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

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

Re: West Lake Landfill Superfund Site, Operable Unit 3, Remedial Investigation/Feasibility Study Work Plan, Field Sapling Plan, Quality Assurance Project Plan, Health and Safety Plan

Dear Mr. Rosasco:

The U.S. Environmental Protection Agency has reviewed the West Lake Landfill, Operable Unit 3 (OU-3), Remedial Investigation/Feasibility Study (RI/FS) Work Plan, Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP), and Health and Safety Plan (HASP), submitted on April 22, 2020 by Trihydro, Corporation, on behalf of the Respondents, Cotter Corporation (N.S.L.), Bridgeton Landfill, LLC, and the U.S. Department of Energy.

The EPA provided the Potentially Responsible Parties (PRPs) with draft comments on the RI/FS Work Plan, FSP and HASP on June 19, 2020 while review of the QAPP continued. On July 1, 2020, the Respondents introduced the EPA to their newly selected OU-3 contractor, ERM. The EPA approval of this contractor is pending. During the call, ERM presented a proposed change to the RI approach which includes the addition of high-resolution site characterization prior to installation of groundwater monitoring wells. The addition of this characterization activity will require changes to the work plan and associated planning documents beyond addressing the draft comments previously provided by the EPA.

Enclosed are the EPA's comments and modifications on the April 2020 RI/FS Work Plan, FSP and QAPP. It is understood that with the proposed change in the approach to characterization, some of the modifications and comments provided may no longer need to be addressed by the Respondents.

It is the EPA's understanding based on the July 1 call, that the PRPs will be developing and submitting a revised RI/FS Work Plan, QAPP, FSP and HASP. The revised documents shall incorporate and address all relevant comments and modifications provided by the EPA on the April 2020 documents, provide additional details regarding the addition of high-resolution site characterization prior to installation of groundwater monitoring wells and include a signed QAPP signature page. The revised OU-3 RI/FS Work Plan and associated documents shall be submitted within 30 days of receipt of this letter.

If you have any questions or concerns, please contact me either by phone at (913) 551-7910 or by e-mail at schwartz.jamie@epa.gov.

Sincerely,

JAMIE SCHWARTZ

Digitally signed by JAMIE SCHWARTZ
Date: 2020.07.10 15:41:00 -05'00'

Jamie Schwartz
Remedial Project Manager
Site Remediation Branch
Superfund and Emergency Management Division

Enclosure

cc: Mr. Ryan Seabaugh, MDNR
Mr. Jeffrey Murl, DOE
Mr. Andrew Keim, DOE

EPA Comments and Modifications to
April 22, 2020 OU-3 Remedial Investigation/Feasibility Study Work Plan

1. **Work Plan, General.** Multiple tasks rely on inputs from OU1/OU2 sampling efforts (e.g., surface water/sediment, soil gas), and details on the timing, locations, and analyses of these sampling efforts would help inform the OU3 sampling effort. Provide this detail as available.

2. **Work Plan, Section 1.1 Purpose and Scope, Page 1-2.** To remain consistent with the Statement of Work (SOW), remove the word 'site' from the first bullet point on this page.

3. **Work Plan, Section 2.2.3, Page 2-7.** This section states "The lateral extent of the NCC was based on the extent of surface RIM defined in the 2000 RI report, additional overland gamma surveying, and collection and analysis of surface soil samples (EMSI 2000)." It was also based on the extent of material previously obtained and spread over the landfill while implementing the Materials Management Plan. Revise the statement for accuracy.

4. **Work Plan, Section 2.4.15, Page 2-23.** Previous comments on this section do not appear to be adequately addressed. Specifically:
    a. Modify the partial sentence at the top of page 2-23 from "suggested" and "suggesting" to "concluded" and "concluding." In the 2015 background study report, the U.S. Geological Survey (USGS) did not suggest but concluded that 47 wells had been affected by landfill leachate.

    b. In the first full paragraph on page 2-23, modify the second sentence to state "Further, 11 of 13 wells with an average combined dissolved radium concentration greater than the EPA MCL had leachate impacts."

    c. Modify the first two sentences of the last paragraph in this section to state "The USGS concluded that concentrations of dissolved and total combined radium in groundwater samples from alluvial or bedrock wells at the site were significantly larger than background, and wells with leachate effects had significantly larger combined radium than wells that did not. Additionally, USGS concluded that there was…"

5. **Work Plan, Section 2.4.6, Page 2-17.** This section states the "WMC's report concluded that the standing water, which was seen in the aerial photographs, was most likely ponded precipitation"; however, no data supporting this conclusion is provided. A discussion of any available precipitation data from Lambert Airport for the week prior to the aerial photograph should be included in the Remedial Investigation Report to support the conclusion.

6. **Work Plan, Section 3.1.3.1.5, Page 3-10.**
    a. Although details are provided for six seeps, a total of 88 seeps are noted later in the paragraph, and the Golder drawing in Appendix H shows many other seeps. When this issue is addressed in the RI Report sufficient detail must be included as justification for the inclusion or not of identified seeps.

    b. Clarify that only the upper half of the quarry highwall (St. Louis Limestone) was observed during the study. The lower half of the quarry appears to have been filled with refuse.

    c. Clarify the date of the study and the Golder drawing in Appendix H.

    d. Modify by deleting the fourth sentence beginning "Of this total…", which appears to be redundant.

e. Modify the fifth sentence to state “The largest seep, Seep 2, was located on the north wall of the South Quarry pit (Sector 5) at an elevation of approximately 330 ft msl. Seep 2 contributed water with a leachate odor at a rate of 500 gallons per hour."

f. The last sentence refers to the “Ld sub-unit,” “Bx sub-unit,” and “Ld-Bx contact.” Clarify that these are part of the St. Louis Limestone.

g. Clarify why the underlying Salem Limestone does not appear to be mapped.

7. **Work Plan, Section 3.1.4, Page 3-13.** The last sentence of the second paragraph states "Peak flow within the historical record occurred on August 1, 1993, with a stage of 452.91 ft msl." Revise to provide the associated discharge value and to distinguish between the measured stage and the stage converted to mean sea level using the datum information.

8. **Work Plan, Section 3.1.4, Page 3-13.** The partial paragraph at the bottom of page 3-13 discusses "gravity flow relief wells." How gravity drives groundwater flow upward to the ground surface is unclear. Modify the paragraph to remove references to "gravity" and "gravity flow." Clarify that the relief wells control excess pore water pressure or artesian pressure in a confined aquifer by allowing the groundwater to flow unrestricted to the surface.

9. **Work Plan, Section 3.1.5, Page 3-14.** The third sentence of the second paragraph of Section 3.1.5 begins: “The shallow alluvial aquifer...” Modify to remove the word “shallow,” as this may be misconstrued as a limited zone of the alluvial aquifer (see Section 3.1.5.1).

10. **Work Plan, Section 3.1.5.1, Pages 3-15 and 3-16.**
    a. The first sentence states: "The bedrock aquifers of interest ... include the St. Louis Formation and Salem Formation." This statement implies that the formations are separate aquifers and conflicts with the third paragraph of Section 3.1.5, which indicates that the St. Louis and Salem limestones, along with the Keokuk-Burlington limestone, are collectively referred to as the post-Maquoketa Aquifer. Revise the work plan to distinguish individual formations and collective aquifers.

    b. The last sentence of the second paragraph of Section 3.1.5.1 indicates that "connectivity of secondary porosity ... will be characterized during this RI/FS." Revise to clarify how the connectivity of secondary porosity will be determined.

    c. The first full paragraph on page 3-16 begins: “The deep, intermediate, and shallow alluvial aquifers ...” However, the next paragraph contradicts the idea of three distinct alluvial aquifers; previous characterization has identified a single alluvial aquifer with three zones in hydraulic communication. Revise Section 3.1.5.1 and the rest of the work plan to distinguish the alluvial aquifer from its zones.

    d. The last sentence of the second full paragraph on page 3-16 states: “(T)he deep alluvium appears to behave as a single aquifer...” Revise to clarify whether "deep alluvium" is synonymous with the "deep zone" or implies some other configuration (e.g., a grouping of the intermediate and deep zones, which have similar hydraulic conductivity values).

11. **Work Plan, Section 3.1.5.2.4, Page 3-19.** Modify the title of this section to "Hydraulic Properties of Solid Waste."

12. **Work Plan, Section 3.1.5.2.5, Page 3-19.** Transmissivity is only discussed for the Alluvial Aquifer zones. Revise to expand the discussion to bedrock.

