Evaluation of potential uncertainties associated with the RIM extent and volume has been added to this section of the text and is also addressed in part in the geostatistical evaluation of RIM extent.

126. **Section 5.4.1, Page 131** – The third paragraph discusses uncertainty in RIM volumes due to limits in the accuracy of existing Site topographic mapping that used aerial photogrammetry without ground control. Clarify whether any more recent, more accurate Site surveys have been conducted that would be useful in the calculation of RIM volumes.

RESPONSE: No more recent, more accurate Site surveys have been conducted. It is anticipated that additional surveying would be performed as part of remedial design.

127. **Section 5.4.2.1, Page 133, Second to last paragraph** – Add a statement to this paragraph that says excavators will be decontaminated, as necessary, when moving between RIM and non-RIM zones.

RESPONSE: The requested statement has been added to the FFS.

128. **Section 5.4.3, Page 138** – Revise this section by clarifying why trans loading of intermodals to flatbed railcars was selected as the preferred option, given that direct load may offer a significant cost savings. Because the full excavation of RIM alternative requires a significant volume of RIM to be disposed of, this should be considered during the cost evaluation.

RESPONSE: Loading of intermodal containers on-Site and transfer of such containers by truck to a rail loading facility was identified by US Ecology as the most likely method for transport of RIM to the disposal facility (with the possible exception of US Ecology's Michigan facility). Selection of intermodal containers over DOT Industrial Packaging (IP) bags or direct transfer from truck into gondola cars was based on the anticipated density of the material relative to the weight and volume restrictions associated with each mode of transport. Intermodal containers were identified by US Ecology as being a better option for lightweight materials. At an assumed density of 1,000 lbs per cubic yard, a 30 cubic yard intermodal container can accommodate 30,000 lbs or 15 tons. A maximum of eight intermodals can be loaded on an individual rail car, and therefore each rail car could haul 240 cubic yards. In contrast, a gondola car can haul 108 tons or 100 cubic yards of material. Gondola cars are generally a better option for transport of soil as the weight limit will be reached before the volume of a gondola car is exceeded. The basis for selection of this process option is described in Section 5.5.3 of the FFS.

129. **Section 5.5.1, Page 145** – Include in this section, or in section 6, a discussion of any options there may be to avoid relocating the transfer station.

RESPONSE: An evaluation of the potential use of shoring to avoid having to relocate the transfer station has been added to Appendix D; however, such an approach may require leaving some RIM in place, which would be inconsistent with the overall scope of this alternative.

130. **Section 5.6, Page 147, Center paragraph** – The 1000 pCi/g excavation scenario does not mention the inclusion of a bio-intrusion/marker layer, as discussed in other scenarios requiring a cap. Revise the paragraph as necessary.

RESPONSE: The discussion has been revised to reflect inclusion of an UMTRCA cover as part of all of the partial excavation alternatives.

Section 6

131. **Section 6, General comment** – Traffic and other industrial injuries/fatalities are not generally environmental risks to be evaluated in a short-term effectiveness analysis. While potential site-related accidents are of concern, potential worker accidents are typically addressed through project health and safety plans and related engineering controls. Consistent with NCP 300.430(e)(9)(iii), evaluate the alternatives, focusing on the extent to which accidents could potentially expose workers or the community to possible releases resulting from such accidents. Remove discussion of the traffic and other industrial injuries/fatalities from the comparative analysis in Section 6. This comment applies to Sections 6.2.2.5.1, 6.2.2.5.3, 6.2.3.5.1, 6.2.3.5.3,

6.2.4.5.1, 6.2.4.5.3, 6.2.5.5.1, 6.2.5.5.3, and 7.2.3.3. Additionally, this discussion of the traffic and other industrial injuries/fatalities should be removed from Appendix H, Section 4.3, 4.3.1, and 4.3.2.

RESPONSE: The respondents believe that these evaluations are important considerations and are not inconsistent with the NCP. They are presented separately so that it is clear they are separate from the environmental risks. Please also see the response to comment 228.

132. **Section 6, General Comment –** Revise all ARARs discussions in this section to be consistent with the EPA's comments in Section 3.

RESPONSE: The additional laws and regulations identified by MDNR have been evaluated to determine which are potentially applicable or relevant and appropriate to the evaluation of alternatives for the OU-1 soil/waste. The prior tables have been updated to summarize the results of this evaluation and are included as part of the revised FFS. Discussions of those ARARs that were identified as being potentially applicable or relevant and appropriate have been added to the revised text of the FFS.

133. **Section 6, General comment** – Add a discussion on the potential impact of severe weather impacts on the short-term effectiveness of the partial and full excavations.

RESPONSE: The requested discussion has been added.

134. **Section 6, General comment** – For each alternative, revise the discussion regarding the potential impacts of a subsurface heating event to be more specific in the discussion of the potential impacts on the remedial alternative. Specify the actions that would need to be taken to address those impacts, and how implementing those actions will affect the long-term protectiveness of the remedial alternative.

RESPONSE: The sections of the text related to the potential impacts of a subsurface heating event have been revised/expanded to discuss the potential impacts on the remedial alternatives and the actions that could be taken if such an event were to occur.

135. **Section 6, General Comment** – Relate the findings of the EJ analyses in each of the remedial alternatives to whether there would be any potential short- or long-term impacts to an EJ community during the implementation of the alternative.

RESPONSE: The text has been revised.

136. **Section 6.1.7.1, Page 157, Second paragraph** – Include in this paragraph, any consideration given to the fact that the RIM materials in OU1 of the West Lake Landfill Site are co-located with MSW, and how that may require other considerations to the removal, transportation, and off-Site disposal services than those considered for the SLAPS and DOE FUSRAP Sites. The focus of these considerations presented in this section should be on how this may affect the cost of these services. In addition, clarify whether the unit costs provided by the U. S. Ecology were taken from information presented in documents related to SLAPS or one of the DOE FUSRAP Sites or were provided specifically for the West Lake Landfill Site.

RESPONSE: The discussion has been revised.

137. **Section 6.2, Page 163, Footnote 32** – Update this footnote as necessary to be consistent with comments provided in this letter related to the industrial risk-based partial excavation scenario.

RESPONSE: The footnote has been deleted as the approach to the development of industrial land use risk-based criteria was revised based on further input from EPA.

138. **Section 6.2.1.1, Page 164 –** Update this discussion to be consistent with the revised updated BLRA. Also ensure that this discussion is consistent with Section 2.6 of this document. Delete the rest of the first sentence after the word, "community." The no action alternative should be evaluated without consideration of any institutional controls that may be in place currently, and without any further actions taking place, including maintaining, monitoring, or enforcing anything to prevent exposures because of site contaminants.

RESPONSE: The discussion was revised to reflect the results of the updated evaluations presented in the June 2017 revision to the updated BRA.

139. **Section 6.2.1.3, Page 165, Fourth paragraph –** Revise the first sentence in this paragraph as follows, "All current and potential future risks identified in the updated baseline risk assessment would remain under the No Action alternative."

RESPONSE: The requested change has been made.

140. **Section 6.2.2, Page 168, First paragraph after the bullets –** While this paragraph provides a description of the GCL layer, including a rationale for the thickness of such a layer, it does not include the permeability coefficient. Therefore, it cannot be compared to the compacted clay layer (CCL). Revise this paragraph by including the pertinent differences between a CCL and a GCL.

RESPONSE: The discussion has been revised to include a typical value for the coefficient of permeability of a GCL.

141. **Section 6.2.2.1, Page 169, Second paragraph –** This paragraph begins by stating external gamma exposure will be prevented through shielding and distance. It goes on to state that the cover will be of sufficient thickness to attenuate gamma radiation. Finally, it states that the required thickness of a clay layer would be 60 centimeters for the necessary gamma shielding. Not stated anywhere in this paragraph is the extent to which gamma radiation will be attenuated, shielded, or exposures otherwise prevented by the cap. Add to this paragraph, the gamma exposure levels that are estimated to be present if a two-foot CCL were installed directly on top of the regraded landfill surface. Provide either the half-layer value or tenth-layer value associated with the CCL. Also, provide this same information for a GCL and any required associated layers, such as a bedding layer and protective layer, if they were installed. Finally, list the gamma exposure levels that must be achieved according to the RAOs, ARARs, and TBCs.

RESPONSE: The text has been revised and Appendix F has been revised consistent with this comment. The ARARs are described in Section 6.2.2.2.

142. **Section 6.2.2.1, Page 169, Third paragraph –** Add to this paragraph, the radon reduction percentage per unit thickness (i.e. percent reduction per inch or centimeter at a minimum) for each layer of the cover being relied on to reduce radon according to the identified ARARs. Comments provided to Appendix F require these unit thickness reduction values to be calculated. Summarizing the results of these calculations in this section allows for a quick determination as to whether the estimated thicknesses will be sufficient to meet the standards.

