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

MAR 14 2017

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

Dear Mr. Rosasco:

The U.S. Environmental Protection Agency has reviewed the Remedial Investigation Addendum (RIA) Report, dated July 29, 2016, and submitted on July 30, 2016. The Baseline Risk Assessment was submitted on October 31, 2016, and the Fate and Transport Evaluation was submitted on November 2, 2016. These documents were developed on behalf of the West Lake Landfill OU-1 Respondents, Cotter Corporation (N.S.L.), Bridgeton Landfill, LLC., Rock Road Industries, Inc. and the U.S. Department of Energy to support the EPA's final remedy decision for the West Lake Landfill Site, Operable Unit-1, Bridgeton, Missouri.

The EPA has coordinated its review of the RIA with the Missouri Department of Natural Resources and the U.S. Geological Survey, and our comments are enclosed with the exceptions noted below. In accordance with the Remedial Investigation/Feasibility Study Administrative Settlement Agreement and Order on Consent (RI/FS ASAOC), Docket No. VII-93-F-0005, and the Abbreviated Work Plan for Remedial Investigation Addendum and Final Feasibility Study (May 6, 2016), the Respondents shall prepare a revised RIA Report that incorporates the EPA's comments and requested changes.

The EPA will provide a supplemental comment letter addressing the Upper Confidence Limits of the Mean (UCLS) for Areas 1 and 2 (Appendix O), the Fate and Transport Evaluation (Appendix P), and the Baseline Risk Assessment (Appendix Q) of the RIA, as well as, the Estimated Three Dimensional Extent of RIM (geostatistical) Document. In that supplemental comment letter, the EPA will set the deadline for the submittal of the revised RIA Report in accordance with the RI/FS ASAOC.

Based upon the volume and complexity of our comments, the EPA suggests that we schedule a meeting with you after your receipt of our supplemental comment letter. The purpose of that meeting would be to discuss the Respondents' proposed responses to the enclosed comments and to comments in the supplemental comment letter. The EPA will work with you to develop an agenda for that meeting that would assist all parties in preparing for and focusing on key changes required to the RIA.

In the meantime, if you have any questions or concerns, please contact me either by phone at 913-551-7141 or by e-mail at jump.chris@epa.gov.

Sincerely,

for Christine R. Jump
Remedial Project Manager
Site Remedial Branch
Superfund Division

Enclosure

cc: Ryan Seabaugh, MDNR

EPA R7 Comments to Draft Remedial Investigation Addendum (RIA) dated July 29, 2016, with additional appendix files received on November 2, 2016 West Lake Landfill OU1.

Primary Comments

I. **Site Definitions** - The term "Site" is not used consistently within the draft Remedial Investigation Addendum (RIA). The term "Site" should be used to specify the overall West Lake Landfill Complex and all associated subareas. It should not be used to specifically refer to the various subareas of the Site, such as Operable Unit 1 (OU1), Operable Unit 2 (OU2), Area 1, Area 2, Bridgeton Landfill, Buffer Zone, Lot 2A2, or others. When discussing subareas, the RIA should specify them by name. The RIA should define the differences between the various landfill cells contained within the Site including the Bridgeton Landfill, both physically and by regulatory authority. Also, the terms for the subareas, including AAA Trailer, Lot 2A2, Ford Property, former Ford Property, Buffer Zone, Crossroads Industrial Park, and Crossroads Property are not used consistently within the text and figures of the document. The RIA should describe the historical use(s) of these terms and better define the specific terms that will be used consistently in the RIA text. If historic names for consolidated properties are needed to describe specific locations, clarify this convention in the text. The RIA should also provide a new or revised figure illustrating these designated areas more accurately. Additionally, text should be added to the RIA to clearly describe the current property owners and provide discussion in the text or a time line documenting property ownership and name changes.

II. **Distribution of RIM** - Another subsection should be added to Section 6 of the draft RIA that specifically discusses what is known or can be inferred from other documents regarding the placement, distribution, and general nature of the Radiologically Impacted Materials (RIM) or Leached Barium Sulfate Residues (LBSR) mixed with topsoil. A description of the Latty Avenue "topsoil" and other potential materials that were possibly incorporated into the LBSR should be included and discussed in the RIA. The RIA should better describe and summarize past activities at the Site during the time of placement and shortly after, referencing aerial photographs and other historical records where possible. Additionally, a discussion on any known (or assumed) weathering, degradation, and settling of the landfill that may have affected RIM distribution should be included in the RIA. The RIA must include discussion of how the understanding of RIM distribution at the Site has evolved since the discussion in the early Nuclear Regulatory Commission (NRC) reports based on the results of the additional investigations conducted since 2008. Incorporate this information into the detailed narrative description in an expanded Conceptual Site Model (CSM) and revise the other sections that include descriptions of RIM placement and distribution to be consistent with the CSM. Text sections that may be affected by this comment include 6.1, 6.3, 6.5, 9.3, and 9.5.

III. Groundwater - Information related to groundwater is to be updated in the RIA by presenting recent groundwater data results collected for OU1 since 2008. Since OU1 is defined based on the presence of radionuclides, groundwater data presented in this document should include any groundwater samples/data that were analyzed for radionuclides, including recent sampling events in and around the perimeter of OU2.

The draft RIA has utilized off-site areas (Weldon Springs, St. Louis Downtown Sites (SLDS), St Louis Airport Sites (SLAPS), etc.) with differing hydrogeology and geologic units to establish a

background level for radionuclides in area groundwater. The RIA should be revised to state that background levels will be evaluated further during the OU3 Remedial Investigation/Feasibility Study (RI/FS).

Throughout the draft RIA there are multiple attempts to classify wells as "background," "upgradient," "crossgradient," and "downgradient" without sufficient information on specific groundwater gradients, consideration of whether the wells contain leachate impacts, or whether the wells are monitoring the same geologic unit(s). Wells potentially impacted by leachate will need further evaluation as a part of the OU3 RI/FS before they can be classified. The RIA should not include conclusions based on upgradient and crossgradient well designations with known or potential radiological and leachate impacts. Also, check all section headers and titles of table and figures for well classifications and revise as necessary.

The OU1 Fate and Transport evaluation (Appendix P) was specifically scoped to evaluate the potential for migration (leaching and loading) of RIM into groundwater but was not intended to address specific contaminant transport mechanisms. These items shall be addressed under the OU3 RI/FS in accordance with the requirements of the National Contingency Plan (NCP). The draft RIA states that the leachate collection system affects "groundwater levels, hydraulic gradients, groundwater flow directions, and groundwater flux (Section 5.6.2.2)," and that it appears to have an effect on groundwater levels in the vicinity of the Site (Section 5.6.2.3). The RIA should clearly identify data supporting these statements. Also the RIA needs to fully acknowledge and discuss potential hydrogeologic influences and impacts from the nearby Missouri River.

Some of the groundwater sampling events have analyzed both filtered and unfiltered (total) samples, but when discussed in the text elevated concentrations of unfiltered contaminants are largely dismissed due to turbidity or particulates and colloids present in the water. The RIA needs to acknowledge the uncertainties associated with these data sets including the potential for colloidal and particulate transport of contaminants within the subsurface environment, and to clearly indicate that additional investigation and evaluation of the groundwater system is necessary and will be conducted under the OU3 RI/FS.

The hydrogeologic system of the Site is more complex than the RIA currently presents. The existing monitoring well network, analytical data, and assessment of the leachate collection system are insufficient when considered with other unknowns related to the site-specific hydrology to draw the conclusions as presented in the RIA. The RIA should be revised to remove unwarranted conclusions and to clearly indicate that additional investigation and evaluation of the groundwater system is necessary and will be conducted under the OU3 RI/FS process. Finally, it should be noted the draft RIA extensively references the United States Geological Survey (USGS) 2014 Groundwater Report regarding the Site and Site area. However, the conclusions made in the RIA based upon this report mischaracterize and over-simplify the USGS report and related data sets. For example, the draft RIA does not include the conclusion statements made by the USGS clearly indicating that some of the radium detected in groundwater could have originated from a RIM source in OU1. Revise the RIA to accurately reflect conclusions contained in the USGS 2014 Groundwater Report.

IV. **Perched Water-** The draft RIA discusses the presence and distribution of perched water in various sections (4.6, 5.6.2.1, 7.4, and 8.5) but does not clearly define the term "perched water" as used in the document. Briefly define the term, and discuss the nature of "perched water" as

used in the text of this document. Also generally discuss the limitations related to identification and definition of "perched water" in a landfill environment. Add discussion to the RIA as to why perched water was reported to be present (or identified) only in 1995; include considerations such as weather conditions, drilling techniques, or that perched water has been defined differently by different reports and associated consultants. Re-evaluate the conclusions regarding perched water in section 7.4 after addressing other comments on changes to topographic contours over the history of the Site and potential infiltration. Also include in the RIA a more detailed discussion of the nature of the seeps identified in Area 2. This revised evaluation of perched water and the seeps should also be reflected in the updated CSM discussion.

V. **Site Topography and Surface/Storm Water** - It is difficult to distinguish in this RIA between historical and current topographical issues at the Site. Include a summary of topographic changes that have occurred at OU1 to aid in the understanding of the Site history and the CSM. This summary should include a chronologic discussion of the relevant topography and infrastructure changes that have occurred at the Site that could potentially affect run-off characteristics and associated outfalls. In addition, include a discussion of historical and current stormwater drainage features and any changes associated with the various "surface water bodies," temporary impoundments, and construction/removal of weirs. The document should include the potential impacts of topographic changes on perched water, seeps, infiltration, and potential impacts to Fate and Transport associated with surface and storm water. The document should include a brief discussion of the ongoing stormwater plans consistent with other text sections regarding stormwater. This comment may be applicable to sections 4.12.1, 4.12.1.1, 4.12.2, 5.3.3.1, 5.3.3.2 and other areas where topography and stormwater are discussed, and should be considered or included when expanding the narrative of the CSM.

VI. **Conceptual Site Model (CSM)** - Completely re-write the section on CSM to be more comprehensive and place it in one location, with references to the CSM key elements that are located in other sections of the document. The CSM should summarize the following items: the Site location and setting; the geologic and hydrologic conditions; a history of the landfills; the nature of the contaminated material including details and data about the source; the transport of the contamination to the Site; placement of the RIM in the landfill; the actions, both natural and anthropogenic, that have and may have displaced materials over time; and any other details pertinent to the nature, extent, potential migration pathways, and potential exposure pathways associated with the Site and contamination.

VII. **Differentiating historical vs. current discussions and conclusions** - Due to the history of the Site, it is often difficult for readers to readily distinguish historical Site descriptions and conclusions in the draft RIA from current descriptions and conclusions. Add text within the sections to clarify where historical descriptions and conclusions were made but no longer represent current Site conditions. The EPA also suggests that past and present conditions be presented in chronologic order with references provided to each section where the subject is being discussed.

VIII. **Peripheral Investigations** - Create a new section in the RIA to present a brief summary of the various peripheral investigations that have been conducted in the vicinity of the West Lake Landfill. Remove detailed discussion related to the Bridgeton Municipal Athletic Complex (BMAC) investigations. This new section should include brief summaries of the BMAC investigation, the Bridgeton Sanitary Landfill Radiological Air Sampling Report (2013) by MDHSS, the West Lake Landfill Radiological Survey (2013) by the MDNR, the Bridgeton/West

Lake Landfill Radiological Sampling Report (2015) by the MDHSS, the West Lake Landfill Vicinity Radiological Survey and Sampling Final Report by the MDNR, the DOE and the USACE Haul Road investigation, the MDNR Haul Road Investigation, and other peripheral investigations that are relevant to the CSM for OU1. Include a summary of the purpose of each off-site investigation and an overview of the data/results. Citations for each investigation should be included in the description and included in the Reference Section of the RIA.

