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August 7, 2020

Mr. Christopher Smith
Remedial Project Manager
EPA Region 1
5 Post Office Square, Suite 100
Mail Code OSRR 07-4
Boston, MA 02109-3912

Subject: **Nuclear Metals, Inc. Superfund Site, Concord, Massachusetts**
Remedial Design Work Plan
Responses to Comments and Revised Remedial Design Work Plan

Dear Mr. Smith:

Enclosed for your review and approval are Responses to Comments (RTC) and the revised Remedial Design Work Plan (RDWP) and its' appendices, which consist of Pre-Design Investigation Work Plans (PDI WP), a Treatability Study Work Plan (TS WP), and Supporting Deliverables.

For reference, the RDWP appendices include:

A - PDI WP – Site-Wide Soils and Sediments

B –PDI WP – In-Situ Sequestration of Depleted Uranium and Uranium

C – PDI WP– Holding Basin Containment

D – PDI WP – 1,4-dioxane and VOCs in Bedrock Groundwater

E – TS WP – In-Situ Sequestration

F - Post Removal Site Control Plan (PRSCP)

G – Health and Safety Plan (HASP)

H – Emergency Response Plan

I - Sampling and Analysis Plan: Field Sampling Plan (FSP)

J - Sampling and Analysis Plan: Quality Assurance Project Plan (QAPP)

K – Site Wide Monitoring Plan (SWMP)

L - Community Relations Support Plan (CRSP)

Initial comments on RDWP Appendices A, B, C, D, E, and J were received on May 14, 2020. Initial comments on Appendices A and C were discussed with EPA, MassDEP, and AECOM representatives on June 1, 2020. Initial comments on Appendices B, D, and E were discussed with EPA, MassDEP, and AECOM representatives on July 5, 2020. Responses to these initial comments were provided on June 16, 2020, and an updated response was provided June 25, 2020.

Final comments were received on RDWP Appendices A, B, C, D, E, I and J on July 2, 2020. Comments on the RDWP and RDWP Appendices F, H and K were received on July 16, 2020. The RTC are attached to this letter, each comment received is followed by our response. The revised RDWP and appendices have been uploaded to Project Portal as MS Word documents in "track changes" with revisions shown in redline / strikeout for ease of review (some of the revised QAPP worksheets became too jumbled in RLSO, so all changes were accepted and a clean revision is instead provided). . Tables and figures that required revision are also provided. A complete revised RDWP will be prepared upon your approval of these responses.

In addition, as we discussed during review of the initial comments, "Implementation Plans" have been produced to detail our approach to certain PDI tasks. Draft Implementation Plans have also been uploaded to Project Portal, in sub-folders with each respective PDI or TS WP. Implementation Plans included with this response include:

SSS-1 and SSS-3 Soil and Sediment Sampling Implementation Plan

SSS-2 Depleted Uranium Penetrator Investigation Implementation Plan

SSS-4 Cooling Pond, Sphagnum bog, Septic field, and Landfill Implementation Plan

ISS TS HB Implementation Plan

HB-1, HB-2 and SSS-5 Drilling and Sampling Implementation Plan

1,4-Dioxane in Bedrock Groundwater Implementation Plan

Please let me know if you have any questions.

Sincerely,

Bruce Thompson

Attachment – Responses to Comments

cc: Garry Waldeck, MassDEP
Settling Defendants
Mark Kelley, PE, Haley & Aldrich, Inc.
Carl Elder, PE, Geosyntec Consultants

Responses to Comments dated July 16, 2020
on the Remedial Design Work Plan dated March 2020

1. Title Page. For correctness, delete "/Remedial Action" from the document title.

Response: Changed as requested.

2. Executive Summary, Page i, Paragraph 3 and Section 2. For clarity please indicate that the property also has soil and sediment contamination but off property contamination is limited to groundwater.

Response: Changed as requested.

3. Executive Summary, Page iv, 4th item. For clarity to reflect the Groundwater NTCRA is no longer applicable please insert "started" between "progress" and "under".

Response: Changed as requested.

4. Table of Contents, Tables. The table names and numbers are not consistent with the actual tables presented in the table section. Please make consistent.

Response: Corrected as requested.

5. Section 2.2.4 Cooling Water Recharge Pond (AOI-4), Page 4. The cited reference, currently shown as "Source", should be identified.

Response: Reference added.

6. Section 2.2.8 Pavement Drain Outfalls (AOI-9), Page 6, Paragraphs 1 and 2. The text references Figures 3.9.2 and 3.9.3 which are not provided in the figures section. Please correct the figure references, or if in another document provide the document name.

Response: References added.

7. Section 2.7 Basis For Remedial Action, Page 11. For clarity please revise the text to indicate that 1,4-dioxane currently does not have a MCL.

Response: Clarification added.

8. Section 2.7.1 Chemicals of Concern, PAHs, Page 11. For clarity please add "above ROD cleanup levels" after "found in the Site soils".

Response: Clarification added.

9. Section 2.7.3 Conceptual Site Model, AOI 4 and AOI 6, Page 13. For completeness, please clarify that surface water did not show unacceptable risk during the risk assessment process.

Response: Clarification added.

10. Section 2.7.3 Conceptual Site Model, AOI 16, Page 14. For completeness, please clarify that surface water did not show unacceptable risk during the risk assessment process.

Response: Clarification added.

11. Section 2.7.8 Performance Standards, Page 22. Sediment cleanup levels are also provided in Table L-4 of the ROD. Please add this reference.

Response: Reference added.

12. Section 2.7.10 Superfund Program Expectations, Page 20. Consistent with the ROD, please revise “expects to select a remedy” to “has selected a remedy”.

Response: Revision made.

13. Section 3.2 Contracting Approach, Page 26, Paragraph 2. For completeness, please add text that all disposal facilities must be approved by EPA.

Response: Text added.

14. Section 4.1 Anticipated Problems, Page 32, Paragraph 2. Because this section also describes anticipated remedial activities, please clarify that perimeter air monitoring is not anticipated to be necessary during the PDIs but may be necessary during the RA. Dust control (and limits) for site worker safety will likely not have the same limits as fence line criteria for protection of the public, so it is assumed that perimeter air monitoring may be necessary for some of the remedial activity components and will be included in the Remedial Design as appropriate.

Response: Text added.

15. Section 4.1.1.3 Site-wide Soil and Sediment Remedy Excavation Sequencing and Duration, Page 34, Paragraph 3. The first reference to an over the road limit for trucking of 20 tons seems to be applicable to any destination. If the 20-ton limit is for destinations outside Massachusetts, then the parenthetical descriptor for the 20-ton limit should be changed from “intra-state” to “interstate”.

Response: Correction made.

16. Section 4.1.1.7 Demonstration of Compliance Approach, Page 36, last paragraph. The text states that a field study will be necessary to evaluate gamma spectroscopy detection limits. However, no details on such a study appear to be presented in any of the supporting documents. Please address.

Response: Clarification provided that the study design will be submitted later in the RD process.

17. Section 4.1.1.11 Fill Between Gabion Walls, Page 37. Typo; assume “between” should be “behind”.

Response: Typo corrected.

18. Section 4.1.1.13 Tank House Foundation, Page 37. The text states “a portion of the basement of the building was reportedly filled with concrete”. Please clarify if this refers to a different historical activity than AECOM’s recollection of the tank house basement being backfilled with sand during the building NTCRA.

Response: The basement was filled with flowable fill during the Building NTCRA. This clarification was made to Section 4.1.1.13.

19. Section 4.2.1 Site-wide Soils and Sediments, Page 44, Paragraph 1. The text references Table 4 as a list of areas and PDIs. However, Table 4 is a list of ARARs. Please resolve.

Response: Text clarified.

20. Section 4.2.1 Site-wide Soils and Sediments, Page 44, Paragraph 1. The text references Figure 1 showing areas to be excavated. However, this information is presented in Figure 3. Please correct the reference.

Response: Reference corrected.

21. Attachment 1, Project Team Organization. Please correct formatting (spacing and capitalization) in the EPA block.

Response: Formatting corrected.

Responses to Comments dated July 2, 2020
on the Remedial Design Work Plan, Appendix A
Site-wide Soils and Sediment PDI WP dated March 2020

General Comments:

1. Following discussion with the project team, it was agreed that additional details and clarifications for procedures to be used to perform PDI SSS-2 (Depleted Uranium Penetrator Investigation) would be provided in an Implementation Plan to be submitted under separate cover for review and approval. Please include text in the revised SSS PDIWP which references this Implementation Plan.

> **Response: An Implementation Plan will be included in the revised SSS PDIWP.**

Specific Comments:

2. **Section 1.1, Page 1, Paragraph 2.** The paragraph lists the COCs, as summarized in the ROD as natural and depleted uranium (DU), PAHs, PCBs, VOCs, and SVOCs. However, the RAOs listed in Section 1.3, Page 2 include reference to copper, mercury, and lead in sediments, and soil cleanup levels in Table 1, Page 3 include arsenic and thorium, and sediment cleanup levels in Table 3, Page 3 include copper, mercury, and lead. For clarity, please also reference the other metals listed as COCs in the ROD.

> **Response: The COC list on Page 1 will be updated to include copper, mercury, lead, arsenic, and thorium.**

3. **Section 2, Page 4, Paragraph 1**. There is discussion about two different Exposure Areas A and B based on future development potential, but no indication of how that corresponds with any proposed activities. Line 7 ends with “and/or contaminant profiles are notably different than at other exposure areas.” It’s not clear what this means. Please clarify. Based on previous discussions, the difference is understood to be about potential future residential reuse. Please provide a figure showing the “A” and “B” areas and how they related to the AOIs.

> **Response: An additional figure showing Areas A and B and the AOIs will be added. Line 7 “and/or contaminant profiles are notably different than at other exposure areas” will be deleted**.

4. **Section 2, Page 4, PDI SSS-1 Paragraphs 1 through 4**. The paragraphs describe what portion, and why, the areas are included in the PDI. It would be helpful to identify where each of the Areas (and corresponding AOIs) are on Figure 1. Otherwise, the reader needs to open up the details of the Attachments. It would aid the reader to include an additional figure showing this with the areas described in the 4 paragraphs color coded to differentiate RAOs (Par 1 for residential exceedance of PCBs; Par 2 for residential exceedance of DU & PCBs; Par 3 for PCB >50 ppm; Par 4 Boundary of landfill/sphagnum bog). Please include a figure similar to the one described.

Response: An additional figure showing the alignment of the RAOs with areas of the Site will be added.

5. **Table 6, Page 7**. For PDI SSS-1, the table should include entries indicating: no samples required at A6, but samples will be collected between A2 and A6; supplemental sampling at AOI 4 and AOI 15; sampling at boundary of landfill/sphagnum bog (Areas B1/A2). For PDI SSS-3, the table should indicate that the proposed borings will evaluate utility impacts. For PDI SSS-4, for clarity please indicate where SSS-4 is tied into other PDI work (i.e. Appendix C).

Response: Text will be added to the table to state that no samples are required at A6 and that samples will be collected between A2/A4 and A6. Additional entries will be added to the table to include supplemental sampling at AOI 4, AOI 15, AOI 3 (Areas B1/A2), and AOI 7. Text will also be added to the table that the proposed borings for PDI SSS-3 will evaluate impacts from utilities. A clarification will be provided for where SSS-4 is tied into other PDI work, which will be contained in Appendix C.

6. **Section 3.1, Page 8**. Based on recent discussions with the project team and de maximis' June 16, 2020 *Response to Initial Comments,* for completeness add text that SSS-1 locations are intended as a first pass that may need additional step-out sampling and that confirmatory sampling will be required during actual excavation.

Response: Text will be added that the SSS-1 locations are intended as initial delineation and additional sampling may be necessary to refine the limits of excavation. Text will also be added that confirmatory sampling will be required during actual excavation.

7. **Section 3.1, Page 8, Paragraph 1**. The paragraph only references areas A4, A5, and B2 as mentioned in Section 2, PDI SSS-1, paragraph 1. If the section does not apply to the areas mentioned in Section 2, PDI SS-1, paragraphs 2 through 4 (Area A6, AOIs 4 and 15, and AOI 3) - what is the proposed methodology for those areas? Please clarify.

Response: Reference to the other AOIs will be included in Table 4 to this paragraph.

8. **Section 3.1, Page 8, Paragraph 2**. The report indicates that, even though PCBs and uranium are the primary COCs at these areas, all soil samples will be analyzed for the entire COC list. Include an explanation for why this decision was made.

Response: Explanation for why all site COCs are being analyzed at each location will be added to the text.

9. **Section 3.4.** Based on recent discussions with the project team and de maximis' June 16, 2020 *Response to Initial Comments,* for completeness please add text that removal or abandonment of the septic systems is part of the remedy.

Response: A clearer discussion of how the investigations conducted within the area of the septic system is to determine the limits of removal required for the full-removal of the septic system components.

10. **Figure 1, pdf Page 18.** The Area Names included in the Legend don't correspond with the text and it is difficult to discern the dashed boundaries. Please revise.

Response: Figure 1 will be revised to define the dashed boundaries and update the Legend.

11. **Figure 2, pdf Page 19.** The coloring within the geophysical survey limit area is not needed and confusing with the underlying excavation depth colors. Please remove the color from the survey limit areas or use cross-hatching.

Response: The limits of the proposed geophysical survey will be shown with cross-hatching on the revised Figure.

12. **Figure 3, pdf Page 20.** Legend indicates drive-point depths of 3-5 and 6-8 feet into sediment rather than 0-3 and 3-6 feet as indicated in the text in Attachment 4. Please clarify.

Response: The text and Figure legend will match. It is anticipated that the soft sediments are only 3 ft. thick within the cooling pond so the drive-points will be screened from 0 to 3 and from 3 to 6 ft. The deeper screened drive point is proposed to be in the natural underlying soil. If there is deeper soft sediment or sludge then the drive point within the natural soil could be deeper than 6 ft.

13. **Attachment 1, Figures 1-8 and 1-9.** The areas depicted don't exactly match the areas shown in Figures 1-1 through 1-7, and some of the labels (AOI 7) are different between 1-8 and 1-9. The area boundaries should be shown consistently.

Response: The areas and labels will be corrected and updated.

14. **PDI SSS-1, Table 1.** For sampling location SB-PD-02011 in AOI 2, suggest adding a sample for depth interval of 8-10 ft because supplemental Figure 11-1f shows elevated PCBs in that interval in that vicinity.

Response: One sample from 8-10 feet will be added at location SB-PD-02011.

15. **PDI SSS-1, Figure 1-1.** No additional samples are proposed in the western portion of AOI 2, south of the Cooling Water Pond. Consider adding sample points in this area or explain why they are not needed.

Response: Two additional sampling locations with samples from 0-1 feet and 1-2 feet will be added along the western portion of AOI 2.

16. **PDI SSS-1, Figure 1-2**. Minimal sampling is proposed in the northwestern area of AOI 4. Consider if additional samples would be appropriate in this area.

Response: Three additional sampling locations with samples from 0-1 feet and 1-2 feet will be added northwest of AOI 4.

17. **PDI SSS-1, Table 2.** For sampling location #40 in AOI 4, suggest adding a sample at SB-PD-04040 for depth interval of 1-2 ft since supplemental Figure 10-2b shows elevated DU levels from that interval in SS-IR-04005.

Response: One sample will be added from 1-2 feet at SB-PD-04040.

18. **PDI SSS-1, Table 3.** Explain why there are so few samples proposed for the 1-2 foot interval in AOI 8.

