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U S NAVY RESPONSE TO REGULATOR COMMENTS TO REVISED DRAFT FINAL FEASIBILITY STUDY REPORT BUILDING 82 SITE NAS SOUTH WEYMOUTH MA
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C-NAVY-05-12-5067W

May 30, 2012

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: Responses to Comments - Revised Draft Final Feasibility Study Report
Building 82 Site
Former Naval Air Station South Weymouth, Weymouth, Massachusetts

Dear Mr. Helland:

Tetra Tech, Inc. has prepared responses to comments (RTCs) received on the Revised Draft Final Feasibility Study (FS) Report for the Building 82 Site, Former Naval Air Station South Weymouth, Weymouth, Massachusetts. Once the RTCs are reviewed and accepted the Final FS will be issued.

On behalf of the Navy, the RTCs on the Revised Draft Final FS for the Building 82 Site are being provided to the recipients listed below. If you have any questions regarding the RTCs, please contact me at (978) 474-8403.

Very truly yours,

Phoebe A. Call
Project Manager

PAC/lh

Enclosures

c: D. Barney, Navy (w/encl. – 1)
C. Keating, EPA (w/encl. – 3)
D. Chaffin, MassDEP (w/encl. – 1)
P. Steinberg, Mabbett & Associates, Inc. (w/encl. – 1)
P. Sortin, Abington (w/encl. – 1)
M. Brennan, Weymouth (w/encl. – 1)
M. Parsons, Rockland (w/encl. – 1)
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Public Library, Rockland (w/encl. – 1)
Public Library, Hingham (w/encl. – 1)
Chief Executive Officer, South Shore Tri-town Development Corp. (w/encl. – 1)
R. Daniels, LNR Property Corp. (w/encl. – 1)
J. Logan, Tetra Tech (w/encl. – 1)
J. Trepanowski, Tetra Tech (w/o encl.)
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File G02073-3.2 (w/o encl.);
G02073-8.0 (w/encl. - 1)

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NAVY RESPONSES TO U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
COMMENTS DATED MAY 1, 2012
REVISED DRAFT FINAL FEASIBILITY STUDY – BUILDING 82
FORMER NAVAL AIR STATION (NAS) SOUTH WEYMOUTH, MASSACHUSETTS

The Navy's responses to the EPA comments on the Building 82 Revised Draft Final Feasibility Study (dated March 2012) are presented below. The EPA comments are presented first (in italics) followed by Navy's responses.

The Navy is disappointed to see the number of new comments on a revised draft final document. There are more comments on this revised draft final FS than were provided on the draft final FS.

GENERAL COMMENTS

1. *Toxicity factors for trichloroethylene and tetrachloroethylene have been finalized on EPA's Integrated Risk Information System (IRIS) (see attached). Since these values are different than those used in the RI report (and the Maintenance Action Risk Screening Evaluation in Appendix G), the draft final FS report should be revised throughout to incorporate these changes. Alternatively, the report could be appended with a technical memorandum that describes the changes that would result from the use of updated toxicity factors and whether these changes, if any, warrant a significant change in the PRGs, remedial alternatives or the conclusions of the Maintenance Action Risk Screening Evaluation (Appendix G). This technical memorandum should include an evaluation that demonstrates that the conclusion that vapor intrusion is not of concern is still valid given the changes in inhalation toxicity values. Because the EPA Regional Screening Levels and the Vapor Intrusion Screening Level (VISL) calculator have not yet been completely updated for these changes, Region 1 has calculated VI target levels and "RSL-equivalent" screening levels for residential and commercial soil and tapwater.*

Response: As the Navy has noted previously, the Navy does not revise final documents when EPA toxicity factors or other criteria change. Therefore no changes will be made to the discussion of the findings of the RI in Section 1 of the FS. However the latest toxicity factors for TCE and PCE have been checked against those used in the PRG calculations. Please see the attached calculation sheets, which will also be included in Appendix B of the FS.

The Maintenance Action Risk Screening Evaluation used the most recent screening levels for TCE; TCE was not selected as a COPC. PCE was not a COPC in the unsaturated soil in the RI and still would not be a COPC in the Maintenance Action Risk Screening Evaluation. For the saturated soil, PCE was selected as a COPC in the RI, but now would not be based on the updated PCE value. Please note that the saturated soil was evaluated in the uncertainty section of the Maintenance Action Risk Screening Evaluation and the evaluation concluded receptor exposure to saturated soil was unlikely anyway.

2. *Uncertainty remains regarding the deep overburden groundwater flow direction due to a scarcity of groundwater elevation data along the south and southeastern sides of the deep plume. Comparison of the groundwater elevation contours with the proposed TCE plume configuration suggests that the two are not necessarily compatible with an original source area in the vicinity of Building 41 and 15. Although the activities in Building 15 are consistent with it being a source, the upgradient end of the TCE plume could just as well be drawn to orient to the northeast toward Building 16 based on the available TCE data. The deep overburden groundwater flow direction needs to be better defined in a pre-design investigation and better constraint on the upgradient TCE plume orientation needs to be obtained before a remedy is implemented.*

Response: The Navy has acknowledged these concerns which EPA has expressed in previous sets of comments on the FS and the RI Addendum. As indicated in the Navy's previous responses, these concerns will be addressed in the remedial design phase following selection of a remedy and completion of the ROD for the Site.

3. *The Navy used Biochlor modeling to estimate the life cycle of the shallow and deep chlorinated hydrocarbon plumes; however, this model is based on the existence of a source area which has been located and reasonably well assessed. The analytical evidence currently available does not support the presence of a distinct source area at the Building 82 site. Current data suggests that a release occurred some time ago at an undetermined location and the source has been depleted. This is evident by the fact that the TCE concentration is greatest in the center of the plume and decreases both downgradient and upgradient of the maximum TCE concentration. Therefore, the Biochlor model may not be a useful tool for analyzing the life cycle of these plumes.*

Response: Navy's CSM indicates that the most likely source of contamination is the storm sewer catch basins south of Building 15 (most likely, C612). While some TCE may have been carried through the storm sewer system, thereby spreading the contamination to the north and west of Building 15, the concentrations in those areas are below the MCL. The Navy believes that the Biochlor model is adequate for the purpose of this FS.

4. *It is not apparent that the vertical extent of the TCE groundwater contamination has been defined. Review of the profiling data indicates that, except for H4, at all the profiling locations where TCE was detected in excess of its MCL the greatest concentration was found in the deepest interval. Furthermore, it appears that none of the profile locations were continued to bedrock suggesting that even greater TCE concentrations could be located in intervals closer to bedrock. Although refusal was reportedly obtained, the use of Geoprobes is an unreliable tool for this task. (This is further supported by available well boring data which suggests that bedrock was not achieved [with Geoprobes].) In addition, there are no bedrock wells installed within the footprint of the plume. Please supplement the FS with a presentation of the vertical extent of groundwater contamination by incorporating figures presenting section views of the shallow and deep plumes, based on current knowledge, together with site geology. Based on the available data, it is not apparent that the magnitude and extent of TCE contamination in deep overburden and bedrock has been adequately evaluated or characterized. Further evaluation is warranted in conjunction with the remedial design.*

Response: The Navy has acknowledged these concerns which EPA has expressed in many prior sets of comments on the FS and the RI Addendum. As stated in the comment, these concerns will be addressed in the remedial design phase following selection of a remedy and completion of the ROD for the Site.

