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

SEP 1 1 2019

Mr. Steve Lombardo
Project Coordinator/Manager
Trihydro Corporation
15000 West 6th Avenue, Unit 100
Golden, Colorado 80401

Dear Mr. Lombardo:

The U.S. Environmental Protection Agency has reviewed the June 5, 2019, Draft Remedial Investigation and Feasibility Study, or RI/FS, Work Plan, West Lake Landfill, Operable Unit, or OU, -3. This document was submitted on behalf of the West Lake Landfill Operable Unit-3 Respondents, Cotter Corporation (N.S.L.), Bridgeton Landfill, LLC, and the U.S. Department of Energy, to support the remedial investigation of groundwater for the West Lake Landfill Site, in Bridgeton, Missouri. The EPA is disapproving the document as submitted. Please revise the document in accordance with the enclosed technical comments.

The EPA has coordinated its review of this document with the Missouri Department of Natural Resources, the Kansas City Districts of the U.S. Army Corps of Engineers, and the U.S. Geological Survey. The EPA requests that the Respondents submit a written response to comments no later than October 22, 2019, in preparation for a meeting to discuss them during the week of November 4, 2019. The Respondents shall prepare a revised RI/FS Work Plan for OU-3 that incorporates responses to the EPA's comments and requested changes within 60 days of receipt of this letter, pursuant to paragraph 52.b of the Remedial Investigation/Feasibility Study Administrative Settlement Agreement and Order on Consent, (CERCLA-07-2018-0259).

Additionally, the EPA is currently working with your firm and the OU-3 Respondents regarding the development of appropriate Data Quality Objectives, or DQOs, to support the on-going OU-3 planning efforts, as required by the Remedial Investigation/Feasibility Study Administrative Settlement Agreement and Order on Consent. The EPA anticipates additional coordination on this item with you and would like to schedule a teleconference with your team to further discuss the DQO

process to accelerate the development and finalization of the OU-3 planning submittals. Please contact me directly to schedule this teleconference on the DQO process.

If you have any questions or concerns, please contact me either by phone at (913) 551-7789 or by e-mail at barker.justin@epa.gov

Sincerely,

Susan Tisler for JB

Justin Barker
Remedial Project Manager
Site Remediation Branch
Superfund and Emergency Managment Division

Enclosure

cc: Mr. Ryan Seabaugh, MDNR

Technical comments on Draft Remedial Investigation/Feasibility Study
Work Plan OU-3, dated June 5, 2019

General Comments: Work Plan Volumes 1 and 2

A. General comment on Conceptual Site Model:

The description of the Missouri River alluvial aquifer as presented in the Operable Unit, or OU, -3 work plan is oversimplified and does not properly account for regional groundwater flow in the Site's conceptual site model, or CSM. The conclusions presented regarding general groundwater flow directions in the CSM appear to be based on a relatively small set of water-level data collected at the Site (Figures 3-11, 3-12 and 3-13a) and two previously developed water-level maps (Figure 3-1). Both of these previously developed maps have several limitations that were not included, discussed, or addressed in the work plan that significantly impacts the interpretation of general groundwater flow.

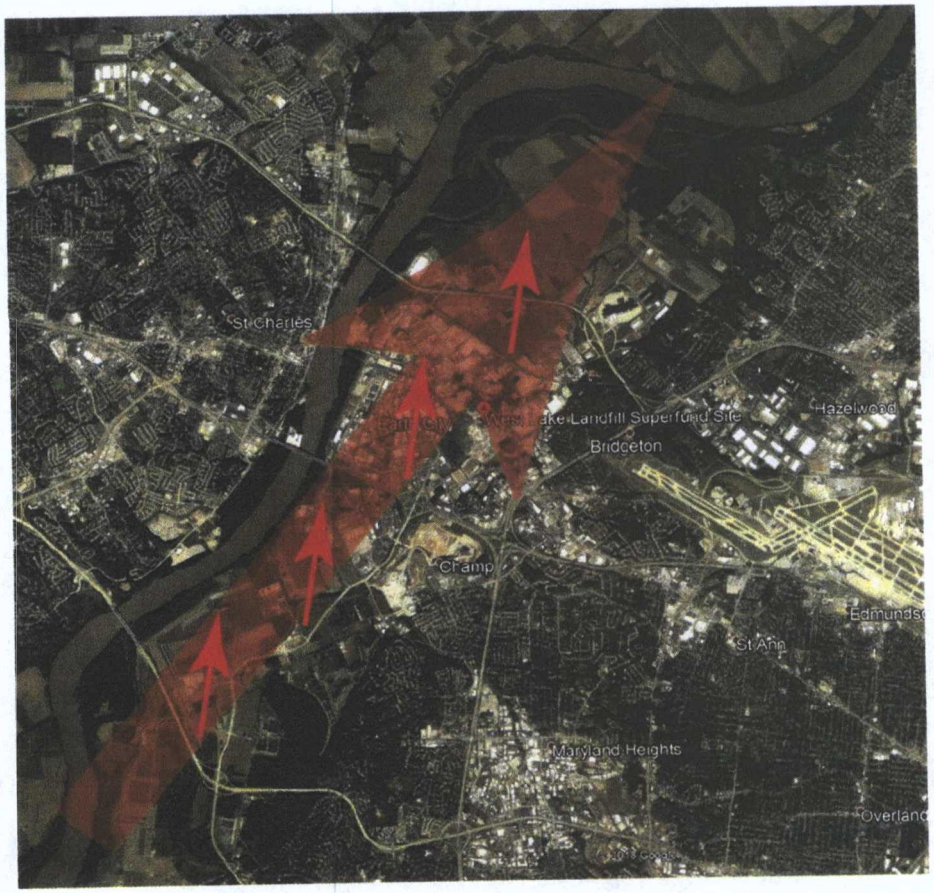
The limitations that exist for the Springfield Plateau aquifer (locally termed post-Maquoketa bedrock aquifer) water-table map (Imes, 1990; presented on fig 3-1) generally include the following items: The water-level map is for pre-development conditions; data points were limited in number and distribution; mapped at a scale of 1:500,000, water-table map does not account for the topography at a local scale;, and water-table map does not account for the increased impervious surface and other anthropogenic modifications of the now highly urbanized area. The limitations that exist for the Missouri River alluvial aquifer water-table map (Burns and McDonnell, 1986; presented in fig 3-1) generally include the following items: no information on date(s) of water-level measurements; no information on the accuracy of the measurements or accuracy of the measuring point elevations; no information on the measurement method; no information on depth of the wells; no information on number or locations of the wells measured; no geohydrologic context of the measurements; no information on the precipitation events prior to the measurements; no information on the Missouri River stage/flow conditions prior to and during the measurements; no information on groundwater withdrawals near the wells prior to and during the measurements; and no mention of the transitory nature of the water-levels in the Missouri River alluvial aquifer and the time scale at which changes occur.

Further the water-level contours as shown near the Missouri River in Figure 3-1 in the alluvium do not represent 'normal' groundwater flow conditions in this area. The presented contours have an orientation that indicates little to no flow down the river valley which is contrary to the generally accepted view of groundwater flow in all alluvial valleys. The EPA notes that the contours presented in the Work Plan could potentially have this orientation temporarily following a relatively lengthy period of low Missouri River stage when the alluvial aquifer is equilibrating with the river stage, and/or after a significant recharge event, and/or when water-levels are equilibrating to the 'normal' river stage from a sustained high flow event in the Missouri River. However, using the limited set of water-level measurements and derived contours without considering the overall state of the transient groundwater flow system and the limitations in the previously developed maps (see below) leads to the misinterpretation and oversimplification of the alluvial groundwater system as currently presented in the draft OU-3 RIFS Work Plan. Based on these concerns, EPA requires the work plan be revised generally as follows:

- Indicate where appropriate that the 'normal' or quasi-steady state flow direction in the alluvium is primarily down the Missouri River alluvial valley with a subcomponent of flow towards the Missouri River. This flow condition assumes long-term stable river stage, no recent precipitation events, and no well withdrawals.
- Based upon this information, propose new upgradient and downgradient sampling/well locations to validate/refute the concept that regional flow in the alluvium is primarily down the Missouri River alluvial valley and not directly towards the Missouri River.
- Revise Section 6.2.1 of the work plan to state that a groundwater model work plan will be developed and submitted to the EPA and the MDNR that accommodates the concept of groundwater flow

discussed in this comment, i.e. alluvium groundwater flow is primarily down the Missouri River alluvial valley.

- Propose sampling and water-level data collection frequency in groundwater and surface water to account for transitory nature of alluvial system on timescale of hours/days for river stage fluctuations or precipitation events to months/years or longer for long-term items such as geo-morphic and climactic changes in the system.
- Update Figure 3-1 to depict regional groundwater flow generally consistent with the figure included below. The red arrows indicate anticipated flow direction.



B. General Comment on Groundwater Modeling discussion:

Groundwater modeling is needed to support the understanding of the Fate & Transport, or F&T mechanisms and potential future risks related to the site-specific contaminates and to refine and update the CSM. Because of the hydrogeologic complexity of the area and the time scales of concern in F&T, an appropriate model capable of simultaneous simulation of groundwater flow through various time scales in three dimensions is required to better understand and predict the fate of contaminates and to support evaluations of potential future risk. The model domain should encompass enough area around the Site such that the model boundary conditions will not adversely limit or affect the model results. Natural groundwater flow boundaries are to be used within the model domain to constrain and help simplify the model where possible. Thus, Section 6.2.1 of OU-3 RIFS work plan should be revised as follows:

- Include the list of potential questions that the groundwater model is intended to answer.
- State the need for an appropriate model capable of simultaneous simulation of groundwater flow through various time scales in three dimensions that is capable of answering the questions to be listed in item 1 above.

- Indicate that the groundwater model will use natural groundwater flow boundaries within the model domain to constrain and simplify the model where possible and that the model domain will encompass enough area around the Site such that the model boundary conditions will not adversely affect the model results at and near the Site.
- Modify the RI/FS study area to include the proposed model domain or revise the work plan to indicate and show the proposed model domain in relation to primary field investigation area.
- Include the search for existing hydrologic data within an area at least encompassing the proposed groundwater model domain and to include new data collection within the groundwater model domain area at locations distributed appropriately to characterize the spatial and temporal distribution of groundwater levels, aquifer properties and other hydrologic data, and where appropriate, groundwater quality, to the extent possible within the model domain.
- Include plans to collect any geohydrologic data necessary to construct and calibrate the groundwater model, and to ensure that the data is collected at the appropriate time and of sufficient quality to be useful in the groundwater model.
- Figures 3-11, 3-12, 3-13a, and 3-14a must be modified as appropriate to be consistent with the input provided in this comment.

C. General Comment on the Fate and Transport of COPCs

The extent of contradictory and vague statements in the Work Plan regarding F&T modeling make it impossible to determined how contaminant fate and transport will be addressed. It is unclear to the EPA how or even if fate and transport modeling of contaminants of concern, or COCs, will be done, and especially when. Further, a general weakness in the RI work plan is the lack of clearly defined objectives for F&T modeling and how this relates to the pending groundwater modeling plan discussed in Section 9.3. These two work elements (RI and Modeling) and associated supporting work plans are interrelated and not isolated efforts. Given the future ingrowth of radium, or Ra, in the radiologically impacted materials, or RIM, at the site, the presence of landfill leachate at the site boundary in several locations, and the noted associated increased of Ra in groundwater with landfill leachate effects, a primary objective of groundwater/F&T modeling is to create a tool used for predicting where groundwater at the site and associated COCs will flow offsite in 3-D space over appropriate time scales and at what rate(s). Thus, the OU-3 Workplan should be revised as follows:

- Clearly state the specific question(s) to be addressed by the groundwater/F&T modeling and indicate how specific data collection efforts will be used to support such.
- Clearly identify and define the modeling objectives and questions to be answered and how they will guide RI data collection efforts.
- Provide a summary of the work to be performed to evaluate the solid phase samples of aquifer materials for phase associations of COCs, such as radionuclides. Revise or remove the statements contrary to this information as found on page 5-13, and elsewhere in the submittal.

D. <u>General Comment on Survey Datum</u>

To combine or compare site and regional land and water elevations from diverse sources, they must be referenced to the same survey datum in a common framework. The work plan appears to acknowledge this fact. Section 3.1.5.3 of the work plan states: *"Measuring point elevations and groundwater elevations were converted to NAVD88 based on the conversion in the RIA [Remedial Investigation Addendum] and are included in Appendix M."* However, Appendix M contains neither the converted data nor information on the conversion process (*e.g.*, difference, error). Only the raw data are provided in Appendix M, and the potentiometric surface maps associated with the data, provided in Appendix N, are historical figures developed prior to the OU-1 Remedial Investigation Addendum, or RIA. Similarly, various survey datum units are provided on Table 3-1 and in accompanying text in Section 3.1.4.

Also, consideration of sources of error, such as original data collection processes and the interpolation process, is not apparent in the RI work plan, and neither the RI work plan nor the associated Quality Assurance Project Plan, or QAPP, appears to have accuracy requirements for geospatial data based on project data quality objectives, or DQOs. Thus, the OU-3 Workplan should be revised as follows:

- Develop a geospatial data QAPP section, consistent with the EPA's "Guidance for Geospatial Data Quality Assurance Project Plans" (EPA QA/G-5G, March 2003) and "National Geospatial Data Policy" (CIO 05-002, 2008), for the collection and management of new and existing geospatial data. Establish quality measures, such as accuracy, in the context of project DQOs.
- Geospatial data should reference the same survey datum in a common framework. Detail any corrections applied, and the error (from all sources) associated with the converted data. Incorporate best practices, as appropriate, from the following references:

  i. Archuleta, C.M., Constance, E.W., Arundel, S.T., Lowe, A.J., Mantey, K.S., and Phillips, L.A., 2017, The National Map seamless digital elevation model specifications: U.S. Geological Survey Techniques and Methods, book 11, chap. B9, 39 p., https://pubs.er.usgs.gov/publication/tm11B9

  ii. Rydlund, P.H., Jr., and Densmore, B.K., 2012, Methods of practice and guidelines for using survey-grade global navigation satellite systems (GNSS) to establish vertical datum in the United States Geological Survey: U.S. Geological Survey Techniques and Methods, book 11, chap. D1, 102 p. with appendixes. https://pubs.usgs.gov/tm/11d1/

  iii. USACE. 2010. Standards and Procedures for Referencing Project Elevation Grades to Nationwide Vertical Datums https://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-6056.pdf

E. General Comment on OU-3 Study Area Boundaries

In general, the proposed boundaries of the OU-3 study area appear too narrowly defined for some objectives/purposes of the RI/FS per the OU-3 SOW. The OU-3 Workplan should be revised as follows:

- The lateral boundary is too narrow to evaluate the "temporal and spatial water elevation effects from nearby surface water features (Missouri River) and storm events," data gap identified the AOC SOW (Section III, p.2). Notably the USGS St. Charles Missouri River Gauge (0693596), which is proposed as a monitoring location on Table 5-2, is outside of the preliminary OU-3 study area. Revise the work plan such that the preliminary boundary of the OU-3 study area extends to the Missouri River, to include the USGS St. Charles Missouri River Gauge (0693596).
- The vertical boundary is too narrow to "document the nature and extent of releases of any hazardous substance from the Site in groundwater," which is a primary objective of the OU-3 RI/FS. Notably, the vertical study boundary does not extend below the Salem Formation. Revise the work plan such that the preliminary vertical boundary includes the Keokuk Limestone.
- The study boundaries do not appear to extend far enough to support the development of a groundwater model that adequately reflects aquifer hydrogeology. Because a Groundwater Modeling Plan defining model boundaries and boundary conditions will be submitted later, revise the work plan to either 1) expand the OU-3 study area to include the groundwater model boundaries (e.g., significant hydraulic conductivity changes, groundwater divides, surface water bodies), or 2) clarify why and how the groundwater model boundaries are expected to differ from the OU-3 study boundaries.
- The lateral boundary appears to exclude numerous historical data points that contribute to understanding of "background groundwater quality of aquifers located at and near the site" (AOC SOW, Section III, p.2). See Figure 5-4. Revise the work plan to either 1) expand the OU-3 study area to include these historical sampling

locations and their associated data, or 2) clarify the extent to which these historical sampling locations and their associated data will be considered during the Phase I investigation.

- The temporal boundary (data collected since 1976) appears to exclude numerous historical data points that contribute to understanding of the conceptual model. For example, the discussion of regional surface water resources and quality in Section 3.1.2.4 draws on chemical and physical data collected from the Missouri River from 1951 to 1970. Revise the work plan to either 1) expand the temporal boundary of the OU-3 study to include these historical data, and/or 2) clarify the extent to which data collected prior to 1976 will be considered during the Phase I investigation.
- Update figure 3-15 to be consistent with the revisions required in this comment to address the EPA's concerns associated with the OU-3 site boundary.

F. General Comment on RIFS Schedule

The schedule summary as presented in Section 10.3 is inadequate and does not meet the requirements of the OU-3 Scope of Work (SOW), as described in Task 1 of the SOW. Revise the OU-3 RIFS Work Plan to provide a schedule for the tasks, sub-tasks, and field activities to be completed in the RI with due dates for the deliverables (draft, interim, and final) for review, as required in the SOW. The EPA requires that the submitted schedule provides sufficient detail to allow for an understanding of the timeframes and general sequencing associated with each work element defined in the SOW.

G. General Comment on Coordination with Pending OU-1 or OU-2 RD/RA Work

The draft OU-3 RIFS Work Plan does not appear to properly take into consideration the pending OU-1 and/or OU-2 Remedial Design and Remedial Action, or RD/RA, work at the Site. The groundwater investigation for OU-3 is intended to support and help inform, to the extent possible, the RD/RA process at the other OUs.

Revise the OU-3 RIFS work plan to generally discuss how the OU-3 RI work will be coordinated with the RD/RA work at the other operable units and further how the groundwater data and other related information gathered from the OU-3 investigation is anticipated be used to support the RD/RA efforts at the other OUs. Additionally, the EPA anticipates that the groundwater monitoring wells located in and at the perimeter of the site will likely be affected by pending RA work and some wells may be destroyed due to the pending intrusive work associated with work at the other OUs. Revise the work plan to discuss the potential impacts to groundwater that could occur from intrusive work activities conducted at the other OUs during RD/RA, and how the OU-3 investigation will account for these impacts, including for the replacement of monitoring wells removed from the monitoring well network.

H. **General Comment on the Data Quality Objectives Planning Process**

Overall, Volume 1 of the Work Plan document does not clearly tie into data quality needs or the accompanying Volume 2 (FSP/QAPP). Earlier sections of the work plan do not provide a clear basis or direction for later sections of the plan or accompanying documents, and later sections of the work plan do not have sufficient detail to evaluate whether the field sampling plan, or FSP, and QAPP can provide sufficient data quality and investigative information to proceed past "Phase 1". Further, the draft QAPP is exceedingly generic and unacceptable in the current form. Specifically, the Work Plan and associated QAPP lacks the full development of project-specific DQOs by application of the DQO Planning Process (EOA QA/G-4). Lack of project-specific DQOs contributes to absence of connectivity between the Work Plan documents (Volumes 1, 2A, and 2B). The EPA requires the development of project-specific DQOs by application of the DQO Planning Process, and documentation of the DQO planning process in one of the Work Plan volumes, such as the QAPP, that the other planning submittals will reference. Additionally, revise the overall submittal to tie the sections and information together resulting in a cohesive plan to meet SOW requirements and data objectives.

I. General Comment on Laboratory Analysis and Quality Control Criteria Related to Accuracy and Precision

Many of the text sections of the Work Plan, primarily in Volume 2, contain discussions of various laboratory actions, analysis, and related laboratory quality control efforts. Most of these discussions appear to focus on organic/inorganic chemistry procedures, and do not generally appear to apply to radiochemistry. For example, in the OU-3 planning submittals various discussions of "reporting limits" are included in some sections that generally do not appear to apply to radiochemical analysis, and there is no discussion of "critical values" and "measurement uncertainty" which would be anticipated for radiological analyses. Since the OU-3 investigation is envisioned to include extensive radiochemical analysis of various media, the discussions included in the QAPP, FSP, and other applicable Work Plan sections must plan for the anticipated radiochemical analysis and any associated quality control work. Revise the Work Plan to properly include radiochemical analysis considerations, terminology and related requirements and the associated quality control as required in the OU-3 SOW, or appropriately reference this information in the laboratory QA manuals.