RESPONSE: The requested information is provided in the revised Appendix F. Due to timing constraints, additional discussion based on that revised Appendix was not able to be included in the text for this draft, but will be included in the next draft of the FFS.

143. **Section 6.2.2.1, Page 169 –** The previous section provided a discussion about the possibility of using GCL as a substitute for the two-foot clay layer, and using soil, potentially more pervious than clay, as the bedding and protective layers. Add the appropriate paragraphs in this section to discuss the impacts to gamma radiation or radon reduction that the use of a GCL would have on the required thickness of the cap.

RESPONSE: Because a GCL was not included in the ROD-selected remedy and because there now is a new alternative consisting of an UMTRCA cover, the discussion of the use of a GCL has been included as part of that UMTRCA cover alternative. The presence of GCL was not included or otherwise considered as part of the evaluation of the ability of any of the cover designs to meet the gamma or radon ARARs or the protectiveness of the cover systems.

144. **Section 6.2.2.1, Page 169** – Add to this section, a discussion that considers a non-woven geotextile between the rock/rubble layer and the clay, or how the rock/rubble layer may need to be altered to be designed as a filter to prevent the loss of clay into the rock, which could allow for sinkholes to form at the surface of the cap if not prevented.

RESPONSE: The discussion has been revised to indicate that the materials to be used to construct the biointrusion layer would be “well-graded” or that a geotextile may be included to prevent loss of material from the overlying layer into void spaces in the biointrusion layer.

145. **Section 6.2.2.2.2, First paragraph –** This paragraph starts by providing a description of 40 CFR 192 Subpart B, but then presents “closure performance standards” provided in 40 CFR 192 Subpart A. Revise this paragraph to include a description of any UMTRCA regulations in 40 CFR 192 that have been determined to be ARARs that provide performance standards that must be incorporated into the design of a cap. Also stated in this section is the following, “For UMTRCA tailings piles, the longevity consideration has often been addressed through placement of a rock armoring layer over the upper surface of the tailings pile capping system.” Provide a reference or citation for this statement.

RESPONSE: The discussion has been revised.

146. **Section 6.2.2.2.2, Page 172, Second to last paragraph, Last sentence –** Replace "…thereby preventing infiltration…" with "…thereby reducing the potential for infiltrated precipitation to cause the migration of radionuclides to groundwater."

RESPONSE: The sentence has been revised.

147. **Section 6.2.2.2.2, Page 172 –** Not mentioned in this section is the standard provided in 40 CFR 192 (a) which states that "[c]ontrol of residual radioactive materials and their listed constituents shall be designed to: (a) be effective for up to one thousand years, to the extent reasonably achievable, and, in any case, for at least 200 years[.]" Include this standard in this section, and describe how the cap has been designed in order to comply with this standard.

RESPONSE: The requested additions have been made.

148. **Section 6.2.2.2.3, Pages 173 and 174 –** Revise this section to be consistent with comments provided in Section 3 of the FFS related to the specific standards in the radon NESHAP that should be followed.

RESPONSE: The discussion has been revised to include additional language regarding post-construction radon flux measurements.

149. **Section 6.2.2.2.4, Last sentence –** Replace "…thereby preventing infiltration…" with "…thereby reducing the potential for infiltrated precipitation to cause the migration of radionuclides to groundwater."

RESPONSE: The requested change has been made.

150. **Section 6.2.2.3, Page 175, Third paragraph –** This paragraph states that, even with the loss of institutional controls and long-term management, the landfill cover would still act to passively prevent potential contaminant migration and human exposures for an indefinite period. Expand this discussion, and revise the statement by summarizing how the proposed cap has been designed to meet the longevity requirement in 40 CFR 192.02 (a). Explain the relationship that Radium-226 in-growth has on the risks posed from direct gamma radiation and radon. Finally, include a determination as to whether the designed cap will prevent unacceptable exposures and comply with ARARs for 200 years, 1,000 years, and the time of peak risk (i.e. when Radium-226 reaches its maximum concentration).

RESPONSE: The discussion has been revised.

151. **Section 6.2.2.3.2, Page 176** – Include in this discussion, a determination as to whether the cover will prevent unacceptable exposures and comply with ARARs for 200 years, 1,000 years, and the time of peak risk (i.e. when Radium-226 reaches its maximum concentration).

RESPONSE: The discussion has been revised.

152. **Section 6.2.2.3.2, Page 177, First partial paragraph –** Remove the sentence that states, "Even with these limitations, infiltration of precipitation has not resulted in discernible leaching of radionuclides or other chemicals to groundwater," since groundwater is being investigated under OU3. Also, add a sentence that states the NCC was neither intended nor designed to provide the protections listed in the previous sentence, and that it was intended to serve as a short-term measure to prevent potential risks from a surface fire.

RESPONSE: The requested revisions have been made.

153. **Section 6.2.2.3.2, Page 177, First partial paragraph** – This paragraph contains the statement, "Although a GCL includes synthetic components which may degrade over time, studies of the projected life of geomembranes exposed to air, water and leachate have indicated that the service life of a geomembrane is on the order of hundreds of years, may exceed 700 years, and would probably be on the order of 1,000 years or longer." However, GCLs are not geomembranes. Therefore, this study would not appear to apply. Revise or clarify this portion of the paragraph, as necessary. Also, provide additional quantitative information specifying the GCL's ability to prevent infiltration.

RESPONSE: The discussion has been revised. Specifically, all references to a GCL have been removed from the discussions of the ROD-selected remedy and are now incorporated as part of the discussion of the UMTRCA cover alternative.

154. **Section 6.2.2.3.3, Pages 179 and 180, Paragraph that spans these pages** – The last sentence on page 179 implies that damage to either the CCL or GCL due to effects of extreme weather events in the future is not expected to be significant because there have not been those impacts to date. The section goes on to discuss and draw conclusions on infiltration impacts to groundwater. The EPA notes that there is uncertainty as to whether RIM in Areas 1 and 2 are contributing to the radium in groundwater that has been detected to date, and if so, to what extent. Revise this evaluation to remove consideration of whether or not there have been RIM impacts to groundwater to date. Instead, focus on the impact of weather events on the cover and associated infiltration and leachability of the RIM.

RESPONSE: The discussion has been revised.

155. **Section 6.2.2.3.3, Page 181, Second paragraph** – Provide additional explanation to justify the conclusion that a tornado is not expected to damage the vegetation layer of the cap.

RESPONSE: The discussion has been expanded to include some of the results provided in the evaluation of potential impacts of a tornado on the ROD-selected remedy that was submitted to EPA in 2013. We note that EPA has never approved or commented on this submittal.

156. **Section 6.2.2.3.4, Page 182, Footnote 38** – Revise this footnote in accordance with comment #22 above.

RESPONSE: The footnote has not been revised because it reflects the current characterization of the SSR and conditions within the South Quarry. Also, we believe the correct reference is to comment #23 not #22.

157. **Section 6.2.2.3.4, Page 182, Second paragraph** – The EPA provided comments to the RIA that required updates to several of the documents listed in this paragraph. Revise this list to include the updated versions of these documents, as well as, the memorandum dated March 28, 2014, with the subject, "Observations on the EMSI report: Evaluation of Possible Impacts of a Potential Subsurface Smoldering Event on the Record of Decision – Selected Remedy for Operable Unit-1 at the West Lake Landfill, dated January 14, 2014."

RESPONSE: As discussed at the May 11, 2017 meeting, EPA has not provided comments on some of the documents, including the final supplemental radon flux analysis from the Area South of the Proposed Isolation Barrier, and final particulate emission analysis from area south of the proposed Isolation Barrier. The text has been revised to include the observations made by EPA ORD and brief responses to those observations.

158. **Section 6.2.2.3.4, Page 182, Third paragraph and corresponding bullets** – In the memorandum listed in the comment above and dated March 28, 2014, the EPA's Office of Research and Development Engineering Technical Support Center commented on the conclusions in the 2014 SSE Impact Study. Revise this section in light of the EPA's comments in its March 2014 memorandum. Include any quantitative evaluations prepared subsequent to the 2014 SSE Impact Study. Revise the rest of the section after updating the documents specified in the EPA's comments to the RIA and the updated exposure factors and air modeling methodologies utilized in the BLRA.

RESPONSE: As discussed at the May 11, 2017 meeting, EPA has not provided comments on some of the documents, including the final supplemental radon flux analysis from the Area South of the Proposed Isolation Barrier, and final particulate emission analysis from area south of the proposed Isolation Barrier. The text has been revised to include the observations made by EPA ORD and brief responses to those observations.