5. *Throughout the FS Region 9 PRGs are referenced; however, EPA now uses Regional Screening Levels (RSLs) in lieu of Region 9 PRGs and several Region 9 values are now obsolete. For example, the Region 9 PRG for manganese was 88 µg/L (HQ=0.1) but the RSL for manganese is now 32 µg/L (HQ=0.1). Please edit the text to refer to RSLs and ensure that the text comparisons are updated to refer to the current RSLs.*

Response: Please see the Response to General Comment No. 1 above.

6. *Review of the catch basin and piping elevations relative to the depths at which trichloroethylene (TCE) was detected indicates that the piping and catch basins are located approximately 10 to 12 feet higher in elevation than the depths at which TCE is detected in deep overburden groundwater and there are no detections of TCE in the shallow groundwater between the catch basins and piping and the deep overburden groundwater. Although the FS speculates that catch basins and piping are suspected to have contributed to the presence of the deep TCE contamination, the absence of TCE detections between those features and the deep TCE and the presence of TCE contamination upgradient of the catch basins and piping calls into question this aspect of the conceptual model. Some evidence of residual TCE would be expected between the source and the plume. Please edit the FS to discuss how these facts are consistent with the conceptual model or revise the conceptual model to account for them.*

Response: The Navy has addressed this EPA concern in previous comments on the FS and the RI Addendum and considers the piping and catch basins to have been adequately investigated. EPA accepted the RI Addendum in an email dated October 17, 2011; please see that document for additional details. However, a recap of the Navy's findings is provided below.

The closest catch basins to the apparent source of the plume are C612 and C613, which are 3.31 and 4.95 feet below ground surface. The elevation of the C612 rim was 153.26 feet (NAVD 88). The closest groundwater profiling location is B82-J-05. The shallow sample at the location was collected from 6-10 feet bgs (ND) and the deep sample was collected from 20-22 feet bgs (14 µg/L). There are two likely explanations for the lack of residual TCE in the nearby B82-J-05 sample: 1) during the field effort, the DPT samples were not put immediately adjacent to the catch basins in order to avoid potential damage to utilities; and 2) TCE in the shallow overburden groundwater may have entered through leaks into the catch basin and pipe material and thus migrated through the storm sewer system.

The pattern of contamination within the shallow overburden follows the path of the storm sewer and the maximum concentrations within the deep overburden appear to follow a path from the southwest corner of Building 15, in the vicinity of the catch basins (which connect to the same storm sewer in the vicinity of the shallow groundwater concentrations). Given that the pattern of TCE contamination is bounded by non-detect concentrations (including non-detect groundwater profiling concentrations along the west side of Shea Memorial Drive as part of the Building 81 RI), the entire area is paved and has few other entry routes to groundwater, and Building 15 was a vehicle maintenance facility, Navy considers the catch basins to be the most likely route of contamination.

These findings will be added to Section 1.3.1 of the FS.

7. *Naturally-occurring, redox-sensitive metals such as arsenic and manganese should also be contaminants of interest for Alternatives G-3 and G-4 because of their impact or potential impact on groundwater geochemistry.*

Response: Please see the responses to the specific Section 2 comments below. These redox-sensitive metals will be included in the monitoring program.

PAGE-SPECIFIC COMMENTS

1. *Page 1-11, §1.2.6 - In the second sentence in the last paragraph, please review and confirm or correct the reference to southwest of the Site.*

Response: The referenced sentence will be replaced with the following details from the RI Addendum: "The shallow groundwater contours show an overall trend of groundwater flow to the southwest with localized flow to the west-southwest at Building 81 (possibly because of recharge from the unpaved area to the northwest) and immediately west of Building 82 where flow may be influenced by the bedrock trough and storm drains. Deep overburden groundwater flow is similar to that of the shallow overburden, with an apparent trough in the vicinity of B81-MW-47I and an area of relatively flat groundwater south and southwest of Building 15."

2. *Page 1-13, §1.3 - Please eliminate qualitative references to "low concentrations" (here, and throughout the document) and replace with a comparison of measured contaminant concentrations to values that have some quantitative meaning, such as RSLs.*

Response: As mentioned previously, Section 1 of the FS is a summary of the findings of the RI. Please see the RI for further details on contaminant fate and transport. Section 1.3 of the FS will not be revised.

3. *Page 1-17, §1.3.1 - In the subsection entitled "Past Leaching of PCBs from the Western Site Drainage Ditch", please change the word "congeners" to "Aroclors."*

Response: The suggested change will be made.

4. *<u>Page 1-19, §1.3.3</u> - Please revise the discussion in this section, and elsewhere in the FS as appropriate, to acknowledge that reducing conditions in the aquifer can mobilize metals at concentrations far greater than their normal background concentrations and that it is well known that the release of organic contaminants to the subsurface can result in the creation of reducing conditions. Consequently, the presence of elevated metals concentrations in site groundwater may be a result of the release of chlorinated hydrocarbons to the subsurface in addition to any background contributions.*

<u>Response:</u> Comment noted. The following sentence will be added to the last paragraph of Section 1.2.7, Nature and Extent of Contamination: "Reducing conditions in the aquifer can mobilize metals and thus contribute to the elevated metals concentrations in site groundwater." No change will be made to Section 1.3.3.

5. *<u>Page 1-21, §1.4.1</u> - Regarding the risk assessment conclusions summarized here, please confirm that the conclusions are based on the recently released TCE toxicity data.*

<u>Response:</u> As mentioned previously, Section 1 of the FS is a summary of the findings of the RI and RI Addendum, including the risk assessments. Please see the RI for further details regarding the risk assessments. TCE remains the primary COC in groundwater at the Site. However, the other site media (e.g. soil and sediment) were re-assessed to confirm that the risk assessment conclusions are not impacted by the latest TCE toxicity value.

The RI soil and sediment data were reviewed; TCE was not detected in the exposed surface soil or future surface soil data sets evaluated. TCE was also not detected in sediment. However, TCE was detected in the 'All Soil 0-8 ft.' data set with a maximum concentration of 10 µg/kg and was not selected as a COPC in the RI. The maximum concentration of TCE in this soil data set is less than the current screening level of 440 µg/kg based on a hazard quotient of 0.1: TCE would still not be selected as a COPC for the 'All Soil 0-8 ft.' data set. Therefore, the conclusions for TCE in soil or sediment would not change based on the current TCE toxicity criteria. Since there is no risk associated with soil or sediment they are not media of concern for the FS.

6. *<u>Page 2-2, §2.2</u> - The discussion in the third full paragraph eliminates five COCs because their concentrations detected in site groundwater were less than their MCL. COCs cannot be eliminated from the risk evaluation based on comparison to MCLs; this is not consistent with risk assessment protocol and not consistent with the National Contingency Plan (NCP). Please revise the FS to carry them into the risk summary tables and provide PRGs for these COCs.*

<u>Response:</u> The COC, PRGs and details of this FS have been discussed at great length since the draft FS was issued in September 2009. This comment was not included in the multiple sets of comments from EPA on the draft FS or the November 22, 2010 EPA comments on the draft final FS. A draft Proposed Plan was issued in January 2011 to address a request from EPA for the Navy's proposed remedy. The Proposed Plan was a key document reviewed and revised cooperatively between Navy, EPA, MassDEP, SSTTDC, and LNR. All parties concurred on the precise wording of the Proposed Plan in late 2011 prior to the closing.

However to ensure that the FS is consistent with the NCP, Section 2.2 will be revised to include the five COCs. PRGs have been calculated, Tables 2-3 and 2-4 have been revised accordingly; these items are attached to these RTCs.

