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LETTER AND RESPONSE TO U S EPA REGION III COMMENTS ON DRAFT FEASIBILITY STUDY FOR GROUNDWATER SITE 3 NWS YORKTOWN VA
10/10/2013
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September 10, 2013

Mr. Moshood Oduwole
Federal Facility Remediation (3HS11)
USEPA Region 3
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Subject: Response to Comments dated July 22, 2013 on the Draft Feasibility Study for Groundwater at Site 3, NWS Yorktown, Yorktown, Virginia

Dear Mr. Oduwole,

This letter is in response to comments dated July 22, 2013 for the subject document. Comments are presented below followed by responses in italics.

GENERAL COMMENTS

1. Section 2.2.2 (Contaminant Fate and Transport) states that, "The presence of TCE reductive degradation products (cis-1,2-DCE and VC) is evidence that reductive dechlorination is proceeding at the site;" however, Section 2.2.2 does not discuss fluctuations in contaminant concentrations at YS03-GW019. For example,

Table 1: Contaminant Concentrations at YS03-GW019

	MCL (ug/L)	Date Unknown[1] (ug/L)	2005[2] (ug/L)	2009[3] (ug/L)
Trichloroethene (TCE)	5.0	860	140	190
cis-1,2-dichlorethene (cis-1,2-DCE)	70	NA	440	330
Vinyl Chloride (VC)	2.0	48	39	58

Acronyms:
ug/L – micrograms per liter
MCL – maximum contaminant level
NA – not available

Source:
1 Section 5.2.4 (History of Contamination) of the Five-Year Review Report, Naval Weapons Station Yorktown, Yorktown, Virginia, dated November 2007 (2007 5YRR)

2 Figure 5-2 (Organic Exceedances of Background and/or MCLs in the Yorktown-Eastover Aquifer at Site 3) of the 2007 5YRR
3 Table 2-1 (Groundwater Detected Analytical Results)

Given the proximity of YS03-GW019 to the marsh area, revise the Draft FS to discuss the fluctuations in contaminant concentrations at YS03-GW019. In addition, discuss how these fluctuations impact the understanding of reductive dechlorination occurring at the site.

Response: *Based on analytical data available from the Phase I and II RI reports, monitoring well YS03-GW019 has been sampled 7 times. In the table above, the date for the sample referenced as "Date Unknown" is from February 1996. The text in Section 2.2.2 has been revised as follows to explain the changes in concentrations observed at YS03-GW01, positive indicators for natural attenuation, and the uncertainty in the degree of biodegradation that may be occurring at Site 3:*

"Analytical data collected from Site 3 groundwater generally indicate favorable conditions for reductive dechlorination. Although there is limited geochemical data available, aquifer conditions are considered to be similar to Site 22 (the Burn Pad), for which a monitored natural attenuation (MNA) remedy for CVOCs in groundwater was selected (CH2M HILL, 2012). Nevertheless, the variable reduction-oxidation (redox) conditions in the aquifer at site 3 adds some uncertainty as to the degree that biodegradation may be occurring. Favorable indicators are summarized below.

- *The decrease in TCE concentrations since the round Two RI and the presence of TCE reductive degradation products (cis-1,2-DCE, VC, and ethene) provide direct evidence.*
    - *TCE concentrations decreased at the monitoring well (YS03-GW019) with the historically highest concentrations from 860 µg/L in February 1996 to 120 µg/L in October 2004; since then concentrations have been stable.*
    - *Since cis-1,2-DCE and VC are not considered parent compounds (or chemicals used during site activities), their presence in groundwater is attributed to reductive dechlorination of the parent compound TCE.*
        - *In YS03-GW019, cis-1,2-DCE was observed to decrease in concentration from the Round II RI through early 2005, at which point concentrations increased. This increase is attributed to the reductive degradation of TCE.*
        - *In YS03-GW019, VC has shown some fluctuation over time and increasing concentrations since 2005. This increase is attributed to the reductive degradation of cis-1,2-DCE. Fluctuations in concentration may be due to the combined effects from generation via reductive dechlorination, degradation via anaerobic and/or aerobic biodegradation, and advection of the plume.*
        - *Changes in cis-1,2-DCE and VC concentrations are not attributed to impacts from the creek since there is no indication from field parameters (such as, salinity) that this well is tidally influenced. Monitoring well YS03-GW020, which is located approximately 50 feet downgradient of*

YS03-GW019 and closer to the creek, has had no fluctuations in concentrations and no COC detections since February 2005.