13. **Work Plan, Section 3.1.5.3, Page 3-20, and Figure 3-12, 3-13, and 3-14 series.**
    a. Figures 3-12a and 3-13a show closed depression and mound contours. Absent a site-specific explanation of a depression contour (e.g., pumping well, spring, other discharge) or mound contour (e.g., topography, less permeable aquifer materials, recharge), these closed contours may reflect inadequate data points, well construction issues, or inappropriate contour interpolation. Revise Section 3.1.5.3 and/or the figure notes to explain the contours based on site-specific conditions or revise the figures to more appropriately represent the contours and any data limitations. (See also the comment on Work Plan Section 5.3.4.)

    b. If the closed contours on Figures 3-12a and 3-13a are appropriate, revise the closed contours with the appropriate hachures.

    c. On Figures 3-12, 3-13, and 3-14, revise the proposed flow paths to be dashed, as these are assumed but not known.

    d. Modify Figure 3-13a to remove the groundwater elevation at S-80 from contouring. Section 3.1.5.3.1 notes perched water at S-80 and a nearly 6-foot difference in water level measurements between S-80 and adjacent well I-50.

    e. On Figure 3-13a, there is no evident basis for the contouring around S-51 or the proposed flow arrow leading to S-51 unless there is a discharge point in the alluvium at that location. Revise Section 3.1.5.3 and/or the figure notes to explain the contours and flow arrow based on site-specific conditions or revise the figures to more appropriately represent the contours and any data limitations. (See also the comment on Work Plan Section 5.3.4.)

    f. On Figure 3-14a, the contouring around PZ-113AS does not seem to honor the groundwater elevation at S-5, yet the S-5 value is shown on the map. Revise the contouring to incorporate the S-5 value or indicate on the figure why the S-5 value is shown but not honored.

14. **Work Plan, Section 3.1.5.3.2, Page 3-21, and Figure 3-13b.** Figure 3-13b does not show flow beneath Area 1 toward the Bridgeton Landfill, as stated in the fourth paragraph of Section 3.1.5.3.2, but instead shows flow toward the flood control channel. Revise Section 3.1.5.3.2 and/or Figure 3-13b for consistency.

15. **Work Plan, Section 3.1.5.3.2, Page 3-22.** The partial paragraph at the top of page 3-22 mentions local groundwater mounding during historical pumping from the North and South Quarries to drainage ditches, surface water infiltration, and storage ponds. Revise to include a reference and water level map supporting the statement or remove the statement as it appears speculative.

16. **Work Plan, Section 3.1.5.3.2, Page 3-22.** The first full paragraph on page 3-22 describes "an observed strong correlation between water levels with (leachate) pumping rates." Revise to include a reference and supporting information (e.g., plot of leachate pumping versus water levels), or remove the statement as it appears speculative.

17. **Work Plan, Section 3.1.5.4, Page 3-23.** The last paragraph of Section 3.1.5.4 establishes "upper (shallow and intermediate alluvium) and lower aquifers (deep alluvium)." As discussed in Section 3.1.5.1 and commented above, previous characterization has identified a single alluvial aquifer with three zones in hydraulic communication. Revise for consistency.

18. **Work Plan, Section 3.1.6.3, Page 3-28.**
    a. Currently, a landfill gas evaluation is being conducted as part of the OU1 program, and perimeter landfill gas sampling is being conducted for OU2. Based on these results, additional evaluation of the potential for soil gas to migrate into indoor air will be conducted as part of this

OU3 investigation. However, whether the OU1 and OU2 landfill gas sampling is consistent with the objectives of the OU3 vapor intrusion investigation is unclear. The work plan does not indicate whether the landfill gas analytes of interest for OU1 and OU2 are consistent with those indicated for the OU3 vapor intrusion investigation, nor does it indicate whether sufficient lines of evidence will be collected for OU3 purposes. Revise to clarify the consistencies and inconsistencies among the three sampling efforts, and to identify any additional investigation needed to address data gaps with respect to OU3.

b. This section indicates that a sub-slab depressurization system was installed at the Scale House to mitigate the potential for vapor intrusion and a fan was installed in the Engineering Office due to odor issues. Note that indoor air samples in these buildings will not reflect the potential for vapor intrusion but rather the effectiveness of existing mitigative measures.

19. **Work Plan, Section 3.1.7.1 Potential Receptors, Page 3-29.** This section states that if new exposure pathways are identified they will be evaluated but does not discuss what actions will be taken if site-related contamination extends or potentially extends beyond the 2-mile limit of the offsite inventory. Modify the statement after the second sentence in the second paragraph in this section "If data collected during the RI/FS process indicate the potential for exposures exist beyond the limits of 2 miles from the site, the offsite well inventory will be expanded accordingly."

20. **Work Plan, Section 3.3.3, Page 3-31.**
    a. This section implies that the list of monitored natural attenuation parameters will be limited to dissolved oxygen, nitrate, sulfate, and oxidation-reduction potential. Revise to reference the more robust list of MNA parameters indicated by the QAPP (e.g., Tables 2-3d and 5-1a).

    b. Modify the fourth sentence of this section by replacing "geochemical conditions" with "redox conditions." As previously commented, the constituents required to assess geochemical conditions are much more extensive than those indicated to assess redox conditions.

    c. Neither the work plan nor the Field Sampling Plan (FSP) or Quality Assurance Project Plan (QAPP) applies the USGS tool for assessing groundwater redox (https://pubs.usgs.gov/of/2009/1004/), despite requests for the use of this or an equivalent tool in multiple comments (e.g., FSP Comment 85, QAPP Comment 185a). Apply this tool or an equivalent.

21. **Work Plan, Section 3.4, Page 3-1.** The second bullet under Section 3.4 mentions "wastewater organic compounds" as a data need. This is the only mention of "wastewater organic compounds" in the work plan, FSP or QAPP. Revise to clarify the compounds intended and how the data need will be filled.

22. **Work Plan, Section 4.0, Page 4-1.** Modify the third sentence of the second paragraph of Section 4.0 as, "The data collected during the *first phase of* the RI ..."

23. **Work Plan, Section 5.2.1 Records Review and Offsite Well Inventory, Page 5-4.** This section does not clearly state that the records review will also seek to identify potential wells within the modeling domain to utilize in place of the 700-series piezometers, as stated Section 5.3.2.6, and that the offsite wells within 2-miles are being evaluated as potential receptors, as state in Section 3.1.7.1.
    a. Modify to add the following sentence at the end of the first paragraph "These records will also be used to evaluate if wells exist within the groundwater modeling domain that could be utilized for modeling purposes, eliminating the need to install the 700-series wells."

    b. Modify the first sentence of the second paragraph to state "An offsite well inventory will also be completed to identify potential receptors within 2-miles of the site."

24. **Work Plan, Section 5.3.** Well installation and staff gauge placement depend on access agreements. The work plan indicates that if access cannot be obtained within a reasonable amount of time, a replacement location will be negotiated with the EPA. Specify a proposed schedule for renegotiation and installation.

25. **Work Plan, Sections 5.3 and 5.4, Pages 5-4 through 5-33 and Tables 5-4, 5-5, and 5-7.**
    a. Many of the wells identified for activities in Tables 5-4, 5-5, and 5-7 are also proposed for abandonment due to OU1 remedy implementation, but this overlap is unclear. (Response to prior Comment 31 identifies these wells for abandonment: I-9, D-93, S-82, S-10, I-11, D-12, D-6, D-83, I-62, I-65, D-13, S-84, D-85, D-3, I-4, and S-5. Section 5.3.2.3 also identifies S-8 and I-66 as likely to be abandoned.) Specifically, Table 5-4 does not include well I-4 and does not indicate that eight of the wells proposed for monitoring are also proposed for abandonment: S-8, I-9, I-65, I-66, S-82, S-84, D-85, and D-93. Table 5-5 does not indicate nine of the wells proposed for slug testing are also proposed for abandonment: S-5, S-8, S-10, I-62, I-65, I-66, S-82, D-83, and S-84. Table 5-7 does not indicate six of the wells proposed for pressure transducers are also proposed for abandonment: S-8, I-9, I-62, S-82, D-83, and D-93. Clarify the wells to be abandoned on the tables and note whether the timing of abandonment will impact activities proposed for those wells.

    b. To avoid misrepresenting the adequacy of the monitoring well network and proposed activities therein, note the difference between the number of monitoring points (existing and proposed) and the number of clustered/nested monitoring well locations with multiple vertical intervals.