7. *<u>Page 2-8, §2.4.1</u> - The paragraph at the top of the page states that the RI determined that there is no vapor intrusion risk, although risk was not recalculated as part of the RI addendum. However, the first table in Appendix B notes for trichloroethene that "The vapor intrusion risk has been added to TCE". Please clarify in the FS text whether or not vapor intrusion has been recalculated and found to present no risk based on the recently released TCE toxicity data.*

Response: The vapor intrusion risk for purposes of the FS has been recalculated using the latest TCE toxicity data. Please see the attached calculation sheets, which will also be included in Appendix B of the FS. The calculations confirm that there is not a vapor intrusion risk at the Building 82 Site.

8. *<u>Page 2-9, §2.4.4</u> - The MCLs cannot be assumed to be sufficiently protective when multiple COCs are present as in this case. According to the NCP, the point of departure when MCLs are not sufficiently protective is a risk of 1×10^{-6}, although this need not necessarily be the final PRG. Please document that the MCLs are sufficiently protective considering all COCs, not just those with MCL exceedances. Either retain the MCLs as PRGs or include a risk-based PRG if that value is lower than the MCL.*

Response: As noted in the Response to Specific Comment No. 11 below, the post-remediation risk will be calculated when the PRGs are met. The following sentence will be added to Sections 2.4.1, 4.2.2.2, 4.2.3.2, 4.2.4.2, and 4.2.5.2: "Once the PRGs have been achieved, the human health risk will be calculated using the groundwater monitoring data to determine whether the concentrations result in excess human health risk."

9. *<u>Page 2-9, §2.4.4</u> - It is stated in the 3rd paragraph that the MCL for TCE and 1,1,1-TCA is "considered to be sufficiently protective given site-specific circumstances." Please provide additional technical support for this statement, either in a revision or response to this comment, given the more restrictive IRIS toxicity factors for TCE. This paragraph also states that the manganese PRG will be the Base-wide background concentration of 2680 ug/l. For reasons stated previously, **<u>EPA continues to disagree with this Base-wide background concentration for manganese in groundwater and does not accept this PRG.</u>***

Response: TCE is the primary COC at the Site. The concentrations of other COCs are typically less than their PRGs, except in one or two samples. 1,1,1-TCA was detected in only one location, GP-A01, and was not detected in the wells that have detections of TCE. Therefore, the Navy believes that the use of the MCL for TCE is acceptable at the Site. The last sentence of the referenced paragraph will be revised as follows: "The EPA Health Advisory for manganese, 300 µg/L, will be used as the manganese PRG." For consistency with this change, the last paragraph on page 2-2 will be revised to mention the health advisory rather than background concentrations.

10. *<u>Page 2-17, Table 2-3</u>: a) This table is incomplete because it does not include all COCs. All COCs with excess carcinogenic risk greater than 1×10^{-6} or non-carcinogenic risk greater than 0.1 must be retained and evaluated in the risk assessment. Five COCs and PCBs have been erroneously eliminated from the risk calculations because their MCLs were not exceeded for site groundwater samples. Please correct this table to include all COCs that contribute to site risk.*

Response: Table 2-3 has been revised to include the five COCs from the HHRA with concentrations less than their MCLs. The table is attached to these RTCs. PCBs do not contribute to site risk and thus are not included in the table. As discussed on page 2-3, PCBs will be included in the monitoring program and the MCL (0.5 µg/L) will be used as a criterion to evaluate the data.

b) Based on the proposed PRGs the groundwater risk exceeds Massachusetts risk-based threshold of 1×10^{-5} even without consideration of the COCs that have been erroneously eliminated from the risk assessment. Please either clarify why the Massachusetts risk-based threshold of 1×10^{-5} is not a ARAR or TBC or else include it as one.

Response: The post-remediation risk will be calculated when the PRGs are met. The MassDEP risk level was determined not to be an ARAR or TBC by both the Navy and EPA (see Comments 38 – 43).

c) Arsenic, manganese, and other redox-sensitive metals should also be retained as a chemicals of interest because they can be mobilized to groundwater under reducing conditions (which currently exist at the site (possibly due to the release of chlorinated hydrocarbons) and one of the proposed *alternatives will actively generate or increase reducing conditions in the groundwater). Please add arsenic and manganese to this discussion and include them as chemicals of interest throughout the FS report.*

Response: Manganese is already included on Table 2-3, and per previous comments, arsenic will be added (see also the Response to Specific Comment No. 6). Please also see the Responses to the Section 2 comments above.

d) The risk-based PRGs appear to be incorrect because they are inconsistent with the RSLs. For example, the RSLs for TCE and vinyl chloride are 0.44 µg/L and 0.015 µg/L, respectively, for 1 x 10^{-6} risk; however, the listed PRGs for TCE and vinyl chloride are 4.5 µg/L and 0.016 µg/L, respectively for 1 x 10^{-6} risk. It is unclear how the PRG for TCE could be 10 times the RSL while the PRG for vinyl chloride is essentially equal to the PRG when the risk is the same for these chemicals. The ratio of the RSL to the PRG for each of the COCs, are different. Please clarify.

Response: The risk-based PRG for TCE was recalculated (see the attached revised version of Table 2-3). The revised PRG based on 1 x 10^{-6} is 0.72 µg/L, which is comparable to the RSL of 0.44 µg/L.

11. *Page 2-18, Table 2-4: a) Please edit the table to present the cumulative risk for the selected PRGs. Include the PRGs for the erroneously eliminated COCs.*

Response: Per previous responses to similar comments, once the PRGs have been achieved, the human health risk will be calculated for the contaminant concentrations achieved to determine whether these concentrations result in excess human health risk. Please also see the Response to Specific Comment No. 8. Table 2-4 has been revised to include the five COCs from the HHRA with concentrations less than their MCLs.

b) Please correct the entry for vinyl chloride in the Federal ARAR column.

Response: The entry will be corrected.

12. *Page 2-19, Table 2-5 - Please include the erroneously eliminated COCs in this table. See comment 10. above.*

Response: Please see the Response to Specific Comment No. 10 above.

13. *Page 3-2, §3.1 - The table of retained process options presented in this section is inconsistent with Table 3-1. Table 3-1 eliminated physical land use controls, groundwater removal by extraction, all ex situ treatment options, and all disposal options. Please review and correct the FS to eliminate these discrepancies. (EPA notes that Table 3-1 in this latest FS eliminated several options that were retained in the September 2010 FS, but the associated text in Section 3 was not updated.)*

Response: Table 3-1 is correct, the text in Sections 3.1 and 3.2 was inadvertently not revised to match Table 3-1. The text will be revised to eliminate the discrepancies.

14. *Page 3-4, §3.2.2.1 - Physical land use controls were eliminated in Table 3-1 so they should not be presented in Section 3.2 (unless there is a mistake in Table 3-1). Please review and correct the discrepancy.*

Response: As noted in the response above, Table 3-1 is correct; Section 3.2.2.1 will be revised to eliminate any mention of physical land use controls as noted in the comment.

15. *Page 3-7, §3.2.3 - Removal of groundwater was eliminated in Table 3-1 so it should not be presented in Section 3.2 (unless there is a mistake in Table 3-1). Please review and correct the discrepancy.*

Response: As noted above Table 3-1 is correct; Section 3.2.3 will be eliminated.

16. *Page 4-6, §4.2 - The first sentence refers to detailed screening presented in Sections 3.2 and 3.3; however, there is no Section 3.3 in the document. Please correct.*

Response: The sentence will be revised to delete the reference to Section 3.3.

