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U S NAVY RESPONSES TO U S EPA AND MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION COMMENTS TO DRAFT STREAMLINED HUMAN HEALTH RISK ASSESSMENT HANGAR 1 WITH TRANSMITTAL NAS SOUTH WEYMOUTH MA
12/28/2009
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Project Number G02073

Mr. Brian Helland, RPM
BRAC PMO, Northeast
4911 South Broad Street
Philadelphia, Pennsylvania 19112

Reference: CLEAN Contract No. N62470-08-D-1001
Contract Task Order (CTO) No. WE11

Subject: Streamlined Human Health Risk Assessment – Area of Concern Hangar 1
Naval Air Station South Weymouth, Weymouth, Massachusetts

Dear Mr. Helland:

Tetra Tech NUS, Inc. (TtNUS) has prepared the final Streamlined Human Health Risk Assessment for Area of Concern Hangar 1, Naval Air Station South Weymouth, Weymouth, Massachusetts. The document has been revised consistent with the Navy responses to comments dated December 15, 2009. The U.S. Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (MassDEP) have indicated that the responses are in general acceptable, with EPA deferring approval until the final document is reviewed.

Through copy of this letter, the final Hangar 1 Streamlined Human Health Risk Assessment is being provided to the recipients listed below. Any questions regarding the document should be directed to your attention at (215) 897-4912. Please contact me at (978) 474-8403 should you have any questions.

Very truly yours,

Phoebe A. Call

Phoebe A. Call
Project Manager

PAC/lh

Enclosures

c: D. Barney, Navy (w/encl. – 1 paper, 1 CD)
K. Keckler, EPA (w/encl. – 2 paper, 1 CD)
D. Chaffin, MassDEP (w/encl. – 1 paper, 1 CD)
P. Golonka, Gannett Fleming (w/encl. – 1 paper, 1 CD)
Y. Walker, Naval Environmental Health Center (w/encl. – 1 CD)
P. Sortin, Abington (w/encl. – 1 CD)
D. McCormack, Weymouth (w/encl. – 1 paper)
M. Parsons, Rockland (w/encl. – 1 CD)
Tufts Library, Weymouth (w/encl. – 1 CD)
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Chief Executive Officer, South Shore Tri-town Development Corp. (w/encl. – 1 paper, 1 CD)
R. Daniels, LNR Property Corp. (w/encl. – 1 CD)
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G. Wagner, TtNUS (w/encl. – 1 paper, 1 CD)
J. Trepanowski, TtNUS (w/encl. – 1 CD)
G. Glenn, TtNUS (w/o encl.)
File G02073-3.2 (w/o encl.);
G02073-8.0 (w/encl. - 1 each)

**NAVY RESPONSES TO U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) COMMENTS (DATED NOVEMBER 13, 2009)**
**DRAFT HANGAR 1 STREAMLINED HUMAN HEALTH RISK ASSESSMENT (OCTOBER 2009)**
**NAVAL AIR STATION SOUTH WEYMOUTH, WEYMOUTH, MASSACHUSETTS**

Navy responses to the EPA comments on the draft Hangar 1 Streamlined Human Health Risk Assessment are provided below. The EPA's comments are presented first (in italics) followed by Navy's responses.

***General Comment:*** *Thank you for the opportunity to review the Draft Area of Concern 1 Streamlined Human Health Risk Assessment, dated October 2009. The Human Health Risk Assessment (HHRA) evaluates risk to future residents exposed to contaminants in subsurface soil at Hangar 1. Risk was based on post-remediation soil data collected in 2000. The HHRA concludes that cancer risk (lifetime cancer risk = 8E-5) and non-cancer risk (max HI = 0.2) are acceptable.*

*The HHRA only evaluated exposure to subsurface soil. EPA agrees that the inhalation pathway does not need to be evaluated quantitatively as the soil-air SSL was not exceeded.*

**Response:** Comment noted.

***Comment 1:*** *No site groundwater data were screened against RSLs. Please confirm that there are no groundwater data available from under the footprint of Hangar 1. Regarding the downgradient wells, page 8 does not say how far downgradient they were collected. Please show the three downgradient monitoring wells referred to in Appendix C on the site figure to make it clear that they can represent the site.*

**Response:** A review of the dataset for samples collected in the footprint of Hangar 1 confirms that no groundwater samples were collected in this location. Figure 2 (attached) has been revised to include the two downgradient groundwater monitoring wells located adjacent to the Hangar 1 main bay.