26. **Work Plan, Section 5.3.2.2, Page 5-7.**
    a. Modify to complete the second to the last sentence as: "...and sampling of the existing *monitoring wells* in Phase I."

    b. Modify the last sentence from "Groundwater concentrations from these wells..." to "Analyte concentrations in groundwater from these wells..."

    c. Consider organizing this section in phases like Section 5.3.2.3 to help clarify that 500-series bedrock wells will be installed in Phase II, with specific locations subject to change based on Phase I results. This also will help clarify the phasing of future step in/step out wells.

27. **Work Plan, Section 5.3.2.3, Page 5-8.**
    a. The text indicates that installing MW-302-AD next to PZ-302-AI will complete an alluvial cluster with S-53. This rationale seems to be in error, as S-53 is not at this location. Modify to replace well designation “S-53” with “PZ-302-AS”.

    b. Modify the third sentence in the MW-304-AD rationale section to “Existing wells PZ-304-AI and PZ-304-AS have documented leachate impacts (USGS, 2015) and there are no deep alluvial or bedrock wells at this location.”

    c. Modify to add the following sentence before the last sentence of the MW-306-AI and MW-306-AD section “Well MW-103 has been shown to have possible leachate effects (USGS, 2015).”

28. **Work Plan, Section 5.3.2.3, Page 5-9 to 5-10.**
    a. 400-Series Wells: Given the presumption that the predominant groundwater flow direction is to the northwest, it does not appear there is an adequate number of 400-series wells along the northwestern border of the site. Additional discussion of the 400-series wells is required with regards to both OU-3 and OU-1 needs.

    b. Modify the MW-400 cluster to include the following sentence “Well D-6 has landfill leachate effects and combined dissolved Ra>MCL (USGS, 2015).”

c. Modify the MW-401 cluster rationale to include the following "Existing well D-83 has possible leachate effects and average combined dissolved Ra > MCL (USGS, 2015)."

d. Modify the MW-402 cluster rationale to include the following "Existing well D-13 had documented leachate affects whereas existing well I-66 has not (USGS, 2015)."

e. Modify the MW-404 cluster rationale to include the following "All of the existing wells at this location (D-93, I-9, S-82) have leachate effects and D-93 has an average combined Ra>MCL (USGS, 2015)."

f. Two bedrock wells, MW-404-SS and MW-404-SD, are proposed "near alluvial wells S-82, I-9, and D-93 in an area beyond the footprint of proposed OU-1 remedy implementation." Because these alluvial wells are likely to be abandoned during OU1 remedy implementation (see Response to prior Comment 31 and Section 5.3.2.3), clarify whether these alluvial wells will be replaced or only sampled until the point of abandonment.

29. **Work Plan, Section 5.3.2.4, Page 5-11.** Background well cluster MW-600 appears to be installed near a waste site under long-term stewardship (see Figure 5-4b). Recommendation is to relocate the MW-600 series to the south or southwest in a generally upgradient location from the long-term stewardship site.

30. **Work Plan, Section 5.3.2.5, Page 5-12.** While additional details regarding step-in and step-out monitoring well placement and decision making have been provided, there is still some uncertainty regarding adequate characterization of groundwater at the Site and the potential for these protocols to limit characterization. Revise this section to include or address the following.
    a. This section is unclear whether the additional step-out and step-in wells will be installed only in the aquifer unit with the exceedance or in multiple aquifer units. Verify that, consistent with QAPP Table 3-1, the additional step-in and step-out wells will include vertical intervals not only for the impacted aquifer unit(s), but also for the aquifer units directly above and directly below the impact.

    b. First Bullet: Considering the complexity of the bedrock aquifer and the absence of a detailed flow model, modify this bullet to state "One or more additional step-out wells will be installed downgradient of a 500-series well…"

    c. First Bullet: In addition, EPA may require compliance wells downgradient of any wells with detections that are not background and not just above risk screening levels (RSLs). Detection of site related COPCs above background is an indicator of offsite migration. Revise this section to address compliance groundwater monitoring wells.

    d. Second Bullet: Modify this bullet to state "One or more additional wells will be installed…"

    e. Modify to add the following as a bullet "In addition to the above outlined protocols, additional wells may be necessary, including between well clusters whether impacted or not, if it is determined that the well spacing is inadequate to characterize the groundwater for purposes of the RI/FS in accordance with the Statement of Work."

    f. In the paragraph below the three bullets, modify by deleting, "…if results from Phase I suggest the need to install additional wells".

    g. Modify by deleting the last sentence of the second paragraph: "Locations for 500-series wells are limited by accessibility and drill crew safety considerations".

31. **Work Plan, Section 5.3.2.6, Page 5-12.** This section refers to Figure 5-4b and references the well inventory actions. Figure 5-4b shows a two-mile boundary but does not show the groundwater modeling boundary. Three of the four proposed 700-series piezometers to be used for the groundwater modeling are located outside of the two-mile boundary and if the well inventory is limited to 2 miles it would not identify wells in similar locations to the proposed 700-series. Please review this section to clarify the well inventory actions and revise Figure 5-4b to illustrate the groundwater modeling boundary.

32. **Work Plan, Section 5.3.3, page 5-13.** The first paragraph states that "Piezometers are not included as part of the monitoring well network, since they are not included in routine sampling." The third paragraph states "The proposed groundwater monitoring network is comprised of 162 total wells, including 80 existing wells, 78 proposed new wells, and 4 piezometers." These two paragraphs appear to be contradictory, please review and revise accordingly.

33. **Work Plan, Section 5.3.4, Page 5-14, Section 5.4.16, Page 5-27, and Figure 5-6.** A surface water body is just south of the former leachate lagoon, near former well S-51. Well S-51 historically had anomalously low water levels. The surface water body may be connected to a drainage mechanism to the northwest and serve as a discharge point for shallow groundwater. Recommend including a staff gauge at this surface water body because the MW-505 well cluster will be installed nearby.

34. **Work Plan, Section 5.4.8, Page 5-19, and QAPP, Table 3-1.** The groundwater model is described as a "geochemical fate and transport" model in the Work Plan and a "COPC fate and transport" model in the QAPP. Revise to clarify the intent of the model(s) and whether more than one type of model is anticipated.

35. **Work Plan, Section 5.4.11.1, Page 5-22, and Figures 5-9a and 5-9b.**
    a. Centralizers or another defined technique should be used to ensure the riser and screen remain centered in the borehole.

    b. One to two feet of fine secondary filter sand between the primary filter pack and bentonite seal should be used to reduce the potential for bentonite to enter the screened interval.

36. **Work Plan, Section 5.4.11.1, Page 5-22.**
    a. Modify the first sentence to state "If HPT results, geologic logs, or equivalent data indicate less than 13 feet of vertical space between ..."

    b. Use of nested monitoring wells is discouraged because of the difficulty of adequately sealing and maintaining separation among multiple wells at multiple depths within a single borehole. If nested monitoring wells are necessary to achieve project objectives, additional measures (e.g., sufficient vertical separation, centralizers) must be taken to ensure adequate sealing and separation among wells, and advanced written approval must be obtained from the Missouri Department of Natural Resources in accordance with 10 CSR 23-4.060 (13).

37. **Work Plan, Section 5.4.14 Page 5-24**. Limiting the pumping test to "one well location which has all five vertical intervals represented" may be overly restrictive. It is unlikely that enough water can be pumped through a 2-inch diameter well to initiate a water-level decline in the alluvial aquifer such that effects would be seen in the bedrock aquifer. As proposed, the concept does not seem likely to produce any meaningful data. Revise to specify larger well diameters for the pumping test wells or otherwise clarify how meaningful data will be obtained from this aquifer test.

38. **Work Plan, Section 5.4.15.3, Page 5-26.** The third paragraph of Section 5.4.15.3 states "A clean, unused filter will be used for each filtered sample collected." The following comments should be reviewed, and the section revised accordingly.

a. A new filter must be used at each well, and for any replicate sample collected at that well. It is otherwise unnecessary to change filters between samples collected at the same well location, except as necessary for high volumes or particulates.

b. Filters must be preconditioned to avoid biasing the sample result low. (See https://www.usgs.gov/mission-areas/water-resources/science/national-field-manual-collection-water-quality-data-nfm).

c. The order of collection for filtered samples should consider the tendency for contamination from the filters themselves. For example, nutrient or anion bottles should be filtered first, then trace elements/radionuclides, etc.