- *The final reductive degradation products ethene and ethane were detected in several impacted wells (ethene and ethane were not detected in the upgradient well YS03-GW018). Ethane was detected at or above 15 μg/L in monitoring wells YS03-GW024 and -GW027. Ethane was detected at trace amounts in 9 other monitoring wells while ethene was detected in trace amounts at 6 wells.*

- *Within the plume, groundwater appears to be primarily under moderately reducing conditions.*
  - *With the exception of monitoring wells YS03-GW024, -GW025, -GW027, and –GW028, groundwater from wells located in the combined TCE, cis-1,2-DCE, and VC plumes had dissolved oxygen (DO) values less than 1 mg/L and oxidation-reduction potential (ORP) values between -50 millivolts (mV) and -269 mV, indicative of anaerobic conditions (see **Table 2-1**).*
  - *In monitoring wells YS03-GW024, -GW025, -GW027, and –GW028, DO values were greater than 2 mg/L and ORP values were 17 mV or higher, indicative of more oxidizing conditions. However, geochemical data in monitoring wells YS03-GW024 and -GW027 had the strongest indicators for anaerobic conditions, including the highest concentrations of ethane, ethene, and methane at the site, chloride concentrations over 4 times greater than in the upgradient well (YS03-GW018), and decreased sulfate concentrations compared to the upgradient well (see **Table 2-1**).*
- *Elevated alkalinity values within the combined TCE, cis-1,2-DCE, and VC plumes compared to the upgradient well are suggestive of biological activity.*
- *Concentrations of Dehalococcoides (DHC), which can facilitate dechlorination of TCE and daughter products to ethene and ethane, were detected at 6.2 and 26.2 cells per milliliter (cells/ml) at Site 3, which is indicative of a population that may sustain dechlorination.*
- *The average hydrogen (ion) concentration (pH) value of 8.2 in groundwater is slighter higher than the favorable range for biodegradation of 6 to 8.*

Total organic carbon (TOC) concentrations in groundwater at Site 3 were very low, measuring between less than 1 mg/L to 6.8 mg/L within the combined TCE, cis-1,2-DCE, and VC plumes. This may limit the rate of reductive dechlorination. However, as the plume moves downgradient, the organic carbon content appears to increase adjacent to Indian Field Creek. TOC concentrations were measured as high as 17 mg/L at YS03-GW012, located near Indian Field Creek. In sediment samples collected from the creek, TOC was detected as high as 22,000 milligrams per kilogram (mg/kg). The TPH present in unsaturated soils may leach slowly into the aquifer and also be a potential source of carbon for reductive dechlorination. However, the carbon available to microorganisms for biodegradation is an uncertainty."

The proposed pre-design investigation at Site 3 will collect additional MNA data, which will be used to support the selected alternative.

2. Outdated screening criteria are referenced in the Draft FS. For example, the Volatile Organic Compounds subsection of Section 2.2.1 (Nature and Extent of Contamination) states that, "TCE and cis-1,2-DCE concentrations were also reported below their maximum contaminant level (MCL)-based soil screening levels (SSLs) of 36 ug/kg [micrograms per kilogram] and 420 ug/kg, respectively;" however, the May 2013 updated MCL-based SSLs for TCE and cis-1,2-dichloroethene (DCE) are 1.8 ug/kg and 21 ug/kg, respectively. Revise the Draft FS to utilized updated screening criteria and clarify if their use impacts the CSM.

   Response: *As stated in Section 2.2.1, a dilution attenuation factor (DAF) of 20 is assumed for Site 3 because it is less than 0.5 acre in size. This is consistent with EPA's 1996 Soil Screening Guidance (EPA). Because the MCL-based soil screening levels presented in the Region 9 Regional Screening Level tables are based on a DAF of 1, these values were multiplied by a factor of 20. Following, the MCL-based SSLs for TCE and cis-1,2-DCE are calculated at 36 μg/kg and 420 μg/kg, respectively. The text will be modified to clarify that this calculation was performed.*

3. Given that MCLs were utilized if available for a chemical, it is unclear why calculated remediation goal options (RGOs) and risk-based preliminary remediation goals (PRGs) were developed in Section 3.4 (Development of Risk-Based Preliminary Remediation Goals). Revise the FS to clarify why RGOs and risk-based PRGs were developed.