Response: No samples were proposed for the 1-2 ft interval as existing data suggest there is contamination from 2 to 4 ft. The proposed delineation sampling is focused on lateral extent and to confirm vertical extent.

19. **PDI SSS-1, Table 4.** For AOI 9, Sample Location ID Numbers for SS-PD-09007 and SS- PD-09009 should be revised to be -000-date.

Response: Noted; these will be revised.

20. **PDI SSS-1, Table 5.** It is unclear why the delineation is limited to surficial soils (0-1 foot)? Elevated DU is detected at SS-RI-07008, 07016, and 07011 at the 1-2 foot interval so it would seem prudent to add that interval in borings 1,2,6, and 7. Please clarify.

Response: The RI data suggest contamination is confined to surficial soils; however, additional samples from 1-2 feet will be added at all seven locations.

21. **PDI SSS-1, Table 6.** For AOI 15, since supplemental Figure 10-6c shows elevated DU at SB-RI-11003 at the 2-4 foot interval, and to a lesser extent at the 4-6 and 6-8 foot intervals, consider adding samples at those depth intervals to one or more of sample locations SB-PD-15001 through SB-PD-15006.

Response: Additional sampling intervals will be added from 4-6 feet and 6-8 feet at SB-PD-15004. This area is planned to be excavated as part of the building demolition and utility removal. The goal of sampling in AOI 15 is to further delineate the extent of PCB>50 ppm impacted soil.

22. **PDI SSS-1, Table 7.** Please explain why three foot sample intervals specified for this area compared to two foot intervals in other areas. Also, since SB-RI-03011 in supplemental figure 10-7e shows elevated DU at 6-8 ft, suggest including a sample at location “SB-PD-03007” for depth interval of 6-8 ft.

Response: The sampling interval will be adjusted to be 0-2 feet, 2-4 feet, and 4-6 feet. Additional samples will be added from 6-8 feet and 8-10 feet at all locations. This investigation is the initial round of pre-design investigations of the old landfill. Due to the complexities of drilling through landfilled debris and difficulty in sampling soils below the debris, the plan is to conduct the future sampling after removal of the debris and landfilled material. The current PDI work is designed to collect enough information for determining debris volumes and types of material for a Contractor to determine the equipment and costs needed to excavate and transport the material off-site. The 30% Remedial Design will include a proposed layout of future borings or soil probes to provide the post-excavation compliance testing to evaluate current and future risk depending on the anticipated future use of the Old Landfill footprint.

23. **PDI SSS-3**. Based on recent discussions with the project team and de maximis' June 16, 2020 *Response to Initial Comments* add two additional boring locations under Building E considering historical pre-construction use of this area as a waste handling area.

Response: Two additional boring locations will be added at Building E.

24. **PDI SSS-3, Section 4.2.** Consider showing the sample locations on a figure that also shows the mapped utilities under the slab.

Response: The available utility information will be shown on the sample location figure for clarity.

25. **PDI SSS-3, Section 4.2, paragraph 1**. Explain why samples are not proposed to be collected in the 10-12, 14-18, and 20-24 foot intervals.

Response: Sampling intervals 10-12 feet, 14-18 feet, 20-22 feet, and 22-24 feet will be added at all locations.

26. **PDI SSS-4, Section 4.1 last sentence.** Suggest indicating that the surveys may be extended based on initial field results.

Response: The geophysical survey limits will be extended depending on the initial field results.

27. **PDI SSS-4, Section 4.3.** Suggest including analysis of VOCs, SVOCs and metals for septic field samples given that it was the common waste collection point.

Response: The analyte list will be expanded as recommended and the QAPP will be revised accordingly.

28. **PDI SSS-4, Section 4.6.** Consider collecting up to 4 rounds (rather than 2) of water level measurements to capture seasonal variability or add a brief explanation outline why no more than 2 rounds is needed.

Response: Quarterly water level measurements will be taken of each installed piezometer couplet to evaluate seasonal variability.

29. **PDI SSS-4, Section 4.7.** Clarify when the groundwater samples be collected. Assuming a complete round will be conducted during the initial event (to correlate with the sediment samples), consider collecting a subset of select samples during each seasonal event to determine if concentrations vary with water levels.

Response: The initial round of sampling will be conducted once all the piezometers are installed so the groundwater and sediment samples are collected within days of each other to correlate the groundwater and sediment concentrations. Quarterly sampling of each piezometer will be conducted to evaluate seasonal variation of the chemistry within the groundwater and surface water.

30. **PDI SSS-4, Section 4.7, Page 6:** The samples for groundwater and sediment will be analyzed for "chlorinated VOCs," but this list is not defined. Please indicate where the list of analytes is located or, if missing from the project plans, include this information. Note that this information is not provided in the QAPP (Appendix J).

Response: The list of chlorinated VOCs will be added to the text and included in the QAPP. The chlorinated VOCs include 1,1-Dichloroethane (DCA), trichloroethene (TCE), tetrachloroethene (PCE), and vinyl chloride. In addition, the groundwater COCs 1,4-Dioxane , bis(2-Ethylhexyl) phthalate, arsenic, barium, chromium, cobalt, copper, iron, manganese, molybdenum, uranium, and nitrate will be included in the groundwater and sediment testing. The analyte list is consistent with the Groundwater Cleanup Levels listed in Table L-1 of the ROD.

31. **PDI SSS-4, Section 4.8, Page 6:** The sediment sampling SOP in the FSP (Appendix I) includes several options for the equipment to be used but the option selected is not identified here. Some of the equipment is better suited to collecting a representative sample uniformly over depth and some are better suited for retaining fines. Please indicate the option that will be used. If the options are dependent on sediment conditions identified at the time of sampling, please provide the hierarchy of tool selection that will be applied.

Response: The Implementation Plan provides details of the sediment sampling and the proposed tool selection based on the sediment consistency and recovery. A summary will be provided in the text to clarify the sampling methods.

32. **PDI SSS-5, Section 1, Paragraph 2.** For clarification please add "for disposal" before "at an off-site …"

Response: Comment noted and edit will be completed.

33. **PDI SSS-5, Section 4.3:** Please clarify how the depths and locations for the 12 samples to be collected will be determined. It seems that the intention is to characterize each stratum encountered within the set of borings. Revise the FSP as necessary.

Response: The intention is to characterize the topsoil, B-horizon soil, and the natural parent geologic material, or C-horizon soil located above the groundwater table. The number of each soil strata tested will be identified in a table that will be added to the figure and referenced in the FSP.

34. **PDI SSS-5, Section 4.3:** Neither this document not the QAPP (Appendix J) present the Mass DEP criteria for background conditions nor demonstrate that the laboratory analyses selected are sufficiently sensitive to meet these requirements. Please provide this information here or in the QAPP.

Response: The laboratory detection limits for the site-specific and MassDEP background values for the compounds analyzed will be discussed in the QAPP.

Responses to EPA Comments dated July 2, 2020, and CREW Comments dated July 13, 2020 on the Remedial Design Work Plan, Appendix B

In-Situ Sequestration PDI WP dated March 2020

These responses also include responses to 13 July 2020 comments provided by Michael Webster and Kevin Trainer of GeoInsight, Inc. on behalf of the Citizens Research & Environmental Watch (CREW). In instances where the citizen groups' comments were not labeled as pertaining to a particular appendix of the RDWP, we used our judgement, given the nature of the comment, to incorporate the comment into responses for the appropriate RDWP appendix.

General Comments

1. As the two documents are closely related, ensure that revisions to both the ISS PDIWP and Appendix E, the Treatability Study Work Plan, are consistent.

> **Response: The project team has worked to ensure that changes to Appendix B and Appendix E are consistent.**

Specific Comments

2. Section 2.3.1, Page 7, Paragraph 3. The text describes the higher hydraulic gradient in the overburden to the west of the Holding Basin; however, examination of hydraulic head data from well clusters in that area indicate that the head in the shallow overburden is up to 18 feet higher than that in the shallow bedrock. Please identify the stratum that creates this unusually high vertical gradient.

> **Response:**
>
> **The following text was added to Section 2.3.1 to relate the high vertical gradient to the presence of a silt unit identified during the Remedial Investigation.**
>
> **" The high groundwater elevations in overburden and resulting steep hydraulic gradients in this area are attributed to a silt unit with hydraulic conductivities ranging from 0.4 ft/day at MW-S08 and MW-S23 and 1.5 ft/day at MW-S04 which are low relative to the rest of the overburden at the NMI property. This unit was identified and discussed in the Remedial Investigation report."**

3. Section 2.4.1.1, Paragraph 2. The text states that historical results are presented in the RI report, but that reference only includes data through 2011. Please provide a reference for the additional historic data presented on Figure 2-5.

> **Response: The additional historical results were collected during the Feasibility Study (FS) (de maximis, 2014) and several documents submitted to support the Non-Time Critical Removal Action (NTCRA) investigation. More precisely, analytical data from years 2012-2013 were collected during the FS and data collected during the 2015-2019 period were collected as part of the NTCRA. The following has been added to section 2.4.1.1 (as shown in the redline provided as Attachment B) to clarify this "…the**

Feasibility Study (de maximis, 2014), and several groundwater NTCRA reports (Geosyntec 2015; 2016; 2017a; 2017b)." New references were also added to the reference section..

Section 2.4.1.1, Paragraph 2. A discussion of why uranium concentrations appear to be attenuating (i.e., biological activity) would be helpful, and if it has any implications on the remedy selection. It is notable that 1,4-dioxane concentrations have not declined while uranium in bedrock has declined significantly. Please address.

Response: Section 2.4.1.1 is on uranium in overburden groundwater and does not indicate that concentrations are attenuating. We are assuming that this comment is with respect to Section 2.4.1.2 relative to bedrock groundwater.

The following text was added to Section 2.4.1.2 to describe the inferred reasons for uranium attenuation in bedrock groundwater.

"As documented in the RI Report, it was hypothesized that solubilization of uranium bearing minerals in bedrock occurred as a result of altered bedrock groundwater geochemistry caused by historic chemical releases into the Holding Basin. Recent decrease in U concentrations in bedrock may be due to removal of historical mechanisms that mobilized bedrock uranium (i.e. natural uranium in bedrock is no longer being released) coupled with dilution by non-impacted groundwater from upgradient areas."

Decreasing U concentrations and the lack of a continuing source has implications for the bedrock remedy which is why we have proposed testing short term pumping as a possible RA. More specifically, data show that U concentrations in bedrock are attenuating (e.g., wells MW-BM03 and MW-BS03 in the centerline of the plume have shown a >50% decrease in U concentrations since 2013). Considering the maximum U concentration in bedrock is currently only about 70 ppb, another 50% reduction in U concentrations would yield bedrock groundwater near or below the MCL. Given this, we feel that it is prudent to stay openminded to a pumping approach since it may enhance the effective attenuation which is ongoing. The pumping tests proposed as a PDI are being implemented as a potential means to accelerate natural attenuation by removing mass where uranium concentrations are higher.

4. Section 2.4.3.2, Page 12, First Bullet. Please state the MCL for vinyl chloride, because it is different from the MCLs for PCE and TCE.

Response: The text was revised to clearly specify the MCL for PCE and TCE is 5 µg/L and the MCL for vinyl chloride is 2 µg/L.

5. Section 2.5, Page 19. For completeness please add 1,4-dioxane to the list of contaminants that were detected above an MCL or ROD cleanup level, as it is a primary COC.

> **Response: The first paragraph of this section now has 1,4-dioxane included in the list of chemicals exceeding an MCL or ROD cleanup level.**

6. Section 3.4.2.3, Page 27, Paragraph 2. It is recommended that the replacement well be installed downgradient of the BarCad well, in case the BarCad is a source of PFAS (as alluded to in the text).

> **Response: The replacement well will be installed approximately 15-20 feet downgradient from GZW-7-2 - which is the closest accessible downgradient location. The proposed well location has been adjusted on figures and the text has been revised to indicate that the replacement well will be installed downgradient of GZW-7-2. It is important to note, that while the PFAS detection may be attributable to the components used in the BarCad system (potentially Teflon tubing), well GZW-7-2 is not anticipated to be a significant source of PFAS in groundwater..**

7. Section 3.4.3.1, Page 28. For completeness please add mineral identification (e.g., pyrite), to the extent possible, as an activity for the field geologist to perform during the logging of holes drilled into bedrock.

> **Response: The text was updated by adding "…as well as minerology, including pyrite to the extent possible, to assess the mineral composition and…" so that mineral identification will be recorded, to the extent possible based on visual observations of air rotary cuttings.**

8. Section 3.5.4, Page 37, Paragraph 2: Please clarify how the 10% "difference" measured between the three sample results is determined. For example, relative percent difference between two consecutive results or relative standard deviation of 10% between all three results. Note that the analyses that will be conducted are not as precise as required for this exercise. According to Worksheet 12 of the QAPP (Appendix J), analyses for metals including uranium and 1,4-dioxane are only precise to within ± 20% as RPD (MS/MSD and LCS/LCSD). Therefore, the precision of the analytical method is not sufficient for the objectives for this task.

> **Response:**
>
> **The work plan text was modified to no longer identify a calculated percentage threshold for change in concentration. Rather, a simple trend analysis will be used where results are plotted and a trend line is fit to the data to assess whether concentrations are increasing or decreasing over time. The revised Section 3.5.4 reads as follows:**
>
> **"The samples collected after pumping will be used to evaluate whether the change in concentrations during pumping persist. Data will be plotted and a trendline will be fit to the data (e.g., in Microsoft Excel) to assess changes/trends in concentration over time between the baseline concentrations and a time when natural gradients have returned following the pump test. These data will help to understand how uranium mass in bedrock can be mobilized toward the pumping wells and removed. "**

We have also revised Note 4 to Table 3-3 to state that at least20% difference will be used to determine which samples originally placed on hold will be analyzed. The revised Note 4 states: "Groundwater samples collected during active pumping and the 21-day samples will be analyzed first and if they are different by at least 20% then other samples will be analyzed to evaluate concentration versus time"

9. Section 3.5.7.2, Page 39. For clarity, please differentiate between the zone of influence, the area within which measurable drawdown occurs around a pumping well, and the capture zone, the area within which groundwater flow direction is to the pumping well.

Response: The zone of influence and the capture zone were clarified in the text of section 3.5.7.2 by defining zone of influence as "an area within which a measurable drawdown occurs at observation wells located around a pumping well" and capture zone as "the area within which groundwater flow direction is to the pumping well".

10. Section 3.5.8.2, Page 40: As noted in a previous comment, the precision for the uranium analysis is ≤ 20% as RPD. If rebound evaluation will be based on an observed change of ± 10%, how will this change be distinguished from analytical error? Also, as requested in the previous comment, please clarify how 10% change will be calculated.

Response: The work plan text was modified to no longer identify a percentage threshold for change in concentration. Rather, the results will be plotted, and a trend line fitted to the data to depict a trend. See response to comment #9. This paragraph now references use of a trendline.

11. Section 4.5.4, Page 51, Paragraph 2. The text states that the groundwater samples will be analyzed for fluorescent tracer dyes using the methods described in the QAPP (Appendix J), but the analysis of fluorescent tracer dyes is not mentioned in the QAPP. Please address by providing the missing information.

Response: Methods for analysis of fluorescent tracer dyes have been added to the QAPP.