39. **Work Plan, Section 5.4.18.1, Vapor Intrusion Assessment Boundaries, Page 5-28.** This section states "The temporal boundary is limited to data from the previous 5 years." Revise this section to include a discussion of how this temporal boundary was determined and how this data will be used.

40. **Work Plan, Section 5.4.18, Page 5-28 and Table 5-9.** Analytes for the proposed vapor intrusion assessment (indoor air sampling) are based on vapor-forming compounds detected in groundwater samples collected since 2000. Additions to the vapor intrusion analyte list for indoor air may be necessary if additional vapor-forming compounds are detected during ongoing and proposed site groundwater sampling and OU1 or OU2 soil gas sampling. Modify this section to include the following "If additional vapor-forming compounds are identified during ongoing and proposed groundwater sampling and OU-1 or OU-2 soil gas sampling, those compounds will be added to the vapor intrusion analyte list."

41. **Work Plan, Section 5.4.18.4, Pages 5-29 and 5-30.**
    a. In an area where vadose zone waste or contamination is contributing to vapors, the groundwater and indoor air lines of evidence may be enough to "rule in" a structure for vapor intrusion but not to "rule out." Soil gas concentrations of vapor-forming COPCs in the vadose zone (not just groundwater) also must be considered. Clarify how this will be addressed.

    b. Five conditions are noted for a complete vapor intrusion pathway. The absence of a current building or building occupants does not negate future potential for completion of the vapor intrusion pathway. Evaluate whether subsurface vapor sources have the potential to pose unacceptable human health risks due to vapor intrusion in the future if site conditions were to change (EPA, 2015).

42. **Work Plan, Section 5.4.21, Pages 5-31 and 5-32.** The types of contaminated investigation-derived waste identified in Section 5.4.21 appear limited to sample collection activities and should be expanded. Revise this section to include drill cuttings, purge water, and materials from well installation, development, testing, repair and abandonment, and any other waste that may be generated.

43. **Work Plan, Section 5.5, Page 5-34.** The second full paragraph on page 5-34 states "The Groundwater Modeling Work Plan will be developed following the first two groundwater monitoring events which include the entire well network." Because the anticipated focus of the model is flow and transport in the alluvial aquifer, it is unclear why the Groundwater Modeling Work Plan cannot be developed until after the first two rounds of groundwater sampling are completed. The bulk of the information needed to define the model boundaries and layers is anticipated to be obtained by the conclusion of Phase I. Although the 700-series model boundary piezometers are currently proposed for installation during Phase II, these shallow wells could be installed readily and cost-effectively during Phase I using direct-push technology. Revise to move the Groundwater Modeling Work Plan earlier in the schedule

44. **Work Plan, Section 6.2.1, Page 6-3.** The second paragraph of Section 6.2.1 states that the modeling work plan "will be developed after review of data collected in the first phase of the RI/FS." This contradicts information provided in Work Plan Section 5.5 and Figure 10-2, indicating that the modeling work plan will be developed after the full monitoring well network has been installed and two rounds of groundwater samples have been collected and analyzed. Revise for consistency.

45. **Work Plan, Section 6.2.1.3, Page 6-5.** Modify the last sentence from, "The effect of pumping on the hydraulic heads and gradients in the alluvial aquifers will be compared to available data observational records" to "The Groundwater Modeling Work Plan will provide a process for determining which geochemical processes are appropriate for inclusion in the transport simulation."

46. **Work Plan, Section 6.2.5.3, Page 6-8.** EPA does not recommend using a detection frequency of less than 5% as a reason to eliminate a chemical as a contaminant of potential concern (COPC.) All chemicals that exceed their respective RSL, using a cancer risk of 1E-06 or non-cancer hazard quotient (HQ) of 0.1, should be retained as a COPC and carried through the risk assessment and quantitatively evaluated.

47. **Work Plan, Section 7.0, Page 7-1.** The second paragraph states "For the purpose of the screening step for human receptors, the BRA will use the latest USEPA RSLs for tapwater (USEPA 2019c) set to a cancer risk of 1E-06 and a non-cancer hazard quotient of 0.1 or 1 depending on the number of detected and co-occurring constituents." The non-cancer HQ of 0.1 is the screening level used by the EPA to identify COPCs. Modify the work plan state that an HQ of 0.1 will be used as a screening level to identify COPCs. It is not appropriate to use an HQ of 1 for screening purposes and any reference to using an HQ of 1 for screening level purposes must be removed from the document.

48. **Work Plan, Section 7.1, Page 7-2.** The first paragraph states that "if the background and site concentration data suggest the presence of local anthropogenic inputs, the baseline risk assessment will assess the relative risk contribution of non-site sources to inform risk management decisions." Although a Baseline Human Health Risk Assessment (HHRA) Work Plan will be submitted at a later date that will provide additional details regarding the use of background data, it is important to note that it is not appropriate to assess the relative risk contribution based on background concentrations in Baseline HHRAs. Assessing relative risk may result in the loss of important information for those potentially exposed receptors, as discussed in the EPA's Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A) (U.S. EPA, 1989).

49. **Work Plan, Section 9.2, Page 9-1.** Clarify that additional addenda to the work plan may be proposed as needed. For example, Response to Comment 142 provided on April 8, 2020 notes that a work plan addendum will be issued if the need for borehole flow measurements is identified.

50. **Work Plan, Section 9.2.2, Page 9-2.** Modify the second sentence to state "In order to facilitate rapid agency review, these addenda are anticipated to consist of a brief letter with a discussion of the proposed well rationale, a figure with proposed new well locations, and a revised project schedule."

51. **Work Plan, Section 9.4, Page 9-3 and 9-4.**
    a. Prior to development of the Groundwater Modeling Work Plan, a summary of all COPC data for each well that has been considered must be provided. This must include the identification of which data from the complete set will be included into a modeling program, and which data will not, along with reasoning. The summary must also indicate whether the data that will be used for risk assessment purposes or not.

    b. Prior to development of the Groundwater Modeling Work Plan, identification of the groundwater modeling programs being considered must be provided. This should also include specific factors which will influence program selection.

52. **Work Plan, Table 5-4.** The notes to Table 5-4 incorrectly define "A" as designating an abandoned well. Modify this designation to "Active".

53. **Work Plan, Table 5-6.** In Table 5-6, "redox indicator constituents" — including alkalinity, dissolved carbon dioxide, and carbonate — are shaded grey. Revise to clarify why alkalinity, dissolved carbon dioxide, and carbonate are considered redox indicator constituents.

54. **Work Plan, Figure 3-11.** Figure 3-11 appears to present Log K values as single points connected by an orange line. Because the text of Section 3.1.5.2.2 (p. 3-18) indicates that both single-point and straddle packers tests were conducted, the source of each Log K value (test type) is unclear. Revise the figure to present the two types of test data with different symbols, using vertical bars to represent tested intervals, and/or add clarifying notes to the figure.

55. **Work Plan, Figure 5-2.**
    a. Revise the figure to show the locations of all leachate risers. Many are missing from the current figure.

    b. Response to prior EPA Comment 32b states that well cluster MW-111-AS, MW-111-AI, and MW-111-AD is proposed east of the asphalt plant and west of Area 1. This well cluster is not illustrated on this figure. Revise figure to show the MW-111 cluster.

56. **Work Plan, Figure 10-2.**
    a. The collection of onsite indoor air sampling is scheduled to take 3 months, not including laboratory analysis and data validation. The reason for this extended sampling period is unclear. Explain and, if possible, condense the sampling period.

    b. The schedule appears to include nearly 8 months for preparation and review of the Groundwater Modeling Work Plan and nearly 8 months for preparation and review of the Groundwater Modeling Report, with only 4 months in between to construct the model, calibrate the model, and run the simulations. Based on professional experience, the 4-month time period to construct, calibrate, and run the groundwater model seems insufficient. Unless the model is already constructed and partially calibrated by beginning of the 4-month period, completion of this task on schedule is unlikely. Revise or clarify as appropriate.

    c. The schedule uses both edays (calendar days) and days (business days), creating a challenge to review due to this inconsistency. For example, groundwater well installation has a duration of 160 days; in business days the task runs from 7/31/20 – 3/11/21, in calendar days the task runs from 7/31/20 – 1/7/21. Please review the schedule and clarify the intent. Also, consider revising the schedule to use a consistent scheduling format.