17. *Page 4-10, §4.2.2.1 - a) The first paragraph (or should it be the second) under LUCs states that treatment time is expected to be one year; however, the last paragraph on page 4-9 states that approximately 2 years would be required for treatment. Please correct the apparent discrepancy.*

Response: The interim LUCs will remain in place until treatment is completed, or for approximately 2 years. The second sentence in the second paragraph ("Because the treatment time is expected to be 2 years, two inspections would be performed.") will be deleted.

b) The referenced text on page 4-10 (first or second paragraph) implies that LUCs would only be in effect for one year. This appears to be inconsistent with the subsequent paragraph which states that LUCs would be maintained as long as they are required (or with the text in Section 4.2 which states that Alternative G-2 requires a longer period of time to allow COCs to attenuate. Please clarify or correct the apparent inconsistency.

Response: Please see the Response to Specific Comment No. 17.a) above.

18. *Page 4-11, §4.2.2.1 - a) Please edit the first paragraph on this page to acknowledge that the locations of the monitoring wells and the frequency of monitoring will be established in the long-term monitoring plan but that for the purposes of this FS, costing is based on monitoring existing wells at the frequency stipulated in this paragraph.*

Response: The following text will be inserted after the 5th sentence in the paragraph: "Thirteen wells are assumed to be needed for MNA monitoring. While the costing estimates in Appendix F are based on the information above, details such as the number and location of monitoring wells, analytes and monitoring frequency, will be determined during development of the long-term monitoring plan as part of the remedial design."

b) Please supplement the discussion of Monitored Natural Attenuation to acknowledge that based on site groundwater data the evidence is weak that significant biodegradation of TCE is occurring at the site; therefore, it may be necessary to enhance the existing microbiological populations under this alternative in order to realize any significant benefit from natural attenuation of TCE.

Response: The 2nd paragraph on the page will be revised as follows: "The baseline sampling event will include collection of samples for the natural attenuation parameters. These data will be used to supplement the limited evidence of reductive degradation discussed in the RI. Should the baseline and subsequent monitoring data indicate little biodegradation of TCE, contingency actions may be required to enhance or stimulate the native microbial population. The baseline sampling event would also include…"

In addition, the following paragraph will be added after the first paragraph of the Component 3 discussion:

"Note that the evidence for biological natural attenuation is weak. Other than the VOC data, there are currently few other natural attenuation indicator data. Of the groundwater sample locations in the area (MW-10S, MW-10D, E03, H01, H02, H03, and H04), all but MW-10S have highly negative ORP values, which are favorable for anaerobic dechlorination. Half of the DO concentrations are less than 1 mg/L, which is also favorable for anaerobic dechlorination. The absence of cis-1,2-DCE and vinyl chloride may be due to a very slow degradation rate due to the very low TCE concentrations. The absence of cis-1,2-DCE and vinyl chloride may also be the result of complete degradation of TCE. Note that biological degradation is just part of the overall natural attenuation process. Natural attenuation also includes physical processes, such as dispersion, dilution, and sorption. Because of the low groundwater velocity, the contaminants will migrate slowly. Sorption to naturally occurring organic material will limit the migration and supplement the attenuation. Additional natural attenuation indicator parameter data will be collected as part of the Remedial Design."

c) Monitoring will also be required for the treatment system installed to remediate 1,1,1-TCA, 1,1-DCA, and NNPA. Please address these COCs in this discussion of Monitored Natural Attenuation.

<u>Response:</u> Because the plumes for these COCs are so small, the Component 1 active chemical oxidation eliminates the COCs completely. After the performance monitoring discussed in Component 1 in Section 4.2.2.1, no long-term natural attenuation monitoring is required.

19. *<u>Page 4-11, §4.2.2.2</u> - Please remove the reference to "surficial" groundwater since the restrictions will apply to all groundwater (e.g., surficial, shallow and deep) at the site.*

<u>Response:</u> The suggested change will be made.

20. *<u>Page 4-12, §4.2.2.2</u> - The second paragraph on this page (one sentence) states that there are no short-term effects; however, oxidation treatment is likely to at least temporarily eliminate any existing microbiological populations in the treatment zone that are currently metabolizing chlorinated hydrocarbons. Please amend this section accordingly and acknowledge that based on groundwater analytical data, evidence that significant biodegradation of TCE is occurring at the site is weak.*

<u>Response:</u> Comment noted. The impact of the oxidation treatment component on the bacterial community was also included in MassDEP comments on the draft final FS. The issue is addressed in the last paragraph in page 4-9. The paragraph referenced in the comment will thus not be changed.

21. *<u>Page 4-13, §4.2.2.2</u> - Please revise the partial paragraph at the top of the page based on the fact that treatment residuals would not be generated by in situ oxidation if the oxidation process goes to completion (otherwise daughter products of the COCs or other products may be generated). In addition, natural attenuation of TCE may produce daughter products that are not subsequently metabolized and could persist in the groundwater at concentrations that create a risk greater than TCE.*

<u>Response:</u> The sentence will be revised as follows: "Treatment residuals would not be generated by the complete chemical oxidation of the COCs."

Because natural attenuation is not treatment, a discussion of the generation of daughter products is more appropriate for the Long-Term Effectiveness section (page 4-12). The following sentence will be added to the end of the fourth paragraph in that section: "Daughter products of TCE degradation that also have a high toxicity, such as vinyl chloride, may persist and will also be monitored."

Similar text will be added to the discussions of the other alternatives.

22. *<u>Page 4-14, §4.2.2.2</u> - The discussion of Implementability should be amended to address potential concerns associated with the presence of active or inactive utilities in the proposed treatment zones.*

<u>Response:</u> An evaluation of utilities at the Site and storm sewer elevations was discussed in the RI Addendum. The depths of the storm sewers and catch basins are generally above the water table; the majority of the injection points for this alternative are at a depth of 25 – 45 ft. bgs. The following sentence will be added to the 3^{rd} paragraph: "The design will also take into account the locations of existing subsurface utilities and storm sewer lines."

23. *<u>Page 4-17, §4.2.3.2</u> - a) Please remove the reference to "surficial" groundwater since the restrictions will apply to all groundwater (e.g., surficial, shallow and deep) at the site.*

Response: The suggested change will be made.

b) The fifth paragraph on this page (one sentence) states that there are no short-term effects; however, oxidation treatment is likely to destroy, at least in the short-term, any existing microbiological populations in the treatment zone that are currently metabolizing chlorinated hydrocarbons. Please amend this section accordingly and acknowledge that based on groundwater analytical data, evidence that significant biodegradation of TCE is occurring at the site is weak.

Response: Alternative G-2A relies on chemical oxidation to treat the entire plume, and biodegradation is not a component of the alternative. No change will be made to the referenced paragraph.

24. <u>Page 4-18, §4.2.3.2</u> - Please revise the discussion of Reduction of Toxicity, Mobility, or Volume through Treatment based on the fact that treatment residuals would not be generated by in situ oxidation if the oxidation process goes to completion (otherwise daughter products of the COCs or other products may be generated). In addition, natural attenuation of TCE may produce daughter products that are not subsequently metabolized and could persist in the groundwater at concentrations that create a risk greater than TCE.

Response: The sentence will be revised as follows: "Treatment residuals would not be generated by the complete chemical oxidation." As noted in the response above, natural attenuation is not a component of Alternative G-2A.

25. <u>Page 4-19, §4.2.3.2</u> - The discussion of Implementability should be amended to address potential concerns associated with the presence of active or inactive utilities in the proposed treatment zones.

Response: An evaluation of utilities at the Site and storm sewer elevations was discussed in the RI Addendum. The depths of the storm sewers and catch basins are generally above the water table; the majority of the injection points for this alternative are at a depth of 25 – 45 ft. bgs. The following sentence will be added to the 3rd paragraph: "The design will also take into account the locations of existing subsurface utilities and storm sewer lines."