12. Table 2-3. After an initial review of the metals results and subsequent discussions with the project team, de maximis clarified that only the total results were originally reported and provided an updated table on June 25, 2020 that lists both total and dissolved results. For the updated table, a row should be added that sums the U-235 and U-238 concentrations to calculate total uranium for comparison to the 30 ug/L total uranium clean-up standard.

Response: A row including the sum of U-235/U-238 concentrations has been added to Table 2.3.

13. Figure 2-6: This figure does not show the MW-01 cluster in this cross section although it is part of the A-A' cross section shown on Figure 2-5. Please add this location to the cross section because the uranium detected in MW-SD01, although below the MCL, has a DU signature as opposed to the lower uranium concentration (and natural uranium signature) at what is considered an up gradient cluster at MW-06.

This will aid the reader in understanding the shape of the DU plume and overburden groundwater flow.

> **Response: The cross section shown on Figure 2-6 has been expanded to the northwest to include MW-S01, MW-SD01, and MW-BS01.**

Response to Comments from CREW dated 13 July 2020

PFAS

Information included in Appendix B – In Situ Sequestration Predesign Investigation Work Plan indicated that groundwater sampled collected from a subset of 19 monitoring wells during the November 2019 comprehensive monitoring event were analyzed for per-and polyfluoroalkyl compounds (collectively known as PFAS). The subset of wells included upgradient, source area, and downgradient areas, and the Acton Water District Assabet Wellfield. The November 2019 sampling was the first time Site groundwater samples were analyzed for PFAS at the NMI Site.

PFAS was detected in groundwater samples from both overburden and shallow bedrock monitoring wells. The general distribution of PFAS was similar to the pattern of depleted uranium and VOCs/1,4-dioxane that have been detected in groundwater (i.e., the higher concentrations of PFAS are generally co-located in areas where higher concentrations of depleted uranium and VOCs/1,4-dioxane have been detected). We expect that PDI activities will include additional sampling to define the magnitude and extent of PFAS in both the overburden and shallow bedrock groundwater at the NMI Site. Once the magnitude and extent of PFAS are defined, the risk posed by these compounds in groundwater should be evaluated

> **Response: PFAS results from November 2019 are presented in Appendix B, ISS PDIWP. Except for one location (GZW-7-2) where the sample is believed to have been affected by well materials, PFAS concentrations are below the limits which would warrant further investigation or remediation. The concentration observed at GZW-7-2 is being addressed by installing a replacement well as described in Appendix B.**

Responses to Comments dated July 2, 2020 on the Remedial Design Work Plan, Appendix C Holding Basin Containment PDI WP dated March 2020

1. **PDI HB-1, Section 2.** Has consideration been given for soil and rock from the borings to be sampled to pre-characterize the containment wall spoils for disposal facility acceptance?

> **Response: The soils collected from the boring program will be collected and submitted for grain size distribution testing, and some soils will be retained for use in bench testing for the slurry and backfill testing. The rock core will be retained for abrasivity testing and compressive strength testing. The amount of recovery of the soil samples may not be adequate for the appropriate level of pre-characterization testing, and the spoils from the containment wall excavation will be a combination of soil, milled rock, bentonite, Portland cement, and the material being injected as part of the ISS program. The native soil may not be representative of the generated material from the construction of the containment wall. As a result, we expected the post excavation material generated to construct the wall would be tested either while generating or after the containment wall is constructed to adequately characterize the chemistry of this material.**

2. **PDI HB-1, Section 4.1, Page 3.** For completeness please provide a reference for continuous Standard Penetration Tests (SPTs), which is assumed to be ASTM D1586.

> **Response: The SPT reference will be included with the other ASTM Standards attached to the RDWP. The ASTM D1586 standard is the appropriate reference for SPT.**

3. **PDI HB-1, Section 4.1, Page 3.** For completeness please provide a reference to a common method for logging soils collected by SPT, such as ASTM D2488 (visual manual procedures or equivalent).

> **Response: The Unified Soil Classification (USCS) will be used to classify the soil. The method is equivalent to the visual manual procedures contained in ASTM D2488, which will be included in the RDWP with the other standards. Details of USCS are contained in the Field Sampling Plan (FSP), included as Appendix I.**

4. **PDI HB-1, Section 4.1, Page 3.** For completeness please provide a reference for rock coring, which is assumed to be ASTM D2113.

> **Response: The ASTM D2113 standard for rock coring will be included with the other ASTM Standards.**

5. **PDI HB-1, Section 4.1, Page 3.** For completeness please provide a reference for rock quality designation (RQD), which is assumed to be ASTM D6032.

Response: The ASTM D6032 for RQD will be included with the other ASTM Standards. Additional detail on the methods of describing rock core are also included in the FSP, included as Appendix I.

6. **PDI HB-1, Section 4.1, Page 3.** In the six initial borings (with 20 to 50 feet of bedrock coring each), please clarify if RQDs be collected at every five-foot interval.

Response: The RQDs will be collected every core-run which will vary from 5 to 10 ft depending on the driller and the tools the driller has available. At a minimum, each core run will be 5 ft. and the RQD will be determined for each 5 ft. interval. The driller may choose to drill two 5 ft. intervals at a time to keep the drilling moving.

7. **PDI HB-3, Section 4.3.** If swell index and fluid loss tests on the bentonite slurry are required based on the initial water chemistry testing, it is recommended the density of the slurry mixture should also be recorded. Please address.

Response: The density of the slurry will be added to the testing of each slurry evaluated.

8. **PDI HB-3, Section 4.4.** For completeness, the **c**oncrete mix design should consider the influence of aggregate size on hydraulic conductivity and strength. Please address.

Response: The aggregate size will be considered and will not exceed ¾-inches. The maximum particle size of each mix will be recorded for each mix.

9. **PDI HB-3, Section 4.4.** It is recommended that the **c**oncrete mix design evaluate the admixtures for anti-washout (Mastermix UW 450 or equivalent) and alternate admixtures to reduce hydraulic conductivity (MasterLife 300D). Please address.

Response: The Mastermix UW450 is for anti-washout and is more appropriate for backfill placed from the surface in a continuously excavated trench and not tremie-pumped backfill for a trench excavated in panels. Equivalent admixtures will be evaluated that will allow for the bentonite and Portland cement mixes to provide the appropriate strength and hydraulic conductivity parameters. The MasterLife 300D admixture will be evaluated for the mixes that are more like a concrete backfill with high compressive strengths. This admixture is much like Xypex, so one or the other will be evaluated for one of the concrete backfill mixes.

10. **PDI HB-3, Section 4.4.** Based on the previous comments more than five mixtures may warrant evaluation. Please address.

Response: The 30% Remedial Design will be prepared using the data collected during these Pre-Design Investigations. At a minimum, five mixes will be evaluated. Minimum requirements for wall permeability and compressive strength are not yet known in this early stage of the project and will be determined based on the outcome of hydrogeologic and

seismic evaluations included in our work scope. As a result, alternate mixes may be evaluated, including concrete containing more bentonite and less Portland cement or cement-bentonite backfill (i.e., not concrete backfill). Potential backfill mix designs could be adjusted several times based on the results of initial testing, resulting in greater than 5 mixes.

The bench scale testing program is intended to provide contractors with a mix design that satisfies the minimum strength and permeability requirements as a basis for their own independent containment wall backfill mix design. The containment wall specification will be performance-based, and the contractor will be required to develop and test mix designs based on their experience with using bentonite, Portland cement, aggregates, sand, and admixtures of their selection as needed to provide backfill that satisfies minimum permeability and strength requirements. Contractor testing will supplement the bench scale testing for more detailed evaluation of the actual mix design to be constructed.

Responses to EPA Comments dated July 2, 2020, CREW Comments dated July 13, 2020, and 2229 Main Street Committee Comments dated July 13, 2020 on the Remedial Design Work Plan, Appendix D 1,4-dioxane and VOCs in Bedrock Groundwater PDI WP dated March 2020

Additional changes in the document stemming from the initial work plan comments received on 14 May 2020, and logistical or implementation considerations are provided in redline strikethrough (tracked changes) and summarized below:

- Section 5.1.4 – Added analyses for total and dissolved uranium with speciation for U^{235} and U^{238} to be collected during the first sampling of monitoring wells MW-BS50 through MW-BS54 following their installation. Although the uranium concentrations at the wells are not anticipated to be elevated (e.g. higher than MCL = 30 µg/L), these concentrations will serve as a baseline and assist in selecting the analytes for future sampling events.
- Section 5.2.3 – Added discussion related to using rotosonic drilling methods to advance the overburden portion of the open bedrock extraction wells (BEWs) due to limited availability of dual-rotary equipment.

Specific Comments

1. **Section 3, Page 4.** Though there is reference to focusing on the downgradient edge of the plume, there is no mention that the pumping remedy is intended to be for containment rather than eventual compliance with cleanup criteria, as has been discussed during subsequent discussions with the project team. This is a critical point that should be made, or at least suggested. For example, this impacts the need to determine if there is a source or to define the impacts upgradient of MW-BS7-2 (the replacement for existing BarCad well GZW-7-2). This well shows a relatively high concentration and there are no nearby bedrock wells with lower concentrations. Figure 2-7 of Appendix B showing the 1,4-dioxane plume indicates the iso-concentration line for the cleanup criteria of 0.46 ug/L has not been defined north and east of this single well.

Response: Section 2 (Objective) and 3 (Purpose) of the Appendix D Work Plan were adjusted based on this comment and clearly state that the objective of the remedial action is to achieve the ROD cleanup levels for 1,4-dioxane and VOCs. Text added to these sections is below and link the RAO to the remedy selected in the ROD which, conceptually, includes overburden and bedrock extraction wells located off-property to capture deep overburden and bedrock groundwater containing 1,4-dioxane and VOCs before they discharge to the Assabet River or move under the River.

The following paragraph was added to Section 2:

> **"A Remedial Action Objective (RAOs) for 1,4-dioxane (and VOCs) stated in the Record of Decision (ROD) is the restoration of groundwater to meet project clean-up levels. The objective of this appendix is to describe pre-design work that will be performed to: (1)**

> **expand the delineation of 1,4-dioxane in bedrock at the Site, and; (2) collect data to assist in the design of the selected remedy for 1,4-dioxane and VOCs in bedrock as described the ROD in order to achieve this RAO.**
>
> **The recalcitrant 1,4-dioxane plume in bedrock covers a large footprint with concentrations several orders of magnitude above cleanup levels. Further, the crystalline bedrock is of low-permeability and relatively deep. As such, the selected remedy described in the ROD includes extraction and ex-situ treatment of VOCs and 1,4-dioxane.**
>
> **Based on the above, the objectives of the PDIs described below focus on design needs for a groundwater extraction remedy.”**

The text in Section 3 was modified to the following, with red text used to show changes:

> **“The purpose of this work plan ~~was developed~~ is to detail ~~the~~ field activities to be conducted to further define the vertical and lateral distribution of 1,4-dioxane in bedrock groundwater, assess the hydraulic properties of the bedrock aquifer, and collect data required to evaluate the feasibility of a pumping remedy. As described above, a pumping remedy is proposed as the treatment approach for 1,4-dioxane and VOCs in bedrock. “**
>
> **With the exception of an additional delineation well along the western edge of the NMI Property line, this work plan focuses on the downgradient portion of the bedrock 1,4-dioxane plume (mainly areas near and to the north of Route 62) where 1,4-dioxane impacts in bedrock are not comingled with the uranium plume (Figure 2). ~~The~~ Pre-design activities, and specifically pumping tests like those described in this Appendix, planned ~~for~~ in the upgradient portion of the plume, where 1,4-dioxane detections coincide with elevated uranium concentrations, are described in PDI-ISS-2 – Appendix B.“**

1,4-dioxane impacts upgradient of MW-BS7-2 will be evaluated via bedrock observation wells (OWs) and wells instrumented with continuous multi-level tubes (CMTs) installed along the alignment of the vertical barrier wall as proposed in RDWP Appendix C - Holding Basin Containment Pre-Design Investigation Work Plan. These wells will be sampled for several analytes, including U-235/U-238, and 1,4-dioxane as described in RDWP Appendix C, Section 4.7. These data will be used to inform the distribution of 1,4-dioxane and uranium in the vicinity of the Holding Basin.

2. **Section 3, Page 4, Paragraph 1 and 1st bullet.** The opening sentence indicates the intent is to define lateral distribution, but the first bullet item talks about vertical distribution. It seems the first sentence should reference both vertical and lateral distribution. Please address.

Response: This sentence has been revised to read "...the vertical and lateral distribution."

3. **Section 4.3, Page 5, last paragraph.** For clarity please review the second occurrence of "vertical gradients" in the last sentence.

Response: This sentence has been revised for clarity by removing "the vertical gradient" when necessary.

4. **Section 5.2.1, Page 9, Paragraph 3, 3rd Bullet.** Words seem to be missing at the end of this bullet. Please revise the bullet by adding the missing words.

Response: This third bullet has been revised to include a missing reference to MW-BS15 (i.e., "…of MW-BS15" was added to the end of the sentence).

5. **Section 5.2.5.1, Page 11.** Please add mineral identification (e.g., pyrite), to the extent possible, as an activity for the field geologist to perform during the logging of holes drilled into bedrock.

Response: The text was updated by adding "…as well as minerology including pyrite to the extent possible to assess the mineral composition and…" so that mineral identification will be recorded, to the extent possible, based on visual observations of air rotary cuttings.

6. **Sections 5.2.5.2 and 5.2.5.3, Pages 11-12.** Formatting. These sections have two numbers each. Please delete the incorrect numbers.

Response: The section header formatting was corrected.

7. **Section 5.3.2, Page 14, 2nd bullet.** BEW-5 is listed twice. Please correct.

Response: The typo was corrected to BEW-6.

8. **Section 6.2.5, Page 19, Last Paragraph.** The text states that the recovery samples will be collected 1, 2, and 21 days after pumping from the extraction well(s) is terminated. Please include an option for collecting additional samples at later times, if the data from the pumping and post-pumping samples suggest that longer-term monitoring would be beneficial to the rebound evaluation.

Response: A sentence in this section was added to include an option of collecting additional samples beyond 21 days post pumping. The added text states:

> **"Additional recovery samples may be collected beyond 21 days if the pumping and post-pumping data suggest that longer-term monitoring would be beneficial to the rebound evaluation."**

9. **Section 6.2.6, Page 20, Paragraph 1.** The text states that water may be pretreated for uranium using resins as described in Section 5.4; however, Section 5.4 has no such description. Please correct the inconsistency.

Response: This section was modified to reference an SOP for management of Investigative Derived Waste (IDW) instead of Section 5.4. This SOP, included in the Field Sampling Plan, describes pre-treatment (and other

handling) of pumped water using resin (where needed) prior to off-site disposal.

10. **Section 6.2.8.2, Page 21.** Please differentiate between the zone of influence, the area within which measurable drawdown occurs around a pumping well, and the capture zone, the area within which groundwater flow direction is to the pumping well.

Response: The text in this section was revised to clarify the distinction between the zone of influence and capture zone. The second sentence in section 6.2.8.2 was revised to define the zone of influence as "an area within which a measurable drawdown occurs around a well" and capture zone as "the area within which groundwater flow direction is towards the pumping well".

11. **Section 6.2.9.2, Page 22.** Please clarify how the 10% change in 1,4-dioxane will be calculated. Note that the analyses that will be conducted are not as precise as required for this exercise. According to Worksheet 12 of the QAPP, analysis for 1,4-dioxane is only precise to within ± 20% as RPD (MS/MSD and LCS/LCSD). Therefore, the precision of the analytical method is not sufficient for the objectives for this task.