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57. **General QAPP Comment.** The current version of the QAPP was prepared by TriHydro, Corporation on behalf of the Respondents. Since submission of this QAPP, the Respondents have notified EPA of their intent to institute a change in contractor for OU-3 work. In addition to the comments included below, the QAPP will also require revisions to include the new contractor's personnel, updated references to revised standard operating procedures, new signed signature page and any other contractor-specific changes that will be necessary.

58. **General QAPP Comment.** The revisions to Table 2-3a-ii, including the establishment of an action level, a lower bound of the gray region (LBGR), and the gray region itself are generally consistent with

EPA's guidance on the data quality objectives process (QA/G-4). This is an important step in ensuring that the data generated will adequately support addressing the principle study questions. In addition, the determination of a required method uncertainty utilizing the gray region is consistent with the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) Manual and is an established way to control measurement uncertainty in radiochemical measurements.

While the revised table provides these items in an organized, concise manner, EPA believes the required method uncertainties listed in the table (0.013 picoCuries per liter) for certain uranium and thorium radionuclides will be extremely difficult, if not practically impossible, for a laboratory to achieve. This difficulty is primarily due to the very narrow gray region listed in the table for these radionuclides. The QAPP states in multiple locations that "… the lower bound of the gray region (LBGR) will be 13% 1-sigma uncertainty of the action level." The QAPP does not provide a basis for selecting this LBGR and further it does not appear to be based on guidance provided in MARLAP. Inevitably this will result in a narrow gray region and subsequently significant challenges in controlling the total variance (sampling and measurement variance) of the data. Revise the QAPP where appropriate to provide the basis for the selection of the LBGR.

EPA also recommends reevaluating the selection of the LGBR, in consultation with the radiological laboratory and in consideration of the DQOs, to determine if the required method uncertainty can likely be met. Selection of a lower LBGR would expand the width of the gray region which would in turn increase the required method uncertainty. If the revised LGBR results in a required method uncertainty that the radiological laboratory cannot meet, the QAPP must be revised to describe how the data quality objectives that rely on radionuclide analyses will be achieved.

59. **General QAPP Comment.** Table 3-1 presents the revised data quality objectives for the RI/FS. Specifically, Step 6 presents the proposed performance or acceptance criteria for each of the principal study questions. The following is included in PSQ-3 and all the sub-questions for PSQ-4:

"*For COPCs, the upper/lower boundary and gray region will remain the same as PSQ #1 at this time. However, they will be subject to change once the initial data are collected and reviewed. Statistical methods that may be employed are listed in Section 4.0 of the QAPP. The data will be reviewed with USEPA prior to deciding on the final statistical approach and if sufficient data or additional data need to be collected prior to data analyses. The DQOs will be revised to reflect changes through this iterative process, as needed.*"

Given that PSQ-3 and PSQ-4 are more complex than simply determining whether groundwater samples have exceeded an EPA screening level, step 6 and step 7 need to be revised. In addition, several statements are included in step 7 (Develop the Detailed Plan for Obtaining Data) that are not currently addressed in step 6. For example, in PSQ-4:

i. "*Evaluate the groundwater and leachate data to determine whether similarities exist between source area groundwater and leachate when compared with offsite impacts (if present) through statistical evaluation of the different populations, geochemical fingerprinting, and redox parameter fingerprinting*." It's not clear what performance or acceptance criteria are needed to determine the similarities described above.
ii. "*Evaluate the groundwater and leachate data to determine whether similarities exist between RIM-impacted groundwater and leachate when compared with off-site impacts (if present) through statistical evaluation of the populations.*" It's not clear what performance or acceptance criteria are needed to determine the similarities described above.
iii. "*Calculate the mean Ra226/Ra228 activity level ratios for each sample location.*" EPA expects that calculating this ratio and estimating a mean of this ratio for multiple samples from each well associated with this PSQ will require specific performance/acceptance criteria which are unique from those proposed for PSQ-1.

iv. "*Evaluate the groundwater and leachate data to determine whether similarities exist between groundwater and leachate in MSW areas when compared with offsite impacts (if present) through statistical evaluation of the populations.*" It's not clear what performance or acceptance criteria are needed to determine the similarities described above.

v. "*Evaluate the potential statistical correlation between landfill leachate indicators from MSW and the presence of COPCs in groundwater.*" Because the purpose of the data collection for this item is to establish a correlation, more than one sample will be needed. This is not similar to PSQ-1 and unique performance/acceptance criteria are needed.

vi. "*Collect aquifer matrix material from sufficient background locations to calculate a COPC background concentration / activity level as described in QAPP Section 4.2.7.*" It is not clear what performance or acceptance criteria are needed to determine the sufficient number of background locations.

vii. "*Collect downhole gamma readings from geophysical logs such as gamma-gamma, natural gamma, spectral gamma to support determination of COPC background concentration / activity level as described in QAPP Section 4.2.7.*" No performance or acceptance criteria have been established for the downhole gamma readings which will apparently be used to support determination of background COPCs.

viii. *"Evaluate the groundwater and leachate data to determine whether similarities exist between groundwater and leachate in MSW areas when compared with offsite impacts (if present) through statistical evaluation of the populations."* It's not clear what performance or acceptance criteria are needed to determine the similarities described above.

ix. "*Evaluate the potential statistical correlation between landfill leachate indicators from MSW and the presence of COPCs in groundwater.*" Because the purpose of the data collection for this item is to establish a correlation, more than one sample will be needed. This is not similar to PSQ-1 and unique performance/acceptance criteria are needed.

x. "*Evaluate the potential statistical correlation between elevated temperature and pressure from the SSR with COPC concentrations in groundwater and leachate.*" Because the purpose of the data collection for this item is to establish a correlation, more than one sample will be needed. This is not similar to PSQ-1 and unique performance/acceptance criteria are needed.

xi. "*Evaluate the potential statistical correlation between landfill gas extraction rates with COPC concentrations in groundwater and leachate.*" Because the purpose of the data collection for this item is to establish a correlation, more than one sample will be needed. This is not similar to PSQ-1 and unique performance/acceptance criteria are needed.

These revisions may made after the initial round of groundwater samples are collected in accordance with the existing language in the QAPP and submitted and approved before the next round of groundwater sampling occurs.

Lastly, PSQ-5 relates to determining the future migration of groundwater contamination. This PSQ will require the use groundwater modeling software and the development of a groundwater model which will be proposed in the Groundwater Modeling Work Plan. Significant revisions to step 6, and possibly step 7, of this PSQ are needed. However, the necessary revisions will undoubtably be informed from the Groundwater Modeling Work Plan. The respondents should consider whether any updates are currently needed based on the initial planning for the groundwater modeling work plan. Nevertheless, modify to add the following to the end of step 6, which is similar to the quoted statement from PSQ-3 and PSQ-4, "*For COPCs, the upper/lower boundary and gray region will remain the same as PSQ #1 at this time. However, they will be subject to change once the initial data are collected and reviewed. The performance and acceptance criteria for PSQ-5 will be updated no later than with the submission of the Groundwater Modeling Work Plan and further development of the associated groundwater model. These proposed updates will be subjected to EPA approval.*

60. **QAPP, Section 3.1.3, Page 3-4.** The section states "The current budget estimate for the completion of the OU-3 Remedial Investigation (RI) scope of work (SOW) is $19 million through 2023 exclusive of long-term monitoring and agency fees." According to Section XXVII, Paragraph 127 of the Administrative Settlement Agreement and Order on Consent (CERCLA-07-2018-0259) the estimated cost of the work is $4,270,368. The Respondents must submit a detailed revised cost estimate that supports the current estimate.

61. **QAPP Section 3.2, Pages 3-6 and 3.7.** The Alternative Outcomes table defines "Near-site Wells" as wells installed outside of the site boundary but within 350 feet of the site. These wells are beyond the current site boundary but have been grouped with the on-site wells for the purpose of establishing alternative outcomes. Use the established site boundary as the line for decision-making purposes, or provide justification for considering "near-site" wells "on-site."

62. **QAPP Section 3.7, Page 3-9.** Clarify that any Key Assumptions (see Table 3-1) identified during the sample design will be verified during the RI.

63. **Sections 3.8.1.2 and 3.8.2.2, General Comment.** Both sections contain statements that certain control limits have been "determined by the laboratory". These statements are confusing as these control limits are established for data validation which necessarily is performed by a separate entity from the laboratory to ensure the data quality meets the requirements of the QAPP. Regardless of whether the radiological laboratory was consulted as part of the selection of these limits, the QAPP must be revised to make clear that these criteria are considered appropriate by the data validator and will meet the objectives of the QAPP.