Further, the text and tables of the QAPP presents various, analyte-specific and sample-specific quality control criteria related to the accuracy and precision of laboratory analysis; however, the criteria presented do not represent the complete set of quality control criteria applicable to the various laboratory analyses. Additionally, it is not clear if the quality control criteria presented in the text and tables of the QAPP differ from the quality control criteria contained in the attached laboratory Quality Assurance, or QA, Manuals and analytical method Standard Operating Procedures, or SOP. The EPA recommends that the text of the QAPP refer to the quality control criteria specified in the laboratory QA Manuals and analytical method SOPs that are attached to the QAPP and not attempt to restate them or portions of them. If a project-specific quality control criterion is required to meet DQOs and the criterion differs from the criterion specified in the Lab QA Manuals and/or Lab SOPs, then, specify in the QAPP text or tables the project-specific quality control criterion and provide a rationale for the differing criterion.

J. General Comment on Background Water Quality

The draft Work Plan focuses on determining background water quality by providing an additional 60 new samples, to be collected from two alluvial well locations. There is no planning for radionuclide sample collection from the on-site leachate risers (important to assess radionuclide ratios from non-RIM areas), nor is there planning for assessing radionuclide distributions within aquifer materials within the Phase I investigation. The EPA agrees that the statistical calculation provided and discussed in Appendix X (once finalized) will help to produce a data set that can achieve the stated confidence goal. However, the EPA has concerns that the statistical approach in Appendix X does not consider the spatial variability within the aquifer. The EPA disagrees that the two proposed background locations (MW-601 and MW-602, Figure 5-4) are adequate to capture the range of spatial variability within the alluvial aquifer. Rather, a more robust approach to achieve the stated confidence goal is to increase the number of proposed sample locations. Reduce the number of samples per proposed location and maintain the total number of specified samples which will provide a more representative background data set. Thus, the OU-3 Workplan should be revised as follows:

- To address identified data gap and provide sufficient data to assess F&T, samples collected for assessing radionuclide distributions within aquifer materials must be collected during installation of monitoring wells as a specific task conducted in the Phase I portion of the investigation.
- Revise Section 2.4.15 to identify as an additional data gap the absence of data from on-site leachate risers. Further, the rationale and conditions used to determine when to collect individual leachate riser samples, also needs to be specifically described in the Work Plan. Revise Section 5.4.16 (p. 5-20) to indicate that leachate samples from locations within the north-south quarries will be analyzed for radionuclides to

support efforts to determine the origin of radium in groundwater and support evaluation of its fate and transport from the site. Also address this radiological sampling in the FSP.

- Revise Section 5.4.7 (p. 5-14) to indicate the sequential extraction analysis and chemical and mineralogic investigation of aquifer materials will be done on samples collected during installation of selected monitoring wells in Phase I to provide information on naturally occurring radionuclide concentrations and isotopic ratios and their phase associations in aquifer materials and support evaluation of its potential migration from the site.
- Revise the OU-3 RIFS Work Plan to specify that alluvial well clusters will be installed at a minimum of 4 locations south of the site and 3 north of the site. Evaluate whether more cost-effective alternatives to sonic drilling, such as hollow stem auger or direct-push technology, would allow for additional well locations in support of a background data set that captures the range of natural variability in the alluvium in the vicinity of the site to the extent possible.
- Revise the OU-3 RIFS Work Plan to specifically address that during the installation of these wells, and perhaps other proposed monitoring wells in Phase I, aquifer matrix samples will be collected to understand the relation between water quality and geochemistry to aquifer matrix (mineralogy, chemical composition, organic carbon, and phase association of radionuclides and their ratios).

The EPA further notes that historical data distributions from 8 alluvial wells and 3 bedrock wells were applied in statistically determining the number of background samples needed to meet the 95% upper confidence limit. The OU-3 RI work plan provides no explanation as to how the subset of alluvial and bedrock wells was selected, and the EPA notes that none of the alluvial wells used are among those that were identified by the USGS (2015) as having the largest combined Radium concentrations. The list does include a mixture of on-site and former off-site wells south of the site. Additionally, although Table 1 found in Appendix X includes Ra-226, Paragraph 2 in Appendix X makes no mention of Ra-226, only Ra-228 is mentioned. Thus, the OU-3 Workplan should be revised as follows:

Revise the OU-3 RIFS Work Plan (see Section 5.3.5) and Appendix X to include Ra-226 or provide an explanation for its exclusion from the discussion and in the Appendix X calculations.

Revise the OU-3 RIFS Work Plan to explain how the specific wells and historical data were selected for the statistical evaluation in Appendix X.

Revise the OU-3 RIFS Work Plan to resolve or explain the apparent discrepancies in the number of required samples and new background collection points listed in the text in Section 3.5.3, Appendix X, and Figure 5-4. Specifically address the following items:

- Figure 5-4 shows 8 new proposed background bedrock wells (in 4 locations) whereas the text on Page 5-9 and Appendix X mention 6 additional alluvial and 6 additional bedrock locations.
- As noted, Page 5-9 discusses 65 additional alluvial and 59 additional bedrock background samples, whereas Appendix X indicates 48 samples from each aquifer after two years.
- Figure 3-12 depicts a deep alluvial groundwater flow direction toward the southwest. Figure 5-4 depicts proposed background well cluster location MW-603 as southwest of the site. As site COPCs may migrate toward this proposed well cluster location, verify the groundwater flow direction and re-evaluate the well placement as presented on Figure 5-4.

K. General comment on monitoring well placement.

As indicated in Section 5.3.2 and depicted on Figure 3-1, the proposed monitoring well network assumes a groundwater flow direction that is contrary to generally accepted flow within the Missouri River alluvium (see

General Comment # A). In addition, the number of additional wells proposed and the approach to selecting their locations appears inadequate, especially in the alluvial aquifer. Additional on-site/near-site wells (300 and 400 series) will be required in addition to those proposed to establish a sufficient network of monitoring wells in the alluvium around the perimeter of the site as the existing on-site and perimeter wells at several locations currently monitor only the shallow or intermediate alluvium. Thus, the OU-3 Workplan should be revised as follows:

- Include an additional alluvial well cluster (intermediate and deep well) at existing well location MW-103, as this well is only ~6 ft deep and does not assess possible contaminant migration in the deeper more permeable alluvium.
- Revise the plan to state that solid-phase association samples will be collected at multiple depths at this location.
- Include a new intermediate and deep alluvial well at existing well PZ-303-AS, for assessing contaminant migrations in the deeper more permeable alluvium as this well has demonstrated landfill leachate effects in the past. Solid-phase association samples should also be collected at multiple depths at this location.
- Include a new deep alluvial well at existing well PZ-302-AI to assess contaminant migration in the deeper, more permeable alluvium, as this well has had landfill leachate effects in the past.
- Include a new deep and shallow alluvial well at existing well I-65 for verifying the absence of landfill leachate effects and contaminant migrations in the deeper more permeable alluvium and assessing effects in the shallow groundwater. Solid-phase association samples should also be collected at multiple depths this location.
- Include a new deep and shallow alluvial well at existing well I-67 AI to assess contaminant migration in the deeper, more permeable alluvium, as this well has had landfill leachate effects in the past.
- Include a new shallow and deep alluvial well at existing well I-68 unless the existing well is at the base of the alluvium because I-68 has demonstrated landfill leachate effects in the past. Solid-phase association samples should also be collected at multiple depths at this location. If I-68 monitors the base of the alluvium, then an additional deep well is not necessary.
- Regarding the proposed 400 Series Wells, the EPA notes that existing well D-6 and the existing well cluster containing D-83 likely will be removed/destroyed by the pending OU1 RA activities. Historic data from well D-6 indicates this well has among the largest landfill leachate effects and Radium concentrations detected in alluvial wells at the site. Because the work plan states that the MW-400 cluster is intended, in part, to be a replacement for D-6 it is important that MW-400 be carefully located. Revise the OU-3 RIFS Work Plan to indicate that monitoring well clusters MW-400 and MW-401 will be installed well before the OU-1 RA activities remove D-6, such that at least two rounds of comparison sampling can be completed from this new cluster and from D-6 before its removal.
- Consider the use of DPT technology along a transect beginning about 200-300 ft south of current proposed MW-400 location to about 300 ft north of the proposed MW-400 location using DPT with temporary screen point samples near the base of the alluvium. If DPT technology is employed, direct-push activities should include downhole tools (e.g., hydraulic profiling), field screening (e.g., chloride, total VOCs), and samples collected for leachate indicators, VOCs, radionuclides and field properties. Then MW-400 should be located as near as practicable to the direct push location with the largest identified radionuclides, VOCs, or leachate indicators to ensure the best continuity with the historical data set from location D-6. Screen placement for MW-400 should consider the higher/highest conductivity zones as identified by the hydraulic profiling efforts.
- If cluster MW-401 is installed at the proposed distance from the site (greater than 125 feet downgradient as depicted on Figure 5-2), an additional alluvial well cluster is needed at the north end of the site between proposed MW-401 and existing well I-65. Revise the OU-3 RIFS Work Plan to include this additional alluvial well cluster or revise text to explain why this well is not needed.

Regarding the proposed 500 series wells, the EPA notes that according to the draft OU-3 RIFS work plan, the three proposed 500 series well clusters are intended to be placed downgradient of the site, and far enough to be beyond an estimated 50-year lateral travel time. This assumes that the CSM provides an accurate direction of groundwater flow, which is questionable at this point in time (see General Comment A). In addition, the EPA questions the use of a simplistic arithmetic estimate for travel time that is based on an assumed homogenous condition within the alluvium and an "average groundwater velocity" that is likely an oversimplification of the actual flow system. Thus, the OU-3 Workplan should be revised as follows:

- Include a discussion of the items noted in this comment and include specific decision points for determining specific monitoring well locations (after revision of the CSM per General Comment A above).
    - The locations of the currently proposed, and any additional proposed, 500 series wells should reflect more traditional groundwater flow as anticipated in this alluvial aquifer.
    - Include at least three additional 500 series alluvial well clusters located in a general clockwise direction from the proposed MW-502 location generally going towards the east.
    - Move all 500 series well clusters generally closer to the site based on field-verified groundwater flow direction and velocity data for the alluvial aquifer.
    - Acknowledge that if site impacts are (or are not) detected in any of the 500 series wells, then additional wells will need to be located further out (or in, respectively) from the site.

Section 5.4.5 and the FSP indicate sonic drilling will be used for installation of all monitoring wells and there is only one mention of direct push technology for sampling in the work plan (Section 10.3) and FSP. The EPA notes that sonic drilling is 1) a relatively higher cost drilling method, 2) may heat soil cores such that volatile substances/contaminates are vaporized or partially vaporized impacting results, and 3) may disturb the soil cores such that fine sediment and other soil structures are amalgamized and/or altered. Further, the SOP attached to the FSP on monitoring well installation procedures appears to conflict with the selected sonic drilling method stating, "Direct-push drilling is the preferred technique for subsurface sampling because it minimizes the generation of soil cuttings and the introduction of foreign fluids into the probe-hole. Direct-push techniques are also known to cause less disturbance to the natural formations." Thus, the OU-3 Workplan (and FSP as applicable) should be revised as follows:

- Discuss other potential drilling options, as applicable for the fieldwork proposed, especially in the alluvial aquifer as several techniques, including direct push, may prove to be more efficient and allow for easier access to smaller parcels or otherwise restricted areas.
- Consider and discuss the general pros and cons of the potential/proposed drilling methods, along with any available precautionary measures, such as those mentioned for sonic drilling.
- Provide specific SOPs that that reflect the actual investigation methods described in the work plan and FSP.

L. <u>General comment on Preliminary ARARs</u>

Although preliminary ARARs are discussed in Section 3.5 as well as Table 3-6, Table 3-7, and Table 3-8, please note that throughout the RIFS process the EPA will provide additional direction regarding the development of ARARs and will request the MDNR to identify state ARARs in the future, as the RI progresses.

M. Nomenclature

Utilize the following nomenclature throughout the document to reduce confusion: "Inactive Sanitary Landfill", "Closed Demolition Landfill", and "Former Active Sanitary Landfill" or "Bridgeton Landfill".

<u>END OF GENERAL COMMENTS</u>

COMMENTS: OU-3 RI/FS Work Plan - Volumes 1.

1. **Section 1.0, Page 1-1, Paragraph 2, Last sentence**. Revise to add the words "*and associated with*" after the word "*beneath*" in the last sentence.

2. **Section 1.1, Page 1-2, Paragraph 2, Last sentence**. Revise the terminology from "*Constituents of concern or COCs*" as used in this sentence to use the correct term "*Constituents of Potential Concern or COPCs*". Check document and revise globally, where applicable.

3. **Section 1.2. Page 1-3, 4th bullet.** Revise to add the following at the end of this bullet/sentence, "*...and the environment.*"

4. **Section 2.2, Page 2-2, and Figures.** To support the CSM in Section 3.0 and work plan rationale in Section 4.0, an accompanying figure should be provided showing the type and extent of the various cap and cover materials in place at the site (*e.g.*, inert fill, non-combustible cover), as well as the anticipated extent of cover planned under the OU-1 remedial action.

5. **Section 2.2. Page 2-3.** Replace "*permitted*" with "*authorized by the county*", in the statement, "*The landfill was not officially permitted for use as a sanitary landfill until 1952.*" as the term "*permitted*" could be confusing to the reader.

6. **Section 2.2.1. Page 2-4.** The paragraph beginning with, "*In 1974, MDNR identified six waste disposal areas...*" is unclear as to whether it is referring to OU-1 radiological Areas 1 and 2 or to areas 1 and 2 of Solid Waste Permit No. 218903. If referring to Permit Number 218903, areas 2 and 4 were denied a permit and areas 1, 3, 5, and 6 were permitted. Revise to clarify the statement such that the "area" designations can be more clearly understood. Also see General Comment M.

7. **Section 2.2.2. Page 2-5**. Remove the sentence, "Pursuant to a Materials Management Plan (EMSI, 2006) approved by MDNR, inert fill material (e.g., clean materials as defined in 10 CSR 80-2.010(11), such as uncontaminated soil, concrete, asphaltic concrete, brick, or inert solids) was placed over portions of Area 1 between 2006 and 2008." since the relevance of the statement to OU-3 is not apparent or stated.

8. **Section 2.2.2, Page 2-5, Paragraph 2, Sentences 2 and 3.** The text indicates that an abandoned underground diesel tank is located beneath the asphalt-paved area. Because chlorinated hydrocarbons have been detected in Site groundwater, additional information is requested to support the CSM in Section 3.0 and work plan rationale in Section 4.0. Indicate whether the tank was properly abandoned, including whether fluids were extracted or released from the tank and whether the tank was filled with concrete or sand.

9. **Section 2.2.2, Page 2-5, Paragraph 3, Sentence 3.** The text indicates that drainage structures were present on the northwestern and northeastern sides of Area 1. To support the CSM in Section 3.0 and work plan rationale in Section 4.0, briefly describe the drainage structures and/or provide a figure indicating their configurations and locations.

10. **Section 2.2.4, Page 2-7, Paragraph 1, and Section 2.2.5, Page 2-8, Paragraph 1.** Section 2.2.4 indicates potential industrial waste disposal in the Inactive Sanitary Landfill, and this section states: "*Some industrial wastes may also have been disposed in this area, but based on the visual inspection and geologic logging of drill cuttings and core samples, industrial wastes do not appear to have been a major portion of the wastes disposed in the Inactive Sanitary Landfill.*", and Section 2.2.5 indicates commercial waste disposal in the Bridgeton Landfill. A

principal objective of the RI/FS per the AOC SOW is to determine the "nature and extent of any hazardous substance from the site impacting groundwater" (Section III, p.2). To support the identification of site chemicals of potential concern and associated analyses, it would be supportive to clearly indicate the types of industrial and commercial wastes identified in drill cuttings, core samples, or records review. Revise section to cite the specific source(s) of information (boring logs) used to support these statements and include additional details on the number, depths and locations of all borings and/or cuttings that were visually inspected in an appendix of the OU-3 RIFS Work Plan.

11. **Section 2.2.4. Page 2-7.** This section states: *"Based on prior reports and the results of drilling and sampling, only C&D debris and wastes are expected to have been disposed of in the Closed Demolition Landfill."* Revise section to cite the specific reports confirming only C&D debris and wastes are present in the Closed Demolition Landfill.

12. **Section 2.2.4. Page 2-7.** Correct this section to properly identify that Areas 1 and 5 of Permit No. 218903 were permitted for demolition waste.

13. **Section 2.2.4. Page 2-8.** The third paragraph describes review of aerial photographic analysis but does not provide a citation or reference. When providing interpretations based on aerial photographs, refer to Appendix A, October 1989 and 1991 Aerial Photographic Analysis or other appropriate reference.

14. **Section 2.2.5. Page 2-8.** This section states: *"A subsurface reaction (SSR) began in 2010..."* If evidence is not available definitively supporting the timing of the start of the reaction, revise to replace the word "*began*" with "*discovered*" or similar description.

15. **Section 2.2.6., Page 2-10**. Revise section to specifically clarify who made the interpretation that the presence of radionuclides on these properties is the result of historical erosion of impacted soil from Area 2 and add citation(s) to supporting documentation.

16. **Section 2.3. Page 2-11**. Revise this section to clarify how the statements regarding risk of bird strikes are relevant to the OU-3 groundwater investigation or delete them.

17. **Section 2.4, Page 2-12.** In accordance with the AOC SOW, when applicable the RI/FS "*shall build on existing information to fill data gaps from previous site work*" (Section III, p.2). As such, the discussion of historical investigations in Section 2.4 should identify the data gaps and data limitations associated with each investigation. Further, the work plan should be revised to clarify which data gaps must be filled to achieve the RI/FS objectives and how specific Phase I activities will address them.

18. **Section 2.4.1, Page 2-13. Paragraph 1, Sentence 1**. Revise this section to more clearly explain that regional flow in the alluvium is down the Missouri River valley.

19. **Section 2.4.1, Page 2-13. Paragraph 1, Sentence 5**. Low gradient (i) does not necessarily imply low flow rates (Q), but rather only indicates the magnitude of potential for flow in a specific direction. Hydraulic conductivity (K) needs to be known for actual flow rates to be known. There is a reasonable expectation that the hydraulic conductivity (K) is highly variable horizontally and vertically in this small study area. Revise this section to more clearly differentiate between the terminology for flow rates and hydraulic gradients.

20. **Section 2.4.1, Page 2-13. Paragraph 1, Last two sentences.** This paragraph discusses the differing gradients and flow directions between the upper part and lower part of the alluvial aquifer and indicates that there is a difference in 'bulk' hydraulic conductivity between the two parts of the aquifer described here. Revise this

paragraph to include a statement as follows, *"To understand hydraulic conductivity properly for this area, the remedial investigation will take into account both the vertical and horizontal distribution of aquifer properties."*

21. **Section 2.4.2, Page 2-14. Paragraph 1, Sentence 2**. The nature of the limestone (karst, fractured, etc.) does not actually control the direction of flow from the limestone into the alluvium. Head differences dictate the actual direction of flow in the system. Revise this sentence/section to clarify that head differences dictate flow and remove contradictory statements.

22. **Section 2.4.2. Page 2-14.** Delete the words, *"without the proper construction of a soil cap"* from the end of the sentence that begins, *"However, it also identified that..."* as this statement as written is misleading, particularly given the text of Section 5 of the 1989 UMC report.

23. **Section 2.4.4. Page 2-15, Paragraph 3, Last sentence.** Revise sentence to include a citation to the specific document section(s) for the statement regarding geologic mapping.

24. **Section 2.4.6. Page 2-16, Paragraph 3, Sentence 3.** Revise text to explain how groundwater quality data confirms a presumed head gradient or delete this statement in the Work Plan.

25. **Section 2.4.7. Page 2-17, Paragraph 1.** Revise text to include a full citation to the specific document (OU-1 RIA) as discussed in this paragraph.

26. **Section 2.4.8. Page 2-17, Paragraph 4, Sentence 4.** Revise text to explain to which aquifer(s) these water-level fluctuations are referring in this sentence. To provide context for these water-level fluctuations, please describe the period of time these statements are referring to and include how much the Missouri River levels fluctuated during this period and if there were significant precipitation events during that time. Without this context this statement is unsupported and not appropriate.