159. **Section 6.2.2.3.5, Page 186, First paragraph** – This paragraph would be easier to understand if it was in chronological order:

a. Move the sentence that starts, "In 2015, Bridgeton Landfill, LLC conducted…" to above the statement that begins, "In April 2016, EPA issued…;"

b. Incorporate the unique language from the statement near the end of the paragraph that begins, "In 2016, EPA issued an…" with the earlier statement that begins, "In April 2016, EPA issued…;"

c. Delete the statement near the end of the paragraph that begins, "In 2016, EPA issued an…;" and

d. Move the sentence that starts, "The HEB was installed…" immediately after the revised statement that begins, "In April 2016, EPA issued…"

RESPONSE: The discussion has been revised as directed by this comment.

160. **Section 6.2.2.4, Page 189, Last paragraph** – Revise the second sentence to ensure consistency with the CSM in the revised RIA. Provide additional details to justify the statement that neither in-situ nor ex-situ treatment techniques are impracticable. Further, define "impracticable."

RESPONSE: The text has been revised and expanded to address this comment.

161. **Section 6.2.2.4, Page 190, Last paragraph in the section** – Include in this paragraph the estimated volume of waste material that is expected to be disturbed during landfill regrading.

RESPONSE: The estimated volume has been added to the text.

162. **Section 6.2.2.6.2, Page 195** – The bird nuisance mitigation discussion does not appear applicable to this section, please delete.

RESPONSE: The text discusses the implementability of bird nuisance mitigation methods, which seems appropriate for the discussion of the implementability of this and the other alternatives. Per discussions with EPA, this text has been retained.

163. **Section 6.2.2.3.3, Page 208, Second paragraph** – This paragraph implies damage to the CCL due to the effects of extreme weather events in the future are not expected to be significant because there have not been those impacts to-date. The section goes on to discuss and draw conclusions on infiltration impacts to groundwater. The EPA notes that there is uncertainty as to whether RIM in Areas 1 and 2 are contributing to the radium in groundwater that has been detected to-date, and if so, to what extent. Revise this evaluation to remove the consideration of whether or not there have been RIM impacts to groundwater to date.

RESPONSE: The discussion (which appears in section 6.2.3.3.3, not 6.2.2.3.3 as noted above) has been revised.

164. **Section 6.2.3.3.3, Page 209, Last paragraph** – The 4th line discusses reducing slope to 2% instead of 5%. However, in Section 6.2.3.2.5, it was assumed a minimum slope angle of 5% would need to be used due to the potential for settlement after the replacement of non-RIM impact waste. Correct this inconsistency.

RESPONSE: The text has been revised to clarify this point. A slope of 2% would be a departure from the 5% slopes required by the solid waste regulations but it could provide benefit in terms of reduction in potential for soil erosion.

165. **Section 6.2.3.7, Page 231, Second paragraph** – $6,190 million appears to be a typographical error. Revise as necessary.

RESPONSE: The number was supposed to been $619 million; in any event, the text has been revised to reflect the updated cost estimates.

166. **Section 6.2.4, General comment** – The EPA notes that the locations and volumes of RIM for the partial excavation of shallow RIM with activities above 52.9 pCi/g will change in response to the EPA's comments provided on the 3-Dimensional Estimate of RIM. Since the detailed analysis presented in this section is subject to change, the EPA will provide comprehensive comments on this section in the next revision of the FFS.

RESPONSE: Comment noted.

167. **Section 6.2.4.6.2, Page 251** – It is unclear why excavation and disposal at FUSRAP sites are singled out in this discussion. Excavation and disposal of RIM has been conducted at many sites across the nation under FUSRAP, CERCLA, the Department of Energy Land Management (DOE LM), and by other agencies. Remove the reference to FUSRAP explicitly here and elsewhere, if not directly applicable to the discussion.

RESPONSE: The text has been revised to indicate that excavation and disposal has been performed at a variety of sites including FUSRAP, CERCLA, and DOE sites.

168. **Section 6.2.5, General comment** – The EPA notes that the locations and volumes of RIM for the partial excavation of RIM with activities above 1,000 pCi/g will change in response to the EPA's comments provided on the 3-Dimensional Estimate of RIM. Since the detailed analysis presented in this section is subject to change, the EPA will provide comprehensive comments on this section in the next revision of the FFS.

RESPONSE: Comment noted.

169. **Section 6.2.5.6.2, Page 280** – The statement regarding FUSRAP having never removed and disposed of radiological material commingled with MSW and disposed in a landfill setting is not correct. The DOE and the USACE have performed excavations at municipal solid waste landfills under FUSRAP.

RESPONSE: The text has been revised per subsequent discussions with EPA.

Section 7

170. **Section 7, General comment –** Revise all ARARs discussions in this section to be consistent with the EPA's comments in Section 3.

RESPONSE: The additional laws and regulations identified by MDNR have been evaluated to determine which are potentially applicable or relevant and appropriate to the evaluation of alternatives for the OU-1 soil/waste. The prior tables have been updated to summarize the results of this evaluation and are included as part of the revised FFS. Discussions of those ARARs that were identified as being potentially applicable or relevant and appropriate have been added to the revised text of the FFS.

171. **Section 7, General comment –** In general, additional explanation and justification should be provided in comparing the remedial alternatives against the nine criteria and against each other. For example, Section 7.2.1 discusses long-term effectiveness and touches on permanence, but ranks the alternatives all the same in Table 7-1. Full RIM excavation should rank higher in permanence and long-term effectiveness than the other alternatives because no further remedial action would be needed in the future based on the presence of radionuclides. Solid waste landfill regulations would still apply to the MSW, but the risk from radionuclides, which are the risk driver at the Site, would be permanently removed.

RESPONSE: The discussions in Section 7 have been expanded to better highlight the differences between the various alternatives.

172. **Section 7, General comment** – The EPA will provide further comments on this section when we have the revised version of the FFS addressing our comments.

RESPONSE: Comment noted.

173. **Section 7.1.1, Page 291, Third paragraph, Fifth line** – Delete "…and partial excavation alternatives…" because it is stated earlier in sentence.

RESPONSE: The text has been revised into multiple sentences to clarify that the first reference to partial excavation alternatives was related to the installation of a new multi-layer landfill cover while the second reference was related to excavation of RIM under the partial excavation alternatives.

174. **Section 7.1.2.2, Page 292, Second paragraph** – At the end of this paragraph, please revise "…and approved by EPA and MDNR." to "…and approved by the appropriate entities," and delete the immediately following sentence.

RESPONSE: The discussion has been revised.

175. **Section 7.2.1, Page 294, Last paragraph** – This paragraph selectively quotes the 2014 U.S. Geological Survey (USGS) report. The USGS report ultimately concluded that RIM could not be ruled out as a potential source of the radium detected in groundwater wells at the Site. Discuss the USGS conclusions more fully, or remove this language from this and other sections of the report.

RESPONSE: The discussion has been revised to remove all references to conclusions from the USGS study.

176. **Section 7.2.1.1, Page 296, First partial paragraph** – The sentence in the middle of the paragraph which states, "however, even without significant cover material, the radon emissions from the surfaces of Areas 1 and 2 are far below the UMTRCA and NESHAP standards," is misleading and incorrect. Flux measurements collected during the RI in areas where RIM was near the surface, exceeded standards. Remove the referenced sentence, and update the discussion based on the EPA's comments on previous sections and Appendix F.

RESPONSE: The text has been revised.

177. **Section 7.2.3.5, Page 305, Third paragraph after bullets** – This paragraph discusses thorium occurrence and verification issues and potential schedule impacts related to laboratory testing. Please clarify in this section, or other relevant text sections, the cost and/or schedule contingencies considered/used to account for the testing procedures and approach presented.

RESPONSE: The requested additional discussions have been developed and included in the revised FFS.

Section 8

178. **Section 8, References** – Please use the acronym "USACE" in reference to the U.S. Army Corps of Engineers. "USACOE" should not be used.

RESPONSE: The acronym has been revised.

Tables and Figures

179. **Table 2-1 and Appendix B – Estimated Three-Dimensional Extent of Radiologically Impacted Material, West Lake Landfill Operable Unit 1:**

a. AC-3b in Table 2-1 indicates that RIM is present based on a downhole gamma reading, yet the core gamma and core alpha readings do not confirm the presence of RIM. Please explain how conflicting soft data is reconciled.

RESPONSE: The downhole gamma readings clearly identified the presence of RIM at this location (see AC-3 Borehole Summary Sheet in Appendix L of the RIA). As noted in EPA comment 146 on the RIA, elevated downhole gamma readings not supported by corresponding core gamma or alpha scans or analytical sampling data are likely the result of the contamination existing near but not in the boring location.

180. **Table 2-2 – Summary of Occurrences of Radiologically-Impacted Material (RIM) in Area 2, and Appendix B – Estimated Three-Dimensional Extent of Radiologically Impacted Material, West Lake Landfill Operable Unit 1:**

a. Also reference Table B-1 in the Revised Work Plan for Additional Characterization of Extent of Radiologically-Impacted Material in Areas 1 and 2 revised September 22, 2015.

b. According to the Additional Characterization work plan, boring numbers "AC24" and "AC25" were drilled specifically to verify the deeper occurrences of RIM previously identified at WL-210 and WL-235, respectively, for revised volume calculations. However, Table 2-2 states, "*NA*," instead of providing the sample results that suggest RIM was not verified at the deeper depths.

c. Potentially conflicting data should be presented fully and discussed/reconciled.