   Response: *The Section 3.4 text, Table 3-1, and Appendix B will be updated to indicate that risk-based PRG calculations and values are not shown for TCE, cis-1,2-DCE, VC, and arsenic in groundwater because MCLs are available for these constituents. Risk-based PRG calculations are only presented for manganese.*

4. A separate assessment of remedial technologies is not provided to address the unsaturated TPH soil contamination. Instead, removal and offsite disposal is the only remedial technology proposed for the potential contingency measure to address the unsaturated TPH soil contamination. Given the potential remedial technologies that are available to treat unsaturated TPH soil contamination, revise the Draft FS to clarify why a separate assessment of remedial technologies was not provided for the potential contingency measure.

   Response: *Although other potential remedial technologies do exist, the Navy considers them unlikely alternatives for TPH in unsaturated soil at Site 3 if the contingency needs to be implemented. The following text will be added to Section 4.2.3 (Contingency Soil Excavation) for clarification:*

   > *"The proposed contingency action for Site 3 is soil excavation. In-situ treatment technologies are not preferred due to the limited extent of TPH in unsaturated soil and the potential impacts that treatment could have on the saturated zone. Ex-situ treatment would likely not be cost effective based on the anticipated treatment volume and the type of contamination."*

5. The Draft FS does not discuss the potential for the in situ injections to be flushed into the marsh area and/or Indian Field Creek. Similarly, the Draft FS does not discuss the potential for the in situ injections to push contamination into the marsh area and/or Indian Field Creek. Given the proximity of the proposed injection wells for Alternatives 3 (Enhanced In Situ Bioremediation, Monitored Natural Attenuation, and Land Use Controls), 4 (In Situ Chemical Reduction, Monitored Natural Attenuation, and Land Use Controls), and 5 (In Situ Chemical Oxidation, Monitored Natural Attenuation, and Land Use Controls) to the marsh area and Indian Field Creek, the uncertainty associated with the hydrogeology, the assumed radius of influences (ROIs), and discharge of shallow groundwater into Indian Field Creek, revise the Draft FS to discuss the potential for in situ injections to be flushed into the marsh area and/or Indian Field Creek and the potential for in situ injections to push contamination into the marsh area and/or Indian Field Creek.

   Response: Additional text will be added to the description of each alternative in Section 4.2 and the evaluation of each alternative in Section 5.3 to clarify that impacts to the creek are not anticipated due to the relatively small radius of influence (ROI) of the injection points and the slow groundwtaer flow rate. No utilities or other features likely to cause preferential pathways or flow to the creek are present at the site and the designed ROI are not large enough to result in direct impacts. While substrate may eventually drift through advection to the creek, it will likely be degraded and diluted to levels which will not impact the creek and associated receptors.

SPECIFIC COMMENTS

1. Section 2.2.1, Nature and Extent of Contamination, Page 2-2: Section 2.2.1 states that, "TCE is the most extensive CVOC [chlorinated volatile organic compound] in groundwater; the maximum concentration of 400 micrograms per liter (ug/L) was detected at YS03-GW024;" however, the 2007 5YRR indicates that TCE was historical detected at 860 ug/L at YS03-GW19. Revise Section 2.2.1 to clarify that TCE has been detected at concentrations greater than 400 ug/L at Site 3.

   Response: *The text will be revised as follows to clarify maximum detections from the most recent (2009) sampling events and historical maximum detections:*

   > "Historically, the highest concentration detected at the site was 860 micrograms per liter (μg/L) at monitoring well YS03-GW19 in 1996. During the 2009 Phase II RI sampling event, the maximum concentration of TCE in groundwater was 400 μg/L at YS03-GW024."