IX. **Aerial Photos** - Add an appendix to the RIA containing historical aerial photographs which should, at a minimum, include those that are utilized to create figures 3-7a through 3-7f which depict changes in surface elevation over time. In addition, include any other historical aerial photographs that support the CSM or are otherwise referenced in the RIA.

X. **QC Summary** - The discussions throughout the RIA related to data quality concerns or anomalous data that was rejected should be added to a new section related to Quality Assurance/Quality Control. This section should identify any data quality issues, explain the problem(s) and the resolution. Specifically discuss any data that is considered unusable. It appears that data that was re-analyzed is not included on some tables and figures and the original data with quality issues was reported or used to support discussions and figure development. This comment may apply to multiple sections, tables, and figures (ex. Tables 6-4 and 6-5, Figures 5-13, Figure 6-4, and 6-8, Appendix M, Figure M 2.6, Appendix C-2, etc).

XI. **Consistent Presentation of Data** - Throughout the draft RIA, different text sections on similar topics are presented with varying levels of detail. Revise the RIA to present topics that are presented multiple times for separate areas or at different time periods in as consistent a manner as possible. If a particular type of data or description is not available or applicable for one area or sampling event, state this in the text and explain why. For example, in Section 7.1.1.1, the presentation of radon flux data in one paragraph includes information about square footage, grid sizes, and mean concentrations on specific areas, but other paragraphs do not include the same talking points. In Section 8.6, some data discussions identify the specific well with the highest detected concentration and others do not.

XII. **Subjective Language** - The discussions and conclusions presented in this document contain a significant amount of subjective language. In general, avoid the use of words such as *significant, generally or most* where possible. Instead, use quantitative language, specific number ranges or supported facts. Instead of using terms such as "well above," simply state "above" and provide the number spread or range, if appropriate. For example, in Section 7.1.2 on page 158, replace text that states gross alpha results are "similar to or only slightly higher than" with "an order of magnitude higher." Refrain from use of terms such as: *all, none, or eliminates* unless it is factually supported.

XIII. Data and Information to be Included in the Next Revision - Remove text throughout the RIA document referring to items to be provided at a later date and revise the pertinent sections to include the current and complete information. This should include, but is not limited to, items such as references to the updated Baseline Risk Assessment and the Fate and Transport evaluation which were not available at the time of the submission of the first draft of the RIA.

In addition to fixing text that references data and reports that were not available at the time of the submission of this draft of the RIA, also include the following data in the RIA by adding to the appropriate appendix and referencing in the appropriate section:

- Any available, validated stormwater data collected under the Surface Fire Prevention UAO
- Any available, validated surface soil data collected under the Surface Fire Prevention UAO
- Any available georeferenced gamma surveying conducted under the Surface Fire Prevention UAO
- Any available, validated data collected as part of the on-site baseline air monitoring program
- Any available, validated sediment data not included in the first draft of the RIA
- Any available, validated the EPA split data including subsurface soil samples (additional characterization) and sediment samples
- The radiological results of the soil samples utilized for the radon emanation portion of the EPA Pyrolysis Study
- The verification data associated with the reanalysis of Cotter samples by SwRI

XIV. **Non-Combustible Cover/Surface Fire Prevention Removal Action -** Use consistent terminology for the Non-Combustible Cover (NCC) and the Surface Fire Prevention removal actions. Clarify in the text the references to these terms and ensure consistent terminology is used throughout the RIA.

Specific Comments

List of Acronyms

1. Change "*ethyl*" in EVOH to "*ethylene,*" and perform a global check in the document.
2. Delete the acronym "*MTG*" (Migration to Groundwater), and perform a global check in the document since it is not an established acronym.
3. Replace "*OSWER*" with "*OLEM,*" Office of Land and Emergency Management, which is the current acronym and title of this office. Use the same descriptor.

Executive Summary

4. Revise the Executive summary in accordance with all comments on the draft RIA.
5. All acronyms throughout the document should be spelled out the first time they are used.
6. Page ES-1, second paragraph, first sentence: Clarify in this sentence and in other locations in the RIA that the Bridgeton portion of the West Lake Complex is no longer accepting waste but is not yet in post-closure monitoring per state requirements.
7. Page ES-1, third paragraph, first sentence: Change "Services" to "*Survey*" in the USGS name, and change ACOE abbreviation to "*USACE*" (global change, including referenced publications).
8. Page ES-1, third paragraph, last sentence: Change "*radiation*" to "*radon.*"
9. Page ES-2, first partial paragraph, last sentence: This statement should reference a figure that depicts this information and refers readers to Section 3.1 of the RIA where this information is discussed in further detail.
10. Page ES-2, last paragraph, second sentence: Revise this sentence as follows: "...containment measures, and limited migration of radionuclides from Areas 1 and..."

1.0 INTRODUCTION

1.1 Purpose and Scope of the RI Addendum

11. Page 1, last paragraph, first sentence: Add the word "*and*" between "*RI report*" and "*to incorporate.*"

2.0 SUMMARY OF INVESTIGATIONS

12. For each document listed in this section that has not been approved by the EPA or the MDNR, indicate the date of the submittal that is being cited, the agency or organization to which the document was submitted, and the status of the document as either draft or approved. Only cite draft documents if they are pertinent to OU1 and discussed in another section of the RIA.

2.1 Pre-RI Reports

13. Page 6, second-to-last bulleted item: Add the 1991 aerial photographic analysis report in addition to the 1989 aerial photographic analysis report.

2.5 Bridgeton Landfill Reports

14. In this section, include a general listing of the documents for the recent North Quarry actions related to the Bridgeton Landfill and the July 2011 AquaTerra Waste Limits Investigation Summary Report. Add documentation related to the Subsurface Smolder Event/Subsurface Reaction (SSE/SSR) to this section.

2.7.4 MDNR and MDHSS Reports

15. Page 15: Add these documents to the lists in Section 2:

- National Pollutant Discharge Elimination System (NPDES) stormwater data for the comingled outfall (Outfall 007)
- Missouri Department of Natural Resources historical operating permits
- MDNR Groundwater Investigation Report for 2015
- Investigations related to the OU1 perimeter fence installation
- Department of Energy and USACE Haul Road investigations
- MDNR Haul Road Investigations

3.0 SITE BACKGROUND

3.1 Site Description and Location

16. Page 17 and 18: Refer to Primary Comment I above on Site Definition. OU1 includes the Buffer Zone, Lot 2A2 and any areas beyond these subareas where radionuclides have been or could be identified in the soil. The phrase "offsite" should not be used when discussing surface features or potential contamination in these areas. Also, clarify references to fences or fence lines by accurately defining the area or property they enclose with respect to property and Site boundaries.

17. Page 18, second paragraph: Revise the first and second sentences of this paragraph to state that an institutional control in the form of a "Declaration of Covenants and Restrictions" was recorded on June 30, 1997 and that a supplemental "Declaration of Covenants and Restrictions" was recorded on January 20, 1998.

18. Page 18, third paragraph: Revise the paragraph to add a discussion specifically for OU1 with respect to the separation distance from the runway.

3.3 Summary of Site Operations

19. Page 19, last bullet: Expand "*Buffer Zone*" bullet to include Lot 2A (or Crossroads property), or create a new bullet for these areas.

3.3.1 Landfill Permit History

20. Page 20, top of page: Areas 2 and 4 of the original six waste areas are cited by an AquaTerra (2011) report to have been "closed" in 1974. Not all of the six waste areas are mapped in figure 3-6. Check and correct figure 3-6.

21. Page 20, second paragraph, third sentence: Permit No. 218903 was issued for operation of a demolition fill landfill, not a sanitary disposal landfill, although the area had been previously used for sanitary disposal. Correct the text to reflect this information.

22. Page 20, fourth paragraph, third and fourth sentences: Permit No. 118912 was issued on 11/18/1985. Permit No. 118912 is permitted for 52 acres but actually covers a larger area (54-59 acres, Herst & Associates, 1995). Confirm and correct text accordingly.

3.3.2 West Lake Landfill Areas 1 and 2

23. Page 20, fifth paragraph, second sentence: Delete the text starting with, "..., *but based on visual inspection... in areas 1 and 2.*"

3.3.2.1 West Lake Landfill Radiological Area 1

24. Page 21, first full paragraph, second sentence: Area 1 was historically included under permits 218903, 118906 and 118912. Confirm and correct text accordingly.

3.3.2.2 West Lake Landfill Radiological Area 2

25. Page 22, first full paragraph, second sentence: The number of acres covered by the NCC as required by the Surface Fire Prevention order listed is not current. Update this value.
26. Page 21 and Page 22: Add text discussing the significant erosion onto the adjacent property that occurred historically in Area 2.

3.3.3 Inactive Landfill Operations in OU2

27. **Page 22, first paragraph in section: Revise Permit No. 118906 to 118908.**

3.3.4 Bridgeton Landfill

28. Page 23, first full paragraph: The reference to Figures 3-7a through 3-7e appears to be incorrect and should be changed to 3-8a through 3-8e.
29. Page 23, second paragraph, last sentence: Add a reference to the appropriate permit number for consistency (Permit No.118912 issued on 11/18/1985).
30. Page 23, third paragraph: Add language to this paragraph to indicate where wastes were placed in the North Quarry based on the 1979 aerial photograph. Also discuss which portions of the North Quarry were filled first based upon the historical aerial photographs.

3.4 Activities Adjacent to the Landfill

31. Expand this section to include text describing other significant nearby issues or features (airport, airport easements, surface water bodies including the Missouri River, flood control channels, etc.).
32. Page 24, first paragraph of section: Revise in accordance with Primary Comment I above on Site Definition.

4.0 SITE INVESTIGATION ACTIVITIES

4.2 Threatened or Endangered Species Assessment

33. Page 26: Create a reference in the text of this section to Appendix Q Baseline Risk Assessment (BLRA) Ecological (ECO) section, and revise the section, if necessary, to reflect ecological risk as presented in the updated ECO risk assessment.

4.3 Surface Gamma Surveys

34. Page 27, first sentence of section: This section mentions seven gamma surveys but lists only six bullets. Revise the section as appropriate to reflect the correct number of gamma surveys.

4.3.3 EPA ASPECT Flyover Survey

35. Page 30, second paragraph, first sentence: Change Consequence Management Advisory Team (CMAT) to Consequence Management Advisory Division (CMAD).

4.3.4 Additional Gamma Surveys for OU1 Post-ROD Investigations

36. Page 31, second paragraph, last sentence, and third paragraph: Include a discussion of the data collected during the installation of the NCC.

4.4 Soil Borings and Logging

37. Page 33, first paragraph, first sentence: Confirm the number of soil borings presented in this section as compared to the text provided throughout the document. This should be checked against existing documentation and other portions of Section 4 and Section 6 of the RIA.

38. Page 33, last paragraph of section, last sentence: Since the GIS information in the tables is provided in the local coordinate system, define the local coordinate system or provide the GIS information in a standard/universal coordinate system. Also, apply this change to Section 4.10, page 63, and other similar text where appropriate.

4.4.1 RMC Investigation Soil Borings (1981)

39. Page 33, first paragraph of section, first sentence: The text in this section states there are 31 NRC borings in Area 2 but only lists 29 boring numbers in the Area. Figure 4-6 shows 30 NRC boring locations, but two of the borings are labeled "PVC-2." Correct these inconsistencies.

40. Page 33, first paragraph of section, last sentence: The text and Figures 4-5 and 4-6 do not appear to match. The text states there are 10 NRC borings in Area 1 but only lists 12 boring numbers. Figure 4-5 shows only 9 NRC boring locations in Area 1, but one

location is labeled PVC-25 twice and PVC-25R once. The symbol for PVC-36 appears to be wrong. Correct these inconsistencies.