***Comment 2:*** *The text states that the downgradient groundwater data are associated with RIA 10C. The 2004 RIA 10C Decision Document does not include these data. Please reference these data so that they can be reviewed. Is the short list of analytes in Appendix C comprehensive for these wells?*

**Response:** The 2004 RIA 10C document included data from MW-305 to MW-308, not MW-302 to MW-304. Therefore, the analytical data from MW-302 to MW-304 will be added to the HHRA, screened against RSLs, and incorporated into risk estimation. The full list of analytes in groundwater data will also be added as an appendix to the risk assessment. A summary of the groundwater risk evaluation is provided below.

Chloroform and manganese were identified as COPCs in groundwater because maximum concentrations exceeded one or more of the screening criteria. The maximum concentration of chloroform exceeded the tapwater RSL but did not exceed the MCL. The maximum concentration of manganese exceeds the tapwater RSL set at an HI of 0.1 but not the actual RSL based on an HI of 1. The maximum concentrations of chloroform and manganese are less than the respective background concentrations for those chemicals.

The VOCs chloroform and trichloroethene were identified as vapor intrusion COPCs for groundwater because maximum concentrations exceeded risk-based U.S. EPA criteria for vapor intrusion. The evaluation of the vapor intrusion COPCs concluded that the vapor intrusion pathway is not expected to contribute significantly to receptor risks at the Site.

A summary of the hazard indices and cancer risks for subsurface soil and groundwater is shown below.

| Exposure Scenario | | | Results | |
|---|---|---|---|---|
| | | | Hazard Index | Cancer Risk |
| Future Residents | Adult | Subsurface soil | 0.02 | 1E-5 |
| | | Groundwater | 0.8 | 8E-7 |
| | | Total | 0.8 | 1E-5 |
| | Child | Subsurface soil | 0.2 | 6E-5 |
| | | Groundwater | **3** | 7E-7 |
| | | Total | 3 | 7E-5 |
| | Lifelong | Subsurface soil | NA | 8E-5 |
| | | Groundwater | NA | 1E-6 |
| | | Total | NA | 8E-5 |

The non-cancer risk for the child resident exceeds 1 (HI = 3) primarily due to manganese in groundwater, via the ingestion route of exposure. The individual hazard index for the central nervous system target organ is also approximately equal to 3 due to manganese in groundwater. The maximum concentration of manganese in groundwater was 620 µg/L which is less than one-fourth of the background value for manganese, 2681 µg/L. Therefore adverse human health effects are not anticipated due to Site-related contaminants in surface soil and groundwater at AOC Hangar 1, and no contaminants of concern (COCs) were identified at this Site.

***Comment 3****: Chemicals with maximum concentrations exceeding the EPA SSL for soil to groundwater include naphthalene, several SVOC PAHs, aroclor -1254, xylenes, cadmium, lead, and manganese. Of these, only manganese was present in downgradient groundwater above the RSL, but the maximum concentration was less than the background UPL. Given this and the rationale provided on page 8 (and pending clarification of the downgradient well locations and data), the data suggest that soil contamination in Hangar 1 has not significantly impacted site groundwater and the rationale for not including this pathway in the HHRA is acceptable.*

**Response:** Comment noted.

***Comment 4:*** *The COPC selection is sound and benchmarks are appropriate. The risk estimates are based on appropriate and conservative exposure assumptions and TRVs. However, the calculations in Appendix E should be reviewed. In particular, please review the cancer intake/exposure concentrations for benzo(a)pyrene equivalents. EPA could not replicate the values presented in Tables 7.1 RME and 7.2 RME for the cancer intake values or the non-cancer intake/exposure concentration for dermal exposure for the child resident. For example, for the child resident, the cancer ingestion intake factor, as presented in RAGS Table 4.2 RME, is 1.1.E-6. This factor multiplied by the soil EPC (1.1 mg/kg) equals 1.2E-06 mg/kg-d, not 6.4E-06 mg/kg-d, as shown in Table 7.2 RME. Please correct.*