2. Section 2.2.2, Contaminant Fate and Transport, Page 2-3: The text states that, "Metals may be discharging to the creek, but were not detected in surface water or sediment at levels posing potential unacceptable risk. Therefore, the discharge of groundwater contaminant from Site 3 into the creek is not considered a significant migration pathway;" however, Section 5.2.3 (Inorganic Constituents) of the Final Phase II Remedial Investigation Report Sites 1 and 3, Naval Weapons Station Yorktown, Yorktown, Virginia, dated August 2012 (Final RI) indicates that several inorganic

constituents were detected above ecological screening criteria and/or RSLs in surface water (e.g., manganese, copper, arsenic) and sediment (e.g., chromium, aluminum, arsenic, and nickel, manganese, vanadium, barium). While these inorganic constituents were not identified as COCs and may not pose potential unacceptable risk, revise the Draft FS to clarify that metals are or have been historically known to discharging to the creek.

Response: *The text in Section 2.2.2 will be revised to clarify that while metals may be discharging to the creek based on previous detections in surface water, they are not detected at levels posing potential risks.*

3. Section 2.2.3, Risk Assessment, Page 2-5: Potential receptors at the site discussed in the first paragraph of Section 2.2.3 are not consistent with the receptors presented on Figure 2-1 (Conceptual Site Model of Site 3). Section 2.2.3 identifies potential child and adult residents, construction workers, and industrial workers as potential receptors whereas Figure 2-1 only identifies child and adult residents and industrial workers. Revise Figure 2-1 to identify the construction worker as a potential receptor at Site 3 and include relevant exposure pathways for this receptor (dermal contact, inhalation of vapors from trench air, etc.)

   Response: *The figure will be modified as suggested.*

4. Section 2.2.3, Risk Assessment, Page 2-5: The total Hazard Index (HI) for the reasonable maximum exposure (RME) scenario for a future construction worker stated in the first bullet of Section 2.2.3 (HI = 1.1) is inconsistent with the total HI for the construction worker listed on Table 2-2 [Summary Cancer Risks and Hazard Indices for Groundwater (HI = 3.1)]. The second paragraph of Section 2.2.3 also states that there were no individual constituents of potential concern (COPCs) with HIs exceeding 1.0 for the construction worker; however, Table 2-2 indicates that trichloroethene (TCE) is a chemical with a HI greater than 1 for the construction worker RME scenario. Revise Section 2.2.3 to address these discrepancies.

   Response: *The text will be edited to be consistent with the tables.*

5. Section 2.2.5, Post Phase II Remedial Investigation Discussion, Page 2-6: The last bullet in Section 2.2.5 indicates that additional Monitored Natural Attenuation (MNA) data should be collected as part of the pre-design investigation; however, the specific MNA data proposed for collection in Section 4.2.1 (Pre-Design Investigation) only includes alkalinity, total organic carbon (TOC), nitrate, nitrite, sulfate, sulfide, and ferrous iron. Based on the Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water, EPA/600/R-98/128, dated September 1998 (Natural Attenuation Protocol) points are awarded for these parameters in addition to dissolved oxygen (DO), oxidation reduction potential (ORP), methane, iron, pH, temperature, carbon dioxide, chloride, dissolved hydrogen, volatile fatty acids, chlorinated volatile organic compounds (VOCs), benzene, toluene, ethylene, and xylene (BTEX), and ethane/ethane. Revise Section 2.2.5 to clarify

the specific MNA data that should be collected as part of the pre-design investigation. In addition, revise the Draft FS to clarify why the geochemical parameters proposed in Section 4.2.1 only include alkalinity, TOC, nitrate, nitrite, sulfate, sulfide, and ferrous iron.

Response: *The following text will be added to the last bullet of Section 2.2.5 to clarify the selection of the MNA parameters:*

> *"This includes TCE and its reductive degradation daughter products (cis-1,2-DCE, VC, ethene, and ethane). Required analyses listed in Table 2-3 of the Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water (USEPA, 1998), TOC, and alkalinity will also be collected to assess if subsurface conditions are favorable for reductive dechlorination."*

Total iron will not be analyzed since ferrous iron will be measured in the field, as recommended in the 1998 EPA guidance. The applicable CVOCs are included in the COC analytical list. Based on previous data, BTEX is not considered a potential carbon source for biodegradation and therefore, will not be included. Chloride, methane, ethane, and ethene will be added to the analytical parameter list. Note 3 of the table in Section 4.2.1 will be revised to list out the water quality parameters (DO, ORP, pH, specific conductivity, temperature, turbidity). A pre-design investigation work plan will be submitted to the team for comment to allow for agreement on the parameters.