41. Pages 33-34: Borings PVC 28, 39 and 40 are located in Area 2, but the text states they are located in Area 1. Correct these inconsistencies.

4.4.3 Supplemental OU1 RI Soil Boring and Logging (1997)

42. Page 36: Revise the section heading to read (1997 and 2000), or add a new section heading after the fifth paragraph for the "*2000*" discussion.

43. Page 37, second full paragraph: This paragraph states, "In addition, elevated downhole gamma readings were not detected during the geophysical logging of these borings." Revise this section to state that the field team performing this evaluation concluded that downhole gamma readings were not elevated sufficiently above baseline to require the collection of samples, however, sufficient documentation does not exist to support this decision.

44. Page 38, first full paragraph: Delete this paragraph and replace with one that describes the investigations and samples collected in this area since the most recent grading work in 2003.

4.4.5 Thermal Isolation Barrier Phase 1 Investigations (2013-15)

45. Page 38: Revise the title/name of this section to "*Phase I Investigations.*"

4.4.5.1 Gamma Cone Penetrometer (GCPT) Soundings

46. Page 40, first paragraph, first sentence: Revise sentence as follows: "...isolation barrier and determine the extent of RIM in Area 1 at the Site."

4.4.6 Additional Characterization of Areas 1 and 2 (2015)

47. Page 45, second paragraph of section, first sentence: Delete this sentence related to schedule of the sonic drill rig.

48. Page 46, second paragraph: The reference to Appendix D-5 seems incorrect. Check, and if appropriate, revise to Appendix C-7.

4.4.7 Borings for Collection of Samples for Fate and Transport Testing (2015)

49. Page 46, second paragraph in section: Add *SSPA* to the acronym list.

50. Page 46, second paragraph in section, first sentence: Define or explain the term "blind drilling" as used in the sentence.

4.4.8 Additional Borings Performed by Cotter Corporation (2015)

51. Page 47: Delete footnote.

52. Page 47, second paragraph, last sentence: Revise sentence to state "In addition to what was prescribed in the work plan..."

53. Page 47, fourth paragraph, third sentence: Reference to Appendix D-8 seems incorrect. Check, and if appropriate, revise to Appendix C-8.

4.5.1 NRC Soil Samples (1981)

54. Page 49, first paragraph, sixth sentence: Appendix Reference C-1 appears to be incorrect. Check to determine if it should refer to Appendix D-1.

4.5.2 OU1 RI Soil Sample Collection and Analyses (1995-97)

55. Page 51, first paragraph, last sentence: State whether VOC samples were also placed in plastic bags and later transferred to glass containers.

4.5.5 Sample Testing and Analyses for Fate and Transport Evaluations (2015-16)

56. Page 56, Fate and Transport bulleted items: Include a reference to the eH-pH diagrams for iron speciation and other inorganics.

4.5.6 Additional Testing Performed by Cotter (2016)

57. Page 57, first paragraph: Consistent with previous statements in this paragraph, list the historical borings which Cotter used in its collection of samples.

58. Page 57: Revise the last paragraph to include a summary of the conclusions from the data validation report by Engineering Management Support, Inc. (EMSI).

59. Page 57: Because of concerns with data quality associated with a subset of these samples, the EPA elected to have a third party verify these results. Include the SwRI data in the appropriate appendix of this RIA. Include a reference to this data in the last paragraph of this section. The EPA plans to discuss interpretation of the SwRI data with the Respondents prior to the submission of the revised RIA.

60. Page 57: Delete footnote 15.

4.6 OU1 Perched Water Sample Collection and Analyses (1995)

61. Page 59, third paragraph: The text indicates many more borings encountered perched water than are illustrated on Figure 4-9. Explain this discrepancy in the text or correct the figures.

4.7 OU1 Geotechnical Sampling and Testing

62. Page 60, fifth paragraph, last sentence: Delete subjective terms "may have" and "potentially" from this sentence.

63. Page 61, third paragraph: Explain how this paragraph relates to OU1.

4.9 Hydraulic Conductivity Testing

64. Page 62, second paragraph in the section: While standard for the day, slug tests have limited utility unless they are applied in relatively simple unconsolidated geology or confirmed by longer duration aquifer stress tests. Add a sentence to this section briefly describing the basic limitations of the slug tests performed at the Site.

4.10.1 OU1 RI Water Level Measurements

65. Page 63, first paragraph in section, last sentence: The reference to Appendix E-2 appears incorrect. Check and, if appropriate, correct this reference to Appendix E-3.

4.11.1 NRC (RMC) Groundwater Sampling (1981)

66. Page 65, first paragraph: The statement regarding groundwater sampling occurring on- and off-site is misleading, as work off-site has been limited. Clarify in the text the number and nature of the off-site groundwater sampling events.

4.11.2 OU1 RI Groundwater Sampling (1994-97)

67. Page 65, second paragraph in section, first sentence: In the text of this section, define the method used to collect the grab sample(s) or include a reference to a section of the RIA that provides this information.

4.11.3 OU1 FS Groundwater Sampling (2004)

68. Page 67, second paragraph in section: The last sentence states the data is tabulated in Appendix F-2; however, the data in this appendix is submitted as raw laboratory data sheets and not summarized in a table. Data from raw laboratory data sheets must also be presented in data summary table(s), either in the appendix or in the text RIA.

4.11.4 Post-ROD OU1 Groundwater Sampling (2012-14)

69. Page 69: This section states that the results of the additional groundwater sampling are presented in Appendix F-3; however, the appendix does not include the Volatile Organic Compound (VOC) and Semi-Volatile Organic Compound (SVOC) data that the EPA directed to be collected and presented. Revise Appendix F-3 by incorporating the VOC and SVOC data.

70. Page 69, first sentence after list of parameters: Add a reference (date) for the SVOC decision as noted in the text.

4.11.5 Sampling of Private Wells (2013)

71. Page 69-70: Starting in the second paragraph, the two wells Herst & Associates sampled in August 2013 (USGS B4-S and USGS B4-D which were both from the same owner) were actually south of the Site and not part of the six wells to the north sampled by the EPA. Correct this information in the text.

72. Page 69-70: Clarify some of the details related to the private well sampling. The EPA sampled the six wells to the north and provided contact information to Respondents for sampling of other nearby off-site wells. After attempts to gain access to these wells were unsuccessful, the EPA requested that the USGS obtain access for sampling. The USGS obtained permission to resample four wells, three of which had been previously contacted by the Respondents: alluvial well B4-S (permission also given for deep alluvial well B4-D but it had been winterized and was thus unavailable) and another alluvial well B3. USGS also obtained permission to sample three bedrock wells (A5, D-1, and E-1). Revise section accordingly to account for this information.

73. Page 70, top of page: Revise to state that the Weldon Spring Well E-1 was a bedrock well, not an alluvial well.

4.11.6 OU2 Groundwater Monitoring (1995-96 and 2004)

74. Page 70, second paragraph in section, last sentence: Appendix F-6 doesn't appear to contain any data. Populate Appendix F-6 with the missing data.

4.11.7 Bridgeton Landfill Groundwater Monitoring

75. Include a discussion of the more recent Bridgeton Landfill groundwater sampling events, including corrective actions implemented to address groundwater-related concerns and implementation of the on-site water/leachate treatment operation.

76. Page 70, first paragraph in section, last sentence: Similar to the comment on Section 4.11.6; Appendix F-6 appears to be missing. Populate Appendix F-6 with the missing data.

4.12 Surface Water and Sediment Investigation

77. Page 71, first paragraph: Revise the second sentence of this paragraph by deleting the words "in accordance with" and replacing them with the words "as required by" and update the paragraph to reflect the current status of the required stormwater monitoring.

4.12.1 OU1 RI Surface Water and Sediment Sampling (1995-97)

78. Page 71, first paragraph in section, second sentence: Figure 4-13 does not appear to clearly show the location of the seep described on the west side of Area 2. Revise the figure to more clearly show the seep location(s). If the seep is no longer believed to exist due to maintenance activities, also include this information in the text.

4.12.2 Post-ROD Sediment and Stormwater Sampling (2016)

79. Page 77, paragraph below bullets: Revise this paragraph to indicate that analytical data sheets are presented in Tables 7.11 and 7.12.

80. Page 77, last paragraph: The statement regarding the NCC construction being complete is not accurate. Revise the text to discuss the status of this action.

4.13.1 Fugitive Dust Monitoring

81. Page 80, last paragraph of section, last sentence: Correct the date of the air monitoring conducted as part of the off-site baseline monitoring by the EPA to *"...from May 2014 through July 2015."*

4.13.1.1 NRC (RMC) Fugitive Dust Sampling (1980-81)

82. Page 80: For clarity, move the majority of this text to Section 4.13.2.1 NRC (RMC) Radon Flux Monitoring (1981). Also, add a description to the text to clarify that Rn222 and Rn220 were also part of the testing wherever Rn219 is mentioned.

4.13.1.3 Particulate Monitoring During the Phase 1 Investigations (2013-2015)

83. Page 81: Clarify the references in paragraphs 2-4 of this section.

4.13.1.4OU1 Perimeter Air Monitoring (2015-2016)

84. Page 82, third paragraph: This section should include an explanation of the use of non-environmental Thermoluminescent Dosimeters (TLDs) for the first three quarters and that this data has limited use.

4.13.1.5 EPA Off-Site Particulate Air Monitoring (2014-2015)

85. Page 82, first paragraph in section, first sentence: Revise this statement to reflect that the EPA off-site air monitoring has now ceased. Include references to the appropriate documents.

4.13.2.3 OU1 NCC Radon Flux Measurements (2016)

86. Page 88, first paragraph: Revise this section to include sampling details similar to those provided regarding the previous RI sampling, i.e., the length, width and area of each grid.

4.14.1 NRC (RMC) Vegetation Sampling (1981)

87. Page 89, last sentence: Replace "and" with "nor."

4.14.2 OU1 Post-ROD Vegetation Sampling (2009)

88. Page 90, first full paragraph: Provide a citation to the report. Delete the last sentence.

5.2 Land Use

89. Page 92, second paragraph in section, second sentence: Replace the phrase "restrictive covenants recorded in May 1997" with "Declaration of Covenants and Restrictions recorded on June 30, 1997."

90. Page 93, second full paragraph, second sentence: In accordance with the distances cited, revise the text to indicate that the Terrisan Reste mobile home park is the nearest residential development.

5.3.3.3 Area 2 Drainage During the OU1 RI (1995-97)

91. Page 97, second paragraph, last sentence: The last reference to Area 2 is missing the number 2.

5.3.3.4 Off-Site Surface Water

92. Page 97, first paragraph in section: This paragraph states that storm water from Area 1 and Area 2 does not enter the North Surface Water Body; however, this statement is inaccurate. Revise the text in this section to account for more recent storm water monitoring documentation.

5.3.4 Missouri River Floodplain

93. Page 98, third paragraph in section: Discussion of the 500-year floodplain states that *"...the entire West Lake Site is outside the 0.2 percent...."* (500-year floodplain). Revise this text to acknowledge that the Buffer Zone and/or Lot2A2 of the Crossroads property are within the 500-year floodplain.

5.4 Biota

94. Page 99: Include a reference to the ECO risk assessment (in the BLRA) in this section.

5.4.1 Plant Communities

95. Page 99: Add a new paragraph (or subsection) to describe how the Site's plant community has recently changed due to placement of the NCC.

5.5 Subsurface Features

96. Page 103: Describe "other wastes."

5.5.2.1 Waste Materials in Areas 1 and 2

97. Page 108, first paragraph: Include additional details on the specific wastes that may have been disposed in these areas.