27. **Section 2.4.8. Page 2-17, Paragraph 4, Sentence 5.** Revise this sentence to explain what the alluvial piezometers showed little response to as described here.

28. **Section 2.4.11. Page 2-19.** Delete the sentence, *"The public comment period was open for over six months in 2006 and reopened for approximately 2 weeks in 2008."* as it is extraneous and not relevant to a groundwater investigation.

29. **Section 2.4.15, Page 2-22, Paragraph 4.** Revise Section 2.4.15 to identify as an additional data gap the absence of samples/data from onsite leachate risers with collection points at various depths in the leachate risers. The USGS study concludes that individual leachate risers in the North and South Quarry areas of the Bridgeton Landfill, and leachate collection points within RIM areas and within landfilled materials between the RIM and underlying alluvium, would support evaluation of differences in radium generated in various intervals within the refuse, and the potential for migration of radiological isotopes from RIM areas compared to radiological isotopes found in leachate collected from non-RIM areas.

30. **Section 2.4.16, Page 2-23.** Section 2.4.16 discusses the quarterly groundwater sampling and monitoring network evaluation presented in the 2016 Groundwater Technical Report. Indicate the conclusions of the detailed review of the data collected from wells within approximately 350 feet of the landfill waste boundary, with emphasis on findings that modify or fill previous data gaps in the CMS (Section 3.0) or that influence the work plan rationale (Section 4.0).

31. **Section 2.4.16, Page 2-23.** Section 2.4.16 incorrectly defines the scope of the 2016 Groundwater Technical Report. Revise the definition of the scope of this report as follows: *"The scope of the report was to evaluate groundwater quality at monitoring wells that are located near the landfill's North and South Quarry but were not being sampled as a part of the facility's detection or assessment monitoring programs and the facility's then current groundwater monitoring well network."*

32. **Section 2.4.18. Page 2-24.** For clarity revise to add *"OU-1"* to the section title/description.

33. **Section 2.4.18 Page 2-24.** This section states: *Further evaluation of the COCs in the BRA indicated: There are no unacceptable LCRs or non-cancer effects to on-property or off-property human receptors under current conditions; For scenarios 1,000 years in the future, LCRs and non-cancer effects to landfill workers that access the surface of the landfill and some off-property receptors exceed regulatory thresholds. The future risks were determined by assuming that the landfill will not have a cover and no remediation will occur."* This section provides only extraneous information that does not support or directly relate to the OU-3 RI/FS process. "Revise to delete this sentence/statement.

34. **Section 2.4.20 2018. Page 2-25:** This section states: *"The EPAs Amended Remedy includes: Groundwater monitoring"* Revise to add the word "performance" after the word "Groundwater".

35. **Section 2.5, Page 2-26.** Groundwater data from more recent MDNR reports is not being incorporated into the development of the RI work plan. Revise table to include summary information on more recent state associated groundwater reports and ensure this data is incorporated into the OU-3 available data set. See comment 132 to Table 2-1 and Table 2-2 for more information.

36. **Section 2.5, Page 2-26.** Section 2.5 indicates that historical investigations were reviewed and mined for data relevant to OU-3 and that the dataset was considered in preparation of the preliminary CSM. Before existing data from a secondary source can be used in a manner that influences project decisions, it must be verified as appropriate and of sufficient quality for its intended use. EPA resources for planning projects that use existing data are at https://www.epa.gov/quality/resources-planning-projects-use-existing-data. Revise this section to cite this guidance and to state the EPA guidance was followed when using/applying historical data for this effort.

37. **Section 3.1.1, Page 3-2, Paragraph 1, Sentence 1.** Elevation of the alluvium near the Site appears to be ~440 ft. Check and revise this sentence as appropriate.

38. **Section 3.1.2.1, Page 3-3, Paragraph 1, Sentence 5.** This sentence is unclear and may have a typographical error. The fluvial alluvium dominates both the Missouri and Mississippi River valleys. Missouri River valley has Missouri River alluvium and Mississippi River valley has Mississippi River alluvium. Check and revise text to clarify this information appropriately.

39. **Section 3.1.2.2, Page 3-3 Paragraph 3, Sentence 3.** Groundwater also potentially enters the alluvium along the entire contact between the bedrock and the base of the alluvium, not just at the margin of the alluvium. Revise this sentence and/or add additional sentences to clarify this information.

40. **Section 3.1.2.2, Page 3-4, Paragraph 2, whole paragraph.** This bedrock potentiometric surface information in this paragraph is from Imes, J.L., 1990, Major geohydrologic units in and adjacent to the Ozark Plateaus province, Missouri, Arkansas, Kansas, and Oklahoma--Springfield Plateau aquifer: U.S. Geological Survey Hydrologic Investigations Atlas HA-711-G, 3 sheets, and the citation is referenced incorrectly on Fig 3-1. The citation also appears to be missing from the references. Revise to include the correct citation and reference.

During EPAs review no data points or elevations were identified on the referenced map. Additionally, EPA reviewers did not find the original map in Appendix N, nor could reviewers find the original reference in a search on-line. Revise Appendix N to include the original map and add the appropriate citation to the text in this section. Further, revise all related information/discussion in the text and Figure 3-1 to be consistent with this comment. See general comment A.

41. **Section 3.1.3, Page 3-6.** Clarify how the geologic principles of sequence stratigraphy and facies models were applied to the characterization of stratigraphic heterogeneity at the site, and how this information will be used to guide the RI/FS work plan rationale (Section 4.0) (e.g., well placement, screened intervals) and remedy selection. EPA resources for applying environmental sequence stratigraphy include "Best Practices for Environmental Site Management: A Practical Guide for Applying Environmental Sequence Stratigraphy to Improve CMSs" (EPA, 2017). Revise section to include a citation to this guidance.

42. **Section 3.1.3.1. Bedrock, Page 3-6.** Revise the statement, *"Bedrock surface elevations are included in Appendix F."* to add *"of the Former Active Sanitary Landfill"* after "elevations".

43. **Section 3.1.3.1.5. Page 3-10.** The available information as discussed in this section appears to suggest the possibility of vertical joints extending into the Warsaw formation. Revise section to provide more detail on features that might affect the CSM and warrant investigation, such as vertical jointing.

44. **Section 3.1.3.1.5. Page 3-10**. Revise to describe in more detail the overall number, sizes, and locations of the cavities discussed in this section. If no details are available, include this item as a data gap for the OU-3 remedial investigation.

45. **Section 3.1.3.2. Page 3-10.** The referenced isopach map has limitations that are not fully detailed or explained in the text. Specifically, this isopach map excludes Area 2 and does not analyze/use more recent borings (newer than 2005). Revise the overall work plan to describe these kinds of data limitations to provide a better understanding of what is missing in the CSM (data gaps) and what will be investigated and ultimately updated during the conductance of the OU-3 Remedial Investigation. Also include what has been done, details on what has not been done and/or what needs to be updated so it can be tied to the work elements as presented in the overall Work Plan.

46. **Section 3.1.3.2.1. Page 3-10.** The location map for the Burns and McDonnell (B&M) Cross Section A-A' in the referenced Appendices is missing. Revise the work plan to include the location map and any additional cross sections from the referenced B&M report to support the discussion found in this section.

47. **Section 3.1.3.2.1. Page 3-10.** This section states: *"Alluvial cross sections and interpretations were updated during preparation of this Work Plan based on EPA guidance on environmental sequence stratigraphy to identify preferential flow and flux pathways."* In order to get a more complete picture of the perimeter profiles at the Site as discussed here, revise section to discuss the eastern and southern boundaries of the site and include a new cross-sectional diagram(s) to support this narrative. If insufficient information is available to add the narrative and/or produce the new cross-sectional diagram(s), indicate this data need in the work plan.

48. **Section 3.1.3.2.1. Page 3-10.** Revise the narrative in this section to specifically reference the well(s) being used to generate the cross sections on the associated location map so the distance(s) between the cross sectional cut(s) and the well(s) can be easily understood and interpreted.

49. **Section 3.1.3.2.4. Page 3-12.** Revise this section to specifically explain how the OU-2 BSLF was "well characterized" in the OU1 Remedial Investigation or delete the statement, *"Solid waste was well characterized in the OU-1 RIA and primarily..."*.

50. **Section 3.1.3.2.4. Page 3-12.** The Inactive Sanitary Landfill has pre-state (MDNR) regulated portions and post-state regulated portions. Revise this section to clearly indicate whether the entire landfill is lined or limited to specific sections/permits and cite supporting documentation of the liner if it is under the entire Inactive Sanitary Landfill.

51. **Section 3.1.4. Page 3-13, last paragraph.** The statement *"Beyond the covered Bridgeton Landfill, the only water available to leach through refuse is precipitation."* is unclear. Either delete this statement or revise to consider that groundwater in the area and directly beneath the site may be "available", depending on fluctuations in the water table that may reach refuse.

52. **Section 3.1.4. Page 3-13.** Revise this section to generally explain how the estimate of 34 inches of precipitation annually was made. (Note: Other portions of the work plan describe 40 inches average annual precipitation in the area.)

53. **Section 3.1.5. Page 3-14:** EPA believes that the statement, *"(up to 60 feet thick based on logging at nearby private well 005322, located approximately one mile southwest of the site)"* is not correct. Review this statement and revise for accuracy.

54. **Section 3.1.5.1, Paragraph 3, Sentence 4.** The third paragraph of Section 3.1.5.1 discusses vertical gradients between wells screened in the shallow, intermediate, and deep zones within the alluvium at the site. To better evaluate the findings of this paragraph, revise text to indicate which wells are nested rather than clustered at the site, and/or include a reference where this information is provided elsewhere (*e.g.*, FSP tables).

55. **Section 3.1.5.2.2, Page 3-18.** The text indicates the geometric means of packer tests are slightly higher than slug tests conducted for the same formation. Based on the values provided, this is the case for the St. Louis and Keokuk Limestones but not the Salem Limestone. Review and revise text to resolve this discrepancy.

56. **Section 3.1.5.2.3, Page 3-18.** The text indicates the triaxial permeability test for the rock cores from the Warsaw Formation yielded a mean vertical permeability of 10-7 ft/day suggesting it acts as a confining aquitard. The packer test results for the same formation indicate a hydraulic conductivity of 10-3 ft/day. Revise the text to describe the relationship between K and permeability and indicate what, if any, variability in interpretation these results present.

57. **Section 3.1.5.3.2. Page 3-1.** Revise this section to provide/cite the location or station used to support the statement *"The average Missouri river stage is approximately 430 feet msl (2000 to present), and depending on the year and season, the river stage can fluctuate by as much as 10 vertical feet."*

58. **Section 3.1.5.3.2. Page 3-20.** The only statement in the section that describes specific planned work for the RI is *"Therefore, monthly water level gauging will be conducted during implementation of this RI/FS."* Revise to move discussion of specific plans to Section 5.

59. **Section 3.1.5.7.2, Page 3-23, Paragraph 2, Sentence 3.** The text indicates a groundwater divide was created in the alluvium due to the pumps in the sumps. The prior paragraph indicates that during heavy pumping, the groundwater divide moves to the west but does not extend into the alluvium due to the large contrast in hydraulic conductivity. Review and revise this section to account for the apparent contrast in position.

60. **Section 3.1.7.1, Page 3-27.** Section 3.1.7.1 indicates that a partial inventory of potable and production water wells was completed during project planning and a full inventory of existing and abandoned wells within 2 miles of the Site will be conducted during this RI/FS. However, the details regarding the process for conducting the inventory are not clear, and no associated field survey discussion is provided in Section 5. Revise this section to include more information on the details for this well inventory including the objectives of the work.

61. **Section 3.1.7.1. Page 3-27.** This section discusses potential ecological and human receptors. There may be additional potential receptors to consider that are not discussed in this section depending on the conclusions drawn from future RI evaluations. For example, the updated Baseline Risk Assessment (BLRA) for OU-1 dated January 22, 2018 includes future off-property receptors such as farmers. Revise this section to include a statement that additional receptors may be considered throughout the RI process if data indicates that an exposure pathway is currently complete or could reasonably be anticipated in future. Also, include a discussion of aquatic receptors that could potentially be exposed to site-related contamination via a groundwater-to-surface water exposure pathway.

62. **Section 3.2, Page 3-28, Paragraph 1, Sentence 1.** The site/investigation boundary as described here and on Figure 3-15 is much too close to the site. Revise this section and the related figure to expand the investigation boundary significantly up/downstream of the site (a distance that will allow boundary effects of modeling to be minimized at the site) and to natural hydrologic boundaries (such as drainage divides on the uplands both North and South outside of the alluvium). Also see General Comment D on site boundary.

63. **Section 3.2, Page 3-28; Figure 3-15; and Section 4.1.1.4, Page 4-4.** Sections 3.2 and 4.1.1.4 and Figure 3-15 define the boundaries of the study too narrowly for some purposes of the RI/FS per the AOC SOW. Examples follow. Expansion and clarification of the study boundaries are warranted.
    - The lateral boundaries of the study do not extend far enough to evaluate the "temporal and spatial water elevation effects from nearby surface water features," a data gap identified in the AOC SOW (Section III, p.2). The lateral study boundary should be expanded to include the Missouri River and other surface water features with the potential to influence site groundwater.
    - The study boundaries are too narrow to "*document the nature and extent of releases of any hazardous substance from the Site in groundwater,*" which is a primary objective of the OU-3 RI/FS per the AOC SOW (Section III, p.2). Notably, the vertical boundaries of the study do not extend below the Salem Formation. Volatile organic compounds have been identified in the underlying Keokuk Limestone (well PZ-104-KS), and as noted in correspondence from the MDNR's Solid Waste Management Program on December 14, 2018, additional investigation is needed to determine the extent of this contamination and whether well integrity issues or other pathways are allowing contamination to migrate below the Warsaw Formation. The vertical study boundary should be expanded to include the Keokuk Limestone and deeper units as necessary to delineate the vertical extent of contamination.
    - The study boundaries are too narrow to develop a groundwater model that adequately reflects site hydrogeology. The AOC SOW (Section III, p.2) requires predictive models to evaluate potential future impacts. Within reason, model boundaries should encompass the natural physical and hydraulic boundaries (e.g., significant hydraulic conductivity changes, groundwater divides, surface water bodies) in the site vicinity.

64. **Section 3, Figure 3-14 Set.** On the Figure 3-14 base map, an abandoned well at the southwest corner of Area 2 does not have a color indicating its screened or open interval. Similarly, an intermediate alluvial well (yellow) along the northwest side of Area 2 does not have a status marker (*e.g.*, active, inactive, abandoned). These missing well characteristics should be added to the Figure 3-14 base map, or clarification should be provided in a note. Revise Figure 3-14 consistent to address these comments.

65. **Section 3.4, Page 3-29.** In addition to identifying data needs for evaluation of remedial alternatives, revise this section to address identification of specific data needs for conducting the human health and ecological risk assessments. Discussions with the remedial project manager, the EPA human health and ecological risk assessor(s), and the PRP risk assessor(s) will be necessary to identify data gaps and ensure adequate data will be collected to meet the data needs for conducting the risk assessments.

66. **Section 3.4. Page 3-29. Section 3.4. Page 3-29.** This section discusses data needs for the evaluation of remedial alternatives. In areas where groundwater may discharge to surface water, sampling and analysis of sediment and sediment pore water needs to be included as potential data needs. Revise the document to include a statement that additional data needs and sampling media may be identified throughout the RI process if data indicates that a particular media or organism could be impacted.

67. **Section 3.5, Page 3-30.** See General Comment L. Revise section accordingly.

68. **Section 3.5, Page 3-30.** Revise the sentence that begins with "*Since OU-3 consists...*" as follows: "*Since OU-3 consists of the groundwater at or surrounding the West Lake Landfill Site which includes OU-1 and OU-2, the previously identified ARARs were utilized as a starting point for identifying OU-3 ARARs.*

~~69.~~ **Section 3.5, Page 3-30.** Refer to General Comment L

70. **Section 4.1, Page 4-1**. Revise this section to include more details on each of the steps through the entire process. Missing information includes what to do with data after it is collected, such as reporting out the data and associated validated results.

71. **Section 4.1.1, Page 4-2.** This section and associated subsections describe current data gaps in general terms, and general types of data to be obtained; however, adequately developed DQOs do not appear. DQOs should be developed to the extent necessary to support a well-defined SAP that answers principal study questions. The OU-3 planning submittal should be revised to follow the systematic DQO planning process described in EPA's *Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4)* (EPA/240/B-06/001, February 2006), and as described in Appendix B to the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) (EPA 402-B-04-001A, July 2004). As noted in Section B.3.2 of MARPLAP, multiple decisions (or estimations) may be required to resolve complex problems, and sequencing of these decisions may be necessary. The draft Work Plan currently presents DQO elements of multiple problem statements/goals; however, these elements should be organized and presented to clearly show relationships between individual problem statements/goals (Steps 1 and 2) and their associated inputs (Step 3), study boundaries (Step 4), decisions rules (Step 5), decision errors (Step 6), and sampling plans (Step 7). Also, see General Comment G.

72. **Section 4.1.1.1, Page 4-2, Paragraph 1, Bullet 5**. Section 4.1.1.1 identifies as a data gap: "*Occurrence and extent of groundwater contamination and landfill gas migration.*" However, the planning documents include no approach to sample landfill gas or evaluate its migration and interaction with groundwater or overlying buildings. Revise the workplan to address this data gap.

73. **Section 4.1.1.1, Page 4-2, Paragraph 3, Sentence 1.** A list of preliminary COCs or preliminary COPCs does not appear in the Work Plan. For the purposes of developing a preliminary CSM and DQOs, a preliminary list of COCs or COPCs should be developed and/or specific data gaps related to identification of COCs or COPCs should be discussed. In addition, clarify the categorical inclusion of "*trace metals*" and "*trace anions*" as COCs/COPCs.

74. **Section 4.1.1.3 Page 4-4. Bullet lists.** The bulleted list includes the use of MCLs for decision making purposes, but additional inputs will likely be identified as the site specific DQO's are developed. For radiological work, EPA asserts that additional items such as action level(s), uncertainty, minimum detectable concentration (MDC) and minimum quantifiable concentration (MQC) may also be used for decision making purposes. Revise the list of inputs as needed to support the DQO's (once fully developed).

75. **Section 4.1.1.4. Page 4-4.** Since portions of the Site reach the Warsaw Formation and vertical joints reaching the Warsaw have been documented, the OU-3 RI should at a minimum include investigation of the Warsaw Formation for preferential pathways, plume delineation, and to support modeling accuracy.

76. **Section 4.1.2., Page 4-4.** This section states: *"Groundwater-surface water interactions will be considered complete if horizontal and vertical hydraulic gradients are characterized near surface water bodies."* The meaning of this statement is unclear. Groundwater-Surface interactions should not be considered complete until surface/groundwater communication and area pumping are well understood and can be modeled with accuracy. Revise section to create decision rules that can meet requirements in the scope of work.

77. **Section 4.1.2, Pages 4-4 and 4-5, Paragraph 3.** Each of the performance criteria in Section 4.1.2 should be tied to specific methodologies, levels, and criteria in the SAP, which are cited here. As examples:

    - Page 4-4, Bullet 1, states: *"The background investigation will be considered complete if data are sufficient statistically to establish background groundwater quality near the site."* Revise the work plan to define the specific statistical approach that will be applied to determine sufficiency of site and background groundwater quality data.
    - Page 4-4, Bullet 2, states: *"The nature and extent investigation will be considered complete if the extent of groundwater impacts above analyte-specific screening criteria or background is defined at, and near, the Site."* Indicate or reference the analyte-specific screening levels.
    - Page 4-4, Bullet 4, states: *"Modeling will be considered complete if predictive tools are sufficient to evaluate potential future impacts."* Indicate how it will be determined that the predictive tools are sufficient to evaluate potential future impacts. Procedures for developing, applying, and evaluating models should be defined in a modeling QAPP, consistent with EPA's *"Guidance for Quality Assurance Project Plans for Modeling"* (EPA QA/G-5M).
    - Page 4-5, Bullet 5, states: *"The need for vapor intrusion studies will be evaluated once the nature and extent of impacts have been defined and receptors have been identified."* Revise the work plan to indicate that evaluation of the vapor intrusion pathway need not wait until all data have been collected and may also be conducted on an interim basis, as radon and other potentially toxic vapor sources are currently identified at the Site. Further, revise to include vapor intrusion screening as part of the Phase I investigation to evaluate existing site data to determine whether known subsurface contamination has the potential to form sufficient concentrations to pose a hazard or risk to human health. Revise the work plan to indicate that both the current and future use scenarios will be evaluated for potential vapor intrusion concerns at the site, consistent with EPA guidance (EPA, 2015).