6. Section 3.3, Applicable or Relevant and Appropriate Requirements, Page 3-3: The text indicates that, "The wetland areas adjacent to Site 3 will remain undisturbed during the remedial actions identified in this report. Therefore, requirements associated with wetland and floodplains are only TBC [to-be-considered];" however, the proposed pre-design investigation and remedial alternatives include the installation of new monitoring wells within the wetland and floodplain areas and potential in situ treatment. Revise the Draft FS to clarify why requirements associated with wetland and floodplains are TBC when these actions are proposed.

Response: *The following text was included in the FS report in error and will be deleted from Section 3.3:*

> *"Therefore, requirements associated with wetland and floodplains are only TBC."*

None of the proposed alternatives include actions within the wetland areas. New monitoring wells will be installed adjacent to the wetland and floodplain areas. The Applicable or Relevant and Appropriate Requirements table (Appendix A) does not include this TBC; and therefore does not require any changes based on this comment.

7. Section 3.4.1, Human Health Remediation Goals, Page 3-3: The first paragraph states, "Chemicals were identified as human health COCs during the RI if they contributed a cancer risk greater than 10^{-6} to cumulative risk greater than 10^{-4}, or a non-cancer hazard greater than 0.1 to cumulative non-

cancer hazard greater than 1." Table 2-2, Summary Cancer Risks and Hazard Indices for Groundwater, only identifies chemicals with cancer risks greater than 10^{-4} and HIs greater than 1, so it is unclear if any other chemicals need to be considered COCs for the site. All chemicals that contributed a cancer risk greater than 10^{-6} to cumulative risk greater than 10^{-4} or a non-cancer hazard greater than 0.1 to cumulative non-cancer hazard greater than 1 should be identified to ensure all COCs are identified and remediation goals established, if necessary, to ensure residual risk and hazard are within acceptable limits. Revise the Draft FS to address this concern.

Response: *Table 2-2 will be revised to show constituents with HIs exceeding 0.1 or carcinogenic risks exceeding 10^{-6}. However, the only constituents (not identified as a COC) in the RI with an HI greater than 0.1 but less than 1.0 or cancer risk between 10^{-6} and 10^{-4} were chromium, iron, and 1,1,-dichloroethane. These constituents were risk managed; the risk management decisions for chromium and iron have been previously summarized in the Section 2.2.3 of the FS report. The following risk management decision for 1,1-dichloroethane will be added to Section 2.2.3:*

> *"1,1-DCA in groundwater only poses risk under the future resident child/adult scenario. However, 1,1-DCA only had a minor contribution ($2x10^{-6}$) to the total cancer risk of $2x10^{-4}$. On the contrary, all other carcinogenic COCs contributed individual cancer risks above 10^{-4}. Therefore, 1,1-DCA was not carried forward as a COC."*

Resultantly, as summarized in the conclusions of the Final RI for Site 3, additional action was determined to only be necessary for TCE, cis-1,2-DCE, VC, arsenic, and manganese.

8. Section 4.2.1, Pre-Design Investigation, Page 4-3: Only one round of groundwater sampling is proposed during the pre-design investigation described in Section 4.2.1. Given the proximity of the monitoring wells to a tidally influenced tributary (i.e., Indian Field Creek) and potential seasonal/storm event variations in groundwater elevations and flow, revise the Draft FS to clarify why only one round of groundwater sampling is appropriate for the pre-design investigation.

   Response: *One round of monitoring is believed to be sufficient because numerous rounds of samples have been collected at Site 3 across all seasons between 1992 and 2009. No significant change in groundwater flow or the plume extent has been observed. Groundwater will continue to be monitored during the remedial action and any changes to the conceptual site model will be noted. No changes to the text are suggested.*

9. Section 4.2.1, Pre-Design Investigation, Page 4-3: Geochemical analysis is not proposed for the new shallow monitoring well (i.e., YS03-GW030) which is intended to serve as a site-specific background location to evaluate the impacts of possible reducing conditions caused by the wetlands on the mobility of the arsenic and manganese in groundwater or for the new deep monitoring well (i.e., YS03-GW035) to be located adjacent to shallow monitoring well YS04-GW027 to resolve data gaps (i.e., refine site lithology, identify the base of the Yorktown-Eastover aquifer, evaluate the vertical hydraulic gradient next to Indian Field Creek, and confirm contaminated groundwater is not migrating under Indian Field Creek). Revise Section 4.2.1 to include geochemical analysis at these locations to provide a better understanding of the geochemical conditions at Site 3.