64. **3.8.1.2 Precision for Radiological Analysis, Page 3-12.** Precision requirements described in section 3.8.1.2 and presented on page 3-12 are a hybrid of MARLAP's measurement quality objective (MQO)-based criteria (Chapter 7 and Appendix C) and metrology-based criteria (Chapter 18). The QAPP must be modified to specify a single, consistent set of criteria. EPA recommends the MQO-based criteria and that Chapter 7 of MARLAP be referenced as opposed to Appendix C.

65. **QAPP Section 4.1, Page 4-1.** Please include statistical information beyond summary statistical numbers.

66. **QAPP Section 4.2.6 and 4.2.7, Page 4-7.** Revise to clarify that statistical tests such as outlier and background COPC evaluations will be performed on data sets where the key assumptions of the statistical test are demonstrated, and where sample size evaluation (Section 4.2.5) shows adequate statistical strength.

67. **QAPP Section 4.2.6, Page 4-7.**
    a. Section 4.2.6 proposes to exclude a potential outlier if it is more than three times or less than one-third of the median concentration "around the time of the potential outlier." Clarify if the median concentration will be based on the two data points bracketing the potential outlier or a broader data set.

    b. Statistical outliers in onsite or downgradient data sets may indicate a site-related hot spot or contaminant release. As such, this section should be modified to indicate that removal of statistically identified outliers from these data sets will be based on sound technical information or knowledge of a field, laboratory, or administrative error or discrepancy (e.g., cross contamination, poor calibration) that can support that decision.

    c. Section 4.2.6 states: "Outlier tests will be used before combining data sets." Clarify the intended data sets and purpose(s).

68. **QAPP, Section 4.2.7, Page 4-7.** Section 4.2.7 (see also, Work Plan Section 7.1) identifies three literature sources of background values for identifying naturally occurring levels of background COPCs that may exist but are not attributable to the site. The following concerns are noted.
    a. "Evaluation of Radon Occurrence in Groundwater from 16 Geologic Units in Pennsylvania, 1986-2015" (USGS, 2017) is proposed as a source of background groundwater concentrations. This report does not appear sufficiently specific to the site or the region. These data may not be applied as a sole line of evidence for purposes of eliminating COPCs as background.
    b. "Vapor Intrusion Database" (EPA, 2012) is proposed as a source of background vapor concentrations. However, this database was compiled for the purpose of determining an empirically based vapor attenuation factor and is not intended to represent background for all types of buildings and their contents. These data may not be applied as the sole line of evidence for eliminating COPCs as background. To assess background at building locations, collect ambient air samples, conduct building surveys and chemical inventories, and remove chemicals prior to indoor air sampling if possible.
    c. "USGS soil surveys for inorganic constituents" are proposed as source of background soil concentrations, but no specific reference is provided. Any literature source of background values must be provided for EPA review and approval.

69. **QAPP, Section 5.1.2.1.4.** Revise to clarify that metadata will be compliant with Federal Geographic Data Committee standards, as required by EPA (https://www.epa.gov/geospatial/epa-metadata-technical-specification).

70. **QAPP, Table 2-2d.** Revise the document to clarify that both radon and radon decay products (polonium) will be analyzed by the radon method indicated.

71. **QAPP, Table 2-3c.** Verify that both radon and radon decay products (polonium) will be reported as part of the analyses indicated.

72. **QAPP, Table 3-1.** The following comments pertain to discussions of background COPC evaluation in Table 3-1.

    a. Change all references to QAPP Section 4.3.7 to QAPP Section 4.2.7, Background COPC/Evaluation.

    b. Revise to clarify that review of background well data must also include a sample size evaluation (see QAPP Section 4.2.5) as soon as possible, so that additional background well installation and data collection can proceed in a timely manner if necessary.

    c. QAPP Table 3-1 indicates that background COPC concentrations will be calculated using a 95% upper confidence limit (UCL). Revise to indicate that the background threshold value will be calculated as upper prediction limits (95% UPLs) or upper tolerance limits (UTL95-95), consistent with QAPP Section 4.2.7 and criteria therein.

73. **QAPP, Table 3-1, Step 1**. As necessary, revise the personnel, budget, and schedule consistent with changes to the planning documents.

74. **QAPP, Table 3-1, Step 2, Principal Study Question (PSQ) 4**.
    a. The first decision statement for PSQ 4 ("Determine which of the site-specific sources are contributing COPCs to groundwater.") appears redundant of subsequent PSQ 4 decision statements and unassociated with the alternative outcomes listed. Revise as: "Determine whether site-specific sources of COPCs in groundwater can be distinguished from one another."

b. For the second decision statement, revise to include an additional alternative outcome: "RIM is not a source of radionuclides in groundwater."

c. For the third decision statement, revise the alternative outcome "Both landfills are sources" to "MSW from multiple site locations is a source of radionuclides in groundwater."

d. For the third decision statement, revise the alternative outcome "Neither landfill is a source" to "MSW at the site is not a source of radionuclides in groundwater."

75. **QAPP, Table 3-1, Step 3, PSQs 1-3.** EPA regional screening levels (RSLs), maximum contaminant levels (MCLs), and preliminary remedial goals (PRGs) are identified as types of information to address PSQ 1 ("Are COPCs present in groundwater above screening levels?"), as well as PSQ 2 and PSQ 3. For screening and risk assessment purposes, the appropriate screening level value is the EPA RSL, a risk-based concentration considering only the relationship between exposure and risk. The MCL weighs additional considerations, such as the cost and availability of analytical and treatment technologies, and the PRG is focused on ensuring that residual risks after site cleanup are acceptable. Because PSQs 1-3 are specific to screening COPCs, remove EPA MCLs and PRGs as types of information to address these questions. Presentation of EPA MCLs and PRGs at the screening stage would be for information purposes only.

76. **QAPP, Table 3-1, Step 3, PSQ 2.**
    a. Under "Identify the Types of Information Needed" for the first PSQ 2 decision statement, revise "Surveyed locations of historic and new wells" to "Surveyed geographic coordinates, top of casing elevations, and ground surface elevations of historic and new wells."

    b. Under "Identify Appropriate Sampling and Analysis Methods" for the first PSQ 2 decision statement, revise "QAPP Section 5.1.2.1.5" to "QAPP Section 5.1.2.1.4."

77. **QAPP, Table 3-1, Step 4, PSQs 1, 2, 3, and 5.**
    a. Under PSQs 1-3 (and by reference, PSQ 5), the lateral boundary for COPC evaluation is the study area boundary shown on Work Plan Figure 3-17. Revise the "Spatial and Temporal Boundaries" section of these PSQs to clarify that the study area boundary will be expanded as necessary to characterize the extent of site-related contamination.

    b. Under "Target Population," revise "onsite wells" to "onsite wells and leachate points" (multiple locations).

    c. For PSQs 1-2, provide "Spatial and Temporal Boundaries" for leachate, consistent with PSQ 3.

    d. For PSQ 5, revise "The boundaries for the leachate sampling are listed above (cite more specifically)" to "The boundaries for the leachate sampling are the same as for PSQ 1."

78. **QAPP, Table 3-1, Step 5, PSQs 1, 2, and 4.** Population parameters for COPC concentrations are limited to "existing and proposed" wells or leachate points. Clarify that historical data from wells that have or will be abandoned may be applied consistent with the QAPP.

79. **QAPP, Table 3-1, Step 5, PSQ 2.**
    a. A decision rule for third party wells indicates that groundwater concentrations below screening levels will be used as a "confirmation" (along with other lines of evidence) to determine the extent of a groundwater plume. Revise a "confirmation" to a "consideration." If a third-party well has a long screened/open interval and the highest hydraulic head zone within that screened/open interval is also the least contaminated, a groundwater sample from the third-party well may underestimate the range of concentrations within that well.

b. A decision rule for third-party wells indicates that groundwater concentrations above screening levels will be considered in estimating the plume extent but not as a basis for step in and step out wells at this time. Revise to clarify that while a third-party well is unlikely to serve as the sole basis for a step in or step out well, results from third-party wells will be considered in determining the necessity and placement of step in and step out wells. The reliability of third-party well data for screening purposes will depend on the construction and integrity of the well.