78. **Section 4.1.2, Page 4-5, Bullet 3.** The third bullet from the top of the page states: *"The need for, and viability of, potential groundwater remedies that may be implemented at the Site will be evaluated when the above bullets are complete."* This statement implies that the FS will not be considered or initiated until the RI is complete. Revise this statement 1) to better reflect the concurrent nature of the RI and FS processes and 2) to clarify that interim removal or remedial actions may be required as necessary to protect human health and the environment.

79. **Section 4.1.2, Page 4-5, Paragraph 1, Last Bullet of Page.** See comment 87 above. Revise this bullet consistent with and taking into account the 4th sub-bullet from specific comment 87 regarding VI. With personnel working in offices on site/property, the need has already been established to perform some level of vapor intrusion studies. Revise section to explicitly include performance of vapor intrusion studies

80. **Section 4.1.2, Page 4-5.** Revise to add appropriate decision rules associated with sediment and sediment pore water sampling from surface water bodies at/near the Site to the list of bullets at the top of Page 4-5.

81. **Section 5.0, Page 5-1. Bullet 10.** EPA asserts that the water level changes in impounded water and other near-by surface water bodies should be further considered and included in the evaluation. Revise this bullet to include water level changes in nearby streams and impounded water bodies.

82. **Section 5.0, Page 5-2. Bullets 2 and 3.** Revise these bullets to generally state that the proposed characterization and aquifer testing will include areas sufficiently far from the site to provide a more complete characterization of the alluvial aquifer such that boundary effects from estimated aquifer information would be minimized at the site.

83. **Section 5.2, Page 5-3.** Some of the figures provided to support the CSM (see Appendix T) discussed in this section appear to be directly extracted from historical documents and do not appear to have been revised to reflect more current site data and holistic site conditions. Update or replace the historic figures to include information that reflects current site conditions.

84. **Section 5.2, Page 5-3.** Section 5.2 discusses compiling, digitizing, and reviewing existing data in support of RI/FS planning. In general, the planning documents lack specifics regarding the findings that resulted from compiling and reviewing the existing data. Revise the work plan to detail how those findings filled previously identified data gaps, changed the CSM, and/or identified new questions or information needs for the RI/FS. Where such findings will be presented in a subsequent deliverable (e.g., Well Inventory Summary Report), revise Section 5.2 to include a discussion of where findings and conclusions from the evaluation of the existing OU-3 data set will presented.

85. **Section 5.3.1, Page 5-4.** Revise this section to include a discussion of general well conditions, well screen occlusions, or the need for well repairs, redevelopment, or replacement or clarify that these findings will be presented in a subsequent deliverable (e.g., Well Inventory Summary Report). Also reference 9.1 of Volume 1 of the Work Plan.

86. **Section 5.3.1, Page 5-4, Paragraph 3.** Revise the fourth sentence to state that photo-documentation information is in Appendix W instead of Appendix X.

87. **Section 5.3.2, Page 5-5.** An expectation of the RI/FS is that "the groundwater monitoring program shall be designed to determine, in part, if site contaminants have migrated in groundwater across site boundaries" (AOC SOW, Section III, p.2). As such, continued monitoring of the Keokuk Limestone below the Warsaw Formation is required. Revise this section to include for investigation/monitoring of the Warsaw and Keokuk formations.

88. **Section 5.3.3, Page 5-6, Paragraph 1.** The text indicates proposed staff gauges on shown on Figure 5-2, but they are not on this figure and are not indicated in the legend. Also, the Area 2 designation should be moved to the east as its current position is partially over the Crossroads Properties LLC Lot 2A2/AAA Trailers. Correct the text and the associated Figure 5-2.

89. **Section 5.3.3. Page 5-6, Paragraph 2, Sentence 1.** This section discusses that combined total radium-226 and radium-228 are considered the "drivers" for the OU-3 investigation. Revise to better define the term "*drivers*" as used in this section. Further consider if this type of discussion should be included in other sections of the work plan discussing the goals of the investigation and site associated risks.

90. **Section 5.3.3, Page 5-6, Paragraph 4.** The text indicates the MW-400 Cluster includes shallow/intermediate/deep alluvial and bedrock wells. However, according to Table 5-2, the alluvial wells are to be nested and the bedrock wells clustered at most of the proposed locations. Review and revise text for each proposed location.

91. **Section 5.3.4, Page 5-8, Paragraph 1.** The text indicates the MW-500 through MW-502 are clusters however, Table 5-2 indicates the alluvial wells are nested at each location and clustered with the bedrock wells. Review

and revise text as necessary. In addition, these wells are proposed to be installed >2,500 ft downgradient of the site. This distance may be too great for adequate COPC/COC delineation and in determining the distance from the site it takes for COPCs/COCs to naturally attenuate toward/below the action level(s). Also, this greater distance may add uncertainty to any modeled product. See General Comment J on well placement and revise this section accordingly.

92. **Section 5.3.4, Page 5-8, Paragraph 1, Sentence 4.** EPA does not agree that the wells discussed here are located down gradient of the site. Regional flow in the alluvium is interpreted to be more towards the north and not directly to the west. Regional flow should not be based upon limited contours with no actual data points or values shown. The information as presented does not include enough detail to know if the data collected in alluvial wells was measured within a day or two or over weeks or years, and no detail is provided regarding the depths of the wells contoured. Additionally, the stage of the river or the river hydrograph immediately preceding the measurements is not included nor is there information regarding precipitation events that may have occurred just prior to the collection of the water level measurements. Revise the entire narrative in this section on well locations in line with the General Comment A.

93. **Section 5.3.5, Page 5-9, Paragraph 1 and 2.** Any well located in the alluvium down valley of the site (north and/or northeast) should not be considered as a background well. Regional flow in the alluvium is anticipated by EPA to be more toward the north and is not directly to the west. Overall regional flow in the alluvium is down valley. Revise this section to be consistent with this understanding and with General Comment A.

94. **Section 5.3.5, Page 5-9, Paragraph 4, Sentence 3.** The term side-gradient is used in this sentence, but the term is not clearly defined in the document. Background wells should be up-gradient and out of the influence of any constituent that may be sourced at the Site. Revise text to clarify the term side-gradient in the Work Plan, carefully consider other comments related to the CSM and groundwater flow and revise this section accordingly.

95. **Section 5.4.1.7, Page 5-20.** Revise section to state that "The collection and management of geospatial data will be defined in a geospatial data QAPP, consistent with EPA's "*Guidance for Geospatial Data Quality Assurance Project Plans*" (EPA QA/G-5G, March 2003) and add a citation to this guidance.

96. **Section 5.4.3. Page 5-11.** This section discusses an ecological survey and provides some basic information related to the survey. Please revise this section to clearly state that the pending BLRA Work Plan will provide additional information and specific details regarding the planned ecological surveys and sampling.

97. **Section 5.4.4. Page 5-12.** Provide additional Information on the criteria to be used to determine the need for well redevelopment, repair, replacement or abandonment. Revise this section to include these details or reference the appropriate location(s) in other documents where these details will be found.

98. **Section 5.4.5. Page 5-12.** The description of "geophysical techniques" is too vague and does not provide adequate detail on how it will be implemented to meet objectives required by the SOW. Revise text to include a narrative describing the techniques to be used and how they will help meet SOW requirements and fill data gaps identified in previous sections of the Work Plan. Include specific references to appropriate sections of the SAP/QAPP.

99. **Section 5.4.6. Page 5-12. Entire Paragraph.** Similar to previous comments, revise this section to include a narrative describing the techniques to be used and how they will help meet SOW requirements and fill data gaps identified in previous sections of the Work Plan. Include specific references to appropriate sections of the SAP/QAPP.

100. **Section 5.4.7, Page 5-13, Paragraph 2.** Revise this section to indicate the concentrations vs. the presence of the various analytes, as appropriate, will be compared to adequately evaluate potential site conditions (e.g., Fe2+ >1 mg/L as an indicator of anaerobic degradation).

101. **Section 5.4.12, Page 5-17.** Revise text to indicate the number of aquifer tests anticipated to be conducted at the selected wells. A greater number of slug tests conducted at each location will increase the confidence in resulting hydraulic conductivity values.

102. **Section 5.4.13. Page 5-17.** Revise text to state that all site-related COCs will be monitored to sufficiently characterize all contaminants and assess risk.

103. **Section 5.4.13.1. Water Level Measurements, (Also see 5.4.14. Staff Gauge Installation, 5.4.15. Pressure Transducers).** Transducers and data loggers are capable of continuously recording water levels and reporting at intervals of up to fractions of a second. There is inadequate explanation and rationale in these sections for taking a snapshot of water levels once a month to understand groundwater/surface water interaction, and monthly intervals would not capture short-term events such as localized flooding and pumping activities. Additionally, the plan for monthly water level measurement does not appear to meet the requirements of the SOW or provide means for supporting effective modeling. Revise these three sections to include for continuous water level monitoring in all wells and staff gauges.

104. **Section 5.5. Page 5-22.** The statement that the groundwater model could be a simplified analytical solution or multi-dimensional numerical flow and transport model does not appear to meet the requirements of the SOW. Revise to include a narrative discussion supporting an appropriate modeling program to meet the requirements of the SOW.

105. **Section 5.6. Page 5-22.** Revise the statement, *"An assessment will be performed to determine the potential for completion of vapor intrusion pathways in on-Site or off-Site occupied structures."* to replace the word *"or"* with the word *"and"* in this sentence.

106. **Section 5.6, Page 5-22.** Section 5.6 notes the criteria for a current complete vapor intrusion pathway. As noted above, the vapor intrusion investigation should also consider the future use of the site properties and surrounding properties above and within an appropriate inclusion zone of subsurface vapor-forming contamination. Revise accordingly to account for consideration of potential future use.

107. **Section 5.6, Page 5-22.** Revise the FSP to include SOPs/methodologies for passive soil gas vapor sampling, sub-slab vapor port installation and sampling, indoor air quality sampling and other appropriate items. Also, revise to indicate how any collected data will be evaluated and the removal management levels/action levels that will be used for COCs. Further, revise this section to reference and clarify that the vapor intrusion investigation is going to follow the EPA vapor intrusion guidance for assessing and mitigating the vapor intrusion pathway (EPA, 2015a), as well as utilize the VISL calculator in the VI evaluation (EPA, 2019b).

108. **Section 5.8, Page 5-23, Paragraph 1, Sentence 1**. Revise the first sentence to state: "A HASP, which includes an RSP for work conducted within the boundaries of OU-1 Areas 1 and 2 and other OU-3 investigative areas that are suspected of, or have been documented to, contain radiological impacts at levels of a potential health concern, is included as Volume 3."

109. **Section 6.2.1, Page 6-3.** Section 6.2.1 provides objectives for the modeling work plan but not for the model itself. The work plan should be revised to clarify how the groundwater model will be used and what

questions it will answer. Revise to include objectives, consistent with Section IV of the AOC SOW, for the model as well as for the modeling plan.

110. **Section 6.2.1, Page 6-3. Section 6.2.1, Page 6-3.** The AOC SOW indicates that the planning submittals will include a (Groundwater) Modeling Work Plan; and the draft project schedule indicates that the Modeling Work Plan is to be submitted on March 1, 2021. Because development of the Modeling Work Plan, in part, will inform and specify data needed to support the groundwater model, EPA requires that the preparation of the OU-3 RI Work Plan include sufficient planning to support the development of the pending Modeling Work Plan such that as many of the data needs as practicable can be filled during Phase 1 of the field investigation. An example is the placement of wells to be installed during Phase 1 (see Work Plan Section 5.4.7, p.5-13, and AOC SOW Section IV, Task 1, p.7). Revise Section 6.2.1 of the OU-3 RI Work Plan to include a broader discussion of the work needed to support the groundwater modeling efforts. This discussion must highlight specific work elements that will be conducted in Phase 1 of the RI to support the development of the groundwater model, prior to the submittal of the Modeling Work Plan, and include input on the following items: (1) identify modeling objectives (2) identify proposed modeling software, (3) briefly discuss the general hydrogeologic framework for the model, (4) briefly discuss potential hydrologic budgets and stresses, (5) briefly discuss geochemical considerations for F&T components of modeling, (6) discuss an initial model boundary/domain, and (7) generally discuss anticipated calibration goals and uncertainty analysis for the model. Further revise Section 6.2.1 to include acknowledgement that groundwater model support work is anticipated to be conducted in Phase 1 of the RI/FS to support the development of a 3-D Groundwater Model and Model Work Plan, and that the Phase I work may be modified during the RI, based on the data collected.

111. **Section 6.2.2, p. 6-3.** Data must be compared to the EPA's regional screening levels, or RSLs, for screening purposes in the human health risk assessment, or HHRA (EPA, 2019a). Revise this section to include for this data comparison step in the process consistent with EPA guidance.

112. **Section 6.2.3, p. 6-4.** Revise this section to add the task of a summary discussion of the pending BLRA Work Plan. Include an overview of what types of information will be presented in the BLRA Work Plan.

113. **Section 7.0, p. 7-1, Sentence 1.** EPA MCLs are suggested as the screening criteria. However, MCLs are not purely risk-based standards and are not appropriate to use to identify COPCs when conducting a HHRA requiring EPA approval. Revise this section to use the EPA RSLs for tapwater equal to a non-cancer hazard quotient of 0.1 and a cancer risk equal to 1E-06 (EPA, 2019a). Also see the prior comment regarding Section 4.1.1.3, p. 4-4, 1st bullet.

114. **Section 7.0, p. 7-1, Sentence 1.** The BRA requires an evaluation of current risk as well as an evaluation of a reasonable maximum potential future risk posed by contaminants at the Site. Therefore, revise the first statement of this section by stating the results will be used to determine if Site-related constituents have migrated or may migrate in the future beyond Site boundaries at concentrations above risk-based screening levels.

115. **Section 7.0, p. 7-1, Sentence 2.** Revise this section to include a discussion generally describing how background is anticipated to be incorporated into the risk assessment in the BLRA Work Plan.

116. **Section 7.0. Page 7-1.** Revise this section to state that the BLRA will include a Screening Level Ecological Risk Assessment first, followed by a Baseline Ecological Risk Assessment, if necessary.

117. **Section 7.1, Page 7-1.** Revise this section to state that a separate BLRA Work Plan will be delivered prior to any work being conducted on the Human Health and Ecological risk assessments. Also, revise to state that the Risk Assessment Guidance for Superfund, or RAGS, Part D tables will be included as part of the HHRA, following EPA's RAGS Part D guidance (EPA, 2001) and cite this guidance in the text.

118. **Section 7.1.1, Page. 7-1, Sentence 2.** "*COCs*" should be replaced with "*COPCs*", and "*COC*" should be replaced with "*COPC*" throughout the entire document, as appropriate. Chemicals that are selected to be carried through the risk assessment are referred to as COPCs and chemicals that are found to exceed target risk levels at the end of the risk assessment are referred to as COC, revise this section accordingly. In addition, revise to state that the COPCs will be selected as described in RAGS Part A (EPA, 1989), e.g., comparing maximum concentrations of chemicals detected at the site to their respective RSL.

119. **Section 7.1.1., Page 7-1.** Revise this section to generally and briefly describe how the data will be analyzed relevant to ecological risk.

120. **Section 7.1.2. Page 7-1.** Revise this section to also discuss how ecological receptors (not just human) will be identified and selected and how the potential exposures will be evaluated.

121. **Section 7.1.3, Page 7-1, Sentence 1.** Rewrite this sentence as follows: "A toxicity assessment of those chemicals identified to be of potential concern for the Site will be conducted."

122. **Section 7.1.3, Page 7-1.** Revise section to also discuss how the ecological toxicity assessment (not just human) will be completed.

123. **Section 7.1.4, Page 7-2, Sentence 2.** Revise this section to state that any modeling used to calculate contaminant exposure levels will be clearly described in the BLRA Work Plan and approved by the EPA prior to use.

124. **Section 7.1.6, Page 7-2 and 7-3.** Revise the steps provided in the text starting on Page 7-2 to reflect the 8-step ecological risk assessment process, as follows:

- Screening -Level Problem Formulation
- Screening-Level Exposure Estimate and Risk Calculation
- Baseline Problem Formulation
- Baseline Study Design and DQO process
- Baseline FSP Verification
- Baseline Site Investigation and Data Analysis
- Baseline Risk Characterization
- Risk Management

125. **Section 7.2.4. Page 7-3:** The statement *"Both natural chemical components and contaminants of some, but not necessarily all, of the following media will be discussed: sources, soil and vadose zone, groundwater, surface water, and air."* is unclear. Revise to clarify and explain the statement.

126. **Section 9.2, Page 9-1.** Section 9.2 discusses differentiation of leachate-induced and/or landfill gas effects from background concentrations on-site and/or near the Site. As noted above, the planning documents do not include an approach to sampling landfill gas or evaluating its migration and interaction with groundwater. Revise the Work Plan to address this landfill gas data gap.

127. **Section 9.3, Page 9-2.** Note that the EPA Quality System includes coverage of environmental data produced from models. See "*Guidance for Quality Assurance Project Plans for Modeling*," EPA QA/G-5M, 2002, for guidance on QAPP development. Revise section to cite this guidance.

128. **Section 9.4, Page 9-2.** In addition to describing the methodologies, the Groundwater Modeling Report must include a discussion of the findings of data corroboration, sensitivity analysis, and uncertainty analysis. Revise the section to include statements that this information will be provided in the pending Groundwater Modeling Plan.

129. **Section 9.6, p. 9-3.** The primary emphasis of the HHRA portion of the pending BLRA Work Plan should be the exposure assessment. Revise this Section to include a summary discussion of items, such as the following (note that this is not an all-inclusive list), that will be discussed in more detail in the pending BLRA Work Plan:

- Data Summary – Present a general summary of data anticipated to be used in the development of the HHRA portion of the BLRA.
- Exposure Assessment – including CSM, Exposure Pathways of Concern, selection process for COPCs, quantification of Human Exposure (equations only, no calculations), exposure parameters, evaluation of lead (Lead Models and Parameters), selection of exposure units, exposure point concentrations (data used and process, but not calculation of any EPCs for inclusion in the work plan).
- Toxicity Assessment – Present table of toxicity values to be used in the HHRA.

130. **Section 9.6. Page 9-3.** The work plan in this section, or elsewhere, does not clearly describe how completion of the Groundwater Characterization Reports, the Groundwater Modeling Report, and the Vapor Intrusion Investigation Report will identify the data gaps that will be addressed in the BLRA work plan (Human Health and Ecological). The data gap discussion in this section needs more explanation and detail. For example, if modeling shows that there is a complete exposure pathway to surface water, the ecological risk assessment will need to address potential aquatic receptors. Revise this section to include more detail regarding how the data collected to meet the data objectives will be used to support the overall development of the BLRA WP.

131. **Section 10.3, Page 10-2.** The project schedule and Work Plan should include when and how the inventory of potable and production water wells (Section 3.1.7.1) will be reported and incorporated into the investigation. Revise Section 10.3 to provide a summary of the efforts associated with the inventory of potable and production water wells as discussed in Section 3.1.7.1. Additionally, see general comment on schedule.

132. **Table 2-1 and Table 2-2.** From a review of Table 2-1 and Table 2-2 groundwater data from more recent MDNR reports is not being incorporated into the development of the RI work plan. Revise table to include summary information on more recent state associated groundwater reports and ensure this data is incorporated into the OU-3 available data set. See web-links below for more details:

August 2015 Bridgeton Sanitary Landfill Groundwater Investigation Report

https://dnr.mo.gov/env/swmp/facilities/docs/bridgeton_report.pdf

May 2017

https://dnr.mo.gov/env/swmp/facilities/docs/May2017GWResults.pdf

Feb 2017

https://dnr.mo.gov/env/swmp/facilities/docs/Feb2017GWSamplingResults.pdf

November 2016

https://dnr.mo.gov/env/swmp/facilities/docs/November2016GWSampleResults.pdf

Aug/Sept 2016

https://dnr.mo.gov/env/swmp/facilities/docs/StateGWSamplingAug-Sept2016.pdf

May/June 2016

Part 1

https://dnr.mo.gov/env/swmp/facilities/docs/May-JuneSamplingEvent.pdf

Part 2

https://dnr.mo.gov/env/swmp/facilities/docs/May-JuneSamplingEventpart2.pdf

Feb/March 2016

https://dnr.mo.gov/env/swmp/facilities/docs/StateGWSamplingFeb-March2016.pdf

133. **Table 3-1b.** The site-specific stratigraphic column indicates the alluvium/terrace deposits/loess can range from 10 to 215 feet thick. Revise to indicate the on-site well(s) where these quaternary deposits are/were this thick. If this is an error revise to correct this item.