Response: *The Navy agrees with this comment. Geochemical parameters will be added to the proposed analysis list for monitoring wells YS03-GW030 and YS03-GW035.*

10. Section 4.2.3, Alternative 2 – Monitored Natural Attenuation and Land Use Controls, Page 4-6: The text states that, "The area would be re-vegetated if necessary;" however, the situation when the area would not be re-vegetated is not specified. Revise the text to clarify when the area would not be re-vegetated.

    Response: *The text will be modified to state that the area would be re-vegetated following the contingency soil removal to prevent soil erosion. The text "if necessary" will be removed.*

11. Section 5.4.5, Short-term Effectiveness, Page 5-10: The second paragraph of the Environmental Impacts subsection states that, "Alternative 4 scored lower because it would likely result in high GHG [greenhouse gas] emissions and energy due to the DPT [direct push technology] injections, material production, and the associated transportation and heavy machinery use. Alternatives 4 and 5 scored the lowest due to their even more intensive intrusive work on the site and reagent projection;" however, the first reference to Alternative 4 appears to actually be referencing Alternative 3. Revise the Draft FS to address this discrepancy.

    Response: *Correct. The text will be revised to state that Alternative 3, not Alternative 4, scored lower in the first sentence.*

12. Table 5-4, Detailed Comparative Analysis of Remedial Alternatives: Several of the ratings presented in Table 5-4 do not correspond with the ratings presented in Table 5-3 (Detailed Evaluation of Remedial Alternatives). For example, the short-term effectiveness for Alternative 1 (No Action) is listed as 7.8 on Table 5-4 but is listed as Low on Table 5-3. According to the scale provided on Table 5-4, a low score would be closer to 1 (lowest score) and 10 (highest score). Revise Table 5-4 to correspond with the information presented in Table 5-3.

    Response: *Table 5-3 will be revised to correspond with the values assigned in Table 5-4. Since each sub-criterion in Table 5-4 is individually evaluated and scored, it is considered to be more accurate. In Table 5-4, the Short-Term Effectiveness scores will be adjusted to match up with the results from the SiteWise assessment. The Implementability scores will be adjusted to account for the potential difficulty with injecting into the clay.*

USEPA TECHNICAL SUPPORT COMMENTS

Biological Technical Support Group (BTAG)

1. According to the text, no ecological risks were identified in previous investigations (Sections 1.1 and 2.2). Also, the selected remedy is to be protective of human health and the environment (Section

3.1). Monitoring of Indian Field Creek and associated wetlands will be needed to ensure the groundwater remedial action does not inadvertently pose risk to ecological receptors. The data contained in Table 2-1 indicates that groundwater concentrations of trichloroethene (400 μg/L), vinyl chloride (1,200 μg/L), arsenic (45 μg/L - total and 34.7 μg/L - dissolved), and manganese (1320 μg/L - total and 1260 μg/L - dissolved) exceed BTAG screening values (21 μg/L, 930 μg/L, 5 μg/L, and 120 μg/L respectively) for surface freshwater. This information supports the need to develop an appropriate monitoring program to ensure that the groundwater remedial action does not increase concentrations of chemicals above levels which may pose risk to ecological receptors. Development of the program will potentially need to consider chemical concentrations in groundwater, pore water, sediment, and surface water. It would also be helpful to clarify if the current groundwater concentration data were included in the previous ecological risk assessment involving sediment and surface water.