**Response:** The benzo(a)pyrene equivalents are evaluated as mutagenic chemicals. Therefore, the cancer ingestion intake for the child is 3.65E-07 from 0-2 years and 7.31E-07 from 2-6 years (child exposure assumptions, Table 4.2). When combined with the age-dependent adjustment factors (ADAFs; 10 for 0-2 years and 3 for 2-6 years), intake for the child receptor is calculated as follows:

$$1.1 \text{ mg/kg} \times (3.65\text{E-}07 \times 10 + 7.31\text{E-}07 \times 3) = 6.4\text{E-}06 \text{ (Table 7.2)}$$

The adult intake presented on Table 7.1 is calculated in a similar manner, with ADAFs of 3 for 6-16 years and 1 for 16-30 years. A footnote will be added to the Table 4s explaining that the benzo(a)pyrene equivalents are evaluated as mutagenic compounds and that intakes/risks are calculated using the ADAFs. Example cancer risk equations with the ADAFs used, will be provided.

For the non-cancer intake for dermal exposure for the child, the non-cancer dermal intake value provided on Table 4.2 is 3.58E-05, which does not include the chemical-specific exposure point concentration (EPC) or dermal absorption factor (DABS). The dermal non-cancer intake for benzo(a)pyrene equivalents is:

3.58E-05 x 0.13 x 1.1 mg/kg = 5.1E-06 (Table 7.2)

where 0.13 is DABS and 1.1 mg/kg is the EPC.

For Aroclor-1254, dermal non-cancer intake is:

3.58E-05 x 0.14 x 0.21 mg/kg = 1.1E-06 (Table 7.2)

where 0.14 is the DABS and 0.21 mg/kg is the EPC.

This is noted as a footnote on the exposure assumptions tables. An additional footnote can be added to provide the locations of chemical-specific EPCs and DABS values (RAGS Part D Tables 3 and 7 and Section 4.3 of the text, respectively).

The following text will also be added to the end of Section 4.3 of the report to explain the use of ADAFs:

"USEPA's Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005) recommends making adjustments to the risk estimates for carcinogenic chemicals which act via the mutagenic mode of action when evaluating early life exposures. The guidance recommends using age dependent adjustment factors (ADAFs) combined with age specific exposure estimates when assessing cancer risks. In the absence of chemical specific data the supplemental guidance recommends the following default adjustments which reflect that cancer risks are generally higher from early-life exposures than from similar exposures later in life:

- For exposures before 2 years of age (i.e., spanning a 2-year interval from the first day of birth up until a child's second birthday), a 10-fold adjustment.
- For exposures between 2 and < 16 years of age (i.e., spanning a 14-year time interval from a child's second birthday up until their sixteenth birthday), a 3-fold adjustment.
- For exposures after turning 16 years of age, no adjustment.

The adjustments were applied using the same method used by the U.S. EPA in the development of the RSLs. Children were evaluated as two age groups, ages 0 to 2 years and ages 2 to 6 years; and adults were evaluated as two age groups, ages 6 to 16, and ages greater than 16 years old. Using this approach the intakes for hypothetical residents were calculated as follows:

IntakeChild = Intake(ages 0 – 2 years) x 10 + Intake(ages 2 – 6 years) x 3
IntakeAdult = Intake(ages 6 – 16 years) x 3 + Intake(ages > 16 years)

The above approach was used only for those chemicals which are identified as mutagenic in the U.S. EPA RSL screening table (e.g., carcinogenic PAHs). Sample calculations demonstrating this approach are included in Appendix C."

***Comment 5:*** *In Table 2, some chemicals (carbazole, EPH aromatics, VPH aliphatics) are not selected as COPC based on no toxicity criteria (NTX). These chemicals should be identified as COPC.*

**Response:** The EPH aromatics and VPHs aliphatics were screened against criteria in Appendix B; maximum detected concentrations were less than relevant criteria. Therefore, these chemicals will not be selected as COPCs, but a footnote will be added in Tables 2 and 3 to explain that concentrations of these

parameters were less than criteria in Appendix B. Carbazole will be selected as a COPC and qualitatively evaluated; the following text will be added to Section 7.0:

"Carbazole was selected as a COPC in soil because no toxicity data are available for this compound. No background concentration was available for carbazole, so it is uncertain how the maximum concentration compares to background. Carbazole was detected in only 2 of 32 soil samples, less than 10 percent of the data set. It is unlikely that the exclusion of carbazole from the quantitative risk assessment resulted in a significant underestimation of risk due to the low frequency of detection."