5.6.1 Regional Hydrogeology

98. Page 112: The first paragraph states that the major bedrock aquifers are the Potsi Dolomite, Gasconade Dolomite, Roubidoux Formation and the St. Peter Sandstone. These units have not been defined as individual aquifers but are geologic units within a single aquifer system known as the Ozark aquifer. Revise this section accordingly.

5.6.2.1 Groundwater Occurrences at the Site

99. Page 113, first paragraph: It is unclear what is meant in the first paragraph by "minor groundwater present within the limestone and dolomite bedrock units." Clarify whether this is referring to water yields from specific wells, volume of water pumped, flow rates, or something else.

100. Page 113-114 last paragraph starting on page 113: It is unclear what this paragraph is trying to imply. The last sentence regarding "porous (bedrock) medium" should be further explained or revised. Fracture flow will dominate flow in the bedrock on the localized scale of the Site.

5.6.2.3 Groundwater Levels and Elevations

101. Page 115: The text in this section indicates that groundwater levels are within the alluvium and not in the landfilled material, however, there is insufficient information to support this conclusion as there are not enough data points at the appropriate locations and depths. Boring 1D-9S and 1D-10S (and others) appear to show RIM intervals located at or very near the base of the waste at an elevation at or below 420 feet which is below the reported water level in the alluvium shown on most figures and near the surface elevation of the Missouri River. There are no wells in this vicinity to measure actual water levels. The closest well, 111-SD, has a water level of approximately 425 to 430 feet indicating that RIM in that area could be saturated. Revise text to remove unsupported conclusions.

102. Page 115, 2nd full paragraph: The last sentence of this paragraph states that the leachate collection activities at Bridgeton Landfill appear to have an effect on groundwater levels in the vicinity of the Site. There are no offsite wells to measure pumping impacts. Provide data or a citation to support this statement or remove it.

103. Page 117, second paragraph: "Table 5-2 presents a summary comparison of the average daily river stage and the range of alluvial water levels measured at the Site over the last 28 years." Include more text and details regarding the river stage data compared to the on-site water level data included in the RIA. Include which monitoring wells were used in the comparison table and how often they were measured. It appears that during previous Missouri River flood event(s), the measured river stage has exceeded both the minimum and the maximum alluvial water level elevations measured at the Site. Explain in the discussion how on-site water levels were affected by the river stages during historic flood events.

104. Page 117, last paragraph: Delete the last sentence on this page. This statement is vague and misleading. The USGS Report did not say that a reverse gradient from the river to the Site could not or would not occur during higher river stages.

105. Page 117, last paragraph: Table 5-2 indicates that the river was higher than the alluvium water level, indicating that this may be a nearly annual occurrence and does not support the statement that "*there is no indication of groundwater flow from the river towards the Site.*" This statement also does not seem to be consistent with the next section (5.6.2.4.1 OU1 and OU2 RIA Hydraulic Gradient Data) or the 2000 RI. Review and revise the text of this section (and other related sections) based upon the complete data set.

5.6.2.4.2 Hydraulic Gradients Based on 2012-13 Groundwater Monitoring Events

106. Page 120, *Horizontal Hydraulic Gradients* portion: Add text to briefly describe the Bridgeton Landfill leachate collection system, including the number and location of collection points and the average volume per day, week or month (depending on data available). Compare this information to Missouri River surface water levels and to an average leachate volume (annual basis). Provide groundwater elevations in North and South Quarry if available. Discuss the potential leachate collection system effects and any other known or suspected impacts that may occur at the overall Site on local horizontal hydraulic gradients in the alluvium and bedrock formations. Briefly describe what is known and identify potential data gaps that will need to be addressed by OU3. See Primary Comment III above on Groundwater.

107. Page 121, Salem Formation Section: Monitoring wells PZ-100-KS and PZ-111-KS are referenced under the Salem Formation Heading, but actually these two wells monitor portions of the Keokuk Formation not the Salem Formation. Revise this section for accuracy.

108. For monitoring well information associated with OU2, incorporate 2014 and 2015 radiological data from the most recent sampling events at OU2 into the discussion.

5.6.2.6 Groundwater Flow Directions

109. Page 128: The referenced figures (K.1 to K. 2) should be oriented in the same direction (not 90 degrees off). Additionally, the K.1 figures do not support the conclusions in the text that during 1994-1996 groundwater flow in the alluvium was primarily in a southern direction toward Bridgeton Landfill. Some data points are not labeled, making full interpretation difficult. Two data points (205AS and I-73) do seem to support this statement, however the other wells on the figures demonstrate a general west/northwest flow direction for groundwater. Precipitation events and changes to Site/area topography

may have affected the readings in 205AS and I-73. Revise the K figures to provide consistent orientation and revise the text of this section to clearly identify limitations related to the information and conclusions presented.

5.6.2.7 Groundwater Velocity

110. Page 129, last paragraph in section: Alluvial groundwater flux of 76,000 gallons per day cannot be verified with the information provided in the RIA. Tables 5-4 and 5-5 contain information to support the flux number but the aquifer thickness of 100 feet is likely too large as the majority of flow in the alluvial aquifer will be through the course sands and gravels in the lower part of the aquifer. It is unlikely that there is substantial flow/flux with the upper 10-30 feet of the silty sands. Provide information on groundwater flux as a range, using a range of estimates (high-low) and using a range of thickness and gradients. Also include a discussion on how this groundwater flux potentially effects the sub-surface environment of the various landfill cells (i.e. North Quarry effects versus effects to Area 1 of OU1). Update tables 5-4, 5-5, and 5-6 as necessary.

5.7 Subsurface Reaction in the South Quarry Portion of the Bridgeton Landfill

111. Page 132, fifth paragraph, and first paragraph on page 133: Update the evaluation in Appendix A (Radon Flux) to be consistent with the methodologies in the draft updated BLRA, 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. This paragraph should then be updated to reflect the results of this updated assessment.

112. Page 133, first paragraph: Revise this paragraph following the update to Appendix A as noted in the previous comment.

113. Page 133, last paragraph, first sentence: Update this paragraph as appropriate to reflect the status of any actions required by North Quarry order such as the installation of a Heat Extraction System (HES), installation of additional Temperature Monitoring Probes (TMPs), expansion of the Ethylene Vinyl Alcohol (EVOH) Cover, and development Inert Gas Injections (IGI) efforts).

6.0 NATURE AND EXTENT OF RADIOLOGICALLY IMPACTED MATERIALS

6.1 Potential Sources of Radionuclides in Areas 1 and 2

114. Page 135, first paragraph, last sentence: Replace "*sulfate ion*" with "*sulfate ions.*"

115. Page 135, second paragraph, second sentence: The statement that "*LBSR is therefore a chemically solidified and stabilized treatment product*" is not in the cited reference (NRC). Delete this statement/sentence.

116. Page 135, second paragraph, last sentence: The EPA does not agree with this statement because materials that may be considered inert under normal conditions may not remain inert in a landfill environment. This statement also does not appear to be accurate in the cited reference (Harrington and Ruehle, 1959). Delete this statement.

117. Page 135, third paragraph: , Please provide a reference to any documentation supporting the disposal of water treatment sludges or any other industrial wastes at OU-1.

118. Pages 136, top paragraph: Include additional details and discussions regarding the effects that reducing conditions can have on certain radium compounds such as radium sulfate and radium sulfite, which are a part of RIM.

119. Page 136, first paragraph: Include a sentence or brief discussion of scientific literature that indicates dissolution and solubilization (leaching) of barium sulfate can occur under the conditions associated with a municipal solid waste (MSW) landfill.

120. Page 136, third paragraph, first sentence: Delete the first two words ("*Over time*") from this sentence.

121. Page 136, third paragraph, first sentence: Change "have been" to "has become" to reflect that this was not actively mixed.

122. Page 136, third paragraph: This paragraph is confusing with regard to how RIM is contained/exists within the waste mass. Revise this information to be consistent with Primary Comment VI above on CSM, and refer readers to Section 9.5 (CSM discussion).

6.2.1 UMTRCA Regulations

6.2.2 EPA OSWER Directive 9200.4-25

123. Page 137-8: Remove the second, third and fourth paragraphs of this section. Discussions of applicable or relevant and appropriate requirements (ARARs) are not appropriate in the RIA.

6.2.3 EPA OSWER Directive 9200.4-18

124. Page 139, second paragraph in section, last sentence: This sentence is unclear. Delete the last sentence.

6.2.5 Background Levels

125. Page 141: There is no figure showing the locations of background samples, no indication of whether background samples are surface or subsurface samples, and no discussion of how non-detect results for specific compounds were addressed in calculating mean averages. Add the missing information (and figure, if appropriate) as related to background samples and data discussions.

126. Page 141, last full paragraph, third sentence: "For example, Th-232 and Ra-228 are members of the Th-232 decay series and should be in equilibrium with each other." Add "when naturally occurring" at the end of the sentence.

127. Page 141, last sentence on the page: Clarify what the term "*short-lived*" means as used in this sentence or delete this term. Further clarify in this section's text how the background level for uranium was determined.

6.2.6 Definition of RIM

128. Page 143, first paragraph, second sentence: Remove the sentence regarding use of the Site for residential purposes.

129. Page 143, third and fourth paragraphs in this section: Provide proper citations for the statements made regarding the stated EPA actions included in the text of this section (concluded/adjusted/determined) and clarify that these items are related to FUSRAP locations.

130. Top of page 145: Add the following sentence "However, the definition of RIM that the EPA has established at this site is consistent with Uranium Mill Tailings Radiation Control Act (UMTRCA) and relevant Office of Land and Emergency Management (OLEM) guidance as discussed in the previous sections."

131. Page 143, second paragraph: Delete the first sentence regarding "... no ARARs... for uranium."

6.3 Procedures Used to Identify RIM Occurrences

132. Page 145, second paragraph in section, first sentence: This statement implies there is additional data that was not available when this version of the RIA was prepared. If so, specify the missing data and update this section to include it.

133. Page 145: Delete this footnote if it is no longer needed or update accordingly.

134. Page 146, first full paragraph, last sentence: Revise the sentence to change "Lastly" to "Additionally."

135. Page 146, second paragraph, sixth sentence: Ensure that the sentence beginning with "Based on review and the results..." is accurate for all of the data collected to date for OU1 and if so, revise this sentence as follows, "Based on review and the results of the evaluation of all the data available at the time this RI was written, it was determined that any..."

136. Page 146, third paragraph: In this paragraph add the basis for deciding how alpha screening values were used to determine that RIM was present.

6.4 Occurrences of RIM in Areas 1 and 2

137. Page 147, second paragraph: Expand this discussion to specify which data sets were used (hard, soft) and clearly describe how the average thickness and depths were determined.

138. Page 147, Third paragraph: Update this paragraph in accordance with previous comments. Also include the average depth for RIM in Area 2.

139. Page 147: Clarify whether the information provided in this section is based upon the Estimated Three-Dimensional Extent of Radiological Material (geostatistical report).

6.5 Areal Extent of RIM in Areas 1 and 2

140. Pages 147-148, entire section: Review this section and revise to be consistent with the geostatistical report as provided to the EPA on September 30, 2016. Also, add all

portions of the geostatistical report utilized to describe the extent of RIM in OU1 as an Appendix to the RIA. The EPA will provide specific comments to the geostatistical report at a later date.

6.6 Radiological Characterization of RIM

141. Page 149-150: The EPA is reviewing its verification data set associated with the samples collected from borings by Cotter Corporation. The EPA will provide additional input to the Respondents following completion of our review.

142. The EPA will review this section further once the final data set for the Site is incorporated.

6.7 Radionuclide Occurrences in the Buffer Zone and Crossroads Lot 2A2

143. Page 152, last paragraph: The document states that no recent sampling has occurred for the Buffer Zone or Crossroads property; however, multiple samples including soil, sediment, and dust have been collected. Include in the RIA the data associated with the samples collected from this area during the installation of the NCC and reference the March 2016 MDNR Vicinity Sampling Report. Update the discussion in this section using this additional data.