26. <u>Page 4-20, §4.2.3.2</u> - Please review the partial paragraph at the top of the page for consistency with the previous discussion of this alternative. Specifically, previous discussions of this alternative states that treatment will last for 2 years and performance monitoring is expected to last three years. Is that a total of five years rather than 1 to 2 years as stated here?

Response: The referenced text will be clarified as follows: "Implementation of Alternative G-2A would have a short-term impact on development of approximately three years: two years during injection of chemical oxidant and a third year for performance monitoring…"

27. <u>Page 4-22, §4.2.4.1</u>: - Please edit the partial paragraph at the top of this page to acknowledge that the locations of the monitoring wells and the frequency of monitoring will be established in the long-term monitoring plan but that for the purposes of this FS, costing is based on monitoring existing wells at the frequency stipulated in this paragraph.

Response: The monitoring described in the referenced section is short-term performance monitoring, not long-term MNA monitoring. Therefore, no changes are to the text are required.

28. <u>Page 4-23, §4.2.4.1</u> - The text states that Component 3 (monitoring) for Alternative G-3 would be identical to that for Alternative G-2. That is not correct because these two alternatives impact the geochemistry of the subsurface differently so the monitoring discussion cannot be the same. Please add the appropriate monitoring discussion to this component of Alternative G-3.

Response: Agreed. The following text will be used for the description of Component 3:

"Natural attenuation would rely on naturally occurring processes within the aquifer to reduce the concentrations of COCs and restore the aquifer to its beneficial use. Monitored natural attenuation activities would be conducted in accordance with OSWER Directive 9200.4-17P.

Natural attenuation monitoring would consist of collecting groundwater samples from monitoring well locations in the deep and shallow TCE plumes. TCE and daughter products of TCE would be monitored within existing monitoring wells to the extent possible. If necessary, additional monitoring wells would be installed. In addition, natural attenuation parameters would be monitored [ORP, DO, pH, alkalinity, temperature, conductivity, TOC, ferrous and total iron, sulfur compounds (sulfide and sulfate), nitrogen compounds (nitrite and nitrate), orthophosphate, chloride, and metabolic gases (methane, ethane, ethene, and carbon dioxide)]. Thirteen wells are assumed to be needed for MNA monitoring. While the costing estimates in Appendix F are based on the information above, details such as the number and location of monitoring wells, analytes, and monitoring frequency, will be determined during development of the long-term monitoring plan as part of the remedial design. Sampling frequency would be quarterly for the first year, semi-annually for the next 2 years, and annually thereafter. Prior to the remedial design and preparation of the long-term monitoring plan, a baseline sampling event would be conducted. Groundwater samples would be collected from monitoring wells that have COC concentrations greater than PRGs to determine the presence of contamination and establish baseline conditions.

The baseline sampling event would also include collection of samples from selected monitoring wells for manganese, MTBE, and PCB analysis. If PCBs are detected, further investigation or remedial action for PCBs in groundwater would be considered."

29. *Page 4-26, §4.2.4.2 - The discussion of Implementability should be amended to address potential concerns associated with the presence of active or inactive utilities in the proposed treatment zones.*

Response: An evaluation of utilities at the Site and storm sewer elevations was discussed in the RI Addendum. The depths of the storm sewers and catch basins are generally above the water table; the majority of the injection points for this alternative are at a depth of 25 – 45 ft. bgs. The following sentence will be added to the 3rd paragraph: "The design will also take into account the locations of existing subsurface utilities and storm sewer lines."

30. *Page 4-27, §4.2.5.1 - Please edit the third paragraph on this page to acknowledge that the locations of the monitoring wells and the frequency of monitoring will be established in the long-term monitoring plan but that for the purposes of this FS, costing is based on monitoring existing wells at the frequency stipulated in this paragraph.*

Response: The following text will be inserted after the 3rd sentence in the referenced paragraph: "Thirteen wells are assumed to be needed for MNA monitoring. While the costing estimates in Appendix F are based on the information above, details such as the number and location of monitoring wells, analytes and monitoring frequency, will be determined during development of the long-term monitoring plan as part of the remedial design."

31. *Page 4-28, §4.2.5.2 - Please remove the reference to "surficial" groundwater since the restrictions will apply to all groundwater (e.g., surficial, shallow and deep) at the site.*

Response: The suggested change will be made.

32. *Page 4-29, §4.2.5.2 - a) Please supplement the discussion of Long-Term Effectiveness and Permanence to acknowledge that there is not strong evidence that significant biotransformation of chlorinated hydrocarbons is occurring at the site and that monitored natural attenuation alone may not achieve the remedial goals in the timeframe calculated using the Biochlor model. Monitored natural attenuation may have to be supplemented with bioaugmentation to provide the necessary microbiological populations and/or electron donor necessary to achieve the remedial goals in the*

timeframe indicated by the Biochlor modeling. (See also the critique of the Biochlor modeling performed.)

Response: The following text will be added to the end of the 2nd paragraph of the Long-Term Effectiveness and Permanence discussion: "If the monitoring results indicate poor progress in achieving the remedial goals, bioaugmentation may be needed to provide the microbial population and/or electron donor to enhance the naturally occurring processes and achieve the remedial goals in an acceptable time frame."

b) Please edit the first sentence under Reduction of Toxicity, Mobility, or Volume through Treatment to clarify that this alternative does not involve treatment and therefore it would not satisfy this criterion.

Response: The referenced sentence will be revised as follows: "Alternative G-4 does not include treatment." However, this is not a criterion that must be "satisfied," so the balance of the text in the comment will not be included.

33. Page 4-35, Table 4-2 - The evaluations in this table need to be edited to acknowledge that monitored natural attenuation is also required to achieve the remedial goals; treatment alone, as implied in these evaluations, will not satisfy the remedial goals.

Response: The suggested changes have been made. Please see the attached revised version of Table 4-2.

34. Pages 4-35 – 4-37, Table 4-2 – See "EPA Comments on ARARs Tables" below.

Response: The Health Advisories have been added as TBCs. The suggested wording has been slightly modified since health advisories are non-enforceable guidelines. Please see the attached revised version of Table 4-2.

35. Page 4-30, Table 4-4 - The evaluation of the Monitored Natural Attenuation TBC states that all cleanup standards would be achieved in 30 years; however, the discussion on page 4-13 states that the remedial goals would be achieved in 20 to 25 years. Please edit the FS for consistency.

Response: The text is correct; the ARAR table has been edited for consistency. Please see the attached revised version of Table 4-4.

36. Page 4-40, Table 4-4 – See "EPA Comments on ARARs Tables" below.

Response: The suggested RCRA ARAR is not pertinent as this regulation applies to ex-situ treatment. This alternative is an in-situ process. There is no process equipment that this regulation can be applied to. In addition, safe handling of reagents is addressed by OSHA regulations.

37. Page 4-43, Table 4-8 - The evaluations in this table need to be edited to eliminate the reference to chemical oxidation (ORC treatment is not a chemical oxidation as otherwise discussed in this FS), which is not a component of this alternative, and to acknowledge that monitored natural attenuation is also required to achieve the remedial goals; treatment alone, as implied in these evaluations, will not satisfy the remedial goals.

Response: The Table has been revised as suggested. Please see the attached revised version of Table 4-8.