134. **Table 3-2.** Table 4-3 from the OU-1 RI Addendum has different Top of Casing Elevation/ Measuring Point Elevation, Top of Ground Elevation/Ground Surface Elevation and screen elevations (as well as other differences). However, both tables indicate a 2012 survey was completed at the site. Review and revise each entry in Table 3-2 as appropriate.

135. **Table 3-6.** There appears to be two separate formats within this table that present the preliminary chemical-specific ARARs. Pages 1-11 contain a column title "*Preliminary Determination*" followed by a column titled "Remarks". On pages 12-18, those columns are missing and instead a column titled "*Reason Why Requirement May Be an ARAR*" and "*Discussion/Analysis*" appears. The last page of the table listing the preliminary policies and guidances to be considered, or TBCs, appears to be consistent with pages 1-11. Revise all of Table 3-6 with similar columns such as those presented on pages 12-18 and the statements below. Change the header of the second column to "*Environmental Standard*" and delete the column with the header titled "*Discussion/Analysis*".

In addition, the reference to Missouri Water Quality Standards, 10 C.S.R. 20-7.031(5), in the "*Requirement*" column is not clear with respect to how the values/numbers were attained as presented in this cell of the table. The 10 C.S.R. 20-7.031(5) standard refers to entries on several tables within the standard. Numerous contaminants from the tables found in 10 C.S.R. 20-7.031(5) are missing from this list and the values in Table 3-6 often do not represent the most conservative value. Revise this citation by either referencing the full 10 C.S.R. 20-7.031(5) citation and the associated tables from the standard or include additional information and justification within the Work Plan that provides rationale(s) to justify the specific information as listed in Table 3-6. This information should be placed in the second column which is to be retitled "*Environmental Standard*".

136. **Table 3-6.** The citation for the State's Public Drinking Water Contaminant Levels and Monitoring regulations has regulated contaminants that are missing from the "*Requirement*" column. Revise the table to include all regulated contaminants or include additional information in the Work Plan that provides further clarification and rationale to justify the specific information listed for this standard in Table 3-6. Place this information in the second column which is to be retitled "*Environmental Standard*" in accordance with the previous comment.

137. **Table 3-6.** Revise this table to include the 10 CSR 80.3010 Appendices I, II, III and IV constituents in the list of potential chemical-specific ARARs.

138. **Table 3-7.** Revise the table to ensure one format is used for the entire table. EPA suggests the columns/headers presented on pages 4 and 5 but the "*Discussion/Analysis*" column must be deleted similar to the comments provided on Table 3-6 above.

139. **Table 3-8.** Delete the last column from this table titled "*Discussion/Analysis*" similar to the comment provided on Tables 3-6 and 3-7 above.

140. **Table 5-1.** The total depth (TD) in feet, or ft, below the measuring point (bmp) for well D-13 is indicated as 135.57 ft rather than 135.7 ft as indicated on Table 3-2 (total pipe length = cap height above grade plus boring depth). Well I-11 is indicated with a TD ft bmp is 94.48 ft; Table 3-2 indicates a boring depth of 93 ft (indicate whether this in ft below ground surface (bgs) plus a cap height above grade of 2.67 ft for a TD ft bmp of 95.67 ft. Resolve any apparent discrepancies for each of the wells on these tables and for the pending for the well inventory summary report.

141. **Figure 2-4.** Final waste limit permit boundaries were surveyed and documented in the Waste Limits Investigation Summary Report, Revised July 2011, prepared by Aquaterra. Some of the waste boundaries provided in this figure appear to deviate from the approved boundary lines. For example, it appears the boundary for Permit No. 118912 presented in Figure 2-4 is the OU-2 ROD boundary and not the actual permit boundary as depicted in the July 2011 report. Compare polygons in this figure with the permit boundaries shown in the July 2011 Report and revise to include the correct boundaries.

142. **Appendix C.** The following comments pertain to the historical boring logs provided in Appendix C. Some logs through landfilled material indicate "HHT" (e.g., GEW-3, GEW-4). Revise the OU-3 RI/FS Work Plan to define this acronym. Some logs through landfilled material indicate subsurface temperatures upwards of 130°F (e.g., GEW-10, GEW-49). The National Institute of Standards and Technology (2008) indicates that first and second-degree burns can occur at temperatures of 118°F and 131°F, respectively. Other logs indicate drilling was stopped for unspecified safety concerns (e.g., GEW-67). Revise the OU-3 RI/FS Work Plan, Sampling and Analysis Plan, and Health and Safety Plan to clearly address how safety concerns associated with drilling through landfilled material will be addressed.

143. **Appendix D.** The appended boring logs and well construction diagrams appear to be incomplete. For example, some shallow wells (e.g., S-1, S-5, S-8, S-84, MW-F3) do not appear to be represented. Revise Appendix D to include all available boring logs and well construction diagrams and acknowledge where boring logs or well construction diagrams could not be located.

144. **Appendix E.** The cross-sections on PDF pages 1302 and 1303 of Appendix E appear to be clipped such that the images and legends are incomplete. Revise to include the full figures.

145. **Appendix I.** Appendix I is intended to present the regional upland soil profile but includes a bedrock stratigraphic column (PDF page 1322). Revise the Appendix I title to better reflect its content or move the bedrock stratigraphic column from Appendix I into its own appendix and include the regional upland soil profile in this appendix.

146. **Appendix J.** Robust historical precipitation data is needed for support of the pending groundwater model. Revise this appendix to the extent possible to include area precipitation data from as far back as possible.

147. **Appendix L.** Aquifer properties maps should be produced to show the spatial distribution of the aquifer properties of the various units. Hydraulic conductivity is necessary for a groundwater model, but the data needs to be spatially distributed and sampled at the relevant vertical units that will be used in the groundwater model. These wells appear to be limited to the immediate vicinity of the landfill. Data throughout the alluvial aquifer should be collected to support this appendix and the pending modeling work plan.

148. **Appendix L-3.** Revise the fly sheet for Appendix L-3 to correct the label *"Labor"* to *"Laboratory Testing Summary."*

149. **Appendix M.** Historical groundwater measurements will be necessary to calibrate the pending Groundwater Model. This groundwater data must be converted into electronic formats/files that can be used in support of model calibration and validation. Further. the data to the extent possible must be spaced over the entire model calibration domain both temporally and spatially. Revise this Appendix, to the extent possible, to add additional groundwater data that is spread over the entire model domain. Additionally, this information must be presented in the pending groundwater modeling work pan.

150. **Appendix N.** To prevent confusion, revise Appendix N to remove the historical Appendix K fly sheets on PDF pages 1968, 1969, and 1974.

151. **Appendix N.** Some data dates are reported as month, year only with no actual day/date provided. Revise to include full dates or explain limitations with this information, as water levels in alluvium can change significantly over the course of a day/days when the Missouri river stage changes or soon after a precipitation event.

152. **Appendix S.** Appendix S is intended to present leachate collection system data but includes Missouri River stage data (PDF page 2023). Revise the Appendix S title to better reflect its content or move the river stage data from Appendix S to its own appendix.

153. **Appendix T.** This appendix includes maps depicting borings that contain RIM and an estimated extent of RIM from the original OU-1 Remedial Investigation Report. Additional investigations resulting in the placement and collection of significant additional borings and soil samples from OU-1 have been conducted since the original RI, as documented in the more recent OU-1 Remedial Investigation Addendum (RIA). The results of these more recent investigations and an updated 3D model estimating the extent of RIM are summarized and presented in the OU-1 RIA. Replace the maps currently in Appendix T with the more current information as presented in the RIA.

154. **Appendix U.** The cross-sections on PDF pages 2050, 2051, 2053, and 2054 of Appendix U appear to be clipped such that the images and legends are incomplete. Revise to include the full figures.

155. **Appendix W.** Appendix W, which presents photographs from a partial well inventory (including two potentially mislabeled wells), is not referenced in the OU-3 RI/FS Work Plan text. Revise the OU-3 RI/FS Work Plan to reference and discuss the photographs in Appendix W, and correct or point out the mislabeled wells.

END OF WORK PLAN Volume 1 COMMENTS

COMMENTS: Work Plan (SAP Field Sampling Plan - Volume 2A)

156. **Section 1.0, Page 1-1, Paragraph 2, Last Sentence.** The text indicates "*OU-3 includes groundwater beneath the entire 212-acre Site.*" According to the Administrative Order on Consent, Section 3, Page 4, "*OU-3 shall mean groundwater at or surrounding the West Lake Landfill Site that has been impacted by contaminants at the Site.*" Revise this sentence to be consistent with the Section 3, Page 4 of the Order.

157. **Section 1.2, Page 1-2.** The objectives of the RI are incomplete, and the objectives of the FS are not stated. Revise Section 1.2 to provide the missing objectives. The RI serves as the mechanism for collecting data to characterize site conditions, determine the nature of the waste, assess risk to human health and the environment, and conduct treatability testing to evaluate the potential performance and cost of the treatment technologies that are being considered. Specific AOC SOW expectations for the RI that are not clearly identified include distinguishing background and on-site groundwater quality and designing a groundwater monitoring program for analysis of radiological and non-radiological contaminants. The FS is the mechanism for the development, screening, and detailed evaluation of alternative remedial actions.

158. **Section 1.3, Page 1-3.** The list of field activities seems to be missing several activities typical of an RI of this nature (*e.g.*, utility clearance, geotechnical sampling, geophysical logging, fluid flow, high resolution fracture characterization, surface/pore water sampling, soil gas sampling, waste characterization, treatability studies). Revise the bulleted list by including all of the expected RI field work as it relates to sampling and field screening. Further, the bullet listing the collection of "soil and bedrock samples", appears to be too restrictive as one of the goals of this effort is to collect aquifer matrix samples from the alluvial and bedrock aquifers to assess their composition for the F&T evaluations. The alluvial aquifer is far more important in this context. EPA notes that the term "*aquifer matrix*" is used/listed in Section 1.4.2. Revise this section and check the rest of the document for use of consistent terminology.

159. **Section 1.3, Page 1-3. Bulleted list.** This bullet list is not complete and would be better if it were organized in a more logical sequence. Many possible and important work tasks (some mentioned in the document) are not listed here, such as the use of geophysics (especially for alluvial aquifer characterization) and direct-push technology for use during a reconnaissance phase before monitoring wells are installed. Also, installation of simple "staff" gages to monitor surface water and groundwater levels is not sufficient. Revise the bullet list to include the missing items and sequence the bullets in a fashion that is more logical and consistent with the anticipated field work. Further revise the text to indicate that continuous recording gages will be used for surface water and groundwater data collection.

160. **Section 1.4, Page 1-4.** Except for assigning field team members and duties, Section 1.4 indicates no responsibilities for the Project Manager or Assistant Project Manager regarding the field team. Revise Section 1.4 to clarify or define PM/APM responsibilities.

161. **Section 2.0, Page 2-1.** This section and the referenced Table 2.1 are inadequate and incomplete in their current form. References to "*sequential extraction*" and "*solid extract*" samples are found on the table, but these methods are not described in the document (including why they are being employed and how the data will be used, extraction designs etc.). There is a statement that a 1-liter bag of soil is enough for all soil analyses, however it is not clear if this includes the sequential extraction. Revise this text for clarity and explain how extraction studies will be carried out to ensure data meets the DQOs or reference other Work Plan volumes/

sections that contain this information, such as the QAPP. Further revise to explain what analysis the 1-liter bag of soil is intended to be used for as discussed in this section and on Table 2-1.

162. **Section 2.0, Page 2-1, and Table 2-1.** The following comments are noted regarding the lists of laboratory analyses. Revision and clarification are warranted to this section, as follows:

- Revise Section 2.0 to cross-reference the lists of analyses to their purposes (*e.g.*, contaminant concentration/nature and extent, redox parameter/natural attenuation, leaching procedure/contaminant mobility).
- The bulleted lists of analyses on page 2-1 indicates soil and groundwater analyses, while the bulleted list on page 2-2 indicates soil analyses. Many of the analyses are duplicated in both lists. Revise Section 2.0 to clarify the distinction between the two lists of soil analyses.
- Several discrepancies exist between the bullet lists of analyses in Section 2.0 and in Table 2-1. Revise the FSP to resolve these inconsistencies.
    - Section 2.0 indicates mercury analysis of groundwater by Method 7470A, but Table 2-1 indicates mercury analysis by Method 7470.
    - Two SW-846 methods are provided for metals analyses of groundwater: Methods 6010 (ICP-AES) and Method 6020 SW-846 (ICP-MS). Section 2.0 indicates total and dissolved metals will be analyzed, but Table 2-1 does not include field filtration as a preservation requirement for dissolved metals analysis.
    - Section 2.0 indicates ferrous iron analysis of groundwater by SM-3500-Fe-B, but Table 2-1 indicates HAC Method 8146.
    - Section 2.0 indicates isotopic uranium analysis of soil by EPA Method 6020, but Table 2-1 indicates HASL 300.
    - Section 2.0 indicates x-ray diffraction of soil by SOP MCL7712, but Table 2-1 indicates SOP MCL 7708.
- Revise the FSP to provide methodologies or standard operating procedures for the four analytical procedures bulleted at the end of Section 2.0: x-ray diffraction (also listed in the soil analytical methods), further sequential extraction analysis, scanning electron microscope/energy dispersive x-ray spectroscopy, and cation exchange capacity.
- A principal objective of the RI/FS is to determine the nature and extent of any hazardous substance from the site in groundwater (EPA, 2019, Section III, p.2). Considering the nature and variety of the wastes disposed at the site, the list of analytes may be incomplete. For example, the list of analytes does not cover some priority pollutants (*e.g.*, organochlorine pesticides like 4,4-DDT, dioxins like 2,3,7,8-TCDD, polychlorinated biphenyls additional to Arochlor 1221). Revise Section 2.0 to include additional groundwater laboratory analytical methods as appropriate for the wastes disposed at the site and the studies proposed or revise the section to explain why these analytes are not required/needed.
- Moreover, the list of analytical methods appears to lack some methods that would help refine the current understanding of the hydrogeological system and determine the potential risk posed to human health and the environment, which are also objectives of the AOC SOW. For example, no laboratory analytical methods are defined for geotechnical parameters, radon in multiple media, or other COPCs as vapors. Revise Section 2.0 to include additional multi-media laboratory analytical methods as appropriate to meet the OIU-3 RI/FS objectives.

163. **Section 2.0, Page 2-1.** The summary bullet list on page 2-1 appears to mix the proposed solid and aqueous phase analysis together and is confusing, incomplete, and generally inconsistent with other sections of the Work Plan. For example, one of the most important constituents in controlling solubility of many inorganic species is alkalinity, yet it is not mentioned in Section 2 or on Table 2-1. The Work Plan (e.g. Section 5.4.13) makes mention of "*leachate indicators*" chloride, bromide, iodide, tritium and human wastewater indicators and selected stable isotopes but there is no mention of these in this section (2.0) or the associated Table 2-1 (however these are mentioned in Section 3.7). EPA also notes that potassium should be included/collected for

all groundwater samples as it is a major ion, can be relatively high in landfill leachate, is important for electrical charge balance verification for groundwater samples, and can be used as a quality assurance check. This section and Table 2-1 also make mention of sequential extraction, yet there is no description of this process in the document or the attachments. There are many potential "custom" sequential extraction methods in literature. The previous RIA generally followed a sequential extraction method developed by Liu et al. (2011). Typically, extraction step 1 in most of these methods is removal of weakly sorbed constituents (e.g. exchangeable), and step 2 is mostly carbonate associated, with iron phases and associated constituents not removed until later extraction stages. From the text and Table 2-1, is appears only 1 extraction step is to be performed and all constituents are being pulled from that one-step process suggesting this is not a sequential extraction nor is it designed to understand phase associations. Based upon EPAs review, the narrative describes a simple batch leaching test with some unknown solution with little understanding of sequential extraction methods and their application to geochemistry. Revise this section to define the various terms used and to better explain the methods to be employed in a clear and concise manner. Additionally, revise to appropriately add Potasium and Alkalinity to the discussion and the relevant list of items and associated table.

Further revise Table 2.1 and associated text in this section or elsewhere if appropriate, as follows:

- Ferrous iron by method SM 3500 is mentioned in the text but Table 2-1 references method HACH 8146. Also, Table 2-1 indicates this sample is to be collected and chilled and then analyzed within 24 hrs. This sample handling technique is not appropriate and the HACH method clearly indicates samples "*must be analyzed immediately and cannot be preserved for later analysis*". Revise to correct this discrepancy (EPA did not attempt to verify other methods/holding times in Table 2-1). Also, what are the DQOs for a screening method such as the HACH ferrous iron and the expected and acceptable uncertainty? A spectrophotometer is required in the field to complete these types of tests but there is not mention of this in the FSP. Please revise the text and Table 2-1.
- Table 2-1 does not include testing methods for Iodide, Tritium, stable isotopes, or wastewater indicators, nor does it mention filtered/unfiltered samples or list types of filters to be used and if containers are to be provided by the laboratories "pre-preserved". Preservatives should be considered in sample bottle filling order, especially if some are required to be added in the field—for example sulfuric acid used for some nutrient preservation can be highly contaminated with metals and handling of these samples should not be done before or using the same pair of gloves. Revise the section and table to include all required analytical methods and the associated constituents and include the order of collection and preservation techniques.
- Table 2-1 includes analysis for total hardness but the specific rationale for this analysis is not provided. If major ions are analyzed then total hardness can be calculated, so it is unclear why this specific analysis is needed. Revise section to explain or delete hardness.

164. **Section 2.0, Page 2-2.** The list in this section appears to make a distinction between "Solid extract" and "Sequential extraction" samples but these two methods are not described in the document. Also, at the bottom of page 2-2 Ra-226 is listed, but Ra-228 is listed as being calculated following sequential extraction. Revise to explain if Ra-226 and Ra-228 are or are not being analyzed by the lab in the same extracted solutions.

165. **Section 2.0, Page 2-3.** The last part of the bullet list here states:" *samples to be tested for fate and transport related parameters may be subjected to...*" following by X-ray diffraction (XRD), additional sequential extraction, Scanning Electron Microscope (SEM), cation exchange capacity (CEC). However, there is no decision tree or other supporting text/rational provided to explain under what conditions samples would be collected or submitted for analysis. Holding times will come into play and the sequential extractions cannot be easily "redone" or "resumed" on samples that have already had some extraction after a delay - so new samples would

need to be obtained which will adversely impact the schedule. Many required details appear to be missing in the document regarding the planned Fate & Transport (F&T) evaluations. Revise this section to include the missing information and details including a logical rational for collecting data to support F&T evaluations.

166. **Section 3.0, Page 3-1. Paragraph 1, Sentence 4**. Revise this sentence to include "sediment" sampling. Additionally, revise the FSP in other relevant sections to include sediment sampling from within the various surface water bodies located at and near the site.

167. **Section 3.1.1, Page 3-1.** The calibration frequency depends on the type and stability of equipment, the intended use of the equipment, and the recommendation of the manufacturer. Revise the Work Plan to include the calibration frequencies and standards for the equipment and other relevant information and/or include a citation or reference to where this information is presented in the text of this section.

168. **Section 3.2.1, Page 3-2.** Based on the diversity of site COPCs/COCs, consider whether a higher electron volt (eV) lamp is warranted to improve photoionization detection, and clarify whether the photoionization detector (PID) will be used for health and safety screening (*e.g.*, breathing zone). If the PID is to be used for other purposes, evaluate whether the detection limit is appropriate for the intended purpose, and revise text accordingly.

169. **Section 3.2.1. Page 3-2.** Revise section to explain the decision criteria and how the location of the soil sample will be selected.