RESPONSE: Responses to each of the specific items listed in this comment are presented below.

a. We do not understand how Table B-1 in the revised work plan relates to subsequent the identification of RIM in Area 1 or Area 2. Table B-1 was the rationale for locations selected for the additional borings.

b. We agree that Table 2-2 should be revised to indicate that samples obtained from the deeper intervals in borings AC-24 and AC-25 did not indicate the presence of RIM. Due to time constraints, this revision did not make it into the latest draft of the FFS, but will be included in the next revision. Please also note that this table is from the RIA and thus will also need to be updated in the RIA. In addition, because the FFS does not include detailed discussion of the results of the various investigations, discussion of the specific results for borings AC-24 and AC-25 is more appropriate for the RIA. Regardless, the downhole gamma logging detected elevated gamma levels in the deeper intervals of borings AC-24 and AC-25. As noted in the response to the prior comment, elevated downhole gamma readings not supported by corresponding core gamma or alpha scans or analytical sampling data are likely the result of the contamination existing near but not in the boring location.

c. This issue seems outside the purpose and scope of the FFS, but instead would be addressed in the revised RIA. Unfortunately, we did not receive this comment until after the revised RIA was submitted.

181. **Table 3-1** – Please revise Table 3-1 in accordance with comments provided in Section 3 of the FFS. In addition, provide more precise citations to the specific ARARs in Table 3-1, such that the exact sections and subsections are identified along with the corresponding detailed narrative description of the individual specific requirement, the legal prerequisite for the regulation's applicability, and a description of the triggering action or location characteristic. This is

consistent with EPA/540/G-89/006, August 1988, CERCLA Compliance With Other Laws Manual.

RESPONSE: Tables 3-1, 3-2, and 3-3 have been updated and supplemented as appropriate to respond to these comments.

182. **Table 6-1** – Provide additional detail on the basis for the operation, maintenance, and monitoring (OM&M) annual cost. Include the basis for the range of the OM&M costs and any anticipated differences based on the alternative selected. Include any anticipated replacement costs.

RESPONSE: The details for the OM&M costs are presented in Appendix K. The range of costs reflect differences in the annual costs associated with variable levels of activity associated with activities that only occur periodically (*e.g.,* Five Year Reviews, cover system repairs, variations in the scope of monitoring between years, etc.). Because all of the alternatives include similar OM&M activities (*e.g.,* annual inspections, maintenance and monitoring, periodic repairs, Five Year Reviews, etc.), the OM&M costs for the various alternatives are similar.

183. **Figure 2-5** – Color shades make it difficult to interpret ownership. Use a different color for the Laidlaw property.

RESPONSE: This figure was previously revised in response to a similar comment on the RIA. Those revisions are reflected in the version of this figure included in the revised draft of the FFS.

184. **Figures 2-10 and 2-11** – These figures have areas with a blue line within a blue line which are difficult to interpret. If the interior blue line is meant to depict an unimpacted area, it would be easier to interpret if the RIM impacted areas are hatched. Also revise all figures based on the revised 3-Dimensional Extent of RIM.

RESPONSE: These figures have been revised based on the revised evaluation of the 3-D extent of RIM (see Figures 2-11 and 2-12 which are also included as Figures 5-5 and 5-6 in the FFS).

185. **Figure 5-2** – It is recommended that the Engineered Landfill Cover Detail show a non-woven geotextile or a filter layer between the biointrusion layer and the clay layer to avoid potential sink holes in the future.

RESPONSE: The figure has not been revised as requested because the conceptual design envisioned that the bio-intrusion layer would be composed of well-graded material such that there would not be void spaces that could result in “sink holes” in the future. Reliance on a geotextile instead of a well-graded material did not seem appropriate relative to the UMTRCA longevity standard.

Appendices

186. **Appendix B** – Please ensure that the first time an acronym or abbreviation is used, it is defined within the appendix. Ensure all acronyms, including those in appendices, are included in the acronym list at the beginning of the FFS report.

RESPONSE: The requested change has been made.

187. **Appendix B, Section 3.2, Pages 3-5, Number 2** – Clarify whether sample elevations were adjusted due to subsidence.

RESPONSE: The discussion has been revised.

188. **Appendix B, Section 3.2** – The last paragraph refers to Figures 1 and 2, but should refer to Figures 6 and 7 instead. Please revise.

RESPONSE: The requested revision has been made.

189. **Appendix B, Section 3.4** – State the range of years that samples were collected.

RESPONSE: The requested addition has been made.

190. **Appendix B, Section 4.2, Last paragraph** – Simplify the text to only include processes actually utilized in this analysis.

RESPONSE: The discussion has been revised.

191. **Appendix C** – Consider whether detailed information about off-Site disposal facilities, particularly design drawings, is needed in the FFS.

RESPONSE: Updated WAC were obtained and included in Appendix C. The WAC information presented in the current and prior versions of the FFS were presented as obtained from the facility representatives or websites without any editing. The updated WAC were substantially briefer than the information previously provided by the offsite disposal facilities, such that much of the detailed information included in the prior versions of the WAC is no longer included. Detailed information about off-Site disposal facilities may be provided at the RD stage if and as appropriate. We do not believe it is needed in the FFS.

192. **Appendix D, Table of Contents, Page ii** – Table 1 is referenced in this appendix, but is not included. Please incorporate this table.

RESPONSE: The appendix has been revised to include Table 1.

193. **Appendix D, Section 1.3, Page 3, First paragraph** – The second to last sentence states, "Neither of these radionuclides has been detected in groundwater at the Site at levels above background." This statement is inaccurate. Delete or revise this sentence and the consequent sentence.

RESPONSE: The discussion has been revised. The text will refer to the fact that with the exception of a few isolated detections of uranium or thorium in a total fraction (unfiltered) sample but not the dissolved (filtered) samples obtained during one of the four groundwater sampling events conducted in 2012-2013, uranium is not present at levels above its MCL and thorium is not present at levels above the Gross Alpha MCL. Therefore, the focus of the apatite/phosphate treatment evaluation is on radium.

194. **Appendix F, Section 2.2, Page 4, Reference to Table 2**–. The residual radium-226 estimates are presented for the partial excavation of shallow (down to 16 fteet) RIM at activities above

52.9 pCi/g. Because RIM at concentrations significantly above 52.9 pCi/g has been found at depths below 16ft, recalculate the concentration of the residual RIM for this remedy alternative.

RESPONSE: We concur with the comment, and the text and table has been revised to reflect a 95% UCL based on the presence of RIM below the 52.9 pCi/g threshold above the 16 foot depth and any remaining RIM located below the 16 foot depth.

195. **Appendix F, Section 2.2, Page 4, Last sentence** – Revise this sentence to state, "Table 2 presents the concentrations of thorium-230 and radium-226 in Areas 1 and 2 at one year, 1,000 years, and 9000 years (maximum concentration of Radium-226) after construction of a particular remedial alternative." Add the 95% upper confidence limits (UCLs) for radium-226 from the revised updated BLRA to Table 2, where appropriate, and the revised residual RIM calculations required in the previous comment.

RESPONSE: The discussion has been revised. Table 2 has been revised and the approximate multiplier (1.83) to calculate risk at 9,000 years has been noted in the text.

196. **Appendix F, Section 3.1, Distance** – Provide a summary within Appendix F of the gamma shielding assessment.

RESPONSE: The discussion has been revised.

197. **Appendix F, Section 3.1, Page 5, Shielding** – Provide a justification for using 1.6 grams per cubic centimeters as an aggregate density for all covers. Provide the MicroShield® input parameters and output files used to evaluate the exposure rates on the surface of each cap.

RESPONSE: The discussion has been revised.

198. **Appendix F, Section 3.2, Page 6, First paragraph** – Revise this paragraph to include a summary of the original (pre-NCC) radon flux measurements. In addition, the recent radon flux measurements should be characterized as having been taken after the installation of the NCC.

RESPONSE: We would like to discuss this comment with EPA; specifically, the relative representativeness of the two sets of flux measurements and the approach (RAECOM model) used in the BRA.

199. **Appendix F, Section 3.3, Page 8** – The flux measurements being considered in this paragraph were not measured from the "bare surface" of OU1. The June 2016 flux measurements were taken after the NCC cover was placed in Area 1 and Area 2 over the portions of OU1 where RIM was at or near the surface. As this cover is a temporary measure, and not considered in the updated BLRA for future risk, the design of the radon barrier portion of any cap should not be based on these flux measurements. Revise these calculations using the previous radon flux measurements, and revise the corresponding text as necessary.