80. QAPP, Table 3-1, Step 5, PSQ 3.

a. A decision rule states: "If the 95% UCL for a COPC from the background well population is less than the screening level, then any exceedance of that COPC will not be attributable to background conditions." For clarity, revise "exceedance of that COPC" to "exceedance of that COPC screening level." See also comment 16.

b. The lines of evidence pertaining to off-site sources of contamination are limited and may be confusing. Revise to clarify that if an off-site source is suspected of contributing to contamination on or downgradient of the site, additional review and/or investigation may be necessary to distinguish the contributions of on-site and off-site sources.

81. QAPP, Table 3-1, Step 5, PSQ 5. For estimation problems, the estimator is specified, but the estimation procedure generally is not. Revise to specify the relevant planning document section.

82. QAPP, Table 3-1, Step 7, PSQs 1-4. The sampling design states: "Results will be used to identify outliers and may trigger a higher level of validation on outliers, if inconsistent with historical or most recent data." As noted above, statistical outliers in onsite or downgradient data sets may indicate a site-related hot spot or contaminant release. As such, removal of statistically identified outliers from these data sets should only be based on sound technical information or knowledge of a field, laboratory, or administrative error or discrepancy (e.g., cross contamination, poor calibration) that can support that decision.

83. QAPP, Table 3-1, Step 7, PSQ 4.

a. Evaluation of the "potential statistical correlation" between multiple sets of parameters. Revise to discuss or reference the statistical test(s) to be applied.

b. The sampling design for PSQ 4 includes only six quarters of sampling, compared to eight quarters for other PSQs. Revise for consistency or provide a basis for the discrepancy.

84. QAPP, Table 3-1, Step 7, PSQ 5. The PSQ 5 sampling design as it pertains to borehole geophysical logging states: "Select at least one tool for evaluating lithology based on vendor availability." The potential use of only one downhole tool differs from Work Plan Section 5.4.9 and Field Sampling Plan Section 3.7.1, which indicate the use of multiple tools for specific purposes. Revise consistent with the level of detail provided in Field Sampling Plan Section 3.7.1: "Select at least one tool from each of the three categories (i.e., lithology and rock structure, hydraulic parameters, and radionuclide information), considering the need for isolation casing and vendor availability. Prior to deploying other geophysical tools, confirm borehole stability using acoustic televiewer logs and caliper logs to obtain information on potential fractures and cavities."

85. Appendix C, Page 10. The quality assurance control limits for QC samples including laboratory control samples (LCS), matrix spike/matrix spike duplicates (MS/MSD) , and other duplicates for the radiochemical analysis of select uranium, thorium, and radium radionuclides appear to be inconsistent with the limits described in sections 3.8.1.2 and 3.8.2.2 of the QAPP. Revise the QAPP accordingly so that it is clear which limits have been selected for QC samples associated with radiochemical analyses.

EPA Region 7 Quality Assurance Manager Comments on
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86. **QAPP, Title/Signature/Distribution Pag**e. It appears this page is also intended to document the list of who will receive a copy of the QAPP to be distributed by the Trihydro PM and Trihydro APM per §2.3. Is this correct?

87. **QAPP, Section 1.0, Page 1-1.** Please note G-9 has been replaced with G-9R and G-9S (as referenced later in this section).

88. **QAPP, Section 2.0, Page 2-1.** Because EPA, MDNR, and USGS are included on Figure 2-1, it would be useful to briefly summarize their project responsibilities here.

89. **QAPP, Section 3.1.3, Page 3-4.** Because this a multi-year project, it should be noted the QAPP will be reviewed periodically (annually is recommended) to ensure it remains current and is updated in a timely manner as needed.

90. **QAPP, Section 3.8.1.1, Page 3-11.** This section gives an RPD acceptance limits of 50% for field duplicates of solid matrices (alluvial and bedrock). However, on page 5-6 the QAPP states there will be no field duplicates for alluvial and bedrock because of the inherent non homogeneity. This inconsistency needs to be addressed. See also pages 7-5, 7-7, and 7-8.

91. **QAPP, Section 3.11, Page 3-21.** If a separate field narrative will be prepared to describe any difficulties encountered, it should be addressed here.

92. **QAPP, Section 5.1.3, Page 5-7.** Although assumptions can be made, it would be helpful to note here why there are no equipment blanks and field blanks for alluvium and bedrock samples.

93. **QAPP, Section 5.1.4.1, Page 5-10**. This section of a QAPP should also address the availability and location of spare parts as applicable.

94. **QAPP, Section 5.1.6, Page 5-12.** The Trihydro quality program is referenced for the inspection and acceptance of supplies and consumables but it is not clear if this quality program addresses the acceptance criteria and the responsible individual(s).

95. **QAPP, Section 5.3.3, Page 5-14.** Is the ArcSDE database described here the USEPA accessible database referenced in the preceding section? If not, additional details for the USEPA accessible database should be provided including any hardware/software requirements.

96. **QAPP, Section 6.2.1, Page 6-7. Is** the RI/FS report described here separate from the monthly reports referenced in § 2.2? If so, the monthly reports should also be described.

97. **QAPP, Section 7.1.2, Page 7-2.** A Region 1 data review guidance is referenced in this section for the evaluation of duplicates. However, this guidance includes criteria based on the sample result in relation to the sample quantitation limit, but this is not specified in the QAPP (see page 3-11) and the Region 1 guidance also includes criteria for solid matrices but as noted previously, the QAPP is inconsistent regarding field duplicates for solid matrices. The field duplicate acceptance criteria to be applied needs to be clarified as well as whether field duplicates will apply to solid matrices.

98. **QAPP, Table 2-2A.** The holding time for hexavalent chromium by 7199 needs to be verified. The method lists a holding time of 24 hours, but this table lists 28 days.

99. QAPP, Table 2-A. The following method versions should be verified with the laboratory to determine if they are still implementing the version listed in this table or if they have switched to the newer version now available:

a. 6010B
b. 8270B
c. 8260C
d. 9012A

100. FSP, Section 3.8, Page 3-26. The reference to ASTM D 4630-96 may need to be verified. The ASTM website appears to show ASTM D4630 – 19 as the current standard.

EPA Comments and Modifications on
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101. Field Sampling Plan, Section 2.3.4, Page 2-7. The partial sentence at the top of the page 2.7 states: "The containers are pre-cleaned and will not be rinsed prior to sample collection." Modify as follows: "The containers are pre-cleaned. However, some unpreserved containers may require a pre-rinse to prevent constituents from absorbing to the containers." See the USGS 2018 "National Field Manual for the Collection of Water Quality Data" and the EPA 2017 "Quick Guide to Drinking Water Sample Collection."

102. Field Sampling Plan, Section 2.4.1, Page 2-10. The last sentence of Section 2.4.1 states "In order to minimize the chance of cross-contamination, field and equipment blanks will be stored and shipped separately from source area samples, to the extent practicable." Because the field and equipment blanks are intended to identify cross-contamination among samples, storing them in a separate container from the samples undermines their purpose. Modify as follows: "In order to minimize the potential for cross-contamination, samples expected to have high levels of contamination based on past analytical results, leachate, or location will be segregated and shipped separately from those samples expected to have lower levels of contamination."

103. Field Sampling Plan, Section 3.5, Page 8. Bullet 8 indicates that, although most sample containers will arrive with preservatives, others will require addition of the preservative to the sample container. Revise to clarify the following:

a. When in the sampling process the preservative will be added (e.g., before sample collection, immediately after sample collection, later).

b. The procedures that will be implemented to address potential error or cross contamination during sample preservation (e.g., procedures, sample collection order, preservation order, QC samples).

104. Field Sampling Plan, Section 3.6.2, Page 3-20. Under Phase I Background Bedrock Wells, modify by replacing MW-604-SD with MW-605-SD for bedrock aquifer matrix sampling. The MW-604-SD location is considerably further from the site and not tangential to the presumed groundwater flow path in bedrock.

105. Field Sampling Plan, Section 3.7.1, Page 3-21.

a. The first paragraph of this section states "This includes the spectral gamma tool ..." Modify to state "This includes but is not limited to the spectral gamma and natural gamma tools ..."

b. Modify to add "Because radionuclide activity may be low and measurements through the isolation casing muted, the downhole tools will be run over a sufficient length of time to yield meaningful results."

c. This section indicates that geophysical logging will be conducted after installing an isolation casing in the alluvium and advancing drilling to total depth. Revise to clarify:
    i. The minimum amount of time the borehole will be allowed to set before geophysical logging and the maximum amount of time. Some logs (e.g., fluid temperature and resistivity) should not be run directly after drilling, as lower yielding wells may require time for flow to stabilize.

    ii. The maximum amount of time the borehole will be allowed to remain open before final casing, to avoid vertical cross-contamination.