***Comment 6:*** *The method for calculating benzo[a]pyrene equivalents should be added in an appendix, showing the calculations for the subsurface soil samples and the individual concentrations used as input to the ProUCL calculations (i.e., sample ID with result used, such as ½ DL, etc.).*

**Response:** Agreed. An example calculation for benzo(a)pyrene equivalents will be added to Appendix C. The full set of analytical data for soil and groundwater, which includes all data used in the benzo(a)pyrene equivalents calculations, will replace the previous detected concentrations table (Table A.1) for reference purposes.

***Comment 7:*** *In Section 8, it is difficult to follow the calculation of cancer risks of mutagenic PAHs from the equations on Tables 5 and 6 because the use of ADAFs is not as transparent as it is in the sample calculations. Please describe the method for calculating cancer risk for mutagenic chemicals (with equations similar to the sample calculations). The equations should be the same as in Tables 5 and 6 so that the calculation is transparent. It might be useful to add an example calculation to the footnotes of Tables 5 and 6.*

**Response:** Agreed. Footnotes will be added to the exposure assumptions tables and to Section 4.3 of the text, discussed above, in order to clarify the use of ADAFs in the cancer risk estimates for mutagenic chemicals.

***Comment 8:*** *In Table C.1, please provide definitions for the acronyms NA, SMCL, MCL, N, C and provide footnotes 5, 6, 7 and 8.*

**Response:** Agreed. The acronym definitions and footnotes will be added to this table, which will become a COPC selection table included in the upfront portion of text in order to fully evaluate these groundwater data as part of the HHRA. See also the Response to Comment #2.

**NAVY RESPONSES TO MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION (MASSDEP) COMMENTS (DATED OCTOBER 23, 2009)**
**DRAFT HANGAR 1 STREAMLINED HUMAN HEALTH RISK ASSESSMENT (OCTOBER 2009)**
**NAVAL AIR STATION SOUTH WEYMOUTH, WEYMOUTH, MASSACHUSETTS**

Navy responses to the MassDEP comments on the draft Hangar 1 Streamlined Human Health Risk Assessment are provided below. The MassDEP's comments are presented first (in italics) followed by Navy's responses.

***Comment 1. Section 2.1:*** *AOC Hangar 1 should be defined to consist of subsurface soil contaminated by releases from the floor drain systems that were addressed during the floor drain system removal actions. In particular, AOC Hangar 1 should be distinguished from the other known and potential release areas located within and adjacent to Hangar 1, including RIA 10C (North and South Lean-tos), RIA 11 (AFFF ASTs), RIA 99 (Radiation Survey), and the concerns identified during the June 30, 2005 inspection of the Hangar 1 interior (refer to July 6, 2005 e-message).*

**Response:** Text will be added to clarify that the site is defined as AOC Hangar 1 floor drains in this section and also in Section 1.

***Comment 2. Section 6.0:*** *As noted in the final paragraph of this section, estimated cancer risks exceeded the state risk limit, indicating that additional evaluation is necessary to demonstrate acceptable risk. A comparison of maximum contaminant concentrations to Method 1 standards is suggested.*

**Response:** Agreed. A comparison of maximum concentrations of chemicals identified as COCs to MCP Method 1 S-1/GW-1 standards has been completed and will be added to Section 7.9 of the risk assessment as follows:

"In this HHRA for AOC Hangar 1, the Risk Characterization concluded that cancer risks were acceptable because the EPA target cancer risk level (1E-06 to 1E-04) was not exceeded. However, the Massachusetts cancer risk threshold of 1E-05 was exceeded for risks estimated for the child resident (7E-05) and the lifelong resident (8E-05). The cPAHs in subsurface soil were the primary risk driver for these receptors. To further evaluate the cancer risks, the following table compares the maximum concentrations of cPAHs detected in subsurface soil to MCP Method 1 Standards:

| Chemical | Maximum Concentration | MCP S-1/GW-1[(1)] | Above Screening Level? |
|---|---|---|---|
| **Semivolatile Organic Compounds (ug/kg)** | | | |
| BENZO(A)ANTHRACENE | 1600 | 7000 | No |
| BENZO(A)PYRENE | 1200 | 2000 | No |
| BENZO(B)FLUORANTHENE | 1700 | 7000 | No |
| BENZO(K)FLUORANTHENE | 620 | 70000 | No |
| CHRYSENE | 1500 | 70000 | No |
| INDENO(1,2,3-CD)PYRENE | 640 | 7000 | No |
| BAP EQUIVALENTS | 1721 | 2000 | No |
| **MADEP EPH (mg/kg)** | | | |
| BENZO(A)ANTHRACENE | 0.85 | 7 | No |
| BENZO(A)PYRENE | 0.68 | 2 | No |
| BENZO(B)FLUORANTHENE | 0.69 | 7 | No |

| Chemical | Maximum Concentration | MCP S-1/GW-1[(1)] | Above Screening Level? |
|---|---|---|---|
| BENZO(K)FLUORANTHENE | 0.72 | 70 | No |
| BAP EQUIVALENTS | 1.12 | 2 | No |

1 - Massachusetts Contingency Plan (MCP) Method 1: Soil Category S-1Standards. S-1Soil & GW-1 Groundwater. 310 CMR 40.0000, 12/14/2007.

As the summary table shows, the maximum concentrations of all individual cPAHs and the BAP equivalents are less than the associated State criteria. Therefore, cancer risks calculated for residents at Hangar 1 are expected to be acceptable."

***Comment 3. Section 7.1****: Analytical data of unknown quality are inadequate for site decision making. Consequently, while formal analytical data validation might not be possible, the analytical data used in the risk assessment should nevertheless be evaluated to the extent possible to develop and present an assessment of usability.*

**Response:** It was not possible to conduct a Tier 2 validation since the complete analytical data packages were not available. However, a Tier 1 validation was conducted on the analytical data used in the risk assessment. The Tier 1 validation did not document any issues that would affect the usability of the data for the streamlined risk assessment. All results were reported down to the laboratory's quantitation limits. All available project action limits (MCP RC-S1 Criteria) were met by the laboratory's quantitation limits for the extractable petroleum hydrocarbons (EPH), volatile petroleum hydrocarbons (VPH), polychlorinated biphenyls (PCB), semivolatile organic compounds (SVOC), and metals fractions. There are no regulatory limits established for the volatile organic compounds (VOC) fraction.

***Comment 4. Sections 7.2 and 8.0:*** *The comparison of site and "natural soil" concentrations should be deleted from the report because the results from samples H1-SS01 through H1-SS05, which were collected from soil not impacted by the floor drain systems, indicate that site-specific background concentrations are significantly lower than the "natural soil" concentrations.*

**Response:** Respectfully disagree. Using only five samples, i.e., samples H1-SS01 through H1-SS05, to represent site background conditions is not appropriate. The NAS South Weymouth background data set indicates that background concentrations are also less than the "natural soil" concentrations. However, comparison of site data to the "natural soil" concentrations is valuable because the "natural soil" data set is more robust. Therefore, the comparison of site maximum concentrations to "natural soil" concentrations will not be deleted from the report. The NAS South Weymouth background concentrations will be added to the table in Section 7.2 as shown below, to better illustrate that background concentrations are lower than the "natural soil" concentrations.

| Chemical | Selected as a COPC? | Background Concentration in Subsurface Soil (µg/kg)[1] | Maximum Concentration in Site Subsurface Soil (µg/kg) | Concentration in "Natural Soil" (µg/kg)[2] |
|---|---|---|---|---|
| Benzo(a)anthracene | Yes | 600 | 1,600 | 2,000 |
| Benzo(a)pyrene | Yes | 16 | 1,200 | 2,000 |
| Benzo(b)fluoranthene | Yes | 810 | 1,700 | 2,000 |
| Benzo(k)fluoranthene | No | 320 | 620 | 1,000 |
| Chrysene | No | 710 | 1,500 | 2,000 |
| Dibenzo(a,h)anthracene | No | 1.7 | Not Detected | 500 |
| Indeno(1,2,3-cd)pyrene | Yes | 390 | 640 | 1,000 |
| BAP Equivalents | Yes | Not Available | 1,721 | 2,000[3] |

1 – Source: Stone and Webster, November 2002.
2 – Source: Massachusetts Department of Environmental Protection, May 2002.
3 – Value is for benzo(a)pyrene.