RESPONSE: We would like to discuss this comment with EPA; specifically, the relative representativeness of the two sets of flux measurements and the approach (RAECOM model) used in the BRA.

200. **Appendix F, Section 3.4, Page 9, First sentence** – Specify in this section the radium-226 concentrations utilized in these calculations. Add to this section, the maximum radium-226

concentration, and perform the calculations for this concentration as well. In addition, specify whether these concentrations are 95% UCLs based on "surface soils" or "all soils" as presented in the BLRA.

RESPONSE: The discussion has been revised. The radon concentration using the maximum radium-226 concentration was generated using RAECOM. The concentration from "all soils" was used.

201. **Appendix F, Table 2, Page 12** – Add to this table the "Initial_Ra-226" and "Initial_Th-230" values being considered in the calculations described in footnotes "b" and "c."

RESPONSE: Changes made in response to other comments resulted in the calculations being performed using an assumed value of 1,000 pCi/g in order to evaluate the relative reductions associated with increased cover thickness and variable radium-226 levels. The initial (Year 1) radium and thorium values are included on Table 9.

202. **Appendix F, Page 12, Footnote "d"** – This footnote is not sited anywhere on this table and does not appear to be correct. Update the table as necessary.

RESPONSE: The table has been deleted from the revised FFS.

203. **Appendix F, Table 3, Page 13, "Uncovered Radon Flux" column** – Revise these values to be consistent with the previous comments on which flux values should be considered for evaluating cap thicknesses. Also, the "b" footnote currently appears to be referring to the entire column of values; however, it should probably only apply to the Current Baseline Condition. Revise the table to clarify what the footnote applies to.

RESPONSE: The table has been revised. Calculations were based on projected radon concentrations using RAECOM. The footnote has been clarified.

204. **Appendix F, Table 5** – Please indicate on the table that these values are unit-less.

RESPONSE: The requested revision has been made.

205. **Appendix G, General comment** – Carefully ensure that the background and history information provided in this appendix is consistent with the body of the document.

RESPONSE: The requested confirmation has been performed.

206. **Appendix G, Section 2, Page 3, Third paragraph** – Use consistent nomenclature for the air monitoring station designations (i.e. A12 versus 12).

RESPONSE: The requested changes have been made.

207. **Appendix G, Section 3.1.2, Page 8, Last paragraph on this page, Last sentence – Delete "… and therefore minimal."**

RESPONSE: The requested change has been made.

208. **Appendix G, Page 13, Section 3.2.2.1, Last bullet** – Delete "Subtitle D" from this bullet.

RESPONSE: The bullet has been revised.

209. **Appendix G, Pages 13 and 14, Section 3.2.2.1** – These sub-sections discuss, in detail, various status and final status (gamma) survey work planned for the Site. Explain how the presence of thorium at the Site will be accounted for in the status and final status surveys.

RESPONSE: The section has been revised to indicate that on-site and off-site laboratory analysis will be required to account for thorium.

210. **Appendix G, Section 5.1.2, Page G-22** – This text discusses estimating cost based upon the monitoring at 24 wells located at/near the perimeter of the Site. This paragraph also includes discussion of a specific pre-determined Point of Compliance (POC) for estimating monitoring cost. The EPA does not agree that a pre-determination of the POC in this Feasibility Study appendix is required to provide a reasonable estimate of long-term groundwater monitoring cost. Delete the 3rd full paragraph and the first sentence of the 4th paragraph.

RESPONSE: The discussion has been revised.

211. **Appendix H** – The risk evaluations in this document should be revised, as appropriate, according to the comments made on the BLRA.

RESPONSE: The discussion has been revised.

212. **Appendix H** – Based on comments made on the BLRA, please make available or include as tables, the inputs and outputs of the PRG and RSL calculators.

RESPONSE: The requested changes have been made. The risk evaluations have been revised to be consistent with those included in the revised BLRA. The input and output values for the PRG and RSL calculators are presented in Attachment A of Appendix H.

213. **Appendix H, ES Page xii** – Define and explain the meaning of short-term and long-term scenarios.

RESPONSE: The text has been revised to include the requested explanations.

214. **Appendix H, ES Page xii** – Update the language in the Executive Summary for this appendix to more clearly state whether the risk to an off-Site resident during and following implementation of the remedy are below the CERCLA risk range.

RESPONSE: The discussion has been revised. The risks to an off-site resident during and following implementation of a remedy have been more clearly stated.

215. **Appendix H, Section ES1, Page xiii** – Add a statement to this section about the non-cancer hazard index of 1.

RESPONSE: The discussion has been revised.

216. **Appendix H, Section ES2, Page xiii** – Although non-cancer hazards are not drivers in this risk assessment, they should be discussed in this section.

RESPONSE: The discussion has been revised.

217. **Appendix H, Section ES3, Page xiv, Bullet 1** – Delete or modify subjective language, e.g. replace "substantially lower" with a quantitative value.

RESPONSE: The discussion has been revised.

218. **Appendix H, Section ES3, Page xiv, Bullet 7** – Specify whether this sentence is describing a worker or a resident.

RESPONSE: The discussion has been revised.

219. **Appendix H, Section 1, Page 2**– It is not appropriate to eliminate the groundwater pathway based on institutional controls. Groundwater will be further investigated in OU3, and therefore, it is premature to make determinations about impacts to the groundwater pathway. Revise Appendix H, as appropriate, to be consistent with this comment (see also Section 2.2.6, Page 10).

RESPONSE: The discussion has been revised.

220. **Appendix H, Section 2.2.3.1, Page 7 and Appendix L, RIM Average Activity Levels** – Specify any software used to calculate EPCs in these appendices. Include the input and output files generated for or calculated from this software. In addition, EPCs should be calculated in a manner consistent with the BLRA.

RESPONSE: The text will be revised to include discussion of the process used to establish the EPCs (database used as input to Pro UCL). The database inputs and/or outputs will be supplied as an attachment. 95% UCLs for COPCs will be calculated for excavated and remaining volumes of soil. The volume (excavated vs. remaining) with the higher EPC will be used to calculate the short-term risk to the remediation worker. The EPCs for the remaining soil will be used to calculate long-term risks. Appendix L will be referenced as the basis for the calculations.

221. **Appendix H, Section 2.2.3.1, Page 7** – Explain why average concentrations of Ra-226 and Th-230 were calculated instead of 95% UCLs.

RESPONSE: The output from the geostatistical evaluation only provided average values. We revised the procedure to allow 95% UCL values to be calculated as described in response to the prior comment.

222. **Appendix H, Section 2.2.4.1, Page 8** – All short-term alternatives should use the radon flux measurements measured prior to the NCC.

RESPONSE: Calculations will be based on projected radon concentrations using RAECOM.

223. **Appendix H, Section 2.2.7, Page 10** – Depending on the length of the short-term exposure, it may be appropriate to use subchronic, if available, instead of chronic toxicity values.

RESPONSE: It was determined that for excavation activities with exposure durations of seven years or less, subchronic toxicity values, where available, should be used. The use of subchronic values is discussed in Appendix H .

224. **Appendix H, Section 2.2.7.1, Page 10** – Update the lead evaluation, including Table 2-4, per the comment on the BLRA. The Adult Lead Methodology has been updated, and as stated in the December 22, 2016, OLEM Directive 9200.2-167, "the current scientific literature on lead toxicology and epidemiology provides evidence that adverse health effects are associated with blood lead levels (BLLs) less than 10 µg/dL." Until a final decision is made on the target blood-lead level to be used in evaluating risks from lead exposure, it is reasonable to use a target blood lead level of 5 µg/dL. For the most up-to-date version of the ALM spreadsheet, contact the Regional risk assessor.

RESPONSE: The requested updates have been performed.

225. **Appendix H, Section 2.2.7.1, Page 11** –Delete the duplicate paragraph.

RESPONSE: The requested change has been made.

226. **Appendix H, Section 4.2.1, Page 21** – Revise the reference to the EPCs to section 2.2.3.1, and correct this throughout the appendix.

RESPONSE: The discussion has been revised.

227. **Appendix H, Section 4.2.4.1, Page 25** – Indicate if the project schedule duration for the remedial alternatives is consistent with Appendix J (Estimated Project Schedules for the Remedial Alternatives). Currently, Appendix H cites project schedules provided by Feezor Engineering at the bottom of pages 25, 39, 53, and 67 for the various remedial alternatives.

RESPONSE: The text has been modified to indicate that short-term risks to the worker are consistent with the time that workers are working with and around RIM as determined from the Estimated Project Schedules for the Remedial Alternatives in Appendix J.