106. Field Sampling Plan, Section 3.7.1, Page 3-22 and Table 3-5.

a. For the hydraulic parameter tools, revise Table 3-5 and item 2 on page 3-22 to reflect that the heat pulse flow meter and fluid temperature/electrical resistivity logging will be conducted at all geophysical logging locations.

b. In the second paragraph of page 3-22, clarify: "Geophysical logging will be conducted at all well locations where bedrock aquifer matrix samples are to be collected." Accordingly, modify Table 3-5 to include MW-205-SD.

107. Field Sampling Plan, Section 3.9.1.1, Page 3-28.

a. The first sentence of the second paragraph on page 3-28 references an isolation casing and an outer casing. Please review this language and revise for consistency or clarify the difference between the isolation casing and outer casing.

b. The fifth and seventh sentences of the first full paragraph imply that drilling will advance to final depth both before and after geophysical testing. Revise to correct the text or clarify the distinction (e.g., rock coring to total depth, then later returning the core barrel to total depth to support well placement).

c. The last paragraph on page 3-28 indicates a 2-foot filter pack between the top of the screen and the bentonite chip/pellet annular seal. This approach is acceptable for non-slurry chip or pellet bentonite. However, if a bentonite slurry is used, MDNR Well Construction Rules (10 CSR 23-4.060) require a secondary filter pack (1 to 2 feet of fine sand between the primary filter pack and bentonite seal) to prevent the bentonite from entering the screened interval.

108. Field Sampling Plan, Section 3.9.1.2 Page 3-29. The third paragraph on this page states a minimum depth of 13 feet between screened intervals of nested shallow and intermediate wells. The well construction as described in this section, and as illustrated in Figure 3-8b, indicates a minimum of 16 feet between screened intervals. Revise to provide consistent information.

109. Field Sampling Plan, Section 3.9.1.2, Page 3-30. The second paragraph on this page describes the piezometer well construction details and states they will be constructed similarly to the single alluvial wells; however, a well screen length is not listed. Revise this section to clarify the proposed screen length for the piezometers.

110. Field Sampling Plan, Section 3.12.1, Page 3-34. It is unclear how it will be determined that the water-level is stable (bullet 4) before opening the pressure valve. Revise to provide clarification.

111. Field Sampling Plan, Section 3.14.2, Page 3-36 and 3-37. The first paragraph indicates a flow rate of 0.2 to 0.5 liters per minute (L/min) and second paragraph indicates a flow rate of 0.2 and 0.5 milliliters per minute (mL/min). Revise this section to use consistent pumping rates.

112. Field Sampling Plan, Section 3.14.3, Page 3-39. The last paragraph makes reference to Ttable 2-4, which appears to be incorrect. Modify this paragraph to reference Table 2-5.

113. Field Sampling Plan, Section 3.14.3, Page 3-40.

a. The first sentence on this page states that groundwater and leachate samples will be collected for isotopic thorium, uranium, and radium. Table 2-4a states tritium will also be analyzed in groundwater and leachate samples. Revise this section to include tritium and provide a discussion of sample container properties and head space requirements.

b. The second paragraph makes reference to samples filtered directly into the "appropriate sample containers" but the order of sample collection is not specified, and the SOP not referenced for the order of filling or preserving. Revise this section to include the SOP that provides the order of bottle filling and preservation.

c. The first sentence of the second paragraph states that field test kit samples will be run for ferrous and ferric iron and ammonium. The text indicates a field test for ammonia is to be used. It is unclear why a field test for ammonium is being done given it is included in the analytical suite on Table 2-2A of the QAPP. Please provide an explanation for conducting this field test or delete the field test for ammonia.

d. The individual doing the ferrous and ferric iron field tests should not be the same person filling sample bottles, and this activity should be not be done in proximity to the filling or preserving of sample containers to avoid cross contamination of environmental samples. Revise the text and SOP to reflect this.

114. Field Sampling Plan, Section 3.16.2, Page 3-44. The first paragraph in this section states two barometric loggers will be placed at the site and used for barometric pressure compensation. Revise this section to provide additional details regarding which one of the loggers will be used and how that decision will be made; if the two loggers have different readings how will this be handled; and how the altitude of the barometric logger compared to the altitude of a well where a data logger is deployed affects the compensation. Also, identify how much vertical difference in elevation between the barometric logger and the wells can be tolerated before this affects the compensation.

115. Field Sampling Plan, Section 4.1, Page 4-2 and 4-3.

a. The first bullet references Appendix F-4 for the water level/interface probe user manual but does not document the field water level comparison procedures in the SOPs. The SOPs must include these procedures. Additionally, revise the text to include a discussion of how to determine which of the two water level probe readings is accurate if there are differences.

b. Bullet 7 is unclear as to the specific methods and standards for calibrating the water quality meter; several are presented in the instrument manual provided in Appendix K-4. Revise to clarify the project-specific calibration methods and standards to be used. Further, revise to clarify that multi-point calibration will be conducted using a project-appropriate range of calibration standards.

116. Field Sampling Plan, Table 2-4a. The text states that groundwater and leachate samples will be collected for isotopic thorium, uranium, and radium. Table 2-4a states tritium will also be analyzed in groundwater and leachate samples. Please revise the text to include tritium and provide a discussion of sample container properties and head space requirements.

117. Field Sampling Plan, Table 2-5. This table lists the sample order by analyte group but does not indicate the order of unfiltered and filtered samples. Additionally, there are several analytes listed in Table 2-6 that are not mentioned in Table 2-5, and the analyte groupings between these tables are not

consistent, such as chlorinated herbicides and PCBs among others. Revise Table 2-5 accordingly to be consistent and complete.

118. Field Sampling Plan, Table 2-6a, Page 3. The third page of Table 2-6a lists 'Radiological Chemistry' samples in two sections. Distinctions between these two sections and the multiple Radium-226 and Radium-228 listings therein are unclear. Please review and revise for clarity.

119. Field Sampling Plan, SOP K-2. There is an insufficient amount of information provided in this SOP to provide an adequate review. This SOP needs to be revised to be consistent with the work plan and clearly indicate sample collection sequence/bottle filling order. Details should include sequencing of unfiltered and filtered bottles to be filled, preservation, and number of field personnel required to accomplish this task. The following specific comments are provided regarding this SOP.

a. **Section 3.4, Step 5b.** The flow rates listed in step 5.b indicate flow rates between 0.1 and 0.5 mL/min. This is inconsistent with the FSP Section 3.14.2 discussion which lists flow rates in liters/minute. Review and revise accordingly.

b. **Section 3.4, Step 5c.** This step indicates temperature will be monitored but not used for stabilization, presumably because at low flow rates of groundwater in the tubing and warming and cooling of the flow-through cell due to differences between the groundwater and surface air temperature. Please clarify how an accurate groundwater temperature will be obtained for use in any geochemical modeling transport evaluation.

c. **Section 3.5, Bullet 3.**
   i. Revise to clarify that final parameter values, including temperature, will be included in the database.

   ii. Because groundwater temperatures may be influenced by ambient conditions at the surface, revise to clarify how surface temperature effects will be avoided (e.g., insulation/shielding) and how a final temperature will be selected.

d. **Section 3.5, Bullet 5.** This bullet states if multiple pump cycles are needed to fill the volatile organic analysis (VOA) vials they should be covered with the lid between. Revise to state that VOA vials should be filled from a single pump cycle.

e. Section 3.5, Bullet 7. Clarify the additional constituents that will be collected after radon and volatile organic compounds (VOCs) have been collected and what specify the order in which they will be collected. The statement of "in order of decreasing sensitivity" is not appropriate criteria for defining the order of sample collection.

f. **Section 3.5, Bullet 8.** For samples requiring the addition of the preservative to the sample container, revise to clarify the following:
   i. When in the sampling process the preservative will be added (e.g., before sample collection, immediately after sample collection, later).

   ii. The procedures that will be implemented to address potential error or cross contamination during sample preservation (e.g., procedures, sample collection order, preservation order, QC samples).

120. Field Sampling Plan, Appendix K-5.

a. There is no certification that indicate the filters are free of CPOCs, other than the statement that they are PFAS, PFOS, and PFOA free. Provide certification that the filters are free of COPCs.

b. Native water should be purged through all filters before filtering for trace elements (see USGS National Field manual). This must be taken into consideration when addressing the bottle filling order comment on Appendix K2, Section 3.5 Bullet 7 above.

References

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