Response: *The ecological risk assessment only evaluated surface water, sediment, and sediment pore water; groundwater was not included. The following text will be added to Section 4.2.3 under the Monitoring subsection:*

> *"As part of the MNA program, groundwater monitoring would also provide warning if the future plume was to begin discharging into Indian Field Creek at unacceptable levels. Based on surface water, sediment, and sediment pore water concentrations, contaminant discharge to surface water via groundwater was not found to pose unacceptable ecological or human health risks at Site 3. Since groundwater is also not considered a significant continuing source of contaminants to the aquatic habitats adjacent to the site, the RI recommended no further action for surface water and sediment. However, in order to ensure that the future downgradient migration of contaminants is not occurring at unacceptable levels and in an effort to continuously refine the nature and extent of the plume, groundwater data would be collected and undergo evaluation. Concentrations across the plume would be monitored to assess plume stability. Concentrations in downgradient monitoring wells would be evaluated against the levels present during the RI. The evaluation process would potentially consider the effects of attenuation (that is, primarily dilution) on groundwater concentrations prior to and during discharge into the creek."*

The following text will be added to Sections 4.2.4 through 4.2.6 under the Monitoring subsection:

> *"Groundwater monitoring would also provide warning if the future plume was to begin discharging into Indian Field Creek at unacceptable levels, as described in Section 4.2.3."*

If additional groundwater monitoring wells were deemed necessary to monitor this process, they could be considered during the pre-design investigation. A future work plan will be developed and submitted separately.

2. Section 2.1 identifies a number of previous investigations and removal actions. A 2008 Technical Memorandum documented no post remediation ecological risks. It is unknown if this TM included risks potentially posed via the groundwater pathway. However, since that time the potential risk to

ecological receptors has been questioned, including the suitability of the backfill material (these data have not been included in the documents provided for BTAG review).

Response: *The following text will be added to Section 2.1 to clarify why the soil used following the soil excavation was appropriate as backfill material:*

> *"Following the excavation, OHM worked with the U. S. Fish and Wildlife Service and WPNSTA Yorktown Natural Resource personnel to develop a grading and site restoration plan that met natural resource management needs to provide wildlife habitat (CH2M HILL, 2008a). All excavated areas were backfilled with clean fill and covered with 6-inches of topsoil and seeded. Backfill was obtained from on-base borrow material and deemed acceptable based on analytical laboratory results. Toxicity characteristic leaching procedure organics and metals, total petroleum hydrocarbons (TPH), and benzene, toluene, ethylbenzene, and xylenes (BTEX) were either non-detect or below regulatory limits (OHM, 2001)."*

3. The development of a third remedial action objective (RAO) is needed (Section 3.2). This new RAO needs to ensure the protection of human health and the environment. It is possible for the currently stated ROs to be met, yet implementation of the remedy could result in an unacceptable risk to ecological receptors.

   Response: *A third RAO will not be added since there were no unacceptable risks identified in surface water. However, the alternative descriptions in Section 4 of the FS report will be modified to incorporate monitoring to assess future potential risks from groundwater discharge to surface water. See response to BTAG comment #1 for details.*

4. Section 6 (Summary and conclusions) indicates that the contingency to excavate soil to remove TPH should reduce concentrations of arsenic and manganese in groundwater. This appears to be the only portion of the selected remedy that "...should reduce..." the concentrations of these two metals in groundwater. Because the text is not clear that concentrations of these metals will decrease, long term monitoring will be needed to ensure these concentrations do not pose risk to ecological receptors.

   Response: *The proposed contingency includes long term groundwater monitoring of arsenic and manganese until remedial goals are achieved. This will be clarified in the Section 6 text.*

Toxicologist Comments

1. In Figures 1-5, 1-6 and 1-7, incorrect units are given in the Legend. For the TCE Isoconcentration Contours, units should be ug/L, not mg/L.

   Response: *The figures will be edited as suggested.*

2. Remedial Action Objectives are provided in Section 3.2 of the report. The second bullet should be revised, as follows: "Prevent exposure of future residents and industrial workers to ground water and intrusive vapors in buildings constructed within 100 feet of the shallow ground water plume, until risk-based clean-up levels or MCLs are met."

   Response: *Consistent with the ROD for Site 22 at WPNSTA Yorktown, the concern regarding future vapor intrusion at Site 3 will be addressed through language in the land use control section of the ROD, rather than established an RAO to address future vapor concerns.*

Please provide acceptance of these responses. Any back comments are requested by October 10, 2013. Should you have any additional questions, please feel free to contact me.

Sincerely,

CH2M HILL

William J. Friedmann Jr

William J. Friedmann, Jr.
Activity Manager

cc: Mr. Wade Smith/VDEQ
Mr. James Gravette/NAVFAC Midlant
Ms. Mary Anderson/CH2M HILL