228. **Appendix H, Sections 4.3.1 and 4.3.2** – Traffic and other industrial injuries/fatalities are not generally environmental risks to be evaluated in a short-term effectiveness analysis, specifically for common earthmoving/hauling alternatives. While potential site-related accidents are of concern, potential worker accidents are typically addressed through project health and safety plans and related engineering controls. Consistent with NCP 300.430(e)(9)(iii), evaluate the alternatives focusing on the extent to which accidents could potentially expose workers or the community to possible releases resulting from such accidents. Remove the discussion of the traffic and other industrial injuries/fatalities from the comparative analysis from these sections, as well as, Section 6.

RESPONSE: While we agree that traffic accidents are not generally considered environmental risks, the NCP 300.430(e)(9)(iii) states that the short-term impacts of alternatives shall be assessed considering the following:

(1) Short-term risks that might be posed to the community during implementation of an alternative;

(2) Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures;

(3) Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation; and

(4) Time until protection is achieved.

We note that the NCP specifically lists environmental impacts only in Item 3. The text in items 1 and 2 under NCP 300.430(e)(9)(iii) do not limit assessment to environmental risks and impacts.

It is a statistical fact that the chance of an accident increases with each mile traveled, and that this holds true for both on-site and off-site travel. Miles driven vary dramatically for the various alternatives. We believe it is important to capture the traffic risks on public roads associated with each alternative. Similarly, while occupational hazards are mitigated by a well-conceived and executed Health and Safety Program, insurance statistics can be used to argue that they are not eliminated, and the chance of injury or death increases as time on the job increases. The traffic and occupational hazard assessments have been provided to allow decision-makers to view a more comprehensive understanding of risks and hazards associated with each alternative.

A semi-quantitative evaluation of potential risks to workers and community that may result from and environmental release during an accident will be added in or near Appendix H. Since the primary mode of exposure during a transportation accident will be from a puff of suspended particulates, risks from a one-hour exposure to an opaque, visible puff of dust will be evaluated. It will consider that RIM transported off site will have been down-blended to meet the waste acceptance criteria (WAC) of its destination. It will have been packed into a burrito wrap held by an intermodal. Concentrations of COCs in the dust will equal the destination's WAC. Exposures via external radiation and ingestion will be evaluated but will most likely be screened out due to the exposure time and surface area of the spill.

The traffic and occupational hazard assessments will be updated in the next draft of the FFS. An evaluation of the environmental impacts from a single truck accident will be included.

Appendix H, Section 4-7, Short-Term Risks – Create one summary table that is inclusive of all short-term scenarios (i.e., 1,000 pCi/g, 52.9 pCi/g, complete rad removal, and ROD-selected remedy) for each of the following types of information: EPCs, exposure inputs to Air PRG and RSL calculators, and short-term hazard risks. This would allow for a side-by-side comparison of this information across the remedial alternatives being evaluated. Perhaps these would be tables that could be added to the end of the short-term risk scenarios, executive summary, or some other applicable location in the document. This summary table could help explain, for example, why the short-term EPCs and carcinogenic risks to a RadCon Tech under the 1,000 pCi/g alternative are higher than for the complete rad removal alternative.

RESPONSE: The requested table has been prepared and is included as Attachment A to Appendix H.

229. **Appendix H, Section 8.2.1** – The method described for calculating soil EPCs for radionuclides other than Th-230 at 1-year post-construction involves calculating the ratio of the alternative-specific cleanup level to the 95% UCL for Th-230 and multiplying that ratio by the radionuclide 95% UCL. State in 8.2.1 that the purpose for the calculation is to represent a proportional

decrease in all post-remedial radionuclide concentrations. However, it is unclear how air EPCs for radon at receptor locations were estimated for the grounds keeper on top of Area 1 and Area 2, one year after construction.

RESPONSE: This section has been revised to indicate that the radon flux is estimated in OU-1 using RAECOM and the concentration of radon at the receptor site is estimated using AERMOD.

230. **Appendix H, Section 8.2.2** – State what method was used to predict future concentrations of radionuclides. Also, specify how the EPCs for radon were determined for each receptor location.

RESPONSE: This section has been revised in response to the comment.

231. **Appendix H, Section 8.5, Page 78** – Update the list of potential receptors based on the BLRA comments (e.g., the future onsite storage yard worker).

RESPONSE: The discussion of receptors has been revised to reflect the RME receptor from the updated BLRA.

232. **Appendix H, Section 8.6, Table 8-2, Page 79** – The exposure frequency listed in Table 8-2 for the grounds keeper is 17.6 days/year. However, the exposure frequency used later in the document (Sections 9.4.3, 10.4.3, 11.4, and 12.4.3) was 6.2 days/year. Reconcile the discrepancy, and provide a justification for how 17.6 days/year represents a reasonable maximum exposure.

RESPONSE: The discussion has been revised. The grounds keeper is no longer the RME receptor and was not evaluated in Appendix H of the revised FFS. The Storage Yard Worker was evaluated instead.

233. **Appendix H, Section 9.3, First paragraph** – The sixth sentence states, "About 20% of radon gas is released to interstitial air and water in the pore spaces of the residual radium and surrounding soils, while the other 80% remains within the solid matrix of the soil particles." Please cite a reference or include a justification for this statement. Clarify whether the 20% release is specific to the types of RIM present in the subsurface at OU1 or if it is a generalization. Clarify whether this information was used in the estimation of air radon EPCs associated with the long-term evaluations of each alternative.

RESPONSE: The discussion has been revised. This text was intended as informational in nature and as a generalized discussion. A reference was located and is listed as footnote 30.

234. **Appendix H, Section 9.4.2 and 9.4.3** – Per Section 9.4.2, clarify how PRGs for direct radiation were generated for the range of cover thicknesses (i.e., 50, 60, 70, 80, 90, 100, 200 and 300 cm covers) if the PRG calculator does not allow the option for entering cover thicknesses. Also, state what cover densities are assumed in the PRG calculations.

RESPONSE: The text has been revised to further describe the methodology used. As stated in Section 9.4.2, the PRG calculator does not allow for entry of a cover thickness of 1.5m. The PRG calculator does allow for the entry of the cover thickness listed above. These were used and then a PRG for 150 cm was interpolated from these results. In the VF equation, there is a default soil density used of 1.5 g/cm^3.

235. **Appendix H, Section 13.1, Presentation of Calculated Results, Table 3-1, Page 11** – Please add an additional discussion of the risks for the various alternatives and how the results differ among the different alternatives. For example, include a discussion explaining why the long-term carcinogenic risk is higher for the "full excavation" alternative than for the two "partial excavation" alternatives.

RESPONSE: The discussion has been revised.

236. **Appendix H, Section 13.3, Page 119** – The second paragraph in this section discusses risk that is based on projected incidences of transportation and industrial accidents. See earlier comment on this topic.

RESPONSE: We would like to discuss this comment with EPA with respect to inclusion of accident evaluations in the FFS.

237. **Appendix H, Table 2-3** – Add a figure showing the on-Site and off-property receptor locations.

RESPONSE: Figures showing the receptor locations for short- and long-term exposures are included in Section 2 of Appendix H.

238. **Appendix H, Tables 9-1, 10-1, 11-1, and 12-1** – Provide references for the values presented for each of the cover properties. Clarify whether the values for erosion rate, total porosity, volumetric water content, and hydraulic conductivity each represent an average of the materials and thicknesses assumed for each layer of the cover.

RESPONSE: The discussion has been revised and the tables now include references for the values.

239. **Appendix H, Tables 9.4.3, 10.4.3, and 12.4.3 and Table 11-4** – Add a figure showing the Areas 1 and 2 receptor locations indicated for long-term exposures.

RESPONSE: Figures showing the receptor locations for short- and long-term exposures are included in Section 2 of Appendix H.

240. **Appendix H, Table 11-4** – Justify why an alternate area correction factor (ACF) for the 2,000 sq. meter slab size was utilized for this alternative. Clarify why it is not presented in the long-term risk/dose evaluations of the other alternatives. Explain how this is applicable to the areal extents of RIM in Areas 1 and 2, which are estimated to be 6.4 acres (25,900 sq. meters) and 22.9 acres (92,673 sq. meters), respectively.

RESPONSE: The discussion has been revised. Since the same receptors are evaluated for each alternative, "Receptor Behavior" should go in the introduction to long-term risks, Chapter 8. As stated, 2000 m^2 slab size was used for each of the alternatives. It is the maximum area allowed for a Class 1 MARSSIM survey unit. As to its relationship to site areas, expanding the size of the area beyond 1,000 m^2 has little to no effect on the risk numbers produced by the calculator (Section 4.10.5 in PRG calculator user's guide), so expanding the area to cover the entire site would not change the result.

241. **Appendix J, Rod Selected Remedy, Page 4, Line 84** – The Buffer Zone Activity has 6 days scheduled, which seems brief considering some of the unknowns related to this area of the Site.

Describe the activities expected to occur during this six-day period, and consider adding additional items to the schedule to address Site preparation, excavation, hauling, etc. This comment applies to all alternatives.