7.0 RADIONUCLIDE OCCURRENCES IN ENVIRONMENTAL MEDIA

144. Reference Appendix Q: Updated Baseline Risk Assessment in this section where appropriate and include references for any figures in Appendix Q that would be pertinent to this section.

7.1.1.1 Surface Emission of Radon Gas

145. Page 154, last paragraph, and page 155, first paragraph: Provide a baseline count rate when discussing gamma screening values in order to provide the reader context as to the significance of particular screening values. Revise to include the missing details.

146. Page 155, first paragraph, second to last sentence: Elevated gamma readings not supported by corresponding analytical sampling are likely the result of the contamination existing near but not in the boring location. Furthermore, radon can also migrate through the soil via various preferential pathways that exist in the heterogeneous landfill substrate. Therefore, radon may not simply diffuse "normally" from the source material. Revise this paragraph to include a discussion of these points.

7.1.1.2 Radon Migration With Landfill Gas

147. Page 155: Revise this section as appropriate to include consideration of the more recent radon flux measurements.

148. Page 155, first paragraph in section, third sentence: Delete the portion of this sentence that states "*...or within the gas extraction system...*"

149. Page 155, first paragraph in section, fourth sentence: Provide more documentation to support the conclusion in this statement. Reference the products that are to be developed as specified by the first comment in section 5.7.

150. Page 155-156, first paragraph in section, last sentence: Replace the word "flux" with "gas." Because the amount of radon at the boundary of the Site as a result of releases from the gas collection system would be measured as an air concentration this section should instead consider the 0.5 picocuries per liter (pCi/L). fence line UMTRCA standard. Revise accordingly.

7.1.1.3 Radon in the Atmosphere

151. In this section (or a new subsection) include a discussion on the deposition of Pb210 onto/into soil from air and as a "natural" part of the overall decay process.

152. Page 156, first paragraph in section, last sentence: Radon flux is not a measurement that directly equates to a human exposure. Delete the remaining portion of the sentence after the word "surface."

153. Page 156, second paragraph in section: Add a reference to figure 4-19 showing air monitoring locations.

154. Page 156, second paragraph in section, fourth sentence: This statement should acknowledge that the first three quarters of sampling were collected for less than the minimum number of days (90) as required by the laboratory specified analytical method.

155. Page 156, last paragraph, last sentence: Technically, 0.5 is 25% greater than 0.4. Revise this paragraph to instead state that the average annual level of radon measured at the Site is below the 0.5 pCi/l standard plus background, i.e. 0.9 pCi/l.

156. Page 157, second full paragraph: Revise the text in this section/paragraph to discuss the prior five EPA off-site stations and associated data in one paragraph and start a new paragraph to discuss Respondents' current 13 on-site stations and associated data. Add a third paragraph to discuss comparisons between the two data sets, as appropriate.

157. Page 157, second full paragraph, last sentence: Check to confirm this statement is still true after incorporating all currently available on-site air monitoring data. Revise section to incorporate all currently available data.

7.1.2 Fugitive Dust

158. Page 157: Include a short description in this section of how the fugitive dust samples were collected. Also, delete the term "extremely low" as it is subjective.

159. Page 158, third full sentence on page: This section should include a discussion to support the conclusion "... there does not appear to be any significant radionuclide transport..." including comparisons of fugitive dust sample results to available background values.

160. Page 158, fifth full sentence on page: Nearly all of the inert fill was placed on areas where RIM is not present near the surface. Placement of inert fill is not relevant in a discussion about the potential significance of the fugitive dust contamination migration pathway. Delete this sentence.

161. Page 158, first full paragraph, sixth sentence: The comparison for gross alpha results is described as "similar to or only slightly higher." Delete this statement as the mean is an

order of magnitude higher in all samples. The text also references additional sampling "ongoing at this time." Revise to include the missing information and data which is now available.

162. Page 158: Update Tables 7-5 through 7-9 to correct for any errors that the EPA identified in the associated quarterly air monitoring reports and revise this section accordingly.

163. Page 158, first full paragraph, last three sentences: The referenced data has been collected. Revise this paragraph accordingly.

164. Page 159, partial paragraph at top of page, last sentence: The phrase "well below" is subjective. Delete the term "well."

165. Page 159, first paragraph, second sentence states: Delete the portion of this sentence from "... the limited area..." to "Areas 1 and 2." Add a discussion after this sentence that briefly describes Site conditions prior to the presence of an "extensive vegetation cover." Revise this paragraph to remove speculation as to whether contamination has migrated via fugitive dust emissions during time periods in the past when Site conditions differed from current conditions described in this section.

166. Page 159, first paragraph last sentence: Revise this sentence as follows, "Based on the monitoring results, along with the presence of the prior vegetative cover and the subsequent rock cover over Areas 1 and 2, atmospheric transport of radionuclides in fugitive dust does not appear to be a significant pathway for offsite migration during the time that the Site was investigated."

7.2 Surface Water Transport

167. Page 159, second paragraph in section: Revise the second sentences as follows, "All of these actions would serve to reduce the potential for radionuclide transport in surface water."

7.2.1.1 OU1 RI Rainwater Runoff Sampling

168. Page 161, third paragraph, last sentence: State whether the May 1997 runoff sample discussed here was filtered or unfiltered. Remove the subjective phrase, "*or even come close to*" in the last sentence.

169. Page 161, fourth paragraph, second to last sentence: Revise to avoid using two parentheticals.

170. Page 161: Delete the footnote related to the North Surface Water Body. Include this information in the body of the text of this section and discuss the various topographic information related to surface water bodies located on and around the Site detailed in Section 5.3.1. Add a reference in this section to the relevant discussion in 5.3.1.

171. Page 162, paragraph at top of page, second sentence: "... *radionuclides were well below* ..." Remove the word "*well*" as it subjective.

7.2.1.2 NCC Stormwater Samples

172. Page 163, first paragraph in section: Some of the NCC outfalls are not mentioned or discussed such as those located near the Buffer Zone. Stormwater exceedances for total uranium occurred in April 2016 at NCC-002 as discussed in the next paragraph of the RIA but the last sentence of this paragraph states the results were "not available." Revise this paragraph by deleting the last sentence and including missing details/information for the entire set of NCC outfalls. Provide details regarding the data collected to date from the various NCC outfalls.

7.2.2 Surface Water Samples

173. Page 164: There is a format issue in the paragraphs at the top of page 164. Check and resolve.

174. Page 164, second paragraph: Correct the Maximum Contaminant Level (MCL) listed for Gross Alpha to 15 pCi/L.

7.2.3 Summary and Conclusions Regarding Surface Water Transport

175. Page 164, first paragraph in section: Revise the second to last sentence in this paragraph by replacing the word "*eliminates*" with "*reduces.*" Revise the last sentence as follows, "The results of the 2016 stormwater monitoring further support this conclusion."

7.3 Sediment Transport

176. Section 7.3, entire section: Define "sediment" as used in this section and in the RIA.

177. Page 165, 1st paragraph, last sentence: Confirm that the Preliminary Remediation Goal (PRG) developed for an outside worker is current and correct per the BLRA. Revise accordingly if necessary.

7.3.1 Sediment Sample Results

178. Page 166-169: Sections 7.3.1.1.1, Area 1 Surface Drainage Sediment; Section 7.3.1.1.2, Area 2 Surface Drainage Sediment; and Section 7.3.1.1.3, Northeast Perimeter Drainage Ditch and Access Road Drainage Ditch need to be added to the Table of Contents.

7.3.1.1.3 Northeast Perimeter Drainage Ditch and Access Road Drainage Ditch

179. Page 168, fourth paragraph: Revise this paragraph to include consideration of the SED-4 combined thorium result of 16.16 pCi and the EPA's split sample result for combined thorium of 20.63 pCi/g which is above 7.9 pCi/g or the definition of RIM.

180. Page 168, fifth paragraph: Revise the last sentence that begins with "*However, to the extent...*" as follows, "However, to the extent that sediment transport occurred along the Northeast Perimeter Drainage Ditch, any sediments that *may have been* transported along this pathway would have accumulated in the North Surface Water Body and, due to the stilling effects of this water body, *would be unlikely to be* transported *further* offsite."

181. Page 169, top of the page: Subjective language. Delete the words "ultimately, likely eliminate" from this sentence.

7.3.1.2 Sediment Transport from Area 2 Slope Erosion

182. Page 169, second paragraph, last sentence: The text states the runoff and erosion were stopped through construction of runoff diversion berms. Include dates or a date range for when these berms were constructed and cite the documentation for this information.

183. Page 170, top partial paragraph, last sentence: The text references Section 4.7 for more detailed discussions but Section 4.7 does not contain substantive additional details. Revise these statements and either revise Section 4.7 or this section to include the detailed discussions referenced.

184. Page 170, last paragraph: As the Buffer Zone and Lot 2A2 are a part of the Site, delete the word "offsite" from the last sentence and replace with "contaminant."

185. Page 171, first paragraph, last 2 sentences: These sentences are not consistent with previous statements. Text in this section indicates the extent of radionuclides from erosional transport is limited to specific areas; however, Section 6.2.2 on page 138 states that current conditions relative to occurrences of radionuclides at these properties are unknown and will be investigated. Remove these two sentences starting with "*These results indicate...*"

186. Page 227-228: The text at the bottom of the page discusses Buffer Zone and history of Lot 2A2. Clarify the "owner" mentioned in the text. Discuss the sample depth information as provided in the text and ensure this is correct for the sample locations discussed (3 - 6 inches).

7.4 Radionuclides in Perched Groundwater or the Former Leachate Seep

187. Page 171, second paragraph in section: The perched water areas shown on Figure 4-9 are fewer than described in the text and are not clearly defined on the figure. Revise the figure to clearly define and explain discrepancies between the referenced figure and the text.

188. Page 172, top of page: The text indicates all samples had less than 1 pCi/L of Th-234 but neglects to state that one high level (133pCi/L) was thrown out. Include the rational for rejecting this result in this section.

189. Page 172, third paragraph, last sentence: Reevaluate the conclusion in this paragraph after addressing other comments related to perched water and closed topographic contours. This evaluation should also be reflected in the CSM discussion. Revise this paragraph to be consistent with that evaluation.

7.5 Radionuclides in Groundwater

190. Conclusions or summary statements within Section 7.5 cannot be made until the groundwater investigation planned for OU3 is completed. These conclusions and summary statements should be removed from the RIA.

191. Add a discussion to this section on the technologies and efforts used to control groundwater and leachate levels at the Site and their potential effects on OU1 and any radionuclides present.

7.5.1 Radium

192. Page 174, third paragraph, last sentence: Remove the statement, "As discussed in sections 5.6.3, there are no drinking water supply wells located at, near or downgradient of the Site, and therefore the MCL is not an applicable requirement." Replace the statement, "However, due to the unlikely potential use of groundwater as a drinking water supply..." with "However, since this aquifer is a potential drinking water aquifer,..."

193. Page 174, last paragraph, last sentence: Replace "likely" with "may."

194. Page 174-175: The terms "upgradient" and "crossgradient," as used in this section, have not yet been site-specifically determined by a full groundwater investigation. Revise the text using and discussing the terms "Upgradient" and "Crossgradient" as appropriate. Refer to Primary Comment III above on Groundwater.

7.5.1.1 Background Radium Levels

195. Page 175: The use of Formerly Utilized Sites Remedial Action Program, (FUSRAP) Hazelwood Interim Storage Site (HISS) and Weldon Springs bedrock and/or glacial wells to establish a background level for groundwater at West Lake is not appropriate. Some of the wells from the other off-site areas may in fact be alluvial but not all. Clarify in the text of this section that background levels for the West Lake Site will be site specific and determined during the OU3 RI/FS.