170. **Section 3.2.1, Page 3-2.** The 1st paragraph mentions that a PID will be used and that it will measure "ionizable particles". Revise this paragraph to clarify what is intended by this statement, as most PIDs have a filter to prevent particulates from fouling the detector. Also, revise this section to identify the specific DQO for the PID screening and the purpose of collecting this field data. If it is for human-health screening then the parts per million (ppm) PID is not the most appropriate option, but a multiparameter meter as described in section 3.2.2 would appear to be more appropriate. Further, given this is a distinct section for describing proposed VOC screening methodologies, and the data is to be used for identifying/mapping VOCs in groundwater, then the ppm level instrument is also not appropriate. If cores are being screened for the presence of VOCs as part of the investigation to determine possible VOC contamination, then EPA asserts that a ppb capable PID such as a ppb-RAE 3000 is more appropriate. Revise this section to describe proper instrumentation for VOC field screening purposes. Further, revise the section to clarify how, why and when the PID will be used or propose other appropriate VOC screening technologies or reference other Work Plan sections where this is discussed.

171. **Section 3.2.2. Page 3-3:** This section discusses the use of a Multi-Gas Meter, and states: *"The instrument sounds an audible alarm when concentrations exceed preset limits."* Revise this section to describe what preset limits will trigger the audible alarm and the purpose of the Multi-Gas Meter. Further, include provisions for direct reporting to regulating entities of alarm occurrences and the reason for the alarm.

172. **Section 3.2.3. Page 3-4.** This section discusses the use of a MicroR Detector and a Dual Phosphor Alpha Beta Scintillator. Revise section to include an explanation of the purpose of using these tools, and what the data will be used for.

173. **Section 3.3., Page 3-5:** Access agreement requests should include all areas needed to determine nature and extent of contamination from or associated with the Site. OU-3 (groundwater) must be sufficiently characterized by the investigation and if access is required to do so, Respondents must seek any and all needed access to meet this requirement. Revise the statement to be less restrictive on access request locations.

174. **Section 3.3.1, Page 3-5, and Section 3.5.1, Page 3-7.** Specify the required accuracy of the global positioning system unit on the equipment lists and in the two associated SOPs.

175. **Section 3.5.1, Page 3-7.** If domestic or groundwater supply wells other than monitoring wells are being visited, a selection of hand tools/equipment will be needed, and potentially several types of water level, or WL, meters, e.g. e-tape and acoustic. Revise this section to include specifics regarding the type of WL meter(s) to be used for non-monitoring well situations as well as how the accuracy is to be determined and verified over time (plastic e-tapes commonly stretch and kink) or provide a reference to an SOP that discusses this information.

176. **Section 3.5.2, Page 3-7.** Any equipment put down a well that is used for sampling water supply/drinking water is to be decontaminated with a bleach solution to prevent microbial contamination (see USGS National Field Manual or other relevant guidance). Revise the FSP and supporting information/documents to account for this decontamination step for all drinking water/domestic well sampling.

177. **Section 3.6, Page 3-8.** The section title mentions aquifer testing, but there is no mention of aquifer testing in the alluvium and only a passing mention of step pump tests in the section on straddle packers in bedrock wells. Additionally, there is no mention of aquifer pumping tests in the Work Plan or FSP, other than a step pump test or single well test. The multi-well aquifer pumping test as described in the EPA guidance provided in Appendix A [Osborne, P. SUGGESTED OPERATING PROCEDURES FOR AQUIFER PUMPING TESTS. U.S. Environmental Protection Agency, Washington, DC, EPA/540/S-93/503 (NTIS PB94107943), 1993. (EPAEPA/540/S-93/503, 1993)] is appropriate and should be performed at multiple well locations to better define the hydraulic properties of the alluvium. This approach can be augmented using narrow diameter wells and even by use of temporary wells installed with direct-push. Revise this section to include a citation to the EPA guidance that is provided in Appendix A and state clearly what the aquifer pump test(s) will include, where they will generally be conducted, and how the data will be used to support the investigation.

178. **Section 3.6, Page 3-8.** The most appropriate manner to assess and identify the transmissive zones in the alluvial aquifer is not to drill and place new wells, but to use direct-push technology with a hydraulic profiling tool (HPT). Direct-push technology with HPT will provide a more comprehensive data set, can be done in advance of well installation and at many more locations providing a much more robust data set, and this data can be directly correlated with continuous cores collected from the alluvium. Revise the document to properly include the potential use of direct push technology with HPT to allow for a more robust data set and for other purposes as identified in this and related comments.

179. **Section3.6.1, Page 3-8.** Sonic drilling has been established as a proven method for advancing through the waste and fill materials located at the site; however, these types of drill rigs are relatively large and often more expensive than other potential options. For the proposed offsite wells in the alluvium, this may not be the most economical and/or the best method for well installations and may not provide for the collection of the most appropriate downhole samples. Other drilling methods should be considered, and a rationale provided to explain why sonic is being exclusively proposed in the Work Plan. Some additional flexibility in drilling/sampling methods is supportive of this work overall. Revise this section to briefly introduce and allow for other types of drilling methods in the remedial investigation.

180. **Section 3.6.1, Page 3-9.** Revise this section to state that the alluvial cores will also be archived. Also, revise section to state the criteria for selection of the minimum 4 "soil" samples from the alluvium cores for geotechnical testing. The proposed number of soil samples does not appear to be adequate, particularly given

the lack of using other more data-rich methods such as direct push technology with HPT. Further, revise this section to explain how the four samples can adequately characterize the alluvium or include more soil samples and/or additional technology, such as direct push with HPT.

181. **Section 3.6.1., Page 3-8.** This section discusses drilling and sampling procedures and states: *"Boreholes will be continuous cored, logged by a field geologist, field screened, sampled, and logged using geophysical techniques."* Revise this section to provide additional specific information or references to the appropriate document location for the geophysical techniques and instruments to be utilized as well as the purpose that each will be utilized for in this investigation.

182. **Section 3.6.1. Page 3-9.** This section discusses drilling and sampling procedures and states: *"A minimum of four (4) soil samples from the alluvial deposits at each boring location will be sent to the laboratory for geotechnical testing."* Revise to describe how the samples be collected or prepared.

183. **Section 3.6.1. Page 3-9.** If the four samples represent discrete borehole intervals, revise section to describe how the sample intervals will be determined.

184. **Section 3.6.1.1, Page 3-9**. This list is incomplete, as the specific field screening meters should be listed, such as ppb RAE, multi-gas meter, hand lens, HCl for testing carbonate (CO3), etc. Revise this section to include the missing information related to the field screening instruments to be used for this work.

185. **Section 3.6.2, Page 3-10.** If aquifer matrix samples are only to be collected from zones proposed to be screened, the characteristics of the rest of the aquifer that is not screened will not be properly measured and evaluated. Revise the section to explain whether this sampling includes the minimum 4 samples mentioned in the previous section above or if these are different samples. Revise this section to explain why only the screened intervals are being sampled and evaluated or revise this section to include for additional evaluation methods (ex; direct push with HPT). Further, the text mentions only 3 samples from the alluvium at water table, median depth, and base of alluvium which is inconsistent with previous text. These 3 intervals do not seem to be within the section to be screened mentioned in the 1st sentence. Collecting 3 samples at 3 prescribed intervals is not sufficient to characterize the hydraulic properties of the alluvium. Revise this section for clarity and consistency and if direct push technology is to be used refer readers to the section in the document discussing that information.

186. **Section 3.6.2, Page 3-11.** The example depth provided in the 1st paragraph (0-5 ft), implies that the entire section is not sampled given the limit of a 1-gallon bag, revise to explain how the core is to be subsampled to ensure representativeness.

187. **Section 3.6.2, Page 3-11.** The 2nd paragraph mentions acid-volatile sulfides, or AVS. This is the first mention of this analysis in the workplan or elsewhere in the FSP document, nor is it included on Table 2-1. Revise to explain how the samples are to be collected, preserved, etc. and further tie this information to the appropriate DQO which will explain why these samples are being collected and analyzed.

188. Section 3.6.3, Page 3-12: In addition to describing capabilities of available borehole geophysical techniques, the purpose of each technique for this investigation and how it will be used in the RI report should also be included.

189. **Section 3.6.3.1, Page 3-11.** This section should acknowledge that the natural gamma levels should also correlate to the silt/clay-rich zones located within the alluvium. Also, include a discussion of how borehole logs

are to be correlated. Revise section to state what is to be the measuring or starting point of the borehole logs, and how this point can be converted to elevations and used for comparisons across the investigation area.

190. **Section 3.6.3.1, Page 3-13.** While a caliper is a basic tool, the acoustic televiewer will provide much more detailed information on borehole diameter, wash outs, and openings. Revise section to briefly discuss and allow for the use of downhole televiewer technology in this section, should it be needed to support RI field work.

191. **Section 3.6.3.4, Page 3-14.** Revise this section to provide for digitized files for the collected borehole data. Borehole geophysical data should not be limited to a static report. Digital files (Log ASCII Standard (las) or other common format) adjusted for tool depth and length also should be provided.

192. **Section 3.6.1, Page 3-8.** This section states that the borings will be advanced using sonic drilling. Note that sonic drilling may heat cores such that volatile COCs are vaporized, or it may shake cores such that fine sediment structures are amalgamized. Revise text to briefly discuss the pros and cons of the drilling method, along with precautionary measures to be taken to minimize and/or prevent loss or impacts to the collected media.

193. **Section 3.6.5, Page 3-15 Paragraph 1.** Correct the inconsistency between paragraph 1 which indicates that up to 44 new wells will generally target the more transmissive zones and Figures 5-2, 5-3 and 5-4 from the OU-3 RI/FS Work Plan which show up to 47 new wells installed at and near the site.

194. **Section 3.6.5, Page 3-15.** Note that the current Missouri Monitoring Well Construction Code permits a minimum of Schedule 40 for wells one hundred feet or less (≤100') and a minimum of Schedule 80 for wells greater than one hundred feet (>100') but does not specify a screen slot size (State of Missouri, 2019). Revise Section 3.6.5 to state that the screen slot and filter pack will be sized as appropriate to prevent migration of formation material and filter pack into the well, consistent with ASTM International D5092 (2016).

195. **Section 3.6.5, Page 3-15.** Section 3.6.5 indicates that the screen length for each well will be a minimum of 10 feet to intersect the water bearing zone, as determined in the field. Note that a well screen shorter than 10 feet may be appropriate to target a discrete water-bearing zone, while a well screen longer than 10 feet may cross multiple water bearing zones (or a plume gradient) and thereby dilute the maximum groundwater concentration crossed by the well screen. Revise Section 3.6.5 to establish a minimum and maximum well screen interval in the SAP, with the actual screen interval based on field conditions and a CSM grounded in environmental sequence stratigraphy.

196. **Section 3.6.5, Page 3-15 Paragraph 1, Sentence 2.** This sentence mentions a deep alluvial well will be installed "*if encountered*", it is unclear what is meant by "deep" and "*if encountered*" as the term "*deep alluvium*" has not been previously defined and previous usage of shallow, intermediate, and deep at the site have been somewhat arbitrary. Revise to clarify these statements or remove them from the document.

197. **Section 3.6.5, Page 3-15 Paragraph 2.** In the 2nd paragraph it is unclear what "*fractures*" are being discussed, as certain sentences make reference to "*fractures in the bedrock surface*" that seems to imply vertical fractures. Revise to state how these fractures will be identified, and if these are anticipated to be horizontal, oblique, or vertical fractures. It will be unlikely that fractures will be readily identified at this step of the drilling process. It seems more likely, that a simple reference to over-drilling 1-2 ft into the bedrock and seating the outer casing with cement (not bentonite grout as a solid seal into the bedrock is required and perhaps what is intended). Also, it is unclear how a tremie pipe is going to be used to have 2-4 ft of "*grout*" inside the pipe and grout to the surface outside the casing. This sounds like a more appropriate application of "*pressure grouting*" or

perhaps Halliburton method of grouting. Revise section to better explain the intended process, how it relates to "*fractures*" and the specifics of how the well casing(s) will be sealed and "grouted.

198. **Section 3.6.5, Page 3-16 Paragraph 2.** The 2nd completed paragraph mentions "*Shallow, intermediate, and deep alluvial/bedrock wells may be nested within a 12-in borehole*". It is unclear how a bedrock well can be clustered with alluvial wells within the same 12-in diameter borehole given the description of installing the bedrock well on the previous page. It may be possible to "nest" several alluvial wells within the same boring, but this will be extremely difficult to do and ensure a good seal between each screen interval. Such nesting is not recommended. Revise this section to provide more clarity on the nesting approach described, taking into consideration this comment.

199. **Section 3.6.5, Page 3-16 Paragraph 3.** The 3rd paragraph mentions "*flush mount*" wells in off-site locations such as parking lots. This is common; however, the last sentence in the 1st complete paragraph states, "*The remaining annular space will be sealed with concrete during surface completion*". If the annulus between the flush cover "*vault*" and the well riser is sealed with concrete, then surface runoff will often accumulate inside the vault and can then potentially seep into the monitoring wells. Revise to state that runoff will be prevented from accumulating in the flush mount vault, that the annular space will be filled with sand inside and extending a short distance below the base of the vault to allow any runoff entering to seep out, and the outside of the vault will be held in place with concrete.

200. **Section 3.6.5, Page 3-15.** Section 3.6.5 states: The screen lengths for each well will be a minimum of 10 feet to intersect the water bearing zone, as determined in the field. Section 3.6.5 indicates that the screen length for each well will be a minimum of 10 feet to intersect the water bearing zone, as determined in the field. Note that a well screen shorter than 10 feet may be appropriate to target a discrete water-bearing zone, while a well screen longer than 10 feet may cross multiple water bearing zones (or a plume gradient) and thereby dilute the maximum groundwater concentration crossed by the well screen. Revise section and other related work plan items (SOPs, etc) to establish a minimum and maximum length for the well screen interval in the SAP, with the actual screen interval chosen to be based upon specific field conditions and a conceptual site model grounded in environmental sequence stratigraphy.

201. **Section 3.6.7, Page 3-21**. The Trihydro SOP for aquifer testing in Section 5.2.1 makes mention of using compressed air. Because of the importance of assessing redox conditions at this Site, compressed nitrogen should be the pressure source rather than compressed air. Also, the SOP for slug testing in Appendix A (Attachment 1) is for a solid slug testing and not for pneumatic tests that are mentioned in the text. Revise text and other applicable items (SOP) to include for the use of nitrogen for aquifer testing and provide/reference the appropriate SOP for slug testing.

202. **Section 3.6.7.2, Page 3-22.** There is mention of a "*soap and water wash*" that is inconsistent with most other decontamination descriptions in the Work Plan that indicate the use of liquinox for decontamination efforts. Check and revise this sentence for clarity and consistency.

203. **Section 3.7. Page 3-23, second paragraph.** The FSP must contain more than generalities of a groundwater monitoring program. Revise the FSP to provide enough detail suitable for implementing the RI sampling activities.

204. **Section 3.7.1., Page 2-23:** This section discusses water level measurements and mentions various timeframes for groundwater depth measurements. The depth to groundwater should be measured

continuously. Any additional measurements during sampling activities should be considered as supplemental. Revise section to provide specific details for continuous groundwater measurement.

205. **Section 3.7.1, Page 3-23 Paragraph 1.** The 1st paragraph makes mention of sounding to the top of the dedicated pump in lieu of total well depth measurement to be done monthly and prior to purging wells for sampling. The value of a monthly measurement to the top of the dedicated pump is unclear. Also, the value of monthly total depth measurements is unclear, especially within a few days prior to sampling which would only increase the potential for increasing turbidity in the water column. Also, the depth readings on the "e tapes" described in this section are calibrated to the sensors on the tape and not to the bottom of the probe. Revise this section (and associated SOPs as needed) to:

- Explain the purpose of monthly total depth measurements and if needed, how these can be done without adding to potential turbidity issues in the wells,
- Explain the purpose of a monthly depth measurement to the top of a dedicated pump,
- Remove reference to depth measurements made before purging wells for sampling as this will only contribute to turbidity issues, and
- Explain how the total depth measurement is going to be corrected as the water level indicator tape marks are typically not to the bottom of the weight but to the sensor that is some distance above the bottom of the weight.

206. **Section 3.7.1.2, Page 3-24.** The decontamination procedure as presented appears inadequate for cleaning indicator tapes. As described, the tapes would be lowered though a long water column to sound the well bottom or top of pump and then wound up on the reel before the decontamination procedure. This will make it impossible to ensure all sediment/particulates on the tape that is wound tightly on the reel are thoroughly removed. Revise this section to include for proper decontamination of the indicator tapes.

207. **Section 3.7.2, Page 3-25. Paragraph 3.** The minimum time of 3-5 minutes between consecutive field parameter measurements may be too short depending upon the actual pumping rate and diameter of the pump discharge line For example, if the pumping rate is 150 ml/min then at 3 minutes 450 ml have been removed—if the pump discharge tube is 0.25-in inner diameter, or ID, then every 10 ft of line will contain about 100 mL. If the tube is 200 ft to the sampling interval at a WL of 50 ft then there is about 1.4-L of water in the tubing requiring at least 10 minutes of purging before any water from the sampling interval reaches the surface and reading before this are simply stagnant water in the tubing. The determination of stagnant water inside the dedicated sampling systems should be calculated for each well sampling event and taken into consideration when assessing "stability" of field parameters. Also, the 3 consecutive readings should not all be trending in the same direction otherwise stability may not have been reached. Revise the text and SOP to indicate that the volume of water in the tubing will be estimated based on tubing diameter, pump depth, and water level and that this volume divided by the purge rate at each well will be used to determine the minimum time interval between field readings and minimum purge volume before sample collection.

208. **Section 3.7.3, Page 3-27 Last Paragraph.** The last paragraph indicates that "filtered" samples will only be collected if turbidity (assuming from flow-thru cell) exceeds 5 NTU (Nephelometric Turbidity Units). Revise this section to include a citation to the guidance document associated with this value in the text. Further, the decision to filter or not filter water samples depends on the end-use of the data and the DQOs. Geochemical modeling and related geochemical interpretation of groundwater data require samples be filtered using at least a 0.45 um pore-size filter. However, comparison to MCLs and health-based assessments rely on unfiltered water samples. Therefore, both unfiltered and filtered samples are required. Filtered data will be used for geochemical assessments and geochemical or fate and transport modeling and unfiltered (or filtered if greater than 5 NTU)

data will be used for comparison to MCLs or health or risk-based assessments. Filtering is critical for geochemical interpretation of radionuclide data (not only concentrations but isotopic ratios). Revise the work plan to include for the collection of both filtered and unfiltered samples. Revise the FSP to specify the make and model of filters to be used and provide certification of non-contamination for COPC and radionuclides od concern at the site for the filters. Further, revise the FSP to include a discussion regarding the processing of equipment blanks that also will include processing through the filters.

209. **Section 3.9, Page 3-29.** Revise text to include a statement that prior to use, the pressure transducers will have equilibrated to groundwater temperature to alleviate potential erroneous readings.

210. **Section 3.9, Page 3-30.** The smallest operating range possible should be used because of the combined additive error between the transducer and the barometer logger - e.g. a 100 ft range transducer has a 0.05 ft accuracy which probably is not sufficient for most applications at this site especially given the anticipated small head difference within alluvium monitoring locations. Additional error (albeit smaller) is added when the barometric compensation is done. This is combined with error in check measurements (e-tape measurement error, staff gauge or survey errors). Revise section to discuss the combined error of these various measurements in the context of DQOs for collected discrete (e.g. manual) and continuous (e.g. pressure transducers) water level data.

211. **Section 3.9, Page 3-30.** The last paragraph indicates the Barometer Logger will not be placed in the same well as a Data Logger. It is unclear why this decision was made, nor is information provided to explain how the loggers are going to be deployed in flush-mount wells as the well must be "vented" to obtain reliable WLs. Previously it was mentioned that construction of flush "vaults" would have concrete between the riser and cover—thus trapping any surface runoff & condensation inside the cover. If the cover of the flush cover forms a "water tight seal" then the inside of the vault may not be in equilibrium with the atmosphere causing additional errors to measurements. This will be compounded if data from flush vaults and traditional well risers and surface water sites are compared. Revise the FSP to account for the various sources of errors and how they will be determined and addressed. Also, revise the FSP to address how many barometer and data loggers will be deployed as more than one barometer logger should be deployed as a backup in the event the primary fails.

212. **Section 3.11, Page 3-32**. Revise this section consistently with prior Vapor Intrusion comments 81 and 87 as provided above.