RESPONSE: Please see assumptions listed under "Buffer Zone/Crossroad Property", page 16 of Appendix K-1 General Construction Assumptions (identified as Appendix K-1.1, in the revised draft of the FFS).

242. **Appendix J, Rod Selected Remedy, Page 6, Line 118** – Provide additional details regarding the activities included in Site Completion (Final Status Survey, removal of temporary irrigation system, and inspection of cap system, including the establishment of a vegetative cover). Consider if this item could be added here or under line 171 heading (Final Cover). This comment applies to all alternatives.

RESPONSE: Please see assumptions listed under "Vegetation and Fencing Information", page 4 of Appendix K-1 ROD Remedy Assumptions (to be identified as Appendix K-1.2 in the next draft of the FFS) and page 4 of Appendix K-1 Excavation Assumptions (to be identified as Appendix K-1.3 in the next draft of the FFS). Further details are contained in the individual construction cost estimate spreadsheets (for example, Construction Cost Estimate - ROD Remedy, lines 105-107).

243. **Appendix J, Rod Selected Remedy Page 8, Lines 171-172** – Final Cover. Starter Berms. This item only includes one-day. Clarify what will occur in one day related to the starter berms.

RESPONSE: Line 172 is a summary task for lines 173-176. (Note that these lines are specifically for Area 1 starter berms; Area 2 starter berms are on lines 87-91.) These durations flow from the construction cost estimate spreadsheet in Appendix K-3 (page 4, lines 82-85). The calculated duration is 1.3 days, which is rounded to the nearest day in the schedule. Associated assumptions are shown on Appendix K-1.2 (ROD Remedy Assumptions) on page 3.

244. **Appendix J, Complete RAD Removal, Page 1, Line 90** – Final Status Survey. Explain why the text of the FFS includes discussions of pre-final status surveys being conducted, but this item is not found on the schedule for the excavation alternatives. This comment applies to all excavation alternatives.

RESPONSE: Pre-final status surveys would be conducted at relevant locations on an on-going basis during RIM excavation. Final status surveys would proceed once excavation has concluded in each location, while excavation moves on to another location. Because neither of these surveys is conducted by the construction contractor, they are not included in the estimated construction schedules.

The exception is that toward the end of excavation, construction activities may be delayed while waiting for the results of a final status survey (for example, at the last excavation location). Thus, an allowance is made for a break in construction while waiting for laboratory analytical results.

245. **Appendix J, Complete RAD Removal, Page 1, Lines 11-32** – Mobilizations. There are several different mobilizations related sub-items listed in the schedules. Consider for the FS level schedule if these items could be truncated or simplified into fewer items. This comment applies to all alternatives.

RESPONSE: As recommended, mobilizations have been shown in a simplified manner on the construction schedules.

246. **Appendix J, Partial Excavation 1000, Page 9, Lines 186-187** – Explain what is intended by the schedule items titled, "Startup Rate" and "Full Production Rate".

RESPONSE: The process of loading RIM for offsite transportation is estimated to be an involved process, as discussed in Section 5.4.3. The 'startup rate' is an accommodation for a learning curve while site operations gain efficiency. It is estimated to begin at a very low shipping rate and gradually increase to full throughput over the course of three months. Please see the relevant lines in the Construction Cost Worksheets in Appendix K; for example, lines 99 and 100 of the worksheet in Appendix K-4, page 5.

247. **Appendix J, Partial Excavation 1000**, **Page 11, Line 336** – Bridge Demolition. This item has only one-day scheduled for demolition. Consider adding additional time to this item, or add lines for removal of debris/materials that will be required following the demolition of the temporary bridge structure. This comment applies to all alternatives with the temporary bridge structure.

RESPONSE: Please see assumptions listed under "Bridge over Entrance Road", page 11 of Appendix K-1.1 (General Construction Assumptions). The installation (and removal) of the modular bridge itself was estimated to be fairly short, relative to the accompanying earthwork. The soil forming the bridge's ramps is projected to be reused later in the project as landfill cap material.

248. **Appendix K** – Include titles on the top of each sheet of Appendix K to clarify what the summarized/estimated cost sheets apply to, and consider renumbering the appendix to have sequential numbers from the first page to the last page. Additionally, consider re-organizing the overall information in Appendix K, such that, Appendix K2 through K6 are provided before the summary information currently in Appendix K.

RESPONSE: To improve the clarity of information presented in Appendix K, the following changes have been included in the revised draft FFS:

1. Page numbers in the footer of App. K-2 through K-6 were revised to include the appendix number.
2. The supporting assumptions found in the prior App. K-1 (Construction Assumptions) have been moved to Appendix K-8 after the cost estimates for the alternatives, which were previously found in K-2 through K-6. Note that the cost estimates have been renumbered as App. K-1 through K-5, and the supporting assumptions are now located in App. K-6.
3. A brief description of the supporting assumptions is included at the beginning of each section, which will be the new K-6. This description indicates whether the assumptions apply broadly across alternatives or are specific to the ROD-selected or excavation-based remedies.
4. The new App. K-8 is subdivided into subsections 1-3 (i.e., K-8.1 through K-8.3) to effectively refer to a specific page elsewhere in the document. Page numbers within each subsection are numbered as Page 1 of X, Page 2 of X, etc.
5. When a specific supporting assumption is referenced in a cost estimate (the new App. K-1 through K-5), the reference has been changed (where possible) from "see separate

assumptions sheet" to refer to the specific page (such as "see App. K-8.3, page 4").

249. **Appendix K** – Add footnotes to Appendix K sheets to include information on how the cost factors provided in the sheets were applied to each alternative.

RESPONSE: As discussed in Response #248, cost estimates now refer to the App. K-8 assumptions for reference as appropriate (see item #5 under the response to Comment No. 248).

250. **Appendix K, Page numbering** – It is sometimes difficult to determine how the sheets are organized within the appendix. Revise as follows: Page 1 of X, Page 2 of X, etc.

RESPONSE: Please note that App. K-2 through K-6 are currently numbered using a 'Page 1 of X' format. As discussed in Response #248 (Item 4), former App. K-1 (now included as Appendix K-8) has been revised to reflect this format.

251. **Appendix K, Page 1** – Construction Assumptions for ROD Remedy Sheets. This sheet includes consideration of Site preparation, decontamination pads, and parking areas. Indicate whether these costs also apply to all of the excavation alternatives.

RESPONSE: Page 1 of Appendix K-1.2 (ROD Remedy Assumptions) lists quantity assumptions related to the ROD Remedy. Similar quantity assumptions for the excavation-based remedies can be found on page 1 of Appendix K-1.3 (Excavation Assumptions).

252. **Appendix K**, **Page 3** – Construction Assumptions for ROD Remedy Sheets. Explain the shading included on this sheet. Also explain if these costs also apply to the other alternatives since all alternatives will require a cap.

RESPONSE: The shading of one field on page 3 of Appendix K-1.2 (ROD Remedy Assumptions) is extraneous and has been removed. The assumptions on this page apply only to the ROD Remedy, however similar assumptions that apply to the excavation-based remedies can be found in Appendix K-1.3 (see pages 3 and 4).

253. **Appendix K**, **Page 4** – Construction Assumptions for ROD Remedy Sheets. Explain the shading included on this sheet.

RESPONSE: The shading of several fields on page 4 of Appendix K-1.2 (ROD Remedy Assumptions) is extraneous and has been removed.

254. **Appendix K, Pages 3 through 8** – Add footnotes to explain how these costs apply to all the alternatives.

RESPONSE: Please see Response #248. A short description has been added at the beginning of each set of construction assumptions. Also, where the cost estimates make reference to backup assumptions, the specific page were referenced.

255. **Appendix K, Page 5** – Leachate Handling. Add a footnote to explain how costs were/are applied to the various excavation alternatives. Also, state if the estimated costs, timeframes, and volumes assume leachate treatment using the existing on-site leachate treatment facility.

RESPONSE: The Construction Cost Worksheet for each remedy contains a section dedicated to leachate handling, which makes use of these assumptions. The worksheets have been updated to specifically refer to these assumptions.

Leachate treatment is assumed to be handled independently of the on-site leachate treatment facility. (Sections 5.3.1.8 and 5.4.2.7 describe the possibility that perched liquid could potentially be discharged to MSD, but cost estimates are based on the conservative perspective that this may not be possible.)

256. **Appendix K, Page 5** – Construction Assumptions for Excavation Alternatives. Most estimates are provided in months, but the RIM excavation is provided in days. Use consistent units.

RESPONSE: The primary function of the RIM Excavation Duration is to estimate the costs for the Off-site Disposal Facility Coordinator and the RIM Loading Crew (for example, see lines 101 and 102 of the Construction Cost Worksheet on Appendix K-4, page 5). These costs are based on daily rate information as shown on Appendix K-1.3 pages 6 and 7, thus 'workdays' is the appropriate unit for this duration. However the RIM Excavation Duration can additionally be displayed in terms of months for reference and easier comparison to other schedule durations.