Response: The work plan text was modified to no longer identify a calculated percentage threshold for change in concentration. Rather, a simple trend analysis will be used where results are plotted and a trend line will be fit to the data to assess whether concentrations of 1,4-dioxane and VOCs are increasing or decreasing over time. The revised Section 6.2.9.2 reads as follows:

> **"The samples collected after pumping will be used to evaluate whether the change in concentrations during pumping persist. Data will be plotted and a trendline will be fit to the data (e.g., in Microsoft Excel) to assess changes/trends in concentration over time for 1,4-dioxane between the baseline concentrations and a time when natural gradients have returned following the pumping interval. These data will help to understand how 1,4-dioxane mass in bedrock can be mobilized toward the pumping wells and removed."**

We have also revised Note 4 to Table 3 to state that at least 20% difference will be used to determine which samples originally placed on hold will be analyzed. The revised Note 4 states:

> **"Groundwater samples collected during active pumping and the 21-day samples will be analyzed first and if they are different by at least 20% then the rest of samples will be analyzed to evaluate concentration versus time."**

12. **Figure 1.** Typo. The title block lists as Figure 2-1. Please correct.

Response: This figure number was revised to Figure 1.

13. **Figure 9.** The legend is missing descriptions for some of the symbols. Please revise the legend as appropriate.

Response: The figure legend was revised to include missing symbol descriptions. The missing symbols were an artifact of exporting the figure from ArcMap into pdf.

Response to Comments from CREW dated 13 July 2020

1. As described in Section 4.1.6 of the RD/RA Work Plan, work performed pursuant to the RI/FS and Groundwater Non Time-Critical Removal Action (NTCRA) Administrative Orders of Consent (AOCs) delineated the downgradient, off-NMI property extent of 1,4-dioxane and VOCs in groundwater. Installation and operation of the NTCRA extraction well, with treatment in the temporary and final systems, appears to have limited the further migration of 1,4-dioxane and VOCs to the Acton Water District Assabet 1A production well. However, there remains 1,4- dioxane and VOCs up gradient of the extraction well in both overburden and bedrock.

Response: We agree with the above CREW statement. Work described in Appendix D of the RDWP includes installation (and sampling) of additional monitoring wells and pump testing to further investigate and assess remedial options for 1,4-dioxane and VOCs upgradient of the operating extraction well.

2. It is CREW's understanding that the NTCRA activities were focused on addressing conditions near the leading portion of the 1,4-dioxane plume, and specifically, cutting off the continued migration of 1,4-dioxane in overburden soils to the supply well. However, it appears that the center of mass associated with the 1,4-dioxane plume in overburden groundwater is located several hundred feet upgradient of the extraction well, on the east side of the Assabet River. The RD/RA Work Plan is silent with regard to evaluating whether the NTCRA successfully meets all of the remedial action objectives associated with VOCs and 1,4-dioxane in overburden groundwater, and more specifically, whether the NTCRA system will be effective at treating the full 1,4-dioxane plume, and can accommodate and/or be expanded efficiently to address possibly more concentrated and larger plume impacts over time (as the plume continues to migrate toward the municipal supply well).

Response: Sections 2 and 3 of Appendix D have been revised to clarify that a goal of the remedial action is to achieve RAOs in the ROD including achieving cleanup levels for 1,4-dioxane and VOCs in groundwater. These sections also better clarify that a purpose of testing described in Appendix D is to gather information needed to design the selected remedy from the ROD. Please also see response to EPA comment #1.

The operating treatment plant constructed under the NTCRA has additional capacity, but the ability to treat this additional groundwater using the existing system, an expansion of the existing system or some other option will be assessed as part of remedial design. The first step of such an analysis is the current scope which is to assess whether groundwater extraction is implementable and potentially effective as well as what might need to be treated (e.g., flow rates, concentrations, chemicals).

3. It is CREW's expectation that the RD process will include evaluation of:

- the efficacy of installing additional extraction well(s) on the east side of the river;

  Response: Appendix D of the RDWP includes installation of bedrock wells and extraction testing to the east of the Assabet River for this purpose.

- analyses of estimated time to achieve groundwater cleanup levels relying solely on the NTCRA extraction well;

  Response: The objective of the NTCRA was to prevent further migration of contaminated groundwater to the Acton municipal wells. Further investigations are targeted at identifying feasible remedial methods and identifying which ones will be most effective at achieving site cleanup levels. An evaluation of the timeframes to reach cleanup levels may be considered for various pumping arrangements as part of the design.

- modeling of expected plume migration and behavior in the absence of addition actions/extraction wells; and

  Response: The trajectory of the 1,4-dioxane and VOCs plumes in the absence of pumping is known from the lengthy historical record collected prior to the NTCRA. The trajectory of 1,4-dioxane and VOC plume when pumping at the existing extraction well (EW-1 only) is understood from recent and ongoing sampling (e.g., the November 2019 event). We recommend relying on site data when they are available in favor of modeling predictions. With that said, the existing groundwater model has been calibrated to the current pumping situation (EW-1 only) and can be further refined to match current water level and Assabet well pumping conditions to evaluate (using particle tracing) the expected migration of the 1,4-dioxane plume.

- modeling of expected plume migration and behavior with installation of additional extraction well(s) on the east side of the river?

  Response: The NTCRA design included modeling to evaluate hydraulic conditions and plume behavior for various wells and locations including a well east of the river. Similarly, modeling may be performed as part of the remedial design; however, an assessment of the ability to extract groundwater from the impacted bedrock zone must be determined first. We expect to evaluate and implement optimization of the NTCRA pumping system, which may include installation of additional overburden and/or bedrock wells east of the river.

Response to Comments from Len Rappoli on behalf of the 2229 Main Street Oversight Committee dated 13 July 2020

1. I thought that a delineation of the bedrock fracture zones was performed as part of an earlier investigation. To what extent is any previous information, if available, on

locations of bedrock fractures taken into account in planning the depth of the new bedrock extraction wells

Response: Only limited delineation of fracture zones at specific wells as opposed to fracture hydraulic connectivity evaluations were performed during the RI. The delineation of bedrock fracture zones was performed at open bedrock extraction well SW-2A in August 2007 and summarized in the Remedial Investigation (RI) report (de maximis, 2014). The fracture delineation entailed borehole geophysics, heat-pulse flow meter measurements, and extraction packer testing of five discrete intervals in bedrock well SW-2A formerly used as a source of cooling water for the NMI facility. The testing indicated the presence of significant water-bearing fractures at 155-169 and 249-262 feet below the ground surface, and that the majority of groundwater flow in this well came from a deep fracture zone located approximately 490-510 feet below ground surface (ft bgs). Uranium impacts were limited to the shallower fracture zones, generally less than 50 ft below the top of the weathered bedrock.

The acoustic televiewer data at SW-2A informed the azimuth and dip magnitude of the water bearing fractures at specific depths and when coupled with uranium concentrations from discrete packer testing were used to extrapolate the likely depth of uranium impacted water bearing fractures at downgradient locations to inform monitoring well depths. In addition, transducers were used in monitoring wells during extraction packer testing of SW-2A, however, no significant responses were observed. There are coring data from numerous other wells on-site and as expected, generally indicate less fracturing with depth. Borehole geophysical logging was completed at only one other well (MW-BM03) at the Site. Thus, there is not significant data relative to hydraulic connectivity in bedrock across the site, which will be a focus of the PDI.

As indicated by the November 2019 sampling results, the uranium concentrations in bedrock across the site have attenuated considerably relative to those observed during the RI; these results, along with existing rock core data were considered in selecting the location and proposed depth (173 feet below ground surface, 73 feet below the top of bedrock) of the open borehole extraction well BEW-1. The work plans describing new extraction wells in bedrock outline the borehole geophysical and packer testing that will be performed in the new wells to identify and assess bedrock fractures.

2. Due to 1,4-Dioxane and VOC plumes being comingled it is my understanding that VOCs in downgradient groundwater are being mitigated along with1,4-Dioxane by the current groundwater extraction system. The focus is on 1,4-Dioxane. Not much is said about VOCs. Is there a figure that displays isocontours of concentrations of the various chlorinated VOCs still present in overburden groundwater based on the November sampling round?

Response: VOC exceedances are not as widely distributed and generally contained within the footprint of the 1,4-dioxane plume. The distribution of VOCs in groundwater during the November 2019 can be seen in the exceedance maps which were provided as Attachment A of Appendix B in the RDWP. Because VOCs do not significantly extend beyond the 1,4-dioxane plume and have lower exceedance ratios, and because it is anticipated that pumping and remediation of 1,4-dioxane would result in VOC concentrations decreasing below their respective remediation goals, 1,4-dioxane is the focus of remedial efforts and received more discussion in the RDWP. In terms of treatment, 1,4-dioxane is notoriously difficult to treat in groundwater as compared to VOCs and the advanced oxidation process used by the NTCRA system destroys both VOCs and 1,4-dioxane.

3. The purpose of the PDI for bedrock VOCs and 1,4-Dioxane is to evaluate a bedrock pumping scenario for removal of these contaminants as an alternative to in situ treatment. If sufficient fracturing is present in bedrock to create an adequate radius of influence, extraction may be the best option for contaminant removal from bedrock groundwater given the problematic nature of adding amendments. Is there a chance that prolonged pumping from bedrock wells may reduce the potentiometric head in bedrock to cause seepage of DU from overburden into bedrock?

Response: A layer of glacial till described as a dense and heterogeneous mixture of clays, silts, sands and gravels, which mantles the bedrock has been observed at the site ranging from 5 to approximately 35 feet in thickness. The till thickness in the area beneath the Holding Basin, where DU is present in the deep overburden, was observed to range between approximately 5 and 15 feet. This layer is expected to limit the downward migration of groundwater and contaminants from overburden to bedrock. Also, the selected remedy includes ISS for uranium in overburden. ISS will be designed to stabilize uranium and prevent migration (including vertical).

As a precaution, Appendix B and D PDI work plans include water level monitoring in overburden wells during the installation and pump testing of bedrock extraction wells. The overburden wells selected for water level monitoring are presented in Appendix B Table 3-2 and shown on a plan in Figure 3-4, and Appendix D Table 3 and Figure 9. The water level data collected in these wells will be used in conjunction with the water levels measured in bedrock during pumping to evaluate the head differentials and assess the potential for vertical groundwater migration from overburden to bedrock.

Finally, the mobilization of DU into bedrock is unlikely based on historical data. Specifically, there was limited DU flux into the bedrock during pumping of bedrock supply wells SW-2 and replacement well SW-2A located just to the south of the Holding Basin. Based on historical records, these wells pumped approximately 49 gpm in the period from 1982 to 1993, with even higher rates reported in the early 1980s (de maximis, 2014). Although, the isotopic signature at shallow bedrock well GZW-7-2 had historically fluctuated below 0.5 percent U-235, this trend reversed in 2009,

indicating that the magnitude of mixing between overburden DU plume and bedrock is likely limited (de maximis, 2014). In summary, if more than a decade of bedrock pumping at nearly 50 gpm adjacent to the holding basin did not cause DU flux from overburden to bedrock, then it is unlikely pumping at much lower rates will induce DU flux into bedrock.

4. The Appendix D PDI plans for five new shallow bedrock monitoring wells to further delineate the bedrock 1,4-Dioxane plume. The figures show some uncertainty in the 0.46ug/l contour at the northwestern extent of the plume near the Assabet River. Will the new monitoring wells address this uncertainty?

Response: The proposed monitoring well locations are designed to better identify and assess the extent of the plume. The additional bedrock monitoring wells are intended to provide delineation to the northeast (MW-BS50 and MW-BS51) and southwest of the plume (MW-BS53 and MW-BS54) as well as the core of the plume (MW-B52). The specific area of the plume referenced by the reviewer as the northwestern portion located near the Assabet River is not accessible to drilling due to the Assabet River and Muskrat Pond, resulting in only a narrow causeway between them where Knox Trail is located. A well cluster was proposed a few feet off Knox Trail, adjacent to Muskrat Pond, as part of the NTCRA Work Plan (Geosyntec, 2015). However, after evaluating the underground utilities, access challenges and the need to block or partially restrict Knox Trail traffic, a decision was made, in coordination with the EPA, MassDEP and the oversight consultants, that it was not possible to install a well in this location. Instead, MW-BS34 and MW-BS32 are in this vicinity and bound the 1,4-dioxane plume; data from November 2019 for these wells are on Appendix D, Figure 7.

5. The new monitoring wells are proposed to extend 25 feet into bedrock. If information about hydraulic connection is needed, is 25 feet adequate or should the borings be extended beyond 25 feet to better the chance of intercepting a fracture.

Response: The majority of bedrock wells installed at the Site have been completed as shallow bedrock wells screened in the top 20-25 feet of the bedrock. This zone is where the 1,4-dioxane plume was identified and where additional delineation efforts are being undertaken. The presence of 1,4-dioxane in deeper bedrock will be evaluated at open bedrock wells BEW-4, BEW-5, and BEW-6, where samples for 1,4-dioxane will be collected from discrete water bearing fractures/fracture zones during packer testing. It is possible that no water-bearing fractures are found in the top 25 feet of bedrock, and drilling needs to continue until a fracture(s) is intercepted. This decision will be made by the project team based on field observations at a specific well. However, given the previous experience at this Site, it is anticipated that drilling deeper than 20-25 feet below the top of bedrock will not be necessary.

6. Appendix D also plans the drilling of several new bedrock extraction wells. Which will be installed first, the monitoring wells or the extraction wells? If the extraction wells

are installed first, would that give a better inkling of how deep to extend the monitoring well borings and at what depth to place the screens.

Response: The bedrock monitoring wells will be installed first and instrumented with pressure transducers to monitor the hydraulic response in bedrock during installation of the bedrock extraction wells and inform the team on the fracture connectivity in the vicinity of the bedrock extraction well (see section 5.2.5.2 of Appendix D of the RDWP). Though additional information gathered during bedrock extraction well installation could assist in monitoring well installation, it is understood that the majority of 1,4-dioxane impacts are present in shallow bedrock as evidenced by results from the MW-BS15/BM-15 well cluster, where the most recent 1,4-dioxane detection at shallow bedrock well MW-BS15 installed 3-13 feet into bedrock was 73.4 µg/L compared to 0.806 µg/L at MW-BM15 installed approximately 35-45 feet into bedrock.

7. On the figures It would help if Route 62 was clearly shown.

Response: Noted, figures that need revisions will include a more evident labeling/marking for Rt 62. These markings will be present in figures moving forward. Historical figures and figures not needing additional revisions will not be revised at this time.

Responses to EPA Comments dated July 2, 2020 and CREW Comments dated July 13, 2020 on the Remedial Design Work Plan, Appendix E Treatability Study Work Plan dated March 2020

General Comments

1. EPA has engaged an expert from the United States Geological Survey (USGS) to assist with the review of this document. EPA will coordinate with de maximis to provide additional comments from the USGS expert upon completion of their review.

Response: Noted.

Specific Comments

2. **Section 2, Page 2, Paragraph 2.** As discussed with de maximis, after an initial review of the proposed treatability amendments, an additional option warrants consideration or further discussion within the treatability study work plan.

EPA's contractor AECOM has experience with another phosphate amendment that was developed by Sandia National Laboratory to sequester uranium and has been applied at several DOE sites (Szecsody et al 2016; Rigali et al., 2018; DOE 2019). AECOM suggests that de maximis consider this amendment as part of their in situ sequestration treatability study.