7.5.1.1.1 Background Values from Published Technical Reports

196. Page 175, second paragraph in section: Delete this paragraph. There is insufficient detail presented to adequately evaluate these statements and the USGS evaluation of public water supplies cited in Section 7.5.1.1.5 is more thorough.

7.5.1.1.2 Sample Results from Off-site Private Supply Wells

197. Pages 176-177: The last sentence on page 176 states the USGS data was not available when the report was prepared; however, that data was collected in 2013 and should be available. Revise this section to include discussion of the private well data collected by the USGS.

198. Page 176: The end of the paragraph incorrectly states that the Weldon Spring well is alluvial but this well was/is situated in bedrock. Correct this information in this paragraph.

7.5.1.1.3 Radium Results From Upgradient Monitoring Wells

199. Many of these samples had Minimum Detectable Activities (MDAs) too high to be usable and the report provides assumptions about high detections. Discuss the data quality issues related to the high MDAs and how this effects the data set.

7.5.1.1.4 Radium Results From Monitoring Wells Located Upgradient of Areas 1 and 2

200. Page 178 and 179: The terms "upgradient" and "cross-gradient" as used in this section have not yet been determined by a full groundwater investigation for monitoring wells located on-site. Wells impacted by leachate should not be considered as "upgradient."

Upgradient/cross gradient or background monitoring wells should not be adjacent to, within, or being affected by leachate. Revise this entire section related to using and discussing the terms "Upgradient" and "Cross-gradient."

201. Page 178, last paragraph: The USGS 2014 report clearly states that a large number of wells sampled at the Site exhibited leachate impacts and that there is a positive relationship between radium in excess of MCLs and the presence of leachate. The USGS report was not conclusive about potential RIM releases to groundwater and specifically mentioned some locations where RIM could not be ruled out. Revise this section (and other related sections) to include the complete summary of groundwater results and conclusions from the USGS 2014 report.

202. Pages 178-179, text below the table: Delete the last sentence on the page which starts, "Regardless, these 32 bedrock wells..."

7.5.1.1.5 USGS Evaluations of Background Water Quality

203. Page 181, last paragraph: The EPA and the USGS collected data from a total of 11 private wells however only nine were in the alluvium (alluvium aquifer). The remaining two wells were completed in the Mississippian bedrock. Revise this paragraph accordingly.

7.5.1.1.5 USGS Evaluation of Background Water Quality

204. Page 181, last three paragraphs of the section: This section appears to omit statements from the USGS 2014 report reading the potential for RIM to contribute to levels of radium identified in groundwater samples. Revise this section to include a complete summary of the data presented in the USGS report, including identifying wells that exhibited effects from landfill leachate and potentially from RIM.

7.5.1.2 Radium Results in Site Groundwater

205. Page 181: This section does not include the conclusion in the USGS report that the radium levels detected in the wells could be from a combination of sources, including RIM. Revise this section to include a full accounting of the conclusions of the USGS 2014 report.

7.5.1.2.1 Combined Total Radium-226 Plus Radium-228

206. Page 183, second paragraph: The figure referenced in this section should be Figure N-1.5 not Figure N-5.

7.5.1.2.2 Combined Dissolved Radium-226 Plus Radium-228

207. Page 184: Figure nomenclature appears inaccurate (Figure 7-4). Check and resolve.

208. Page 184, last paragraph, conclusion paragraph: Delete this paragraph as it provides very broad definitive statements that are not supported.

7.5.1.2.4 Time Series Trends in Radium Levels

209. Page 187, last paragraph, last sentence: Reference to Section 4.2.1.1.1 is incorrect as this section is not included in the document. Revise with the correct reference.

210. Page 187: Add linear regression trend lines to Figures 7-5 through 7-12. Also, the results specified in the text do not seem to be consistent with radium levels in alluvium and the text does not specify whether the wells are in bedrock or alluvium. Clearly distinguish between bedrock and alluvium wells/data.

7.5.1.3 Geochemical Controls on Combined Radium Occurrences

211. Page 189: Delete the entire first paragraph of this section as it presents unsupported conclusions.

212. Page 190, first paragraph: Delete the first sentence of the paragraph and revise the last sentence to read: "One potential mechanism responsible for the broad distribution of radium at the Site is mobilization of naturally occurring radium from the soil and rock in response to changes in the geochemical environment caused by decomposition of the landfilled wastes."

7.5.1.3.2 Radium Occurrences in Leachate

213. Page 190, last paragraph: Define in the text of this section whether the leachate results are pre- or post-treatment levels and where the leachate samples were collected.

214. Include the laboratory data on a new summary table of radionuclide data collected from or in support of the leachate collection system, including water quality parameters and leachate collection volume.

215. Page 191: Estimate source contribution of groundwater into the quarry as bedrock or alluvium. Provide a citation or source for the statement made in the last sentence of this section.

216. Figures in Appendix N are mislabeled. Figure N-1 should be Figure N-1.1.

217. Include a brief discussion on the discharge/permit limits for radionuclides to the Metropolitan Sewer District.

7.5.1.3.3 Landfill Chemistry and Radium Occurrences at the North and South Quarry Portions of the Bridgeton Landfill

218. Page 192, last paragraph: Delete conclusions provided in this Section that cannot be supported due to insufficient information related to groundwater gradients onsite. Specifically delete "including areas upgradient of Areas 1 and 2" from the first sentence on page 192 and the following sentence that begins, "Therefore, the source ...." Revise the third sentence to state, "One possible source of the radium ... "

7.5.2 Thorium

219. Page 192, third paragraph: Edit the sentence that begins with, "The five bedrock wells ... " by deleting the conclusion " ... and therefore are upgradient from and unimpacted by the presence of RIM in Areas1 and 2."

220. Page 192-193. Explain why the November 2013 PZ-210-SD result is considered anomalous or delete this statement.

221. Include figures for thorium similar to Figures 7-3 and 7-4, color coded by results that are above and below standard deviations.

222. Page 193: Remove the entire last paragraph of this section. The conclusions regarding thorium presented in this paragraph do not take into consideration several previous comments made on the RIA above by the EPA.

7.5.3 Uranium

223. Include figures for uranium similar to the radium Figures 7-3 and 7-4, color coded by results that are above and below standard deviations.

224. Page 194: Remove the entire last paragraph of this section. There is insufficient evidence to draw these conclusions at this time.

7.5.4 Summary of Radionuclide Occurrences in Groundwater

225. Page 194: The conclusion drawn in this section is not supported by data, and should be deleted or significantly revised in accordance with previous the EPA comments to acknowledge the existing data gaps. There is limited analytical data and the existing monitoring well network is insufficient to determine whether the RIM is causing or contributing to the radionuclide impacts to groundwater above MCLs. Additional investigation is necessary.

226. Page 194: Identify and discuss existing data gaps in the current knowledge of groundwater so that an adequate investigation and evaluation may be designed and conducted during the OU3 RI/FS process to draw conclusions regarding the nature and extent of radionuclides in groundwater at the Site. Add statements to this section regarding the pending OU3 RI/FS.

7.6 Radionuclide Fate and Persistence

227. Upgradient and side gradient designations are used in this section for wells with leachate impacts. Revise to exclude these designations See Primary Comment III above on groundwater.

7.6.1 Radioactive Decay7.6.2 Changes in Radionuclide Concentrations

228. The RIA should provide an estimate of the time period required for radium to reach peak concentrations in Areas 1 and 2. Include this information in the text of this section.

7.6.3 Other Fate and Transport Processes

229. Add a reference in this section to Appendix P and make sure the text in this section is consistent with the Fate and Transport evaluation in Appendix Q.

7.6.3.1 Leaching Potential and Sorption

230. Page 198: Update and revise this section to be consistent with the findings of the Fate and Transport evaluations in Appendix P.

231. Page 199: Include a reasonable range of hydraulic conductivity (Kd) values appropriate for the Site area. State if the alluvium is considered silty.

232. Clarify in the text of this section that the values used and discussed in this section are consistent with reducing conditions.

233. Pages 200-201, last paragraph in section: Add a reference to the Toxicity Characteristic Leaching Procedure (TCLP) data and include any relevant corresponding analysis of that data to this section. The text in the last paragraph states that the TCLP data demonstrated that the radionuclides are "generally retained at 90% or more of the original activities." This does not address whether any of the samples failed the TCLP test. Clearly discuss the results of the TCLP analysis in the text of this section. The EPA is currently reviewing the TCLP data and will provide additional comments to Respondents regarding this data at a later date.

234. Page 201, last paragraph in section: Provide additional evidence and discussion to support the statement regarding an anoxic environment in the vadose zone of the waste profile, and discuss potential methods to confirm this statement.

235. Page 201, last paragraph of this section: The EPA is still evaluating appendix P related to the Fate and Transport evaluation of RIM, and will be providing comments that may impact this section.

7.6.3.2 Volatilization

236. Page 201: Delete this section as radon gas is discussed in previous sections and it does not provide new or useful information.

7.6.4 Summary of Fate and Persistence of Radionuclides

237. Page 201, second paragraph in section: The use of the term "significant" in the first sentence of this paragraph is subjective and should be removed. There is insufficient groundwater data to evaluate the potential impact of OU1 to groundwater at this time. Revise this first sentence accordingly. In the last sentence of the paragraph, replace the words "Additional evaluations" with "Modeling."

8.0 NON-RADIOLOGICAL CHEMICAL OCCURRENCES IN AREAS 1 AND 2

8.1 Occurrences of Non-Radiological Chemical Constituents in Soil/Waste

238. Page 202: In this section briefly describe the process used for selecting the sampling intervals for the non-radiological samples.

8.2 Non-Radiological Constituents Detected in Erosional Sediment

239. Page 204: Identify the locations where erosional sediment samples were collected and cite the figure that shows the locations.

240. Compare non-radiological data results in this section and any other sections/tables where these sample results are discussed to standard regulatory levels.

241. Page 204-205: It is unclear from the sediment tables presented in Appendix G-2 what the analytes were. Add a table summarizing the analytical parameters for the non-radiological sediment samples.

242. Page 204-205: Discuss the more current sediment sampling locations and results for non-radiological samples. If the more current sediment samples were not analyzed for non-rad constituents, clearly state so in this section.

8.3 Non-Radiological Constituents Detected in Rainwater Runoff Samples

243. Page 205, last paragraph: The first sentence states samples were collected from four stormwater monitoring points but only three locations are discussed in the text. Revise text to include a discussion of all four locations. Also include a brief discussion on exceedances above regulatory standards and summarize any follow-on actions conducted as of a result of review of this data.

8.4 Non-Radiological Constituents Detected in Surface Water Samples

244. Page 206: Summarize additional information about the surface water sampling, including how many samples were collected, the location that were sampled, and the compounds for which the samples were analyzed.

8.5 Non-Radiological Constituents in Perched Water and Area 2 Seep

245. Page 206: Define the term "perched water" as used here and describe its nature at the Site (see comments in previous section and in Primary Comment IV above about Perched Water). Add a reference to other sections in the RIA where perched water is discussed.

246. Page 206: Cite the table and/or appendix where the data discussed in this section can be reviewed in the document and is compared to regulatory values.

247. Page 206, second paragraph in section: The statement regarding both filtered metal detections being below MCLs is inaccurate because lead does not have an MCL, and the lead detected at 17 micrograms per liter (ug/L) does exceed the lead drinking water action level of 15 ug/L. Unfiltered analytical results should also be reported and discussed because migration of contaminants can occur in colloidal form. Revise the text in this section to resolve these issues.