213. **Section 5.1, Page 5-1.** Revise this section to specify the weather information to be documented (*e.g.*, temperature, cloud cover, precipitation). For example, the barometric pressure, wind speed/direction, and recent precipitation events should be noted for vapor intrusion sampling.

214. **Section 5.1.1, Page 5-1.** Blank portions at the end of logbook pages should be crossed through, initialed and dated. Revise this section to include this convention.

215. **Section 5.1.3, Page 5-2.** The field logbook or field photography log should also specify the camera used (e.g., make, model, number) and a line-of-sight direction for each photograph taken. Photographs should include rulers or other items for scale, when feasible and appropriate. Revise to include this convention.

216. **Section 5.2, Page 5-2.** Sample identifiers are only provided for groundwater and soil samples. Guidance for identifying other types of samples should be provided or referenced. Revise this section to include identifiers for all potential sample types (landfill gas, VI, etc.)

217. **Table 3-1.** The following comments are noted regarding the monitoring well survey data:

- Various survey sources are provided. Revise Table 3-1 to describe what corrections have been applied, if any, to align the survey data to a common point of reference and coordinate system.
- Revise the table to present the well installation dates consistently as the month, day, and year, as available.

218. **Figure 3-1** The flow lines in the alluvial aquifer do not seem consistent with typical GW flow in the Missouri River alluvium. Revise this figure to be consistent with General Comment A on CSM and groundwater flow.

219. **Figure 3-5**. See previous comment to Section 3.6.5 regarding flush mount wells. The neat cement at the top of the flush covers between the PVC risers and edge of flush cover vault will trap water possibly resulting in surface water entering the wells. The flush cover seals should not be considered water tight. Sand should be placed in the annulus between the risers and the flush vault and extend several inches below the base of the flush vault to allow any water entering the cover to drain and not accumulate inside the vault. Revise this figure accordingly.

220. **Figure 3-5.** The 0.005 slot screen at all depths seems arbitrary as screen slot size is determined based on aquifer grain size which then determines optimum filter pack size and finally screen slot size. It is likely that a larger screen could be used in deeper alluvium depending on the lithology ASCII (text) tab-delimited format (ATD) files. EPA suggests that the 0.010 slot and appropriate filter pack material also be available. Revise figure and associated text discussions to include for the potential use of the 0.010 slot size screen.

221. **Figure 3-6.** The proposed additional wells for the monitoring network appear insufficient as presented on this figure. Revise figure to include an appropriate number of off-site locations for the alluvial aquifer (bedrock wells are not necessary at all proposed locations). Consider the general comments on CSM, groundwater flow monitoring, and well placement when revising this figure.

222. **Figure 3-6.** The location of proposed surface water level monitoring locations as presented appear inadequate. The two ponds located on the north side of St. Charles Rock Road (one east of Rock Industrial Park Road and the other at the NE corner of Rock road and 141) must also be gauged. Also, the surface water feature being monitored by SG-500 appears to have an outlet control structure at Hwy 141 and to the south at Lake Front Drive. Surface Water level gages also should be installed on the other side of these structures to assess Surface Water levels in those areas. Finally, the surface water body located on-site between the PZ-212 well cluster and the site also must be gaged. Revise the figure to include these additional monitoring locations.

223. **Appendix A (FSP).** The following comments are noted regarding the standard operation procedures SOPs.

- An index or crosswalk of SOPs would be helpful. An SOP does not appear to be provided for all field activities proposed. Revise to include an index of the SOPs provided and develop/present SOPs for field items that currently do not have an SOP.
- In some cases, multiple SOPs are provided for the same activity (*e.g.*, EPA and Trihydro guidance on aquifer testing). In the case of a discrepancy among guidance documents, clarification should be provided as to which document will be followed and why. Revise to remove duplicative SOPs.
- For some SOPs (*e.g.*, field documentation, equipment decontamination), the FSP text should be checked against the SOP and revised for consistency. See specific comments and check and revise text and/or the SOPs.

- Revise Appendix to include a SOP for *Radiological Decontamination*.
- SOP for *Field Measurement of Residual Radiation* references Ameriphysics SOP RCP-4.3, Survey Instrument Procedure and also references 10 CFR 835 for contamination limits. Revise to also include an appropriate Nuclear Regulatory Commission (NRC) reference.
- SOP for *Packaging and Shipping of Nonhazardous Substances to Laboratories for Analyses*. This procedure has a markup comment in Attachment C, so this procedure does not appear to be a final draft. Revise to finalize this SOP.
- SOP for *Packaging and Shipping of Department of Transportation (DOT) and International Air Transport Association.* This SOP is presented twice. Revise to remove the duplicate SOP but ensure retained version of the SOP includes Attachment 2.
- Ameriphysics SOP: *SURVEY INSTRUMENT PROCEDURE*. This procedure lists a few other references that should be included: RCF 4-4 Instrument Validation Checklist, RCF 4-5 Scalar Instrument Set-up, RCF 4-6 Daily Instrument Response Check, RCF 4-7 Non-Scalar Instrument Set-up and Daily Response Check. Revise to include the missing references.
- Current Missouri Well Construction Rules must be provided and followed: https://dnr.mo.gov/geology/geosrv/wellhd/wellsanddrilling.htm. Revise the appendix to remove the SOPs that are not applicable (EPA Region4 and Arcadis SOPs) and include/cite the current Missouri Well Construction Rules.
- Revise to remove the Region 1 SOP, and include (cite) one or more of the following EPA general guidelines for groundwater sampling:

  https://www.epa.gov/remedytech/ground-water-sampling-guidelines-superfund-and-rcra-project-managers

  https://www.epa.gov/remedytech/low-flow-minimal-drawdown-ground-water-sampling-procedures

224. **Appendix B (FSP) Forms.** There are no radiation survey or radiation instrument forms. For example, there should be a background and response check log (or digitally logged) for each instrument so that day-to-day entries of background and the response check value can be noted. There should also be a contamination survey form for equipment and personnel, etc. Revise Appendix B to include these forms.

END OF WORK PLAN (SAP Volume 2A - Field Sampling Plan) COMMENTS

COMMENTS: Work Plan (SAP Volume 2B - Quality Assurance Project Plan)

225. **General Comment to QAPP:** There is no detail on Quality Assurance for types of data other than groundwater samples for laboratory analysis. Revise QAPP to include detail on Quality Assurance for all data that will be collected.

226. **General Comment to the QAPP:** The QAPP is not sufficiently detailed to understand the DQOs and whether those are being met. Revise the QAPP such that it is sufficient to understand and agree that data quality will be sufficient to determine if objectives are being met and the plan can comply with the AOC and statement of work.

227. **Section 1.0, Page 1-1, Paragraph 1, Sentence 2.** The second sentence of this paragraph states that the QAPP will be implemented to ensure the data collected are complete, representative, comparable, accurate, and precise. Most of these metrics exist on a continuum. For example, no one specific numerical value renders a data set accurate or precise. The purpose of the QAPP is in part to establish clear DQOs that can be used to determine appropriate metrics associated with data completeness, representativeness, accuracy, etc. Revise the sentence as follows: *"This QAPP contains the procedures that will be used to help ensure that data collected*

during OU-3 Remedial Investigation and Feasibility Study (RI/FS)-related sampling activities are sufficiently complete, representative, comparable, accurate, and precise to meet the established data quality objectives."

This paragraph also states that the QAPP is intended to address quality procedures associated with sampling and analytical procedures outlined in the Work Plan. It does not seem necessary to include sampling and analytical procedures in Volume 1 of the Work Plan, as these topics should be more appropriately addressed in the FSP and QAPP. Remove this information from Volume 1 of the Work Plan to avoid duplication and need to update multiple documents in the future if circumstances change during the investigation and instead include it in the SAP portion of the Work Plan only.

228. **Section 1.1.1, Page 1-7, Paragraph 1**. The text includes the following sentence: *"The Pace and MCL (Materials & Chemistry Laboratory, Inc.) PMs (Project Managers) prior to release of data will provide independent QA (Quality Assurance) Review."* While the Pace and MCLI PMs can conduct an internal review of data, their reviews cannot be considered an independent QA review. Remove this responsibility from any personnel associated with the laboratory. Revise to clarify the roles and responsibilities under the Trihydro Quality Assurance Director (QAD) to indicate that independent QA reviews will be a part of the data validation process and, therefore, a responsibility of the Trihydro QAD, if that is the intent of the QAPP.

229. **Section 1.1.1., Page 1-4:** This section on "Roles and Responsibilities" states: *"Furthermore, the EPA Project Manager has the authority to inspect Trihydro's field methods; therefore, the Trihydro PM and APM will communicate the schedule of field events with the EPA PM. The Trihydro PM and APM will report directly to the EPA Project Manager and are responsible for technical QC and project oversight."* Sections X, XI, and XII of the AOC provide the same or similar access for State personnel. As such, designated State personnel should also receive direct communication and reporting for these events in a timely manner. Revise the language to include similar communication and reporting for State (MDNR) oversite.

230. **Section 1.2, Page 1-7 and 1-8, Paragraph 4**. Revise to add "approved" prior to "work plan"

231. **Section 1.2, Page 1-8, Paragraph 1**. The text presents a list of bullets and provides text that discusses the problem definition. The bullets described in the problem definition are very broad and are not appropriate to use solely to determine DQOs. Revise this section so that it either contains or references the fully developed DQOs.

232. **Section 1.2., Page 1-8.** This section titled "Problem Definition and Description" states: *"Is there potential for workers, the public, or ecological receptors to be exposed to contaminants?"* This problem definition only describes the exposure portion of risk assessment requirements. The other portion, dose, may provide some further insight into sampling needs. Revise section to include problem definitions that fully incorporate needs of an adequate risk assessment.

233. **Section 1.2. Page 1-8.** This section titles "Problem Definition and Description" states: *"Is there evidence that any potential COCs are migrating outside of the target area?"* This problem definition appears to limit the scope of sampling and modeling to a target area which is undefined in this bullet. Revise the problem definition to address the need for collecting enough data to determine COC extent and accurately support modeling of contaminant movement.

234. **Section 1.2. Page 1-8.** This section titled "Problem Definition and Description" states: *"Is there evidence that any potential COCs are being remediated?"* It is unclear what this problem definition is suggesting. If the Responsible Parties want to determine past natural attenuation, this needs to be clearly detailed in the Work Plan/QAPP/SAP. If the PRPs want to determine if leachate pumping at the Former Active Landfill is performing a type of site-wide remediation, this needs to be clearly detailed in the Work Plan/QAPP/SAP. If there is another purpose(s), it needs to be clearly detailed in the Work Plan/QAPP/SAP. Revise this item to clearly indicate the purpose(s) or delete.

235. **Section 2.0, Pages 2-1 through 2-7.** This section of the QAPP titled "Data Quality Objectives" is a general description of the DQO process along with some basic definitions of terms. As noted in the General Comment, it does not include, as it should, DQOs for this effort. The section refers to "if-then" statements presented in other documents but does not properly move the discussion into the development of actual DQOs. Revise the section such that the DQOs are clearly stated or referenced in this section along with a description of how the DQOs were generally developed. Also, see the general comment on this topic.

236. **Section 2.0, Page 2-1, Paragraph 1.** The first paragraph states that the site-specific DQOs are included in the Work Plan, but no citation is provided to state where in the Work Plan the DQOs are presented. Section 4.1.1 – *Data Quality Objectives* in the Work Plan includes a list of bullets that state the general objectives of the OU-3 RI/FS; however, this list does not appear specific enough to evaluate the criteria for measurement data presented in the next section. Revise the overall Work Plan to include fully developed DQOs that can be referenced to determine appropriate type of data to collect, appropriate conditions under which to collect the data, necessary quality of the data, and tolerable limits on sampling and measurement error. Also, see related specific comments and the general comment on DQOs.

237. **Section 2.1. Page 2-1.** This section on criteria for measurement data is too broad and does not adequately connect to specific criteria or processes to determine data quality using these measures. Revise to provide enough detailed information to develop or show actionable data and decision criteria.

238. **Section 2.1. Page 2-1**: In this section discussing the criteria for measurement data, it is unclear to EPA why "decision rule" has been included in this list for data quality indicators. The decision rule covers what follow-on actions will be taken when the data quality indicators have or have not been met. Revise section to provide an appropriate relationship between data quality indicators and the decision rule or relocate to an appropriate location in the QAPP and FSP documents.

239. **Section 2.1. Page 2-1.** The Data Quality Indicator for Bias was not included in the data criteria. Revise to include the data quality indicator of Bias and discuss specifically how it will apply to each type of analyses.

240. **Section 2.1.1, Page 2-2, Paragraph 3.** The RPD equation presented in Section 2.1.1 while adequate for chemical analysis (organic and inorganic) is not appropriate for radiochemical analysis. Another equation to assess laboratory precision for replicate radiochemical analysis which includes the measurement uncertainty should be included in this section or such equations can be referenced to Pace Radioanalytical SOPs which appear to be currently attached to the draft QAPP.

241. **Section 2.1.2, Pages 2-2 and 2-3.** This section on accuracy includes language indicating that Tryhydro and the laboratories have yet to determine precision requirements, including this text as found on page 2-3: *"Laboratory precision methods will be discussed between Trihydro and the laboratories prior to the sampling event."* The project specific Quality Control (QC) requirements are to be established and presented in the QAPP, to meet project data quality needs and as part of the DQO process. Revise this section to properly present and discuss this topic. In addition, this section discusses requirements that appear to apply to specific entities generating data (field personnel, MCLI or PACE), and to others that are universal; however, it is not always clear which requirements apply to which entity. Revise the text to clarify this information.

242. **Section 2.1.2, Pages 2-2, Paragraph 7.** This paragraph states that Contract Laboratory Program, or CLP, requirements will be applied during validation; however, the CLP <u>does not</u> address radiochemistry parameters. Revise the text to reference the *Multi-Agency Radiological Laboratory Analytical Protocols Manual* (MARLAP) guidance and the American Nuclear Society Standard 41.5-2012 (ANS-41.5–2012) for the validation of the radiochemistry parameters and revise the text accordingly to properly describe and account for radio-chemical validation efforts.

243. **Section 2.1.2, Page 2-2, Paragraph 7.** This paragraph describes the qualification of environmental sample results associated with blank samples found to contain contamination. The paragraph states:

"If a contaminant is detected in the equipment, field, or trip blanks, the reported value will be multiplied by 10. Then the associated environmental sample results will be compared to the blank detection results. If the environmental sample results are found to be within 10 times the original blank detection, the data will be 'JB' qualified and considered an estimated value due to possible cross-contamination."

For clarity, revise this passage as follows: *"If a contaminant is detected in an equipment blank, field blank, or trip blank, the detected concentrations of that contaminant in any associated environmental sample will be qualified as follows: if the contaminant concentration in the environmental sample is found to be within 10 times contaminant concentration of the blank, the associated environmental sample concentration will be 'JB' qualified and considered an estimated value due to possible cross-contamination."*

This paragraph later states: *"However, if contaminants are detected in environmental samples at values below the original blank detection or the associated reporting limit (RL), the contaminants will be qualified with a "U" and considered non-detect at the RL."* Revise this text to specify a sub-qualifier (e.g., "B") to accompany the "U" qualifier (e.g., to make a "UB" qualifier) for these occurrences.

244. **Section 2.1.2, Pages 2-3, Paragraph 1.** Laboratory precision is discussed in this paragraph; however, precision should be addressed in Section 2.1.1 – *Precision*. Revise to remove the precision discussion from this section.

245. **Section 2.1.3, Page 2-4, Paragraph 1.** The text states that *"critical parameters"* are listed in the Work Plan. No such reference to *"critical parameters"* appears to be present in the Work Plan. Revise the text to define the term "critical parameters" and clarify whether a separate completeness objective has been defined for other parameters. The paragraph also states that project completeness goals may still be met if qualified data are suitable for specified project goals. This statement is overly broad and provides users of this QAPP the ability to determine when or whether a specific sample analyses will be considered valid. Revise this paragraph to clarify how data will be determined to be valid.

246. **Section 2.1.4, Page 2-4, Paragraph 2.** The text generally defines representativeness and discusses the relationship between this criterion and sample collection/preparation. Revise this section by summarizing the specific requirements for sample collection and laboratory sample preparation that will be used to ensure results of sample analyses are sufficiently representative of the condition being measured for the Operable Unit (OU)-3 RI/FS. Also, revise to reference the specific location(s) in the FSP and/or QAPP where the detailed procedures are presented.

247. **Section 2.1.4, Page 2-4.** This section overall discusses representativeness and the discussion appears too general and does not adequately explain the criteria for determination of representativeness. Revise section to generally explain how field personnel will use the various information available to them, what attributes will be used to evaluate representativeness, what "corrective action" will be employed and how the process will be recorded and utilized in the investigation.

248. **Section 2.1.5, Page 2-4, Paragraph 3.** The text generally defines a decision rule in the context of a QAPP and specifies that these rules will include action levels assigned to individual analytes. No such action levels appear to be described in the QAPP or in the referenced Volume 1 of the Work Plan. Further, the section in Volume 1 that presents decision rules (Section 4.1.2 -*Develop the Analytical Approach*) neither provides action levels nor the series of "if-then" statements described in the QAPP. Revise this section to include a discussion of action levels and specific decisions to be based on these action levels.

249. **Section 2.1.6, Page 2-4, Paragraph 4.** This subsection regarding comparability does not address any specific procedures and/or requirements related to assurance of adequate data comparability. Revise this section by summarizing potential issues that may arise during comparisons of data and the procedures to address these issues, and/or reference the sections of the FSP and QAPP that convey the detailed procedures.

250. **Section 2.1.6, Page 2-4.** The discussion on comparability is too general and does not adequately explain how comparability will be measured among existing data or collected data. Additionally, it does not discuss

types of data subject to comparison nor comparison criteria. Revise the QAPP to include site/data-specific information on how comparability will be quantified and types of decisions to be made on comparability issues.

251. **Section 2.1.7, Page 2-4, Paragraph 5.** Revise this section to include or reference the sensitivity requirements for sample analysis to ensure (1) usefulness of data for aid in decision-making (based on the decision rules discussed in Section 2.1.5), and (2) data comparability as discussed in Section 2.1.6.

252. **Section 2.2, Page 2-5, Paragraph 1.** Revise the first sentence of Section 2.2 – *Special Training and Certification* as follows: "Field and Laboratory personnel will participate in site-specific training and acquire specified certifications as required in this QAPP and associated FSP."

253. **Section 2.2.1, Page 2-5, Paragraph 2.** Revise this section by listing company procedures or SOPs with which field personnel must be familiar and use to ensure data quality for the project. In addition, revise to describe or reference other document(s) where it is describes (i.e. FSP) how and when field personnel will be familiar and/or trained in these procedures. This must include a description of any required training certifications or related documentation.

254. **Section 2.2.2, Page 2-5, Paragraph 3.** Revise the last sentence of this paragraph as follows: "*A rigorous QA/QC program is maintained in accordance with this QAPP and the associated FSP to ensure that data quality is sufficient to meet the objectives of the investigation.*"

255. **Section 2.3.2, Page 2-7, Paragraph 1.** This section states that sample collection logs are to be captured for water and soil samples; however, sediment samples are not mentioned. Revise the text to specify that sample logs will also be utilized for other sample matrices, such as sediments. Further, revise section to state that the laboratory data deliverables will contain all information needed to sufficiently and unambiguously document and recreate lab results.

Additionally, the paragraph states "*MCL[I] will provide data packages containing the necessary information to document the laboratory analysis procedure and process,*" indicating potentially different record keeping and reporting requirements for this lab (MCLI). Revise the text to provide the rationale for having different requirements for the analytical laboratories or revise to use the same requirements for both laboratories.

256. **Section 3.0, Page 3.** This section, *Data Quality Assessment* does not include or reference any site-specific requirements associated with uncertainty tolerance, preliminary data reviews, statistical method selection, or data quality evaluation. Revise this section to include or reference the site-specific information associated with the five steps that are listed in this section. Further, revise this section to include sufficient site-specific details to be able to agree on specific data quality assessment methods.