The suggested amendment is a mixture of calcium chloride, trisodium citrate, and several phosphate reagents, of which dibasic sodium phosphate (Na2HPO4) predominates (DOE 2019), that are dissolved in water and injected into the subsurface to precipitate an in situ permeable apatite barrier. The primary advantage of a precipitated apatite barrier over competing trench and injection technologies is that the injected solution flows into areas with the highest soil porosity prior to precipitating apatite, so more apatite forms in areas where larger volumes of impacted groundwater flow.

The apatite barrier can be formed in a few ways, depending on the soil characteristics and the type of contaminant needing treatment. Typically, an aqueous solution containing a compound of calcium or sodium citrate and sodium phosphate is dissolved in water and pumped into the subsurface. The indigenous soil bacteria biodegrade the citrate (an organic compound) leaving calcium available to precipitate with phosphate as poorly crystalline apatite, an insoluble and stable mineral that immobilizes contaminants. As groundwater flows through the permeable apatite barrier, the contaminants sorb to the precipitated apatite and are subsequently sequestered. The precipitated apatite also serves to treat the uranium source by coating the soil with an insoluble precipitate that reduces uranium leaching from urainiferous minerals in the aquifer sediments.

Please either consider adding this amendment as part of the TSWP or provide an explanation for why the proposed amendment is not worth investigating further for the Site.

References

Szecsody, J.E., R.C. Moore, M.J. Rigali, V.R. Vermeul, and J. Luellen, 2016. Use of a Ca-Citrate-Phosphate Solution to Form Hydroxyapatite for Uranium for Uranium Stabilization of Old Rifle Sediments: Laboratory Proof of Principle Studies, Pacific Northwest National Laboratory. March. PNNL-25303. 26 pp and appendices.

Rigali, M.J., and others. 2018. In Situ Hydroxyapatite Permeable Reactive Barrier Performance at the Old Rifle, CO Uranium Processing Mill Site. American Geophysical Union, Fall Meeting, Abstract H21D-01.

U.S. Department of Energy Legacy Management (DOE). 2019. Results of the Laboratory Batch Test of Phosphate Amendment Added to Shiprock Sediment and Groundwater. May. LMS/SHP/S24333. 14 pp.

Response: Thank you for pointing out this alternative amendment. Please consider the background relative to possible amendments as described herein. As part of the RI, we had discussions with scientists from the Pacific Northwest National Laboratory (PNNL), located at the Hanford Site. PNNL used a soluble phosphate and calcium amendment to form apatite in-situ. We sent them our data and after reviewing our hydrogeologic regime and groundwater geochemistry, their recommendation was to use solid apatite if it could be injected directly and not rely on a liquid amendment that needs to have an in-situ reaction occur as a precursor to the sequestration reaction. In fact, it was the recommendation of Dr. Dawn Wellman, Division Director at PNNL, that led us to investigate the use of Apatite II from PIMS. Based on conversation with PNNL, we did not consider trying to form apatite in-situ and did not evaluate the chemistry of the reaction with conditions at NMI. While the Sandia approach could be feasible at NMI, it requires biological and chemical reactions to occur in-situ to form apatite as a precursor to the sequestration of aqueous uranium. A simpler and more reliable approach is to inject apatite directly as suggested by scientists at PNNL.

We have reviewed two of the three references provided in the comment (we could not locate the USDOE 2019 report about the Shiprock lab work). The work by Szecsody et al. 2016 describes lab column tests on Rifle, CO sediments; these contain sediments with up to 1.4 ppm extractable uranium and groundwater at ~32 ppb (amended to achieve 170 ppb). Columns were amended with calcium at 0.4 ppm, phosphate at 4 ppm, and citrate at 2.6 ppm. In November 2019, uranium concentrations at the NMI site in the overburden groundwater were as high as 2,600 ppb, and calcium concentrations were as high as 165 ppm. We expect there to be adequate calcium in the groundwater and soil to facilitate precipitation of calcium phosphate in our tests of sodium monophosphate, and we do not believe the use of citrate is needed to successfully deploy an apatite-based uranium sequestration strategy. Of concern is the uranium present in the soil at NMI, up to approximately 500+ mg/kg in the overburden. Citrate is a strong chelator of uranium and the addition of citrate may mobilize uranium from the overburden soil, contributing to higher concentrations in groundwater after injection of calcium citrate (uranium forms a stronger

complex with citrate than does calcium (i.e., uranium-citrate logK is 8.7 and calcium-citrate is ~3). In addition, there is the potential to form a ternary uranium-iron-citrate complex that is also very stable and soluble (logK 17 – 20; Kantar et al., 2005). The application of citrate to soil has been evaluated as a means of mobilizing uranium and metals (Francis and Dodge, 1998). Uranium citrate is resistant to microbial degradation and may persist in groundwater (Francis et al., 1992), and may be resistant to precipitation with phosphate. Chelation and stabilization of uranium and iron in the aqueous phase is therefore not favorable for immobilization of uranium, and we are concerned about the risks of using citrate at the NMI site.

References

Francis, A.J., and Dodge. C.J. 1998. Remediation of soils and wastes contaminated with uranium and toxic metals. Environmental Science and Technology 32: 3993-3998.

Francis, A.J., Dodge, C.J., Gillow, J.B., and Cline, J.E. 1991. Microbial transformation of uranium in wastes. Radiochimica Acta 52-53: 311-316.

Kantar, C., Gillow, J.B., Harper-Arabie, R.H., Honeyman, B.D., and Francis, A.J. 2005. Determination of stability constants for ternary Fe-U-citrate complexes. Environmental Science and Technology 39: 2161-2168.

3. **Section 2, Page 3, Paragraph 1.** For completeness and to aid the reader, specify the chemical formula for chernikovite ((H3O)2(UO2)2(PO4)2 •6H2O), a member of the meta- autunite mineral group.

Response: The chemical formula for chernikovite has been added to the text.

4. **Section 3.2.1, Page 6, Step 5.** The text discusses establishing a calibration curve from a handheld radiation survey instrument to a mass-based uranium concentration of mg/kg using the on-site laboratory. However, in discussions with the project team after the initial evaluation of the Site-wide Soils and Sediment Pre-Design Investigation Work Plan (provided in Appendix A), de maximis indicated no on-site instrumentation (such as XRF) that was capable of mass based measurement was planned to be deployed during the PDIs. Furthermore, the text estimates a detection limit of 10 mg/kg using the survey instrument, but no information on using the radiation survey instrumentation for conversion to mass based results is provided in either the Field Sampling Plan (Appendix or the Quality Assurance Project Plan (Appendix J). Please address.

Response: Matt Norton of DDES has indicated that they will be using gamma spectroscopy (Falcon 5000 HPGe Spectrometer) to identify and quantify in mg/kg the isotopes of uranium in soils. Guidance on using the Falcon 5000 HPGe Spectrometer is included in the FSP as Standard Operating Procedure HP-NMI-024 (Operation of the Falcon 5000 HPGe Spectrometer)

5. **Section 3.2.1, Page 7, Step 7.** The soil samples' geochemistry might be better preserved and unnecessary exposure to the atmosphere reduced by vacuum sealing

the samples in plastic bags once they have been radiologically screened. At minimum, refrigeration should be considered. Please address.

> **Response: The referenced text states that samples will be sealed in zip top plastic bags to limit unnecessary exposure to the atmosphere and preserve sample geochemistry. Later, in Step 9 the work plan indicates that samples will be placed in coolers with ice for shipment to the laboratory. A note has been added to the text stating "Samples to be stored on-site shall be placed in a refrigerator until packing for shipping is complete". Text has been added to Step 7 to indicate that as much as possible the air should be pushed out of the bag prior to sealing with the zip top.**

6. **Section 3.2.1, Page 7, Step 10, 2nd bullet.** Please clarify why iron, aluminum, and calcium were selected for analysis. Arsenic is included in later sections, and should it be included here. It is recommended manganese also be included as hydrous manganese oxides are common in soils. If there are other leachable metals that might compete for uranium sorption sites they should also be analyzed. Please address.

> **Response: In addition to evaluating the concentration of uranium in the HB soil, the analytes selected to be included in the baseline characterization of the HB soil are based upon the following:**
>
> **Iron: an important sorbing phase for uranium and is also redox-active – since zero-valent iron is one of the amendments proposed for study as a stabilizing agent for uranium. The aqueous iron concentration is an important indicator of soil redox environment, which can influence uranium speciation.**
>
> **Aluminum: another sorbing phase for uranium, knowing its concentration will allow us to assess how much of a role this element may play in this regard, and it is also an indicator of the clay (aluminosilicate) content of the HB soils.**
>
> **Calcium: Given that calcium carbonate is likely a significant component of the HB soil mineralogy, the concentration of calcium in combination with inorganic carbon content of the soil will provide information on aqueous uranium speciation and lability in the HB soil.**
>
> **We agree that manganese is also a sorbing phase for uranium, and some manganese may be introduced into the soil through the addition of ZVI (manganese is typically a trace constituent in the iron). Manganese oxides are also redox active and may dissolve in response to the addition of amendment that alter the redox status of the soil.**
>
> **Manganese and arsenic have been added to the baseline analysis. The baseline concentration of these elements is relevant to the overburden soil as the addition of amendments may result in their mobilization. Constituents that may be mobilized in the HB soil will be contained by the barrier; however, identifying which constituents may be mobilized in response to the HB soil amendments will be important to select the best**

amendment that balances robust uranium immobilization with minimal mobilization of other soil constituents.

7. **Section 3.2.1, Page 7, Step 10, last bullet.** Please define what would be considered “sufficient” baseline uranium soil content.

Response: Our reporting limit (RL) target for uranium in aqueous samples will typically be low enough to evaluate treatment of uranium to below the EPA maximum contaminant level (MCL). The MCL for uranium is 0.030 mg/L, therefore we will target an RL of 0.01 mg/L. The SPLP procedures uses 2-liters of water and 100 grams of soil (20:1 solution:solid ratio). To detect 0.01 mg/L, the soil will need to have 2 mg/kg uranium (assuming 10% of this uranium is leachable, this gives 0.01 mg/L leachable uranium). Since soil uranium concentrations that are above the RL by 10x or 100x are preferable for reliability of the results, sufficient baseline uranium soil content is 20 to 200 mg/kg, with higher concentrations preferable to testing in-situ stabilizing amendments. “Sufficient” baseline uranium soil content has been defined in the text.

8. **Section 3.2.2, Page 8, Paragraph 1.** As discussed with the project team after an initial review of the proposed investigation, the well proposed for low uranium concentration appears to have much lower native metals concentrations than typically seen in other wells and may not be considered representative of groundwater in contaminated areas. It is understood that alternative wells are being evaluated that consider the groundwater geochemistry. Please address.

Response: MW-S21 has always been considered a background well for the DU plume, which is why we chose this location. However, it is correct that other wells have elevated metals concentrations more similar to that observed within the DU plume. Thus, we evaluated the geochemistry and metals content relevant for uranium mobility (Ca, Fe, Mg, K, Na, DO, ORP and pH) of numerous wells near the plume without detectable levels of DU and have determined that MW-S30 is a good choice. The text has been revised to reflect the change in background well from MW-S21 to MW-S30.

9. **Section 3.2.3, Page 8, Paragraph 2, bullet list.** For completeness, please discuss the basis for the selected amendment weight percentages in the soil column.

Response: The mass loading of Apatite II and ZVI amendments in the column tests for Holding Basin soils was selected to be representative of a typical bulk mass loading achieved in the field using direct-push technology (DPT) jet injection. The bulk mass loading of injected amendments is a function of the mass of amendment per fracture, the fracture ROI, the vertical spacing between individual fractures at each injection location, and the overlap of ROIs between adjacent injection locations. As described in Appendix B, injection design parameters will be evaluated based on the results of the treatability studies as well as ISS pilot testing in overburden. Assuming typical values for these parameters based on previous experience implementing DPT direct-push jet injection,

a mass loading of 1% to 1.5% was selected for the column tests. A discussion of the basis for the mass loading has been added to the text.

10. **Section 3.2.4, Page 9, Paragraph 2.** Nitrate is not specified for baseline analysis in Section 3.2.2 (Groundwater Collection) but is included here. Also, on page 10, please clarify why arsenic is included for analysis here (and in the subsequent section) as it also was not included in the baseline analyses. Please resolve.

Response: Arsenic is included as part of the baseline groundwater characterization (Section 3.2.2) and we will add this to the baseline HB soil characterization (see response to comment 6 above). Nitrate is proposed to be analyzed in the influent groundwater to the HB soil column before the initiation of reducing conditions (weeks 2-3 of the column test) to determine the necessary glucose amendment to the column influent to achieve iron-reducing conditions. We propose measuring nitrate in the column influent during the column test rather than during baseline groundwater characterization to ensure that the glucose dosing is accurate.

11. **Section 3.2.4, Page 10, Paragraph 3.** The procedure states dissolved iron will be monitored as a redox indicator (based on higher dissolved iron concentrations reflecting more reducing conditions). Has there been any consideration given to directly measuring ferrous iron to evaluate reducing conditions? Please address.

Response: We will consider the use ferrous iron analysis in the lab if this is convenient and available at the laboratory (e.g., if they are able to use a spectrophotometer to measure the o-phenathroline-Fe(II) complex that forms in a colorometric analysis (i.e., Hach kit for ferrous iron)). In the absence of this being available, samples that are taken, filtered, and immediately preserved with nitric acid will provide a reliable indicator of the presence of dissolved iron (ferrous iron).

12. **Section 3.2.4, Page 10, last paragraph.** For completeness, please define what the criteria are for total results that would trigger analysis of dissolved constituents.

Response: If total uranium results fall above the target for uranium stabilization (total uranium concentrations ≥0.030 mg/L) in two consecutive sampling events, these samples will be filtered and analyzed for dissolved constituents in order to understand whether colloidal (micro- or nano-particulate) uranium is present in the samples analyzed for total (unfiltered) uranium. This has been clarified in the text.

13. **Section 3.4, Paragraph 2.** Based on text in other associated documents and additional discussions from the initial review of the work plans, the means for how a drill rig will access the holding basin will be provided in an implementation plan to be provided under separate cover. Please revise the text to reflect this detail.

Response: Text has been added to the work plan to indicate that drill rig access information will be provided in the implementation plan.

14. **Section 4.2.1, Page 12, Paragraph 3.** For clarity please explain if "Total (acid digestible)" refers to standard EPA metals soil preparation methods (to reflect environmental availability) or a complete mineral breakdown via hydrofluoric acid to measure all of the analyte present in a sample.

> **Response: Total refers to acid-soluble elements based upon digestion by EPA Method 3050B, "environmentally-accessible" elements determined by leaching in nitric acid and hydrogen peroxide. The digestion with hydrofluoric acid will result in the dissolution of strongly bound elements in soil (e.g., those associated with silicate minerals that are not likely to dissolve from soil under the geochemical conditions presented by the overburden groundwater system). The text has been revised to clarify that EPA Method 3050B will be used to measure environmentally accessible elements in soil samples**.

15. **Section 4.2.1, Page 12, last paragraph.** For completeness, please define "enough" in terms of concentration. Also please correct the typo "in" to "is".