8.6 Non-Radiological Constituents Detected in Groundwater Samples

248. Page 207: Section 8.6: Create and include new tables for each analyte group, including the chemical parameters analyzed for (VOCs, SVOCs, Metals). Present relevant sampling events (not just 2012-2014) side by side so that they can be compared over time. Include both filtered and unfiltered analyses. Clarify which analytes were included in each analysis. Include this information in the tables or create a new table that shows the analytes considered during each sampling period or event. Also include the appropriate allowable regulatory concentrations (ex., MCLs, PRGs) on the table(s).

249. Page 207: Section 8.6: Include a brief discussion in this section regarding any statistical trends seen in the analytical results and sample locations over time. For example, in 1995-1997 benzene was detected in OU1 Area 2 in monitoring wells D-93 and I-9, but was not detected in these wells in 2012-2014. Briefly discuss these findings in the appropriate Section 8 sub-sections.

8.6.1 OU1 RI Groundwater Sampling for Chemical Constituents (1995-97).

250. Page 207: Clarify which analytes were included in each analysis during the 1995-1997 sampling events. Cite where this information is available in this document.

8.6.2.1 Volatile Organic Compounds

251. Page 212, first paragraph: The first sentence begins with, "Except for the August 2012...," but this exception is never explained. Explain the exception in the text.

8.6.2.3 Trace Metals

252. Page 213: Provide a new summary table(s) showing all the results of the groundwater trace metals analysis, both filtered and unfiltered. Discuss findings in the text and reference the new table(s).

253. Page 213, second paragraph in the section: Naturally occurring metals may be present at elevated concentrations due to landfill conditions and their presence in colloidal form does not preclude their ability to migrate. Delete this paragraph.

8.6.2.3.1 Arsenic

254. Page 213: The effects of redox conditions on arsenic levels should be discussed in this section as it is for iron and manganese.

8.6.2.3.3 Manganese

255. Page 215, first paragraph, third sentence: This sentence refers to iron rather than manganese. Revise the statement.

8.6.2.3.4 Barium

256. Page 215-216: Summary tables are included for the trace metals arsenic, iron, and manganese but not for barium. Present a summary table for barium.

8.6.2.4 Inorganic Constituents

257. Page 216: This comment applies to the all the subsections in this section related to inorganic constituents. Revise any language where appropriate to be consistent with the Comprehensive Phase 1 report.

8.6.2.4.1 Sulfate

258. Page 216, first sentence: This sentence is incorrect. Revise to indicate that wells D-12 and S-10 are in Area 2, not Area 1.

8.6.2.4.4 Iodide, Bromide, Boron and Strontium

259. Page 218-219: The figure number for the Iodide figure appears to be cited incorrectly (Figure N-3.26 in Appendix N in the text and Figure N-3.14 in Appendix N). Revise the appendix references.

260. Page 219, last paragraph of section: Remove the last sentence of this paragraph. There is insufficient data to definitively determine upgradient wells and to make this conclusion at this time.

8.6.3 Correlation of Radium and Non-Radionuclide Occurrences

261. Page 219-220: This section makes little or no mention of the strong association of radium greater than its MCL in wells with landfill leachate effects as reported by the USGS (2014). However, there is insufficient data at this time to determine the source of the radionuclide occurrences in groundwater. Additional data collection and evaluation on this issue should be conducted as part of OU3. Revise this section accordingly.

8.6.4 Possible Radionuclide and Chemical Contributions to Groundwater from Areas 1 and 2

262. Page 220 and 221: Remove the first paragraph from this section on p. 220, and the last sentence of the section on page 221. The groundwater data shows the presence of radionuclides above MCLs. The comparison of radium concentrations in the alluvial wells associated with Areas 1 and 2 with higher radium concentrations in the (primarily) bedrock wells associated with OU2 is insufficient to draw conclusions about contribution from RIM because the report is evaluating different geologic units, different landfill leaching environments, and wells with and without leachate effects without accounting for the differences. There is more complexity to the system than is presented here. Ultimately, there is groundwater with radionuclides in excess of MCLs and there is an insufficient monitoring well network, insufficient analytical data, and an insufficient assessment of Site-specific hydrology to draw the conclusions presented in this section. Revise this section in accordance with the comments above and indicate that additional investigation/evaluation will be necessary as a part of the OU3 RI/FS.

9.0 SUMMARY AND CONCLUSIONS

9.1 Site Location and Land Uses

263. Page 222-223: Revise so that the text presented in this section, including the summary bullets, succinctly mirrors the CSM to be developed and presented in the text of the revised document. Ensure that this text is consistent with other sections in the RIA regarding Site location and land uses.

264. Page 222-223, listed bullets: Revise to add a statement or bullet regarding the proximity of residential developments to the Site.

265. Page 222-223, listed bullets: Revise to add a bullet specifically regarding the proximity of OU1 to the Lambert Airport runway.

266. Page 223, bullet at top of page regarding 500-year floodplain: See similar comment on Section 5.3.4. Revise this text to acknowledge that the Buffer Zone and/or Lot2A2 of the Crossroads property are within the 500-year floodplain.

9.2 Geology and Hydrogeology

267. Review the summary bullets in Section 9.2 for consistency with changes made to the RIA in response to earlier EPA comments on geology and hydrogeology.

268. Page 223, second bullet: Instead of a general statement, revise this bullet to be more factual. State the deepest occurrence of RIM, the deepest occurrence of refuse and the highest measured groundwater elevation at the Site.

269. Page 223, third bullet: Add the word "Regional" at the start of this statement/bullet and indicate that Site-specific groundwater gradients will be further evaluated in OU3.

270. Page 223, fourth bullet: Revise this bullet to state: "*The alluvial aquifer is a potential drinking water aquifer; however*, there is no known groundwater use in the immediate vicinity of the Site, and use of groundwater within a 1 to 2-mile radius of the Site is, according to the MDNR data bases..." Revise this text to be consistent with comments to Section7.5.1.

9.3 Radiologically Impacted Materials

271. Page 223: Revise the beginning of the second sentence in the section to state, "The specific criteria approved by the EPA to define RIM at the site are..."

272. Page 223, last paragraph: Revise the beginning of the first sentence of this paragraph to state, "*Based on the definition of RIM...*"

273. Page 224: In general, revise bulleted statement in this section to be consistent with the Primary Comment II above regarding RIM Distribution.

274. Page 224, third bullet: Revise bulleted statement to "RIM has been found to be present at the surface or beneath..."

9.4 Potential Migration Pathways

275. Page 225, fourth bullet: Delete the words "downward" and "underlying alluvial" from this bullet.

9.4.1 Airborne Transport

276. Page 225: Order bullets in this section in chorological order.

277. Page 225, third bullet: Indicate whether these flux readings were collected before, during or after construction of the NCC.

278. Page 225, last two bullets at bottom of the page: Rewrite this section as text without the bullets.

279. Page 226, second bullet under heading *Radon monitoring in ambient air*: Delete the words "...did not differ from." Revise this bullet to state: "...radon levels in ambient air at the Site were generally consistent with background levels."

280. Page 226, second bullet under *Fugitive dust monitoring* heading: The term "significant" in this bullet is subjective and should be replaced with the range of values detected during the monitoring.

9.4.3 Soil Erosion and Sediment Transport

281. Page 227, first paragraph of section, second sentence: Revise this sentence to replace "...from the northern slope (landfill berm) of Area 2." with "...from OU1."

282. Page 227, second bullet: The bullet references a risk-based worker level. If this sample was collected from a ditch outside the fence, include a comparison to a risk-based level for residential and trespasser exposures.

283. Page 227, third bullet first sentence: Add the phrase "but can occur" to the last sentence in this bullet.

284. Page 227-228: The text at the bottom of the page discusses Buffer Zone and history of Lot 2A2, etc. Clarify who is the "owner" mentioned in the text. Discuss the sample depth information provided in the text and ensure this is correct for the sample locations discussed (3-6 inches).

9.4.4 Leaching to Groundwater and Groundwater Transport

285. Page228, first paragraph: Delete the words "downward" and "underlying alluvial" from the first sentence.

286. Page 228, second paragraph: Delete the entire second sentence of this paragraph. Revise the language regarding perched groundwater to be consistent with revisions and clarifications requested in other sections of the RIA.

287. Page 228, third paragraph: Delete the words "all of" from the first sentence.

288. Page 228, first bullet: Delete this bullet.

289. Page 228, fourth bullet: This statement that starts with "No contiguous area of radium..." cannot be fully substantiated by the current data set which did not include data from beyond the perimeter of the Site. Additional investigation is required. Delete this bullet/statement from this section and elsewhere in the text.

290. Page 228, fifth bullet: Revise this bullet by replacing "*The most probable*" with "*One potential.*" Also add the other hypotheses from the USGS 2014 Groundwater Report.

291. Page 229: Delete the bullet at the top of the page starting with "Based upon the relatively low solubility of radionuclides..." Add a bullet that states the existing monitoring network and sampling data is insufficient to draw overall conclusions regarding RIM contributions to groundwater and that additional groundwater investigation will be conducted as a part of the OU3 RI/FS.

292. Page 229, first paragraph: Replace "*Additional evaluations*" with "*Modeling.*" Also, delete the second sentence of this paragraph starting with, "Subject to the EPA..."

293. Page 229: Revise the bullet at the bottom of this page which states, "Radon flux emissions from..." to specify that the radon flux emissions were measured after the installation of the non-combustible cover. Include a statement discussing the 1996-97 radon flux data set as well.

294. Page 230, second bullet: Delete the phrase "immediately after" to reflect discussions in other sections of the RIA regarding when this erosion was documented to have occurred. Revise this bullet after the words, "construction of a non-combustible cover have" to say, "reduced the potential for contamination to migrate via this pathway."

295. Revise the third bullet to be consistent with other comments provided related to the use of terminology such as "Crossroads property" and any other comments about these adjacent properties. See Primary Comment I above on Site Definitions and specific comments on section 6.7.

296. Page 230, third bullet: Revise this bullet to indicate that evaluation of the extent of radionuclides on the adjacent property has not been finalized and will be a required part of any final remedy for the Site.

297. Page 230, fourth, fifth, sixth, and first half of seventh bullets: The comment regarding radionuclides occurrences in groundwater cannot be substantiated by the current data set. Delete all such statements. Retain last portion of seventh bullet regarding OU3, as follows, "Additional evaluations of radionuclide transport are ongoing and the EPA has..."

9.5 Conceptual Site Model

298. Completely re-write section 9.5 to expand this discussion with full citations in one comprehensive location and references to the CSM key elements that are located in other sections of the document. See primary comment for this item.

Tables

General Comment for data/results tables

299. Add footnotes/keys to tables with data results to identify data qualifiers and other acronyms. Tables 7-11/7-12/7-14/7-25, etc., already has this information in footnotes, but it is not provided on all tables. Check and as appropriate revise tables to include this information.

Table 4-5: Wells Sampled and Split Samples Collected (2012-14 events)

300. Add a footnote to this table to explain why there is no MDNR or EPA split data for the sampling of the wells associated with PZ-209, PZ-210, PZ-211, PZ-212.

Table 5-2: Comparison of Alluvial Groundwater Elevations to Missouri River Stage

301. Table 5-2 indicates that the river was higher than the alluvium water level, indicating that this may be a nearly annual occurrence and does not support the statement (in the last paragraph, page 117) that "*there is no indication of groundwater flow from the river towards the Site.*" This statement also does not seem to be consistent with the next text section (5.6.2.4.1 OU1 and OU2 RI Hydraulic Gradient Data) and with the 2000 RI. See primary comment on this item.

Table 5-7: Summary of Available Information on Water Supply Wells Within Two Miles of the Site

302. Add the wells identified and sampled by the EPA and the USGS to this table and highlight which of the wells were sampled by each agency.