38. Pages 4-44 – 4-52, Tables 4-5 – 4-7 – See "EPA Comments on ARARs Tables" below.

Response: The Health Advisories have been added as TBCs. The suggested wording has been slightly modified since health advisories are non-enforceable guidelines. Please see the attached revised version of Table 4-5. The suggested RCRA ARAR is not pertinent as this regulation applies to ex-situ treatment. This alternative is an in-situ process. There is no process equipment that this regulation can be applied to. In addition, safe handling of reagents is addressed by OSHA regulations. No changes have been made to Table 4-7.

39. Pages 4-53 – 4-55, Table 4-8 - See "EPA Comments on ARARs Tables" below.

Response: The Health Advisories have been added as TBCs. The suggested wording has been slightly modified since health advisories are non-enforceable guidelines. Please see the attached revised version of Table 4-8.

40. Page 4-59, Table 4-10 - The evaluation of the Monitored Natural Attenuation TBC states that all cleanup standards would be achieved in 30 years; however, the discussion on page 4-26 states that the remedial goals would be achieved in 20 to 25 years. Please edit the FS for consistency.

Response: The text is correct; the ARAR table has been edited for consistency. Please see the attached revised version of Table 4-10. Table 4-13 has also been edited for consistency and is attached.

41. Pages 4-59 – 4-60, Table 4-10 - See "EPA Comments on ARARs Tables" below.

Response: The suggested RCRA ARAR is not pertinent as this regulation applies to ex-situ treatment. This alternative is an in-situ process. There is no process equipment that this regulation can be applied to. In addition, safe handling of reagents is addressed by OSHA regulations.

42. Pages 4-67 – 4-68, Table 4-11 - See "EPA Comments on ARARs Tables" below.

Response: The Health Advisories have been added as TBCs. The suggested wording has been slightly modified since health advisories are non-enforceable guidelines. Please see the attached revised version of Table 4-11.

43. Page 4-69, Table 4-13 - See "EPA Comments on ARARs Tables" below.

Response: Per the Response to Specific Comment No. 7, there is no unacceptable risk associated with vapor intrusion. Therefore, the Vapor Intrusion Guidance Document will not be included.

44. Page 5-2, §5.1.3 - The first sentence in the second paragraph is incorrect because there is essentially no difference between Alternative G-1 and Alternative G-4 with regards to the attenuation of contamination. Alternative G-1 would not be effective because it does not include LUCs to prevent exposure to contaminated groundwater. Please clarify this discussion by combining the first and second sentences.

Response: The referenced sentences will be revised as follows: "Alternative G-1 would have no long-term effectiveness and permanence since contaminated groundwater would remain on site and there would be no LUCs to restrict site use and building construction methods. Therefore, the potential would exist for unacceptable risk for human receptors through groundwater use."

45. Page 5-3, §5.1.4 - a) The first sentence of the third paragraph needs to be amended to acknowledge that treatment residuals of concern will be generated unless more toxic breakdown products (i.e., vinyl chloride) can also be eliminated.

Response: Per previous comments, this issue needs to be addressed in two places. In 5.1.4, the sentence will be revised as follows: "Alternatives G-2, G-2A, and G-4 are not expected to generate treatment residues of concern assuming complete chemical oxidation of the COCs."

In 5.1.3 (Long-Term Effectiveness), the following sentence will be added: "For Alternatives G-2, G-3, and G-4, daughter products of TCE degradation that also have a high toxicity, such as vinyl chloride, may persist and will also be monitored."

b) The second and third sentences should also note that the reducing environment generated by Alternative G-3 will also mobilize redox-sensitive metals such as arsenic and manganese in groundwater. Due to the potential toxicity of these compounds, this process will have to be actively monitored and managed, if necessary.

Response: The need to monitor for redox-sensitive metals is discussed in Section 4.2.4.2. The referenced sentences will be revised as follows: "For Alternative G-3, the reducing conditions may also increase the solubility and mobility of redox-sensitive metals (e.g., arsenic and manganese) and may increase the concentrations of these compounds in the vicinity of the treatment zone. The additional manganese may result in an extension of the period of time for manganese monitoring."

46. *Page 5-3, §5.1.5 - The discussion in this section needs to acknowledge that oxidation treatment is likely to destroy any existing microbiological populations in the treatment zone that may be currently metabolizing chlorinated hydrocarbons. This may or may not impact the effectiveness of these alternatives depending on the effectiveness of the oxidation treatment in reducing the chlorinated hydrocarbons to below remedial goals.*

Response: As noted in the Response to Specific Comment No. 20, the bacterial community downgradient of the treatment area in Alternative G-2 is not expected to be affected. As noted in the Response to Specific Comment No. 23a, Alternative G-2A treats the entire plume, and biodegradation is not a component of the alternatives. Therefore, no changes to the text are required.

47. *Page 5-4, §5.1.6 - The discussion of Implementability should be amended to address potential concerns associated with the presence of active or inactive utilities in the proposed treatment zones.*

Response: The following sentence will be added to the end of the 2rd paragraph: "The remedial design will take into account the locations of existing subsurface utilities and storm sewer lines."

48. *Table 5-1 - a) The last sentence on page 2 (in the discussion of Short-Term Effectiveness for Alternative G-1) is incorrect because there is essentially no difference between Alternative G-1 and Alternative G-4 with regards to the attenuation of contamination. If the RAOs will eventually be met for Alternative G-4, they will also be met for Alternative G-1; however, no monitoring would be performed to confirm compliance for Alternative G-1. Please revise the subject text.*

Response: The referenced sentence will be revised as follows: "Since no monitoring would be performed, there would be no way to determine if the RAOs are achieved."

b) For consistency, please edit the discussions for Alternative G-4 regarding the time to cleanup. Depending on which criterion is referred to, the text in this table states that time will be 50 years, 40 years or 30 years. The discussions that describe this alternative in the body of the FS state that the time to cleanup will be 40 to 60 years.

Response: The reference on page 1 of the table will be changed to: "persist for more than 40 years…" The two references on page 2 of the table will be changed to: "in excess of 40 years…"

49. *Appendix B - Please update the example PRG calculation for TCE based on the new IRIS values. Please include the recalculation of PRGs for PCE in this appendix, as well as the text and tables of the FS as appropriate.*

Response: PRGs for TCE and PCE have been recalculated. The calculations are attached and will be included in Appendix B. The PRG tables have been revised accordingly.

50. *Appendix C - There appears to be contradictory information presented in this appendix. Review of the data in the table on "Page 1 of 4" suggests that only the monitoring well data were considered for the calculations (the maximum TCE concentration is listed as 9 µg/L). Data collected from DPT borings were apparently not used to calculate the contaminant mass because the greatest deep groundwater concentration detected at the site is 25 µg/L not 9 µg/L as shown in this table. However, on "Page 2 of 4", the average TCE concentration in the deep plume is reported as 11 µg/L, which exceeds the maximum value listed for TCE on Page 1 of 4. Please clarify. Also, please confirm that the average values presented on "Page 2 of 4" are in fact the geometric means (as the discussed on page 1).*

Response: The maximum TCE concentrations listed are incorrect and will be revised to 5 µg/L for the shallow plume and 25 µg/L for the deep plume. However, the column values were not used directly in the calculations in the spreadsheet cells. The calculation of the average TCE concentration for the shallow plume was the geometric mean of the maximum (5 µg/L) and the contour (2.5 µg/L). The calculation of the average TCE concentration for the deep plume was the geometric mean of thirteen samples within the 5 µg/L contour. Therefore, the calculations do not require revision.