> **Response: Similar to the response to comment 7 (above) we require enough uranium to be present in the soil to achieve the RLs for the individual selective extraction steps. In the sequential extraction procedure, typically 20 – 100 mL of extraction fluid is employed with 1 – 5 g of soil. Assuming 5 g of soil extracted by 100 mL of fluid, with 10% extracted and at 10x - 100x the RL, enough uranium is defined as 20 - 200 mg/kg (in this case, this gives us 0.1 – 1 mg/L leachable uranium in the extraction step). This has been clarified in the text.**

16. **Section 4.2.2, Page 12, Paragraph 1.** This is the first mention of a "sorption capacity test". For completeness, please describe this test.

> **Response: The sorption capacity test is described in Section 4.2.3. The text has been revised to refer the reader to Section 4.2.3 for additional details.**

17. **Section 4.2.4, Page 17, 3rd bullet.** Typo. Footnote reference number should be superscript to distinguish from preceding publication year.

> **Response: The footnote reference number has been changed to superscript.**

18. **Section 4.2.4, Page 19, Paragraph 3.** Please clarify how the solubility of Apatite II (27 mg/L) was determined. How does this value relate to the solubility of hydroxyapatite? Also, clarify why it is important to keep the phosphorus solution concentration at approximately 5 mg/L.

> **Response: The provided value is determined based on the observed concentration of phosphorus for groundwater (wells MW-8A and MW-S24) equilibrated with Apatite II, which is approximately 5 mg/L (Lammers et al., 2017). This measured P concentration agrees with the value calculated in PHREEQc using an experimentally determined value for Apatite II solubility (Oliva et al., 2012) in equilibrium with Site groundwater at the measured pH. This reference has been added to the text.**

Based on the phosphorus content of Apatite II (18.5 wt % phosphorus), 27 mg/L Apatite II is equivalent to 5 mg/L phosphorus assuming stoichiometric dissolution. This value, we stress, is approximate and may be slightly different for groundwater equilibrated with Apatite II in batch mode. A constant phosphorus concentration in the column influent is ideal for data analysis and determination of the phosphorus distribution coefficient.

The solubility of Apatite II (Ksp = -50.8 = $a_{Ca2+}^{5}\,a_{PO4\text{-}3}^{3}\,a_{OH\text{-}}$, Oliva et al., 2012) is greater than the solubility of hydroxyapatite (Ksp = -59.4 = $a_{Ca2+}^{5}\,a_{PO4\text{-}3}^{3}\,a_{OH\text{-}}$, USGS PHREEQC database).

19. **Section 5.2.2, Page 22, Paragraph 1, 3rd sentence.** For clarity, please revise “expected” to “initially assumed”.

Response: The word “expected” has been changed to “initially assumed”.

Response to 13 July 2020 CREW Comments

Appendix E - Treatability Study Work Plan

The proposed set of studies are well described and appear complete and well thought out. Bigger picture questions based upon an initial review include.

1. One key question is associated with how long the sequestered material will remain insoluble. How will the results of these relatively short-term tests be used to predict long-term behavior, and possible changes in ambient geochemical conditions?

Response: Sequential extractions and solid phase analyses of the final solids in the column and batch tests will be used to evaluate the stability of the sequestered uranium under each amendment. Uranium that is only extractable in the later steps of the sequential extractions for this study is in the mineralized or highly sorbed phases. These forms are highly stable over the long term.

Although the treatability studies are relatively short in duration, the column and batch studies will be used to identify the best performing amendment under the geochemical conditions of the site in terms of removing uranium from groundwater. These results will be evaluated in consideration of other published studies in which the long-term stability of different forms of sequestered uranium were evaluated. By way of example, there are “natural analog” studies where natural systems that contain uranium phosphate minerals have been studied and have shown little solubility of uranium in groundwater. The Coles Hill uranium deposit in Virginia is a good example of this – autunite is a component of the uranium ore in this deposit, and in the saturated zone, uranium is present in groundwater at very low concentrations.

2. On page 10, #7, the Work Plan indicates that soil samples collected from the saturated and unsaturated zones will be homogenized before undergoing baseline characterization. Homogenization was chosen in part based upon the assumption that

"alteration of the redox state of the column influent will overpower any differences in geochemical conditions between the saturated and unsaturated zones." We ask that USEPA evaluate the validity of this assumption, and the homogenization approach. It seems that the focus of the treatability studies should include evaluating likely "in-situ" conditions as much as is possible/feasible, considering a likely in-situ injection and treatment approach.

> **Response: For the Holding Basin, it is important to note that the in-situ conditions post-installation of the vertical barrier wall and cap will very likely be different than the current in-situ conditions. Thus, simulating the current conditions is not germane to the TS-1 Holding Basin Treatability Study, as it is in the TS-2 Treatability Study for the overburden downgradient of the Holding Basin where the saturated zone will remain an unconfined aerobic aquifer.**

3. Descriptions of the number and types of amendments/reagents varies between Appendix B and Appendix E, and is somewhat confusing (2 reagents, 3 reagents, 4 reagents?). Inclusion of a flow chart might make the proposed tests and sequence of amendments/reagents more clear.

> **Response: There are flow charts for each treatability study in Appendix E as Figures 1A, 1B, and 1C that illustrate the number and types of amendments proposed. What is presented in Appendix E are amendments to be tested in the laboratory during treatability studies. From these laboratory studies, a subset of amendments which show the most favorable results, will be field (pilot) tested as described in Appendix B. Given this, a different suite of amendments is identified in Appendix E than in Appendix B, and the exact amendments identified for pilot testing (in Appendix B) will be determined depending on results of the treatability testing.**

Holding Basin – AOI 1 – Paragraph 3

Currently, there are no groundwater data for conditions directly beneath the Holding Basin. De maximis cites safety concerns to justify the not installing a monitoring well or conducting groundwater sampling within the Holding Basin during PDI activities. While CREW does not dismiss the cited health and safety considerations, we do ask de maximis and the agencies to consider the possible implications of not having "baseline" groundwater quality information for the area directly beneath the holding basin (i.e., the concentrated source area). In particular, we note the following two considerations:

- baseline groundwater quality information would be very useful for evaluating and designing a uranium stabilization approach for the dissolved and adsorbed uranium that will remain in the soils within the containment wall/area; and

> **Response: We appreciate this comment and agree that the mobilization of equipment into the Holding Basin for the collection of treatability study samples presents a unique opportunity to collect a groundwater sample beneath the Holding Basin. We propose to collect a groundwater sample from the shallow saturated zone (within 10 feet of the water table) when collecting**

saturated soil samples. The groundwater sample will be collected using a temporary well or the Push-Ahead sampler developed by Cascade Drilling (this was created for use with sonic drilling equipment and was the device used in the downgradient plume area during the NTCRA investigation several years ago). We have added the Section 3.2.2.1 – Groundwater Sample Collection Beneath the Holding Basin to the Appendix E Work Plan. This new section describes the collection of the groundwater sample as follows:

"As discussed in the sections above, drilling equipment will be mobilized into the Holding Basin to collect soil samples for treatability studies, including from the saturated zone beneath the Holding Basin. A groundwater sample will be collected from the shallow saturated zone (approximately the upper 10-feet) using a temporary well or a Push-Ahead sampler developed by Cascade Drilling. If the Push-Ahead sampler is used, the sampler will be driven at least 5 feet ahead of the override casing and into the native formation without the use of drilling water that could alter the geochemistry. Prior to the sample collection, the temporary well screen or the Push-Ahead sampler will be purged until field parameters (temperature, dissolved oxygen, oxidation-reduction potential, pH, specific conductance and turbidity) stabilize consistent with low-flow groundwater sampling procedures."

- an understanding of "baseline" groundwater conditions within the Holding Basin will be useful for evaluating the success of remedial approach and integrity of the containment wall, once constructed, and interpreting groundwater quality monitoring results for areas near and in the vicinity of the containment wall.

Response: We agree that having a current understanding of the geochemistry in the saturated zone beneath the Holding Basin may be useful if conditions are significantly different than observed in wells immediately downgradient of the Holding Basin (HBPZ-2R and MW-S24). As indicated in the response above, we have added Section 3.2.2.1 – Groundwater Sample Collection Beneath the Holding Basin to the Appendix E Work Plan. This section will state that:

"The groundwater sample will be analyzed for the following suite of parameters:

- **VOCs via Method 8260**
- **1,4-dioxane via Method 8270SIM**
- **SVOCs via Method 8270**
- **Total and dissolved uranium with U^{235}/U^{238} speciation via Method 6020A ICP-MS**
- **Total and Dissolved Metals via Method 6020A ICP-MS (Al, Sb, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Ag, Tl, Th, V, Zn)**
- **Nitrate/Nitrite via Method 353.2**
- **Total Phosphorous via Method 365.1**

- **Orthophosphate via Method SMP4500P-E**
- **Dissolved Organic Carbon via Method 9060**
- **Total and Dissolved Cations (As, Fe, Mn, Ca, Mg, Na, K) via Method 6020A ICP-MS**
- **Anion (Sulfate, Fluoride, and Chloride) via Method 300**
- **Carbonate and Bicarbonate Alkalinity via Method 310.1**

This suite of analytes is consistent with the November 2019 parameters sampled in monitoring wells MW-S24 and HBPZ-2R to allow for a direct comparison of groundwater beneath the Holding Basin and immediately downgradient."

- Baseline information from the middle of the Holding Basin could potentially be obtained during the PDI using one-time, discrete sampling methods that would not require the installation of permanent well(s).

Response: As noted in the responses to comments above, we have added collection of a groundwater sample from beneath the Holding Basin to Appendix E of the RDWP.

Responses to EPA Comments dated July 16, 2020 on the Remedial Design Work Plan, Appendix F Post Removal Site Control Plan dated March 2020

General Comments

1. **Holding Basin and Landfill Covers**. To prevent further potential spread of contamination, the routine inspections should also include an overall evaluation of the integrity of the temporary covers installed by EPA during the 2002 Time Critical Removal Action (TCRA). If not appropriate to include with this document which focuses on the Building NTCRA, please include in the appropriate RDWP appendix.

   Response: The text has been modified to include inspections of "temporary cover over the holding basin" and "temporary cover over the landfill" in Section 3.1. References to the "temporary cover" has been modified to "temporary covers" throughout the document. Additionally, Attachment A, of the text, has been modified to include sections for inspections of the holding basin and landfill covers.

2. **Figure 2**. The dashed magenta lines are not included in the legend. Please add.

   Response: The figure has been updated to include the dashed magenta lines on the legend and labels them as "overhead electric line".

Responses to EPA Comments dated July 16, 2020 on the Remedial Design Work Plan, Appendix H Emergency Response Plan dated March 2020

General Review Comments

1. The document covers both the NMI property (located in Concord) and the groundwater treatment plant (GWTP) located in Acton, with references to each specific town's appropriate public safety organizations and utility providers in most but not all instances. For example, Section 3.4 (Electrical /Power) appears to cite only utilities for the NMI Property but not the GWTP. Please review the document to ensure applicable organizations are referenced to cover both the NMI property and the GWTP.

> **Response: The text has been revised to provide missing information for the GWTP where necessary. The missing utility information addressed in the comment has been updated in Section 3.4. Additional revisions referencing Acton-specific contact information and reporting authorities have been made where applicable throughout the text.**

Specific Review Comments

1. Section 2.3, Page 6, Paragraph 2. The text states "The SPM reports to the SPM." Please clarify.

> **Response: This sentence has been deleted from the text. Paragraph 1 of Section 2.3 explains that the Site Project Manager (SPM) is to report to the Project Coordinator (PC). The contradictory sentence identified in the comment has been removed.**

2. Section 2.4, page 8, first sentence. There is a period typo at the end of this sentence, please correct.

> **Response: This sentence was reviewed and the punctuation error identified in the comment was not apparent. Upon review of Section 2.4, a period typo in the fifth paragraph of Section 2.4 was identified and resolved. It is assumed that this comment was applicable to the observed punctuation error and has thus been addressed.**

Responses to EPA Comments dated July 16, 2020 on the Remedial Design Work Plan, Appendix K Site Wide Monitoring Plan dated March 2020

General Review Comments

1. For ease of reference, please include page numbers on the text.

Response: The text has been updated with page numbers.

2. Attachment – Monitoring Well Evaluation. The Attachment is called "Monitoring Well Assessment" in the Table of Contents and Well Evaluation and Maintenance Summary in Section 2.2. Please correct the inconsistencies in the naming of the attachment.

Response: The title of the "Monitoring Well Integrity Assessment" has been corrected throughout the document. Revisions were made to the table of contents, Section 2.2, and the attachments section of the text for consistency.

Specific Review Comments

3. Section 2 Background, 3rd to last paragraph. For the 2016 monitoring well installation event the text references the proposed plan from 2014. As the Record of Decision was issued in September 2015, prior to the well installation, please reference the ROD as the controlling document.

Response: The reference in the text has been updated to cite the ROD as the controlling document. Section 5 has been updated to add the citation of the ROD the list of references.

4. Section 3.1 Sampling Design and Rationale, First Paragraph in Section 3.1. The second sentence states that a second comprehensive round will be performed once all wells proposed under the PDI WPs are installed (targeted for Fall 2020). The first sentence in Section 3.1.4 states that a second comprehensive round is anticipated to be performed one year after installation of the final PDI well. Please revise these sentences to eliminate any inconsistency.

Response: The text has been modified to remove the inconsistency identified in the comment. The phrase, "(targeted for Fall 2020)" has been removed from Section 3.1 as a targeted date is not relevant until completion of PDI monitoring wells. Additionally, Section 3.1.4. has been updated to state "A second comprehensive sampling event will be completed upon installation of all monitoring wells associated with the Pre-Design Investigations."

5. Section 3.1.1 Monthly Sampling, Second Bullet. Clarify Assabet 2A will also be evaluated for 1,4-dioxane.

Response: The text has been updated to include 1,4-dioxane analysis at both Assabet 1A and 2A production wells.

6. Section 3.1.4 Comprehensive Sampling, First Bullet. The statement in the first paragraph that the wells to be sampled in the second comprehensive round include all wells in which a cleanup level was exceeded in the first round, seems somewhat inconsistent with the first bullet, which states that one objective of the second comprehensive round is to confirm that the various contaminant plumes are still contained (or not expanding). Please explain how plume expansion will be detected or confirmed if wells outside the plumes are not sampled to clarify this apparent, or actual, inconsistency.

Response: Agreed. The second comprehensive event will be a duplicate effort of the November 2019 sampling scope with the addition of the new monitoring wells installed during the pre-design investigations.

Table 2.4.1 has been updated to mirror the 2019 comprehensive sampling scope. Additionally, Figure 4 (Comprehensive Monitoring Well Network) has been removed, as Figure 1, monitoring well network presents the wells to be included in the comprehensive sampling. Figure 1 will be modified upon final installation of all PDI wells.

7. Section 4.1 Reporting. The annual reports should also include plume maps for primary COCs, to illustrate extent in comparison to previous data and to demonstrate plume stability or containment. Please revise the text to include this element of reporting.

Response: The following has been added to the text, "figures depicting concentration contours for primary contaminants of concern will be incorporated to assist in monitoring the conditions of the various plumes."

8. Section 4.2, Schedule. States "In summary, select wells are scheduled to be sampled monthly, a larger set will be sampled semi-annually, and an even larger sampling program is scheduled to occur annually." This sentence is confusing given that the semi-annual sampling is for groundwater levels only, while the monthly sampling includes 1,4-dioxane analysis. Please clarify.

Response: We agree this sentence is confusing and has been removed. A table has been included in Section 4 to summarize the sampling schedule and provide the total number of wells to be sampled and monitored during each event.

9. Table 1, First Page. The heading for the far-right column is "Misc (see Footnote 5)", but the table has no such footnote. Please correct the inconsistency.