257. **Appendix K, Page 5** – Construction Assumptions for Excavation Alternatives. Add a footnote to indicate if the time estimates include a contingency factor or not. If yes, list the factor in the footnote or refer readers to appropriate text section(s).

RESPONSE: The time estimates on this page do not include contingencies, apart from 1) assumptions built into individual task estimates, and 2) weather contingencies included in the schedule estimates.

Please note that the durations listed on this page are an output of the schedule estimation process, and are used to estimate costs of line items that are duration-based. A note has been added on this page to clarify the source of these durations.

258. **Appendix K, Page 7** – Construction Assumptions for Excavation Alternatives. Add a footnote to explain which of the various load rates were used in the actual estimated values for each of the alternatives.

RESPONSE: Each of the listed RIM Loading Rates was used for one or more excavation areas of at least one remedy. See the "Handle Excavated RIM" sections of the Construction Cost Worksheets in Appendices K-4 through K-6, specifically lines titled "RIM Hauling & Disposal".

These lines have been changed to refer to the specific assumptions page in the column "Estimate Source" that currently lists a general "See Assumptions" reference.

259. **Appendix K, Pages 6 through 8** – Add a footnote to explain how costs were/are applied to the various excavation alternatives.

RESPONSE: The Construction Cost Worksheets have been modified to refer to specific assumption pages on the relevant lines where they are applicable. Please see Response #248.

260. **Appendix K, Page 8** – Explain if the estimate includes cost for a decontamination pad, wash-down areas, and electrical hook up for the proposed RIM load-out area.

RESPONSE: Sufficient electrical power is included to facilitate T-5 fluorescent lighting. Decontamination is projected to take place at the final stage of the loading lane for OTR semi's (see Figure 5-7). Water and sewer are included on the Fire Suppression line item.

261. **Appendix K, Page 9** – Summary Table. Consider adding a "summary table" to each cost estimate sheet in Appendix K to explain how costs were applied to the calculations for various excavation alternatives.

RESPONSE: The Construction Cost Worksheets has been modified to refer to specific assumption pages on the relevant lines where they are applicable. Please see Response #248.

262. **Appendix K, Page 11** – Bridge Estimate. Add a footnote explaining to which alternatives these costs apply.

RESPONSE: The modular bridge is a projected traffic improvement for each of the excavation-based remedies. The relevant Construction Cost Worksheets have been modified to refer the specific assumptions page.

263. **Appendix K, Page 12** – Stormwater Handling. This estimate considers a 5.6-inch rainfall event (25-year storm); however, in Section 5.3.1.6 of the FS, the 24-hour precipitation max is provided as 8+ inches of rain. Please clarify why this storm event value (5.6") is appropriate for the cost estimate. Additionally, discuss why the 10-year storm event is appropriate for the "Secondary Storm" value.

RESPONSE: Section 5.3.1.6 and Appendix K-8.1 have been synchronized to refer to the same design storm. The final response described the rationale for the design storm choice.

264. **Appendix K, Page 13** – Stormwater Treatment Plant. Add footnote to explain that these costs apply to all alternatives.

RESPONSE: The appendix has been revised.

265. **Appendix K, Page 14** – Stormwater Recurring Cost. Add footnote to explain that these costs apply to all alternatives.

RESPONSE: The appendix has been revised.

266. **Appendix K, Page 15** – Add footnote to explain that these costs apply to all alternatives.

RESPONSE TO #264, 265, and 266: The relevant Construction Cost Worksheets have been modified to refer specifically to the Stormwater Treatment Plant assumptions page as necessary. Appendix K-8.1 contains construction assumptions that are not specific to either the ROD-selected remedy or excavation-based remedies; as mentioned in Response #248, introductory text has been added to the FFS.

267. **Appendix K, Page 17** – Explain why the Construction & Debris rubble stockpiles are assumed to be handled without crushing/processing for size reduction.

RESPONSE: It is assumed, but not verified, that the construction and demolition material can be relocated without special handling. These items are already present in the landfill and can presumably be

relocated without additional processing. There are no requirements under the solid waste regulations relative to the size of the materials that can be placed. Additional processing would require additional cost and time beyond what are estimated for this task. However, in response to this comment, additional costs have been added to each alternative to reflect additional handling and processing of this material

268. **Appendix K3, Spreadsheets, Construction Cost Estimate, ROD Remedy** – Several entries in the first couple of pages of the spreadsheets include a variety of acronyms (ex: BCY, LCY, SF Flr.) Please include a key to define the various acronyms used in the spreadsheets, and apply to all remedy estimates.

RESPONSE: Unidentified acronyms for units of measure in the Construction Cost Worksheets have been added to the List of Acronyms on page xiii of the FFS.

269. **Appendix K3, Page 2 of 20, Spreadsheets, Construction Cost Estimate, ROD Remedy, Estimate Source Column** – Some of the entries refer readers to a separate assumption sheet. Provide a reference/footnote to the location this information, and apply to all remedy estimates.

RESPONSE: Entries in the Estimated Source Column of the Construction Cost Worksheets that indicate "See separate Assumptions sheet" have been modified to refer to the specific assumptions page(s). Please see Response #248.

270. **Appendix K3, Page 10 of 20, Spreadsheets, Construction Cost Estimate, ROD Remedy** –Air Monitoring During Construction. Explain the meaning of the "minus contingency" term. Additionally, please explain if this is a new estimate or is based upon previous actual site cost related to air monitoring activities. If it based upon actual cost, please include a more specific reference to the source used for this estimate.

RESPONSE: Please note that the "Preliminary Estimated Capital Costs" summary worksheet (see p. 1 of the sub-appendix) applies overall contingencies to the subtotal of capital costs and professional services. Auxier included a contingency for the FY2016 estimate of the Air Monitoring Program, but the contingency was excluded from the page 10 worksheet to avoid a double contingency on this program. This is the meaning of the "minus contingency" term.

Auxier prepared an estimate in February 2016 for continued operation and maintenance of the air monitoring system. This estimate was used to prepare the cost estimate for continued maintenance and operation for the FFS. The estimate generated in February was a new estimate based on the experience gained from operating and maintaining the system since May 2015.

271. **Appendix K4, Page 13 of 27, Spreadsheets** – Construction Cost Estimate Laboratory Cost (off-site). Please provide additional detail for this estimate of lab cost. This comment applies to all excavation alternatives.

RESPONSE: Additional details have been provided.

272. **Appendix K4, Page 14 of 27, Spreadsheets** – Construction Cost Estimate Laboratory Cost (on-site lab). Provide additional details on this cost sheet or in the FFS to include how the equipment is adequate to support the testing and quality control requirements of the project.

RESPONSE: Additional details have been provided.

273. **Appendix K4, Page 15 of 27, Spreadsheets** – Construction Cost Estimate Groundwater monitoring wells. Please include costs for well development, surface completions, bollard placement, etc. or state that the estimated cost provided is "all inclusive." This comment applies to all alternatives.

RESPONSE: We believe the estimated costs were all inclusive but will check this and, if necessary, revise the costs as part of the development of the revised FFS report.

274. **Appendix K4, Page 17 of 27, Spreadsheets** – Construction Cost Estimate – Stormwater and Air Monitoring estimates. Provide the basis for these estimated costs. This comment applies to all excavation alternatives.

RESPONSE: The air monitoring stations were installed in May 2015, and the air monitoring program estimate is based upon experience monitoring and maintaining the system since that time. The basis for the estimated costs for the stormwater management has been provided with the revised FFS.

275. **Appendix L, General Comment** – Provide additional details to clarify tables L-1 and L-2. Define more clearly what "All Material" and "RIM Only" volumes or surfaces areas are represented for each of the 5 scenarios presented. In addition, clarify whether the >52.9 scenario also assumed an excavation depth limited to 16 feet.

RESPONSE: Former Appendix L has been deleted from the revised FFS. The approach to calculated exposure point concentrations has also been revised and is now included as part of Appendix B. Specifically, the 95% UCL values for the RIM that is to be excavated and disposed offsite have been calculated using ProUCL. These values have been used in Appendix H to calculate potential risks to the MEI, in this case the radtech worker working in the RIM loading building. The 95% UCL values for all of the material that would remain on-site have been calculated using ProUCL. These values were used as the basis for the calculation of long-term risks. The >52.9 scenario evaluated in Appendix B did not a-priori assume an excavation depth limited to 16 feet, rather, it assumed that only material defined by >52.9 pCi/g that lies within 16 ft of the 2005 ground surface is identified as RIM that needs to be excavated. The subsequent excavation calculations undertaken during post-processing of the 3D RIM extents should not have resulted in excavation depths that were greater than 16 ft below the 2005 ground surface by more than one grid cell thickness (i.e., 0.5 feet).