Table 6-4: Summary of Occurrences of Radiologically Impacted Material (RIM) in Area 1

303. Add to this table the maximum alpha screening value, the depth to the maximum alpha screening value, and elevation of the maximum alpha screening value.

Table 6-6: Summary Statistics for Radium and Thorium Results — Areas 1 and 2

304. The EPA is currently evaluating appendix O and other statistical descriptions of the analytical data contained in this RIA and will provide comments on this subject area in a subsequent letter that may impact this table.

Table 7-4: Fugitive Dust Analytical Results

305. Add the sampling dates to table 7-4.

Table 7-5: Summary of Gross Alpha Results in Particulate Air Samples

306. Update the Tables 7-5 through 7-9 to correct for errors and related corrections that the EPA identified in the associated quarterly air monitoring reports and revise the associated text section accordingly.

Table 7-16: Radium Results From Prior and Existing Upgradient Monitoring Wells at the Site

307. This table has many empty cells. Explain or revise this table.

308. Combine all radium groundwater results (Table 7-13) into one table with the exception of the off-site results (Table 7-14). Do the same for thorium and uranium results.

Table 7-17: Bedrock Monitoring Wells Near Waste Disposal Units but Upgradient of Areas 1 and 2

309. This information should be incorporated into Table 7-19.

Table 7-18: Alluvial Monitoring Wells Near Waste Disposal Units but Up-/Cross-Gradient of Areas 1 and 2

310. This information should be incorporated into Table 7-19.

Table 7-23: Historical Pre-RI/FS and RI/FS Radium Isotope Results: 1983-2004

311. Format (font size) should be checked and revised for this table. Many blank columns are presented. Include these results in one more readable. Also see comment for Table 7-16.

Table 7-24: Oxidation-Reduction Potential Monitoring Results — May 2014

312. The table indicates redox was measured only once on a single day. Discuss in the text the limitation of this data due to only having one sample and include the sample location on a relevant figure/map.

Table 7-27: Summary of Thorium-230 Decay and Radium-226 In-Growth Over Time — Area 1

313. Correct the half-life value for Th-230 to 75,400 years. Update the corresponding value for Lambda and update the table accordingly.

Table 7-28: Summary of Thorium-230 Decay and Radium-226 In-Growth Over Time — Area 2

314. See the previous comment and update this table in a consistent manor to correct the half-life for Th230 and update Lambda values in this table.

Table 8-1: Summary Comparison of Soil Sample Results to RCRA Toxicity Characteristic Regulatory Levels

315. Not all qualifiers are identified on table footnotes (J- JY). Update to identify the qualifiers.

316. Add summary statistics to this table including the number of detects and number of samples for non-rad results. Add a brief description of what this data means (Tables 8-1 thru 8-6) in the text RIA.

Figures

317. Check nomenclature on all figures for consistency issues (example: landfill cells, Crossroads, Lot 2A, Ford, etc. on 3-2, 3-4, 3-5, 4-19, etc.) and revise as appropriate.

318. Check that figure legends include all of the used symbols (i.e. fence line, roads, etc.) and that sources are consistently cited where relevant.

Figure 3-2: Site Location Map

319. Check nomenclature on all figures for consistency with other figures (example: 3-5, 4-19, etc.) and revise as appropriate.

Figure 3-3: Landfill Property Ownership

320. Some of these color choices are difficult to see/differentiate and could be problematic for readers. Revise the figure to include texture fill for clarity.

Figure 3-5: Areas of Landfill Operations:

321. Revise figure 3-5 to incorporate the Buffer Zone into OU1 Area 2 and make this change for all other figures as necessary.

322. Check nomenclature on this figure for consistency with other figures (example: 3-2, 4-19, etc.) and revise as appropriate.

Figure 3-8b: Change in Elevation from 1971 to 1973 — West Lake/Bridgeton Landfill

323. The added elevation line along the perimeter of the south side of the North Quarry appears to be an artifact and in error. Check and correct as appropriate.

Figure 3-8c: Change in Elevation from 1973 to 1974 — West Lake/Bridgeton Landfill

324. The added elevation line along the perimeter of the south side of the North Quarry appears to be an artifact and in error. Check and correct as appropriate.

Figure 4-6: Soil Boring Locations — Area 2

325. Check Figure 4-6 for location identification errors. PVC2* location appears to be incorrect and is listed twice; correct to be PVC 22.

Figure 4-7: Summary of Downhole Gamma Logging Results — Area 1

326. Add the derived background value from the text in Section 4.4.5.1 to the figure's legend.

327. GCPT13-3 lists its count rate a: 4 cps, which is much lower than the other results. Check to see if this is an error and correct as appropriate.

Figure 4-9: Occurrences of Perched Water and Leachate Seepage in Areas 1 and 2 during RI Investigation

328. Review the "perched" water figure and revise per the primary and specific comments on this item.

Figure 4-14: Post-ROD Sediment Sample Locations

329. This figure does not appear to have all of the sediment sampling locations. Update this figure to include all sediment sampling locations.

Figure 4-16: Bridgeton Landfill Stormwater Monitoring Outfall Locations

330. This figure shows outfall 7; however, the legend has not been updated to show the approximate location of outfall 7 as it does for all other locations. Update this figure to include all relevant outfalls.

331. The EPA understands that a new draft Bridgeton NPDES permit is pending from the MDNR. Update the text discussion of this figure to include that a pending permit is anticipated, which may affect the number and location of stormwater outfalls.

Figure 5-4: Site Topography

332. Update this figure to include the former leachate lagoon located to the southwest and any related infrastructure areas as a part of the overall "Site"

Figure 5-6 Missouri River Geomorphic Flood Plain

333. Define the flood plain line on this figure as being either the 100-year or 500-year boundary.

Figure 5-13: Cross Section A — A'

334. Update the figure to reflect potentially fluctuating groundwater conditions at the Site by including a range of groundwater levels as determined by all the available groundwater investigations.

Figure 5-14: Cross Section B — B'

335. See the previous comment and update this figure in a consistent manor.

Figure 5-17: Missouri River Stage

336. Expand the scale of the elevation in this figure in order to depict the range of surface water elevations in the Missouri River.

Figure 5-18: Registered Wells (from Missouri DNR Websites) Within Two-Mile Radius From Site

337. A radius is a circle. The yellow perimeter line is not. Correct text or figure to account for this misstatement.

Figure 5-19: SSR Migration in South Quarry Based on Observed Settlement Areas

338. Include the other North Quarry features (Heat Extraction System, Temperature Monitoring Probes, Gas Extraction Wells, Ethylene Vinyl Alcohol Cover, etc.) on this figure or add another figure to demonstrate current and pending North Quarry actions/ infrastructure.

Figure 6-1: Combined Radium 226+228 in Soil/Waste – Area 1 and 6-3: Combined Thorium 230+232 in Soil/Waste – Area 1

339. Location "2-2 Geoprobe" appears to combine "GP2-2" and "GP 2-3" data sets for radium and thorium based on a comparison of Phase 1 Comprehensive report (3/22/16) Figures 8 and 9. Check this discrepancy and revise if necessary.

340. The "5-3 Sonic" box is missing the original sample concentration value at the 29-30 foot interval of 450.33pCi/g.

341. Add the surface soil samples collected and analyzed per the Surface Fire Prevention UAO to these figures.

Figure 6-2: Combined Radium 226+228 in Soil/Waste - Area 2 and Figure 6-4: Combined Thorium 230+232 in Soil/Waste – Area 2

342. Add the surface soil samples collected and analyzed per the Surface Fire Prevention UAO to these figures.

343. Add the soil samples collected around Area 2 as a part of the 2015 Vicinity Sampling report conducted by the MDNR to these figures.

Figure 6-5: Combined Uranium 234+235+238 in Soil/Waste – Area 1

344. Add the surface soil samples collected and analyzed per the Surface Fire Prevention UAO to these figures.

345. "WL-106A" appears to be missing from this figure. Revise accordingly

346. The data presented for "WL-113" for combined U appears to be different from what is presented in Figure 10 of the Phase 1 Comprehensive (3/22/16). Check this discrepancy and revise this figure as necessary.

Figure 6-6: Combined Uranium 234+235+238 in Soil/Waste — Area 2

347. Discuss in the text section related to this figure how past activities conducted on the Buffer Zone and on Lot 2A may have potentially affected the sample locations and

related data points as shown on this Area 2 figure. Verify that the values provided for this figure (and Figure 6-5) are consistent with the values as provided in the Comprehensive Phase 1 Report.

Figure 6-7: Approximate Extent of RIM — Area 1

348. The extent of RIM "line" is heavier on 6-7 than on 6-8. Check and revise figures to use consistent line weights, as appropriate.

349. Choose a color for the "RI Soil Boring" classification that is more distinctive from the "Presence of RIM" classification.

Figure 6-8: Approximate Extent of RIM — Area 2

350. Discuss in the text section related to this figure how past activities conducted on the Buffer Zone and on Lot 2A may have potentially affected the sample locations and related data points as shown on this Area 2 figure.

351. Check this figure for samples that have been identified as "RI Soil Boring" vs "Presence of RIM." If samples have data that meet the definition of RIM, revise accordingly.

352. Explain why the "Extent of RIM" estimate does not encompass all the boring locations that were positive for RIM (example WL 206, RC 02).

Figure 6-13: Buffer Zone and Crossroad Properties

353. The MDNR sample S09 is shown on this figure, but is not discussed in the text. Other MDNR sample locations are not shown or discussed in the text. Revise the figure and related discussions to include the relevant MDNR sample locations and results.

Figures utilized in section 7

354. Check these figures for wells that may be missing such as S-1 and I-2 in figures 7-3 and 7-4.

Figure 7-2: Well Groups Used for Evaluation of Radium Results

355. Revise this figure to exclude designations of upgradient and/or side gradient for wells.

Figure 7-5 through 7-12: Well Radium Results

356. Add trend line (linear regression) to each of these plots.

Figure 9-1: Potential Exposure Pathways

357. The title of the figure per the tile block is "Site Conceptual Model" which does not match the title as provided on the Table of Contents (TOC). Check and correct the Table of Contents or the title block of Figure 9-1.

358. Delete the "*1" footnote on this figure.

APPENDICES

Appendix D: Soil Sample Analytical Results Summary Tables

359. Soil Tables in this appendix do not indicate whether the tables represent all compounds analyzed for or just detections. If only detections, there should be a table identifying the compounds looked for.

Appendix F-6: Bridgeton Landfill Groundwater Monitoring Results

360. No data or information is included in Appendix F6.

Appendix G-1: OU1 RI Rainwater/Runoff Sample Results

361. The non-radiological tables should state whether they include only detected compounds or all compounds analyzed. Also, the non-radiological sample tables do not include the date they were collected. Since there have been multiple sampling events, the tables should include sample collection date (or analyzed date).

Appendix G-2: OU1 Sediment Sample Results

362. Correct the figure to add sample dates. Without dates, it is not possible to correlate results with specific sampling events.

Appendix M: Cross-Sections

363. Discuss boring locations that show over 100 ft. of alluvium in the section that discusses the corresponding investigation.

Appendix N-1: Maps of Radionuclide Monitoring Results

364. Figures in Appendix N are mislabeled; Figure N-1 should be Figure N-1.1.

Appendix N-2: Tabular Comparison of Radium Results From Pre-RI/FS, RI/FS and 2012-13 Samples

365. PZ 101 data does not appear to be included in the comparison set. Include a summary of all relevant wells or discuss why some wells are not included on the comparison tables.

Appendix O: Upper Confidence Limits of the Mean (UCLs) for Areas 1 and 2

366. The EPA will provide comments to Appendix O in a separate comment letter.