Response: The format of this table has been corrected and the footnote now states, "5. Geochemistry Parameters include: Total Phosphorous (Method 365.1), Orthophosphate (SMP4500-E), Dissolved Organic Carbon (Method 9060), Anions (Method 300) and Alkalinity (Method 310.1)"

10. Table 2.2. Because the semi-annual monitoring rounds are for water-level measurement only, please delete "and Quality" from the table title.

Response: "and Quality" has been removed from the title of the table.

11. Table 2.2, Last Page. The footnote appears to be cut off. Please show the complete footnote.

Response: The format has been adjusted to display the entire footnote.

Responses to EPA Comments dated July 2, 2020 on the Remedial Design Work Plan, Appendix I Field Sampling Plan dated March 2020

General Comments:

1. EPA finds that the Standard Operating Procedures (SOPs) are comprehensive, clear, and well-written.

Response: Noted.

2. EPA's comments on other RDWP appendices may necessitate revisions to the FSP. Please make any additional revisions as required.

Response: SOP NMI-005 – Investigation Derived Waste Handling and Storage and NMI-GW-020 – Field Analysis of Fluorescent Tracer Dye in Groundwater have been updated to reflect changes based on EPA's comments on other RDWP appendices.

3. The QAPP (Appendix J, Worksheet #14) states that field sample identification is provided in the FSP, but the nomenclature for single-blind field duplicates, trip blanks, equipment blanks, and other field QC samples is not described. Please indicate where this information is located or include it if it is missing.

Response: QAPP Worksheet #14 has been updated to include field sample identification.

Specific Comments

1. **SOP NMI-S-001, Section 1.2, Page 1:** Although the documents (e.g., Appendix A, SSS-1) mention use of aluminum pans for homogenization instead of stainless-steel bowls, it is not clear whether the pans are disposable and they are not an option presented in this SOP. Please revise either the PDI documents or the SOP and please clarify whether these are single-use pans. If including an option for aluminum pans, please include cautions in SOP describing when use is not appropriate (e.g., sampling for aluminum).

Response: An option for disposable aluminum pans has been included throughout the SOP and a note has been added that disposable aluminum pans shall not be used if analysis of aluminum is required.

2. **SOP NMI-S-001, VOC Sampling Text, multiple locations:** The method used to collect soil samples with stainless steel spoon or tongue depressor is not consistent with current best practices of using either an encapsulated collection device or a coring device which is then used to transfer a preset mass of soil into pre-weighed vials pre-preserved with water or methanol such as that described in NMI-S-007. For clarity and consistency, please revise the VOC sampling text to reference the VOC sampling SOP.

Response: The VOC sampling text has been updated to reference the sample methods described in NMI S-007 – Extraction/Preservation of Soil/Sediment for VOCs.

3. **SOP NMI-S-002, Sediment Sampling, Section 2.4, Page 14:** The SOP states that samples may be frozen to suspend holding time. Sample preservation and holding time are not presented in the QAPP for sediment samples. Please indicate whether the intention is to freeze sediment samples to suspend holding time and whether that is suitable for VOC analyses.

> **Response: As there is no intent to freeze sediment samples to suspend hold times, all references have been removed.**

4. **SOP NMI-S-002, Sediment Sampling, General:** The EPA Region 1 data validation guidelines indicate that analytical data must be rejected if solids content falls below 30% unless, in the judgement of the validator, “sampling and/or analytical preparation steps were employed to address high moisture soil/sediment/solid samples, such as removing the aqueous portion or increasing the sample size.” Either in the SOP, WP or QAPP, please present the approach that will be used in order to avoid losing data because of elevated moisture content.

> **Response: The following text has been updated to indicate the approach that will be used in order to avoid losing data due to elevated moisture content.**
>
> > **“Per EPA Region 1 data validation guidelines, analytical data must be rejected if solids content for a sample falls below 30% unless, in the judgement of the validator, sampling and/or analytical preparation steps were employed to address high moisture soil/sediment/solid samples. If solids content for a sediment sample is determined to be below 30%, the sample will be discarded, and a new sample will be collected.”**

5. **SOP NMI-001, General:** The SOP is for CoC, handling, packaging and shipping of non-radioactive samples. Soil samples collected as part of PDI SSS-2 will include soil from locations with elevated gamma emissions based on the gamma walkover survey. Please provide a reference.

> **Response: A reference to SOP HP-NMI-12 – Radioactive Materials Receipt and Shipment has been included in SOP NMI-001.**

Responses to EPA Comments dated July 2, 2020 on the Remedial Design Work Plan, Appendix J Quality Assurance Project Plan dated March 2020

General Comments

1. EPA's comments on other RDWP appendices may necessitate revisions to the QAPP. Please make any additional revisions as required.

Response: Noted.

2. Format, Typos, Production Errors. There are several typos and production errors. For clarity, please correct the following:

a. Several of the bookmark links are not working or there are multiple links for parts of the same page. For clarity, please review and fix the bookmarks. Please add the missing bookmark definition to the table of contents.

Response: Noted, bookmarks will be updated.

b. Section 1.0, second to last paragraph, last sentence: There are words missing. For clarity, please include the missing text.

Response: Noted, text has been added.

c. Section 3, references: Delete the duplicate reference to "USEPA, 2005a" listed within "USEPA, 2004."

Response: Noted, text has been deleted.

d. Worksheet #6: Correct typo "Manaager" in third row.

Response: Noted, text has been corrected.

e. Worksheet #12 and #28: The worksheets are numbered, but the numbers are not sequential, and several tables have the same number. For clarity, please correct the numbering of the worksheets.

Response: All worksheets have been corrected.

f. Worksheet #12: For clarity, please add the footnote references to the worksheet where missing (e.g., Worksheet 12-5, perchlorate, page 1, notes 4 and 5).

Response: Worksheet has been corrected.

g. For completeness and clarity, please include document control headers and page numbers on the Worksheets #15.

Response: Worksheet has been corrected.

h. Please correct the entry in the table of contents for Worksheet #15. It says the limits are for groundwater but there are other matrices included.

Response: Worksheet has been corrected.

i. On Worksheet #15, ALPHA Wet Chemistry, "Nitrogen, Nitrite" is listed twice with the same laboratory limits and units.

Response: Worksheet has been corrected.

j. For Worksheet #15, GEL Soil, the table title says soil but the units shown for metals and isotopes are for aqueous analyses.

Response: Worksheet has been corrected.

k. For Worksheet #15, GEL Soil Wet Chemistry, the table title says soil but many of the analyses are for aqueous analyses.

Response: Worksheet has been corrected.

l. On Worksheet #15, GEL Soil Wet Chemistry, dissolved inorganic carbon is listed twice with the sample limits and units.

Response: Worksheet has been corrected.

m. On Worksheet #20, Dissolved Organic Carbon is listed twice with the same SOP and Polonium-210 is listed three times with the same SOP. Please correct for clarity.

Response: Worksheet has been corrected.

n. On Worksheet #20, please correct the frequency typos in the laboratory duplicate column starting with Soil/sediment Uranium-235 and continuing in all rows below.

Response: Worksheet has been corrected.

o. On Worksheet #20, it appears the SOP numbers in the soil/sediment starting with Uranium-235 and through zinc are incorrect (sequential numbering was applied).

Response: Worksheet has been corrected.

p. On Worksheet #25, for the GEL SOPs, replace “ME” with “MA” or include these SOPs in Worksheet #23.

Response: Worksheet has been corrected.

q. Worksheet #27, third bullet in section on sample handling should indicate the tape is to prevent the cap from coming loose, not the label.

Response: Worksheet has been corrected.

r. Worksheet #37: For clarity or completeness, please remove or explain the highlighting.

Response: Worksheet has been corrected, highlighting has been removed.

3. UFP-QAPP Worksheets: The document uses a combination of two versions of the UFP- QAPP worksheets, the original and the streamlined versions. For clarity, please indicate which version is being used and use only those worksheets throughout the document.

Response: Noted, worksheet has been corrected, separate WS 19 and 30 have been created.

4. Inconsistencies and Errors in Analyses Presented: Several errors, inconsistencies and omissions in the information provided for the sample analyses were noted. As a result, most of the information required for the intended sample analyses is

unclear. Analyses appear on one worksheet, but not on others. There are incorrect or inconsistent SOP references associated with an analysis and matrix. SOPs are cited but are not included on Worksheet #23. For correctness and clarity, please conduct a thorough and detailed review of all worksheets in the QAPP against the intended analytical program and the laboratory SOPs that will be used. Correct the errors and inconsistencies that are identified. The following are examples, not a complete list:

Response: Noted, inconsistences have been corrected.

a. Laboratory limits for Bismuth-210 and Actinium-227 are included in Worksheet #15 under soil analyses, but the units are aqueous. The preservation and containers are included under groundwater in Worksheet #19&30.

The SOP is listed in Worksheet #23 and QC samples are presented for water in The SOP is listed in Worksheet #23 and QC samples are presented for water in Worksheet #28, but there is no information for the analytical technique (gamma spec) in either Worksheet #24 or #25.

Response: Bismuth-210 and Actinium-227 These would only be analyzed as part of the natural uranium decay series if gamma-spec was to be used. The PDI does not call for any gamma spec analyses. However, it is possible that gamma spec would be used at some point in the future as a component of confirmatory sampling. Therefore, Bismuth-210 and Actinium-227 analyses were added for soils only (and removed all aqueous references) to appropriate worksheets. Worksheet 24 and 25 has been updated to include gamma spec information.

b. In general, the wet chemistry and IDW analyses are presented in some worksheets and not others. For clarity, please take a consistent approach in presenting the information for these groups of analyses, please include text clarifying what is not included, and please provide justification for the omissions.

Response: Noted, worksheets have been corrected.

c. It is not clear when analysis will be performed for lead versus lead-210. Lead-210 is listed for soil analysis on Worksheet #15, however the units are aqueous. There is no Worksheet #12 that lists lead-210 (no table lists the SOP associated with it, GL-RAD- A-018). Worksheet #20 indicates groundwater and soil/sediment samples will be analyzed for lead, but both cite the lead-210 SOP.

Response: Aqueous samples for Lead-210 will not be collected, but soil samples will be collected for Lead-210 analysis. All appropriate worksheets have been updated to reflect this.

d. The metals analyses are unclear, possibly owing to omissions in the SOP Worksheet (#23) and/or errors in the methods cited. Method 6010 is cited for aqueous and soil in Worksheet #12, but Worksheet #15 contains only the limits for soil and TCLP analysis for leachate (no groundwater). Worksheet #19&30 show preservation/ containers for 6010 for groundwater, but not soils. Worksheet #20 lists metals analyses using SOP GL-MA-E-014 but that is the ICP-MS SOP (according to Worksheet #23). There is no SOP in Worksheet #23 for ICP-AES (SOP listed in Worksheet #12 is GL-

MA-E-013). Also, different method versions (6010B and 6010D) are listed in different worksheets. Because individual isotopes for uranium (U-235 and U-238) are to be reported which can only be accomplished via method 6020 (ICP-MS), please clarify when method 6010 (ICP-AES) will be used for analysis of Site samples.

Response: All metals analyses (with the exception of radiochemistry parameters) will be analyzed using Method 6020A. The 6020A analysis will include Uranium-235, Uranium-238 and / or Total Uranium. All appropriate worksheets have been updated to reflect this. NOTE: TCLP Metals will be analyzed by Alpha using Method 6010.

e. Analysis of mercury is also unclear. Mercury analyses in aqueous and soil are listed in Worksheet #12, #15, 19&30 and are also listed in Worksheet #20, but with different SOPs: For water, the ICP-MS SOP is listed (GL-MA-E-014). For soil, an SOP is listed that is not named anywhere else in the document (GL-MA-E-018). Worksheet #28 lists mercury analysis by SOP GL-MA-E-010, but there is no such SOP on Worksheet #23. It seems likely that SOP GL-MA-E-010 is the correct SOP and is missing from Worksheet #23. However, since Worksheet #20 should list the analyses to be performed, it cannot be determined whether the error is in listing the SOPs or including mercury as an analyte when analysis will not be performed.

Response: The correct SOP reference is GL-MA-E-010. All affected worksheets have been corrected.

5. Inconsistencies in Analyses between the Work Plans and QAPP: The terms used to describe the analyses to be conducted are not consistent between the work plans and QAPP, therefore the required details of the analytical program cannot be discerned. Please use consistent terms for analyses between the PDI work plans and QAPP. Some examples follow:

Response: Noted, inconsistences have been corrected.

a. PDI SSS-1 indicates PAH analysis is required. There is no analysis specifically for PAHs identified in any of the QAPP worksheets. Worksheet #20, for example, lists the number and type of samples to be submitted, but only SVOCs is listed for soils. To complicate matters further, SSS-1 lists PAHs but other PDI documents specify only the four PAHs with cleanup levels.

Response: Noted, this has been corrected.

b. PDI SSS-1 indicates that soil will be analyzed for uranium using Method 6020. There is no mention of analysis of soil for uranium in the QAPP except one entry on Worksheet #15 but that is for uranium by Method 6010. Some of the other worksheets list analysis of soil for Uranium-235 and 238 by Method 6020.

Response: Noted, this has been corrected.

c. PDI SSS-4 indicates that groundwater and sediment will be analyzed for chlorinated VOCs. There is no mention of chlorinated VOCs in the QAPP therefore the intended analyte list is not clear.

Response: Noted, this has been corrected and will be clarified in the revised SSS-4.

Specific Review Comments

6. Worksheet 1, Page 1. The preparer's contact information and the preparation date are missing. For completeness, please include this information.

Response: Noted, this has been corrected.

7. Worksheet 3, 4, 6 and 7. The titles applied to certain individuals are not consistent from one worksheet to another. Some of these are not correct (e.g., the EPA RPM on Worksheet #6 is listed as the "Project Coordinator"). On Worksheet 7, there are roles and responsibilities for titles that do not exist in the table above (e.g., "QA Manager" for non-laboratory organizations, "Field Program Coordinator," "Field Project Manager"), and there are titles for which the roles and responsibilities are not presented (e.g., "Field Team Manager"). For clarity and completeness, please use a consistent set of titles to describe the roles of staff involved in the project and please present the roles and responsibilities for each of those project staff.

Response: Noted, this has been corrected.

8. Worksheet 4-1, Page 1. The QA Manager should be independent of the Project Manager to avoid conflicts of interest while addressing quality issues on a project. "QA Coordinator" is the title provided that comes closest to "QA Manager" for de maximis. The QA Coordinator is the same as the Alternate Project Coordinator and the Project Manager for two of the PDIs. Please identify the QA Manager or explain how quality assessment and corrective actions will be conducted in a manner independent of the pressures of project management.

Response: Noted, this has been corrected, the QA Coordinator has been changed.

9. Worksheet 8, Page 1. PDI SSS-2 describes gamma walkover surveys using an NaI detector. If special training is required for the use of this instrument, please include that information.

Response: Noted, an Implementation Plan (Site-wide Soils and Sediments Depleted Uranium Penetrator Investigation Implementation Plan (PDI SSS-2)) has been added as Attachment 6 to the revised RDWP-Appendix A Site-wide Soils and Sediments with additional details.

10. Worksheet 12: Some of the data validation criteria are inconsistent with the most recent validation guidelines. For example, application of a blank action limit to qualify results as non-detected is not consistent with EPA National Functional Guidelines. Please review the data validation criteria and revise those that are not consistent with the current validation guidelines. Please populate the reference number in the sampling procedure column.