51. *Appendix D - Alternative G-2A: a) Please correct the discussion on page 2 of 4 to indicate that the injection area for the deep TCE plume extends to the 5 µg/L contour not the 10 µg/L contour as stated. In addition, EPA notes that dividing the area encompassed by the 5 µg/L contour (36,078 ft^2) by the injection area per well (314 ft^2) results in the need for 115 injection wells versus the 104 proposed. Finally, there is a minor inconsistency between the text, which defines the deep plume as 25 to 45 feet deep as compared to these calculations which only assume wells to be 30 and 40 feet deep resulting in a 15% shortage in drilling depth.*

Response: On page 2 of 4, 10 µg/L will be corrected to 5 µg/L. The number of injection well locations is 104 based on a count of the locations on Figure 4-2. The depth range in the text was generic, and will be revised to match the calculations. A review of the cross-sections shows that the depth is 40 feet.

b) Alternative G-2A: In the last table for this alternative please correct the entry in the first column for the 44 well scenario; these wells will be installed between the 5-10 µg/L contours, not the 10-20 µg/L contours.

Response: Agree. 10-20 µg/L will be corrected to 5-10 µg/L.

c) Biochlor Modeling: Please correct the chemical references on page 1; TCE is a chlorinated ethene and the chlorinated ethane plume should refer to 1,1-DCA (not 1,1-DCE).

Response: The text will be corrected as suggested. The second paragraph will be revised to the following: "Determine the amount of time needed for the chlorinated ethene plume (TCE) and the chlorinated ethane plume (1,1,1-TCA and 1,1-DCA) to attenuate to below MCLs or PRGs via natural attenuation only."

d) Reviewing the big picture based on the data input to the Biochlor model, it appears that it would take approximately 163 years for TCE contamination to reach MW-202D (adjacent to the 42-inch culverts) based on the seepage velocity of 9.5 feet per year and the retardation factor of 2.87. The travel time being calculated by dividing the distance of 540 feet by the contaminant velocity of 3.3 feet per year. Unless Navy postulates an intermediate source of TCE to the deep aquifer, the modeling is off by roughly a factor of 4, assuming the release occurred no more than approximately 40 years ago. Please reconcile this apparent discrepancy in the modeling.

Response: The seepage velocity cited in the comment is the lowest potential seepage velocity in the range (9.5 to 13.6 ft./year) indicated by the RI reports for the deep plume. The Biochlor modeling was intended to determine the potential biodegradation and travel times for the plume in its current configuration (e.g. from the location of the current maximum concentration). As the initial maximum (source) concentration is unknown, the anomalously low travel times determined purely based on seepage velocity may be due to biodegradation or other plume attenuation mechanisms.

> *e) The essential problem to resolve for remediation is how long it will take for the 25 µg/L concentration to degrade to less than 5 µg/L, assuming 25 µg/L is the maximum TCE concentration in the deep aquifer. The modeling could focus on this problem to arrive at a solution for the time required to achieve the cleanup goals.*

<u>Response:</u> The modeling does focus on the length of time required for the *current* plume to degrade. That is, the current position of the plume and concentrations are taken from the current maximum concentrations (as represented by GP-K10 for the shallow plume and GP-K13 for the deep plume), as described on Page 2 of the Biochlor section in Appendix D. Navy agrees that the initial, spilled concentrations are unknown; therefore the modeling does not attempt to use initial conditions to determine future plume movement.

EPA COMMENTS ON ARARS TABLES

<u>Comment: Pages 4-35 – 4-37, Table 4-2</u> – *Please insert the following chemical-specific ARAR for Alternative G-2:*

Health Advisories	*EPA Office of Drinking Water, EPA-822-R-04-003, January, 2004*	*TBC*	*Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water where the standard is more conservative than either federal or state statutory or regulatory standards. The Health Advisory standard for manganese is 0.3 mg/l.*	*This alternative will achieve these standards since non-carcinogenic risk resulting from exposure to compounds identified in the Health Advisory (e.g., manganese) will be addressed by chemical oxidation. Land use controls will prevent short-term exposure until protective levels are reached.*

<u>Response:</u> Agree. See the attached revision of Table 4-2.

<u>Comment: Page 4-40, Table 4-4</u> – *Please insert the following action-specific ARARs for Alternative G-2:*

RCRA, Interim Status TSDF Standards, Chemical, Physical and Biological Treatment	*40 C.F.R. Subpart Q*	*Relevant and Appropriate*	*The regulations in this subpart apply to the treatment of hazardous wastes by chemical, physical, or biological methods in other than tanks, surface impoundments, and land treatment facilities. Treatment reagents must not be placed in the treatment process or equipment if they could cause the treatment process or equipment to rupture, leak, corrode, or otherwise fail before the end of its intended life. Inspections are required to make sure treatment process is operating correctly.*	*In-situ treatment using chemical oxidation will be conducted in compliance with these standards, in particular regarding the handling and management of treatment chemicals*

<u>Response:</u> Disagree. The suggested RCRA ARAR is not pertinent as this regulation applies to ex-situ treatment. This alternative is an in-situ process. There is no process equipment that this regulation can be applied to. In addition, safe handling of reagents is addressed by OSHA regulations.

Clean Air Act National Emission Standards for Hazardous Air Pollutants	*42 USC § 112(b)(1) et seq.* *40 CFR Part 61*	*Applicable*	*Regulations establish emission standards for 189 hazardous air pollutants. Standards are set for dust control and other release sources.*	*If remedial activities generate regulated air pollutants, then measures will be implemented to meet the standards.*
Draft Guidance for Evaluating Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance	*OSWER EPA530-D-02-004 (November 2002)*	*TBC*	*Guidance for assessing and mitigating vapor intrusion risk*	*Since the future use includes housing, offices, and commercial/retail, assessment and mitigation of potential vapor intrusion risks will be conducted in accordance with the guidance until such time as groundwater cleanup levels are achieved.*

<u>Response:</u> Disagree, neither suggested ARAR/TBC is applicable. There is no NESHAP category that matches the remedial activities. Fugitive dust is addressed by MassDEP regulations. Also there is no vapor intrusion risk (see the Response to Specific Comment No. 7).

<u>Comment: Pages 4-44 – 4-52, Tables 4-5 – 4-7</u> *– Please see comments above for Alternative G-2.*

<u>Response:</u> Please see the Responses to the Alternative G-2 comments above.

<u>Comment: Pages 4-53 – 4-55, Table 4-8</u> *- Please insert the following chemical-specific ARAR for Alternative G-3:*

Health Advisories	*EPA Office of Drinking Water, EPA-822-R-04-003, January, 2004*	*TBC*	*Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water where the standard is more conservative than either federal or state statutory or regulatory standards. The Health Advisory standard for manganese is 0.3 mg/l.*	*This alternative will achieve these standards since non-carcinogenic risk resulting from exposure to compounds identified in the Health Advisory (e.g., manganese) will be addressed by bioremediation and chemical oxidation. Land use controls will prevent short-term exposure until protective levels are reached.*

<u>Response:</u> Agree. See the attached revision of Table 4-8.

<u>Comment: Pages 4-59 – 4-60, Table 4-10</u> *- Please insert the following action-specific ARARs for Alternative G-3:*

RCRA, Interim Status TSDF Standards, Chemical, Physical and Biological Treatment	*40 C.F.R. Subpart Q*	*Relevant and Appropriate*	*The regulations in this subpart apply to the treatment of hazardous wastes by chemical, physical, or biological methods in other than tanks, surface impoundments, and land treatment facilities. Treatment reagents must not be placed in the treatment process or equipment if they could cause the treatment process or equipment to rupture, leak, corrode, or otherwise fail before the end of its intended life. Inspections are required to make sure treatment process is operating correctly.*	*In-situ treatment using chemical oxidation will be conducted in compliance with these standards, in particular regarding the handling and management of treatment chemicals*

Response: Disagree. The suggested RCRA ARAR is not pertinent as this regulation applies to ex-situ treatment. This alternative is an in-situ process. There is no process equipment that this regulation can be applied to. In addition, safe handling of reagents is addressed by OSHA regulations.