257. **Section 4.2.2, Page 4-2, Paragraph 4**. The section states, "*The WP (Trihydro 2019a) includes tables and figures that delineate the sample locations,*" and then provides a list of analytical methods for analysis of soil and groundwater samples. However, it is unclear how the sample locations relate to laboratory analytical procedures. Revise this section to establish the relationships between sampling locations and analytical procedures or refer to the section(s) that provide this information. Also, the text prefacing the list of analytical methods states the following: "*groundwater and soil samples <u>may</u> be analyzed for the following.*" Revise the section to indicate how individual laboratory analytical methods specifically relate to the DQO elements referenced in Section 2.0 (*Data Quality Objectives)* and reference the associated method detection limits or quantitation goals or refer to the section(s) that provide this information.

258. **Section 4.2.2, Page 4-3, Paragraph 1, Bullets 2 and 3.** EPA Drinking Water Method 903.1 and Method 904 are listed for the analyses of soil samples. This is a misapplication of drinking water analytical methods that were developed and validated specifically for the analyses of drinking water samples. Radiochemical methods developed and validated for soil methods should be applied for these analyses. Revise this section to describe appropriate soil testing methods.

259. **Section 4.2.2, Page 4-4, Paragraph 1.** The phrase "*sequential extraction*" is used multiple times within this section but it is not defined. This process should be clearly defined in the QAPP along with the associated QC

procedures. Revise the QAPP to adequately describe or reference the various terms and procedures presented in the submittals.

260. **Section 4.2.2, Page 4-4, Paragraph 3 and following bullets.** A list of analyses and procedures to be performed by MCLI are referred to as *"fate and transport related parameters."* Given the way these analyses are singled out from the other analyses for COPCs, developing and documenting a separate set of DQOs for these analyses is necessary. Develop and present appropriate DQOs for the "fate and transport related parameters."

261. **Section 4.2.2, Page 4-5, Paragraph 1.** The text states: *"These SOPs provide sufficient details to evaluate quality of the analytical methods and are applicable to the data goals and sample media of this investigation."* Because project-specific DQOs have not been sufficiently developed, EPA cannot determine the validity of this statement. Once project-specific DQOs have been developed through the DQO process and documented in Section 2.0 of the QAPP, a suitable justification of how each SOP will result in the generation of data that meets the objectives of this investigation must appear in this section. Revise this section accordingly.

262. **Section 4.2.2, Page 4-5, Paragraph 3.** The last sentence of this paragraph is not clear and does not provide rationale for how Trihydro will determine the *"appropriate levels of precision and accuracy (as feasible)."* EPA acknowledges that detection/reporting limits depend on various factors inherent to a specific sample. However, the purpose of the QAPP is in part to establish required levels of precision and accuracy, select procedures to help achieve these levels of precision and accuracy, and provide a process for how to respond to data that do not meet these requirements. Revise the last sentence to read as follows, *"To ensure the data are useful for addressing the principal objectives of the remedial investigation, samples will be analyzed and evaluated in accordance with this QAPP."*

263. **Section 4.3.1, Page 4-6, Paragraph 1, Bullet 3.** The third bulleted item of this paragraph indicates that one field blank per 10 groundwater and soil samples will be collected for every analysis to occur. Specify whether field blanks will be required/collected for soil samples, and revise if necessary.

264. **Section 4.3.1, Page 4-6, Paragraph 2.** Revise the second and third sentences in this paragraph to clearly specify references to samples versus sample results. Additionally, the text as provided is not clear regarding what distinguishes a field QC check from a laboratory QC check. Revise to clarify and detail the differences between these two types of quality control checks. Further, the paragraph specifies that for soil samples, matrix spikes will occur only for total organic carbon analysis and subsequent associated analysis. No rational is provided for the absence of matrix spikes for other soil analysis/analytes. Revise the section by defining and explaining how and when the field and/or laboratory QC checks will occur. In addition, matrix spike samples must be incorporated into the quality assurance (QA) procedures for all soil analyses. Finally, the last sentence of the section states that the field crew may be required to return to the Site to meet completeness objectives. The paragraph must be revised to also indicate what procedures the field crew must follow/do when they return to the Site so that it is clear how this will meet completeness objectives.

265. **Section 4.3.2, Page 4-7, Paragraph 1.** The paragraph states that data obtained will be properly recorded, but no standard or rationale is cited to define what constitutes *"properly."* Revise the section to clearly explain how data and related items will be properly recorded and maintained. In addition, the paragraph is not clear about how and who will determine that a reanalysis of any sample is necessary if the original analysis did not meet the quality control and/or other criteria as specified in the QAPP. The paragraph first states that there must be a requirement in the SOP and that laboratory personnel must determine reanalysis to be necessary before this would occur. If the SOPs are to be followed and an analysis triggers a criterion in an SOP for a reanalysis, then the sample should be reanalyzed. Similarly, if laboratory personnel determine that reanalysis is necessary and a suitable rationale is documented, then the sample should be reanalyzed. However, later in the paragraph, it states that Trihydro and the OU-3 Respondents will determine next steps on a case-by-case basis for any sample analysis that fails any quality control criteria. Revise the paragraph to clarify how and when laboratory quality control checks will be performed to determine data usability and what process will be followed for sample analyses which fail quality control criteria.

266. **Sections 4.4 and 4.5, Pages 4-8 and 4-9.** Revise these two sections to clearly indicate what documentation requirements are associated with routine field equipment maintenance and calibration procedures, similar to documentation requirements associated with laboratory equipment maintenance and calibration. If these requirements are conveyed in the FSP, provide a citation in these sections.

267. **Section 4.8, Page 4-9, Paragraph 5, Last sentence.** The last sentence of this paragraph states that MCLI does not produce electronic data deliverables (EDD). This may be problematic for adding site-related data from MCLI into the project database. Revise section to state what procedures will be used to accurately add data and supporting documentation from MCLI to the EPA-accessible Site-wide OU-3 database discussed in Section 6.1.2 of the RIFS Workplan.

268. **Section 4.8, Page 4-10, Paragraph 1, Sentence 4.** The fourth sentence of this paragraph states that following the data validation process, final laboratory flags will be entered into the Project Direct database. EPA requires that the EPA-accessible database include both original laboratory-assigned data qualifiers and qualifiers as amended via the data validation process. Revise to state that both sets of qualifiers will be entered into the EPA-accessible database.

269. **Section 4.8.2, Page 4-10, Paragraph 5.** EPA was unable to identify the formulae that make allowances for the effects of matrix interferences. Revise the paragraph by clearly identifying which formulae make allowances for sample matrix interferences and provide additional explanation or remove this statement.

270. **Section 5.1.3, Page 5-4., Last paragraph.** EPA and MDNR require adequate notification of nonconformance issues. Add the following sentence to this paragraph, *"Nonconformance reports will be provided to EPA and MDNR within 30 days of identification of any nonconformance condition unless suitable rational for additional time is provided subject to EPA and MDNR approval."*

271. **Section 5.2, Page 5-6, Paragraph 1 Sentence 1 and 2.** The first two sentences of this paragraph appear to contain typographical errors or unfinished text. Revise as necessary.

272. **Section 5.2.1, Page 5-6, Paragraph 2.** This paragraph describes "report sheets" that will be transmitted for the reporting of field data. Revise this paragraph by stating where these "report sheets" will be transmitted to, how the report sheets will be created, and specifically list what type of measurement data, supporting information (such as date, time, and location of collection), and calibration information must be recorded on each sheet. If some of this information is specified elsewhere in the QAPP or other deliverable, a specific reference may be included instead. Ultimately, EPA requires incorporation of field data into the EPA-accessible database, as specified in Task 3 (Data Management) of the SOW. Revise section to generally describe or summarize how the field data will be captured in the field and included and entered into the EPA-accessible database or include a reference in this section where this information is presented in the Work Plan.

273. **Section 5.2.2, Page 5-7, Paragraph 1, Sentence 1.** The first sentence of this paragraph states: *"Documentation and validation of the cause of outliers will accompany any attempt to correct or delete data values, because valid but extreme values will not be altered."* Data values should not be deleted. Revise the text to indicate that all data will be subjected to the verification and validation processes as described in the QAPP and flagged as appropriate.

274. **Section 5.2.2, Page 5-7, Paragraph 2.** A discussion in this paragraph addresses the application of a "J" qualifier on results between the reporting limit (RL) and method detection limit (MDL). This application of the "J" qualifier is not recommended for radio-assay analyte concentrations because these concentrations are reported with a quantitative measurement of uncertainty rendering a qualitative designator of uncertainty (e.g. the "J" qualifier) unnecessary (see Section A.7 of ANSI/ANS-41.5-2012). However, the application of a "J" flag to radio-assay analyte concentrations is generally only appropriate in circumstances where the reported uncertainty associated with the result may be significantly underreported (e.g., spectral resolution problems resulting in interfering or overlapping peaks) as described in ANSI/ANS-41.5-2012. Revise the text to specify the assignment of data qualifiers to radio-assay analyte concentrations that are in accordance with ANSI/ANS-41.5-2012. Additionally, the last two sentences of this paragraph state that radiochemistry results will be reported in

units of average picocuries per gram and average picocuries per liter. Explicitly define the term "average" in this context or revise/delete this statement as necessary.

275. **Section 6.0, Pages 6-1 through 6-1.** This section is written from a chemical (organic and inorganic) perspective. Not mentioned are concepts relevant to radiochemical analysis such as measurement uncertainty, tracer yields, background measurements, etc. Either revise the text to incorporate radiological terms and concepts into this section, or add a separate section devoted to data validation and usability of radiological data. Establishment of data validation procedures for radiological data should accord with MARLAP Chapter 8 (Radiochemical Data Verification and Validation) or ANS-41.5–2012 (Verification and Validation of Radiological Data for Use in Waste Management and Environmental Remediation).

276. **Section 6.1.2, Page 6-1, Paragraph 4, Sentence 1.** The first sentence of this paragraph states: "*The data validation will include Tier I, and Tier II, Tier III, or Tier IV data validation reviews as described in Section 6.1.2.1, 6.1.2.2, and 6.1.2.3, respectively (MCL[I] data will require only Tier I data validation).*" Not clear is the level of data validation review for non-MCLI data or if the level of data review is variable between the two identified labs. Clarify this item and in addition, provide rationale for subjecting MCLI data to only a Tier I data validation.

277. **Section 6.1.2, Page 6-1, Paragraph 4.** The references provided for data validation are not appropriate for validation of radiological data according to MARLAP guidance. American Nuclear Society Standard 41.5-2012 (ANS-41.5–2012) should be utilized for validation of radiological data. Revise this section accordingly.

278. **Section 6.1.2.4, Page 6-7 through 6-8.** This section describes data quality flags to qualify analytical data. Descriptions of data qualify flags in the text do not appear to include considerations unique to radiological analyses, for example:

- Radiological results should not be assigned an "R" qualifier when temperature exceeds 6 degrees Celsius if thermal preservation is not a requirement.
- Radiological results associated with very low or no chemical yield should be qualified.
- Radiological results with poor tracer peak resolution resulting in spectral overlap should be qualified.

Revise this section to properly incorporate considerations for qualifying radiological results based on MARLAP and/or ANSI/ANS 41.5.

279. **Section 6.1.2.4, Page 6-8, Paragraph 0, Bullet 4.** The fourth bulleted item of this page describes the data qualifier flag to be applied to results reported as detected, but due to cross contamination, suggested for interpretation as non-detected by the data validator. This bulleted item indicates the flag as "U"; however, the intended flag may have been "UB." Verify this and revise as necessary.

280. **Table 2.2.** In Table 2.2, change the acceptance criteria for QC samples for radiochemistry to criteria/ equations that incorporate measurement uncertainty. These equations and criteria can be referenced to Pace Radioanalytical SOPs which are already attached to the QAPP file.

281. **Table 2.2.** Table 2.2 specifies that soil samples for radium, uranium, and thorium analyses should be preserved in nitric acid to pH < 2. There is no scientific rationale or need to preserve soil samples for subsequent radium, uranium, and thorium analyses with nitric acid. Revise Table 2.2 to remove this requirement.

282. **Table 2-3a.** This table lists desired reporting limits for groundwater sampling and identifies both EPA MCL and MDNR Groundwater Protection Standards (GWPS) as screening levels for comparisons to anticipated laboratory method reporting limits (MRLs) and method detection limits (MDLs). Project quantitation limit goals (PQLG) other than EPA MCLs and MDNR GWPS could be identified after full development of DQOs (e.g., PQLGs necessary for assessing background groundwater quality or PQLGs necessary to support a BLRA that quantitatively estimates risks to receptors by referencing risk-based screening levels such as EPA Preliminary Remediation Goals [PRG]). Characterization of risk as part of a BLRA is specifically required by Task 5 (Risk

Assessment) of the SOW. Revise the desired MRLs and MDLs listed in Table 2-3a as necessary after full development of DQOs.

283. **Table 2-3a, Footnote 2.** Footnote 2 of this table suggests that the fourth column of this table lists screening levels based on a target cancer risk or a hazard quotient; however, the values listed in this column appear to be a list of groundwater MCLs only. Revise the footnote or table as necessary. Additionally, if an EPA MCL is not established, list the EPA regional screening limit instead.

284. **Table 2-3b.** This table lists desired reporting limits for soil sampling. The table appears to erroneously list EPA MCLs, and also lists some method reporting limits (MRLs) and method detection limits (MDLs) in units of picoCuries per liter, which is not appropriate for soil samples. Revise this table to resolve these issues.

285. **Table 2-3c.** This table lists desired reporting limits for samples to be analyzed by MCLI for parameters related to fate and transport modeling. The table does not indicate a basis for the desired reporting limits, and neither was this basis identified in the rest of the submittal. Desired reporting limits should be evaluated as part of the DQO process. Following the DQO process, revise this table as appropriate.

286. **Table 2-3c.** This table indicates that EPA Method 6020 will be applied for analysis for isotopes uranium-234, -235, and -238. Confirm that this method will involve an isotopic analysis, and revise if necessary.

END OF WORK PLAN Volume 2B (FSP) COMMENTS

Comments to Work Plan Volume 3 Health and Safety Plan (HASP)

287. **General:** There is no discussion of or reference to the Site's currently implemented Incident Management Pan (IMP) in the OU-3 HASP. Consider if the Bridgeton Landfill/OU-1 IMP should be mentioned and discussed in the OU-3 HASP and how potential on-site incidents associated with pending OU-3 field work will be managed and addressed between these two planning documents, should an incident occur on-site during the conductance of OU-3 field work, which could occur in the OU-1 areas and/or within the Bridgeton Landfill portions of the Site.

288. **General:** Revise the HASP to clearly address how safety concerns associated with drilling through potentially hazardous landfilled material will be addressed.

289. **General:** The HASP should be updated to identify an on-site rally point in case of inclement weather and/or for other emergency type situations, or reference other documentation describing the rally point.

290. **Section 2.4.1, Page 2-2, and Appendix C.** Generic field tasks are identified for Job Safety Analysis, or JSA. The following comments are noted:

- The generic JSAs provided may be inadequate to address some Phase I remedial investigation field methods (as examples, ecological field surveys, aquifer testing, management of investigation-derived waste).
- The generic JSA for Summa canister sampling is not checked or appended. Consider whether this JSA is appropriate considering the above comments pertaining to landfill gas sampling and vapor intrusion investigation.
- The generic JSAs for direct-push sampling and drilling do not appear to include rig-specific information. Section 7.13.1 of the HSA states: "The job hazard analysis must be specific to the rig to be utilized." Rig-specific JSAs should be provided as appropriate.

Note: Section 2.4.1 of the Health and Safety Plan was generally reviewed only to determine if the JSAs were consistent with the field activities as specified in the other OU-3 planning documents.

Comments to the Radiation Safety Plan (Appendix J of the HASP)

291. **General Comment to Appendix J of the HASP.** The Radiation Safety Plan uses the term technically enhanced naturally occurring radioactive material, or TENORM. Revise to use the term "uranium process waste" in the plan. There are several uses of TENORM throughout the document that need to be replaced.

292. **General Comment to Appendix J of the HASP.** The Plan references an Ameriphysics' Radiological Control Manual and several different Radiological Control Procedures (air monitoring, training, contamination control, instruments, etc). Revise this appendix to include full citations/references to this information.

293. **Section 3.0 Responsibilities.** The Plan references off-site support from a Radiation Safety Officer and a Health Physicist (and references each by name). But a Radiation Control Supervisor and a Health Physics Technician(s) provide for actual implementation on-site. Revise the Plan to specifically list the minimum training and experience requirements for both of these positions.

294. **Section 3.1.3, 1st sentence.** The word "*designed*" should be "*designated*". Revise sentence accordingly.

295. **Sections 4.2 Occupational Exposure Limits and 4.3 Airborne Exposure Limits.** Section 4.2 lists a total *As Low As Reasonably Achievable* (ALARA) goal of 100 millirem (mrem) per year total dose (includes internal and/or inhalation), but Section 4.3 notes the ALARA level for airborne is 10% of the derived air concentration, or DAC, which is based on 5,000 mrem, so the airborne ALARA goal is 500 mrem per year. The two sections' ALARA levels don't correspond. Section 4.2 may have meant to reference the ALARA level as 100 mrem just for external exposure and not include the internal contribution. Revise these sections to clarify.

296. **Section 4.4.2 Personnel Exposures.** This section references dosimetry and dosimeters but it's not clear if a permanent record such as thermoluminescent dosimeters (TLDs) or an electronic personal dosimeter, or maybe both will be used. Revise to state that workers who enter "radiologically controlled areas" will be required to have a permanent record dosimeter. Also, "radiologically controlled areas" stated in the Plan is not defined. Revise to add a site-specific definition for this term.

297. **Section 4.4.3 Portable Air Sampling, 2nd sentence.** "*With concurrence from the RSO, air sampling may be ceased when it is demonstrated that work does not result in airborne concentrations above 0.1 DAC.*" Additional detail and rationale are needed to explain this statement. Revise section to include a list of specific activities and locations to be evaluated beforehand to determine if air monitoring is required, weighing the extent of RIM disturbance and any engineering controls utilized or surveys performed to eliminate an inhalation uptake.

298. **Section 4.4.3 Portable Air Sampling.** This section also references a Radiation Control Program (RCP) 4-4, *Airborne Radioactivity Control Program* that is not provided in the Safety Plan. Details expected in the procedure include: the number of air monitors at a job site, volume and flow rate of air monitors used, analytical method, minimum detectable activity expected, etc. Revise this section to include the missing information.

299. **Section 5.1, 1st sentence of 2nd paragraph.** Revise to remove the second "*that*" as follows: "*A few of the engineering controls that ~~that~~ may be implemented...*"

300. **Section 5.2 Surveys and Monitoring.** This section refers to procedure RCP 4-2, *Surveys and Monitoring Procedures* but does not provide any details. Revise the section to provide the missing details and procedures. Specific items expected to be in the procedure include distance and speed of contamination surveys with the Model 43-93 detector, minimum number of wipe samples per piece of equipment, and basis of efficiency determination. Also, in paragraph 3, the Ludlum 3030E used for wipe sample analysis is the meter portion only, please add the detector to be used (likely a 43-10-1 alpha/beta sample counter).

301. **Section 5.3 Survey Instrumentation.** This section refers to procedure RCP 4-3, *Survey Instrument Procedure* but does not provide any details. Revise the plan to provide the missing details and procedures. Specific items expected to be in the procedure include response check requirements of instruments, and background radiation measurements.

302. **Section 5.2 Surveys and Monitoring; last paragraph.** The reference to Regulatory Guide 1.86 is obsolete although the contamination limits cited are still valid. Revise the Work Plan to add a second reference as follows: Regulatory Guide 8.23.
https://www.nrc.gov/docs/ML1622/ML16225A394.pdf

References

a. *EPA, 2019. Statement of Work, Remedial Investigation and Feasibility Study, Site Wide Groundwater (Operable Unit 03), West Lake Landfill Site, Bridgeton, Missouri. September 14, 2018.*
b. *EPA, 2004, Multi-Agency Radiological Laboratory Analytical Procedures Manual [MARLAP], NUREG-1576, EPA 402-B-04-001B, July.*
c. *EPA, 1994, National Oil and Hazardous Substances Pollution Contingency Plan, 59 FR 47416, September.*
d. *National Institute of Standards and Technology. 2008. Fire Facts. Special Publication 1102. August.*
e. *United States Geological Survey (USGS), 2015, Background Groundwater Quality, Review of 2012-14 Groundwater Data, and Potential Origin of Radium at the West Lake Landfill Site, St. Louis County, Missouri, Administrative Report Prepared by the U.S. Geological Survey Missouri Water Science Center for the U.S. EPA, Region 7, Interagency Agreement DW-14-92380501, April.*