Response: Sampling SOP references have been added to all Worksheet 12s. The data validation criteria presented is consistent with how the NMI project has been validated in the past. ddms acknowledges that validation criteria have changed slightly, but feels it is important to keep validation criteria as is for project consistency.

11. Worksheet 12: The data validation criteria column presented on the worksheet suggests that outdated validation guidelines are being cited. For example, on Worksheet 12-5 page 1 (Ammonia Nitrogen), the validation action for blank contamination indicates results up to 5 times the blank concentration will be qualified as non-detected (U). Per current EPA guidance this is no longer considered appropriate. See later comments on the validation guidelines required. If this column is retained in Worksheet 12 (see previous comment), please correct the validation requirements for consistency with the latest National and Regional data validation guidelines.

Response: Same as response to comment 10.

12. Worksheet 12: The worksheet must document the MPCs in terms of precision, bias, sensitivity and completeness. Only the requirements for precision and bias are presented. For completeness, please include the information for sensitivity and completeness for each worksheet.

Response: Noted, Sensitivity requirement added to WS-12 only where there was a project required RL. Completeness is discussed on WS-37.

13. Worksheet 12-5, Metals ICP: There are two worksheets titled Metals ICP for aqueous samples. Both list SW-846 6010B and SOP GL-MA-E-013 but one lists GL-MA-E-006 and the other lists GL-MA-E-009. Of these three SOPs, only one is listed in Worksheet 23 (GL- MA-E-009L hot block digestion). Please indicate the difference between these two worksheets and indicate where in the UFP-QAPP it is made clear which worksheet applies to which samples.

Response: Noted, All Metals worksheets have been revised/corrected and updated.

14. Worksheet 12-5, Metals ICP, Metals including Uranium and Thorium: The method listed is 6020A. This is an ICP-MS method. “ICP” as used in the title refers to ICP-AES (not MS). Please correct the table title.

Response: Noted, All Metals worksheets have been revised/corrected and updated.

15. Worksheet 14: The listing of analysis tasks on this worksheet does not include a level of detail consistent with the example in the 2005 UFP-QAPP Manual where all the methods of extraction and analysis are presented for each analysis task. For completeness, please add information on the analyses that will be conducted for each FSP, PDI and TSWP.

Response: The RDWP appendices are very detailed in listing where to sample, when, how and why. Repeating this in the QAPP would be unnecessary and duplicative. We suggest leaving those details in the PDI and TS WPs, so that future changes to PDIs or TW WPs do not then mandate revisions to the QAPP.

16. Worksheet 14, page 4. There are three levels of data reporting presented. Please indicate where the data reporting level that will be used is presented for each analysis, matrix, sampling event and investigation.

Response: Noted, worksheet 14 has been updated Level 2-Modified Reporting: Modified reporting is used for analyses that are performed following standard USEPA-approved methods and QA/QC protocols. Based on the intended data use, modified reporting may require some supporting documentation, but not full CLP or CLP-type reporting will be performed on all data.

17. Worksheet 15: The worksheets are not complete, and the information missing is critical to determining whether the analyses proposed are adequate to meet project objectives. Please revise the worksheets to include the following:

a. the project action limits (PALs) for each matrix, method, analyte and project objective;

Response: Noted, PALs have been added to all worksheet 15s.

b. the reference limits on which the action limits are based; the project quantitation limit goal (PQLG);

Response: Noted, PQLGs have also been added to all worksheet 15s.

c. the laboratory-specific quantitation limits and laboratory-specific detection limits;

Response: These were already present on worksheet 15.

d. definition of and basis for determining the laboratory-specific quantitation limit and the laboratory-specific detection limit (note that the laboratory-specific quantitation limit cannot be lower than the lowest calibration standard for any given method and analyte);

Response: Footnote was added to Worksheet 15.

e. highlighting to indicate all laboratory-specific quantitation limits and laboratory-specific detection limits that are at or above the PQLG;

Response: Noted, completed

f. an indication (i.e., highlighting, footnote) of which analytes are critical to project-specific decision making;

Response: Noted, completed

g. on worksheet 15 or other suitable worksheet, the basis for arriving at each set of PALs; and

Response: Noted, completed

h. on worksheet 15 or other suitable worksheet, discussion of how limitations in the data resulting for PQLs above the PQLG will be addressed while still achieving project objectives.

Response: Noted, see below.

PALs and DQOs for the same matrix and analysis may vary between the various RD/RA activities and even within the activity depending on the specific objectives for each sampling and analysis task. Versions of Worksheet 15 for all anticipated aspects of the RD/RA program should be provided in the QAPP. For example, PALs may differ for aqueous samples depending on if the data will be used for comparing groundwater concentrations to cleanup criteria, comparison to surface water discharge criteria, or comparison to risk criteria. Optionally, it may be clearer if completed versions of the Worksheets 15 that pertain to a specific RD/RA activity are presented in the detailed WP for that activity if they differ from those presented in this QAPP. Please address.

> **Response: It is not practical or workable (for field staff) for execution of the PDIs to have separate work sheets for each sampling and analysis task. The work plans are detailed on work to perform and sampling. Further, and perhaps more importantly, the RDWP uses similar analyses by compound and media across the site. For example, groundwater will be analyzed for 1,4-dioxane to <MDL in sheet 15 whether it is a sample from a MW for delineation and comparison with the standard or a sample collected during a pump test for trend analysis. Because our MDLs in sheet 15 are below cleanup standards, then they will achieve all DQOs for any task objective. Stated differently, the approach is to use a MDL that will meet all DQOs, and not to adjust MDLs to meet a DQO. PALs have been added to worksheet 15.**

18. Worksheet 15: Although several of the tables list soil in the title, the units in the tables are aqueous. Unless the units are wrong, most of the analyses required for soil and sediment (other than those required for waste characterization) are missing. Please correct the units or provide the missing information.

> **Response: Noted, corrected.**

19. Worksheet 15: PALs and the requirements for each analysis will vary by matrix and objective but only general media (e.g. aqueous) are listed. For clarity, please indicate the applicable matrix on each worksheet.

> **Response: Noted, corrected.**

20. Worksheet 15, Wet Chemistry: The UFP-QAPP manual indicates that the analytical methods should be presented in this worksheet, but that information is missing from this worksheet. For completeness, please add the analytical methods in an additional column represented by the information provided.

> **Response: Noted, Methods and SOP references have been added to worksheet 15.**

21. Worksheet 19&30: The UFP-QAPP manual specifies that the laboratory name and data package turn-around time be included on this worksheet. For completeness, please include this information.

> **Response: Noted, this information has been added to worksheet 30.**

Worksheet 19&30: Please correct the jars for soil/waste classification to indicate where amber glass is required and correct the type for “ounce”.

> **Response: Noted, corrected.**

22. Worksheet 19&30: The worksheet should include the required information for soil and sediment samples and analyses, in addition to the waste characterization analyses. For completeness, please include the missing information.

Response: Noted, corrected.

23. Worksheet 19&30: Although listed under groundwater, the container, preservation, and holding time for metals including uranium and thorium by Method 6010 is for soils. Please correct.

Response: Noted, corrected.

24. Worksheet 20: For clarity, please clarify that submittal of samples for field duplicates, MS/MSD and laboratory duplicates will be 1/20 per investigation per sampling event (as opposed to 1/20 samples submitted for groundwater over the life of the program combined).

Response: Noted, a footnote has been added for clarification.

25. Worksheet 20: The logic behind which analyses and matrices have rinsate blanks is not clear. For example, one might assume only analytes considered contaminants (as opposed to supporting data for groundwater chemistry) would merit a rinsate blank. If that were the case, it is not clear why there is no rinsate blank for perchlorate or metals, but there is a rinsate blank for alkalinity. For clarity, please indicate the logic behind the rinsate blanks or correct the table.

Response: Noted, information has been added to Worksheet 20.

26. Worksheet 20: The worksheet presents QC samples that are not consistent with typical performance of the analysis or other information in the QAPP. Analysis of MS/MSD for TO- 15 air samples is listed, however MS/MSD is not typically performed and the QC sample is not identified on the corresponding Worksheet 28. Trip blanks are listed for each cooler for air samples, but Worksheet #19/30 indicates the air samples will be collected in 6L canisters, cooling is not required, and trip blanks are not listed on the corresponding Worksheet #28. MS/MSD is listed for TSS, reactive cyanide and reactive sulfide, but these are not typically performed and MS/MSD is not listed on the corresponding Worksheet 28. Please review the field QC samples required for each analysis and matrix and correct Worksheet 20.

Response: Noted, worksheet 20 and 28 have been corrected.

27. Worksheet #23: There are laboratory SOPs missing from this table. Please include the missing SOPs. Examples: GL-MA-E-009, GL-MA-E-013.

Response: Noted, worksheet 23 has been updated

28. Worksheet 27: According to the sample handling procedures, the sample container cap will be wrapped with clear packing tape. Because samples will be submitted for PFAS analysis, additional precautions may be required to avoid contamination. Please confirm that this procedure is acceptable for PFAS samples or clarify.

Response: Noted, additional details have been added to individual RDWP PDI and their accompanying Implementation Plans.

29. Worksheet 27: The sample handling section indicates samples are placed in bubble wrap, but no mention of placing the samples in zip-seal bags is made. It is recommended to avoid cross-contamination in the event of breakage or sample leaks that the containers are individually bagged.

Response: Noted, additional details have been added to individual RDWP PDI and their accompanying Implementation Plans.

30. Worksheet 28: For these worksheets, the sampling SOP listed is "TBD" and the number of sample locations is listed as "numerous." For completeness, please include this information or identify the specific places where the details are presented.

Response: Noted, sampling SOP references have been added to all WS-28.

31. Worksheet 28: For these worksheets, the frequency of the field duplicates and field equipment blanks are listed as "TBD." For completeness, please include this information or identify the specific places where the details are presented.

Response: Noted, this information has been added to all WS-28.

32. Worksheet 28: As indicated in an earlier comment on Worksheet 12, some of the validation actions shown are outdated and require correction. Please revise for consistency with the most recent validation guidelines.

Response: As previously stated, for project consistency, the validation criteria presented in the QAPP are the criteria historically used for this site.

33. Worksheet 36: The validation requirements are presented for "water." Please confirm that this applies to all aqueous samples associated with the RDWP, excluding those for waste characterization as noted, regardless of the task or data quality objectives. Please provide the validation requirements for the other sample matrices that will be collected and analyzed.

Response: Noted, corrected.

34. Worksheet 36: For analytical methods with a basis that is the same or similar to the methods included in the EPA Region 1 and national validation guidelines, validation actions should be based on EPA guidelines. Measurement performance criteria (e.g., surrogate recovery criteria) may default to the requirements presented in the QAPP. If a similar analytical method is not addressed by the EPA Guidelines, alternative guidelines may be proposed.

Response: As previously stated, for project consistency, the validation criteria presented in the QAPP are the criteria historically used for this site.

35. Worksheet 36: Please include in the QAPP copies of the ddms validation SOPs that are referenced in this worksheet.

Response: SOPs have been included.

36. Worksheet 37: The worksheet addresses how the usability of laboratory data will be assessed, but much of the data supporting the objectives for the RDRA will be generated in the field. Please discuss how the usability of these data will be assessed.

Response: The work plans provided as Appendices A-E of the RDWP describe the field testing (included collection of field data) and the decisions which will be made using these data on a task-by-task basis. There is also discussion on the use of field data in some SOPs - specifically, how field parameters will inform when a groundwater well has been sufficiently purged.

37. Worksheet 37, page 1: The introduction for the data usability assessment indicates it will be performed for data associated with delineation, risk assessment or confirmation of remedial achievement. Please clarify what data will be generated to support the RDRA that is not intended to be included in this assessment.

Response: The RDWP includes data which will not be used for these purposes. Some examples include, data collected during pump testing to assess changes in concentration, data collected as part of IDW management, parameters which does not have a clean-up criteria, etc.

38. Worksheet 37, page 3. According to this worksheet, completeness for the project is calculated using the total number of valid results generated to the total number of results generated. Assuming that the term project in this case applies to all the sampling and analysis associated with the RA program, calculating completeness in this manner will not provide information useful in determining whether there are sufficient data to meet project objectives for each of the investigations or studies to be conducted. For example, the goal of 90% completeness could likely be met even if all results for 1,4-dioxane in groundwater for the program were rejected. Please provide a more meaningful means for assessing whether sufficient data were gathered to meet each of the project objectives associated with each project within the RA program. Planned samples that were not collected should also be accounted for in the total sets of results considered.

Response: This QAPP is not intended for a RA but rather to collect pre-design data necessary for the RD. An updated/revised QAPP will be generated for the RA.

39. Worksheet 37, page 4. The text concerning sensitivity indicates that the laboratory MDLs must satisfy the project requirements as they relate to the project action limits. Although the laboratory MDLs must certainly be below the project action limits, it is more critical that the laboratory-specific quantitation limits are at or below the project action limits. For completeness, please revise the text accordingly.

Response: Noted, WS-37 has been revised.

40. Worksheet 37, Page 4. The National Functional Guidelines proposed for guiding the validation are out of date (2014). Please cite the most recent National Functional Guidelines. Currently these are from 2017. Please update the references in Section 3 accordingly. Note that the validation guidelines must be adapted to the non-CLP methods and differences between the older SW-846 methods that will be used and the current CLP methods (e.g., for both 8260C and 8270D, the lack of closing calibration standards, surrogates instead of deuterated monitoring compounds).

Response: Noted, WS-37 has been revised.

41. Worksheet 37, Page 4. Please include the full reference for the EPA New England Environmental Data Review Program Guidance and correct the title. Data validation should also be conducted in accordance with the EPA New England Environmental Data Review Supplement for Region 1: Data Review Elements and Superfund Specific Guidance/Procedures (Final #1, June 2018).

Response: Noted, WS-37 has been revised.

42. Worksheet 37, Page 4: It is not clear from the text what is MassDEP protocol and how it will be used in combination with the EPA national and EPA regional validation guidelines without resulting in conflicting validation guidance. Please clarify what is meant by MassDEP protocol and how it will be used in combination with EPA guidance.

Response: Noted, WS-37 has been revised.

43. Worksheet 37, Page 4: It is not clear why the CT RCPs (Connecticut Reasonable Confidence Protocols) should apply to the reporting limits, hold times, preservatives and QA/QC for this project, which is in Massachusetts. Please correct or explain.

Response: Noted, WS-37 has been revised.

44. Worksheet 37, Page 6: The qualifiers listed for validation do not include J+ and J- which are included in the updated National Functional Guidelines. Please update the list of qualifiers presented.

Response: Noted, WS-37 has been revised.

45. Appendix J-1: According to the text in Section 2, page 5, the laboratory QA Plans, SOPs and certifications should be included in Appendix J-1. The appendix does not include QA plans or laboratory certifications. Please provide the missing information.

Response: QA Manuals and certifications included. (GEL certifications are included in the laboratory QA Manual).

46. Appendix J-1: Although the SOPs listed on WS #23 are included in the Appendix, additional SOPs not listed on WS #23 are also included. It cannot be confirmed that all the SOPs required are included because it is not clear that WS #23 presents a complete list of the SOPs applicable to the project. Please clarify.

Response: Worksheet 23 has been updated as needed.

47. Appendix J-1, SOP GL-RAD-D-003: Pages 19 through 37 of the SOP are missing. Please include the missing information.

Response: Noted, these have been added.