Draft Guidance for Evaluating Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance	*OSWER EPA530-D-02-004 (November 2002)*	*TBC*	*Guidance for assessing and mitigating vapor intrusion risk*	*Since the future use includes housing, offices, and commercial/retail, assessment and mitigation of potential vapor intrusion risks will be conducted in accordance with the guidance until such time as groundwater cleanup levels are achieved.*

Response: Disagree, because there is no vapor intrusion risk (see the Response to Specific Comment No. 7).

<u>Comment: Pages 4-67 – 4-68, Table 4-11</u> *- Please insert the following chemical-specific ARAR for Alternative G-4:*

Health Advisories	*EPA Office of Drinking Water, EPA-822-R-04-003, January, 2004*	*TBC*	*Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water where the standard is more conservative than either federal or state statutory or regulatory standards. The Health Advisory standard for manganese is 0.3 mg/l.*	*This alternative will achieve these standards since non-carcinogenic risk resulting from exposure to compounds identified in the Health Advisory (e.g., manganese) will be addressed by bioremediation and chemical oxidation. Land use controls will prevent short-term exposure until protective levels are reached.*

Response: Agree. See the attached revision of Table 4-11.

Comment: Page 4-69, Table 4-13 *- Please insert the following action-specific ARARs for Alternative G-4:*

Draft Guidance for Evaluating Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance	*OSWER EPA530-D-02-004 (November 2002)*	*TBC*	*Guidance for assessing and mitigating vapor intrusion risk*	*Since the future use includes housing, offices, and commercial/retail, assessment and mitigation of potential vapor intrusion risks will be conducted in accordance with the guidance until such time as groundwater cleanup levels are achieved.*

Response: Disagree, because there is no vapor intrusion risk (see the Response to Specific Comment No. 7).

March 12, 2012

Screening levels based on changes in toxicity values

	Residential			**Commercial/Industrial**		
PCE	10E-6 cancer risk	HI = 0.1	HI = 1	10E-6 cancer risk	HI = 0.1	HI = 1
Soil (mg/kg)	21.90	8.60	86.00	110.00	41.30	413.00
Indoor air (µg/m^3)	9.36	4.17	41.70	47.20	17.50	175.00
Tap water (µg/L)	9.74	3.48	34.80	NC	NC	NC
Soil gas (µg/m^3)	93.60	41.70	417.00	472.00	175.00	1,750.00
Groundwater for VI (µg/L)	12.53	5.56	55.6	62.93	23.33	233.33

	Residential			**Commercial/Industrial**		
TCE	10E-6 cancer risk	HI = 0.1	HI = 1	10E-6 cancer risk	HI = 0.1	HI = 1
Soil (mg/kg)	0.91	0.44	4.40	6.38	2.00	20.00
Indoor air (µg/m^3)	0.43	0.21	2.09	2.99	0.88	8.76
Tap water (µg/L)	0.44	0.26	2.58	NC	NC	NC
Soil gas (µg/m^3)	4.30	2.09	20.90	29.90	8.76	87.60
Groundwater for VI (µg/L)	1.02	0.50	4.96	7.10	2.08	20.81

	Residential			**Commercial/Industrial**		
Vinyl Chloride	10E-6 cancer risk	HI = 0.1	HI = 1	10E-6 cancer risk	HI = 0.1	HI = 1
Soil (mg/kg)	0.06	7.36	73.60	1.67	39.30	393.00
Indoor air (µg/m^3)	0.16	10.40	104.00	2.79	43.80	438.00
Tap water (µg/L)	0.02	3.59	35.90	NC	NC	NC
Soil gas (µg/m^3)	1.60	104.00	1,040.00	27.90	438.00	4,380.00
Groundwater for VI (µg/L)	0.15	9.45	94.55	2.54	39.82	398.18

NC = Not Calculated

ATTACHMENTS TO EPA RTCS

GW-SCREEN
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
79016	9.00E+00	Trichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	244	SI	9	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
SI			SI	1.35	0.489	0.167

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	76	350

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET - TRICHLOROETHENE - MUTAGENIC

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.0E-06	0.0E+00

END

INTERMEDIATE CALCULATIONS SHEET - TRICHLOROETHENE - MUTAGENIC

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm³/cm³)	Vadose zone effective total fluid saturation, S_{te} (cm³/cm³)	Vadose zone soil intrinsic permeability, k_i (cm²)	Vadose zone soil relative air permeability, k_{rg} (cm²)	Vadose zone soil effective vapor permeability, k_v (cm²)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm³/cm³)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm³/cm³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm³/cm³)	Floor-wall seam perimeter, X_{crack} (cm)
229	0.322	0.267	6.73E-09	0.830	5.59E-09	163.04	0.489	0.107	0.382	4,000

Bldg. ventilation rate, $Q_{building}$ (cm³/s)	Area of enclosed space below grade, A_B (cm²)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm²/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm²/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm²/s)
1.69E+04	1.00E+06	4.00E-04	15	8,569	4.52E-03	1.95E-01	1.75E-04	7.59E-03	2.03E-04	2.83E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm³/s)	Crack effective diffusion coefficient, D^{crack} (cm²/s)	Area of crack, A_{crack} (cm²)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m³)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m³)
229	15	1.76E+03	0.10	8.33E+01	7.59E-03	4.00E+02	1.66E+119	7.18E-05	1.26E-01	1.0E-06	NA

RESULTS SHEET - TRICHLOROETHENE - MUTAGENIC

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.47E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.3E-07	NA

MESSAGE SUMMARY BELOW:

END

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Soil Properties Lookup Table

SCS Soil Type	K_s (cm/h)	α_1 (1/cm)	N (unitless)	M (unitless)	n (cm^3/cm^3)	θ_r (cm^3/cm^3)	Mean Grain Diameter (cm)	Bulk Density (g/cm^3)	θ_w (cm^3/cm^3)	SCS Soil Name
C	0.61	0.01496	1.253	0.2019	0.459	0.098	0.0092	1.43	0.215	Clay
CL	0.34	0.01581	1.416	0.2938	0.442	0.079	0.016	1.48	0.168	Clay Loam
L	0.50	0.01112	1.472	0.3207	0.399	0.061	0.020	1.59	0.148	Loam
LS	4.38	0.03475	1.746	0.4273	0.390	0.049	0.040	1.62	0.076	Loamy Sand
S	26.78	0.03524	3.177	0.6852	0.375	0.053	0.044	1.66	0.054	Sand
SC	0.47	0.03342	1.208	0.1722	0.385	0.117	0.025	1.63	0.197	Sandy Clay
SCL	0.55	0.02109	1.330	0.2481	0.384	0.063	0.029	1.63	0.146	Sandy Clay Loam
SI	1.82	0.00658	1.679	0.4044	0.489	0.050	0.0046	1.35	0.167	Silt
SIC	0.40	0.01622	1.321	0.2430	0.481	0.111	0.0039	1.38	0.216	Silty Clay
SICL	0.46	0.00839	1.521	0.3425	0.482	0.090	0.0056	1.37	0.198	Silty Clay Loam
SIL	0.76	0.00506	1.663	0.3987	0.439	0.065	0.011	1.49	0.180	Silt Loam
SL	1.60	0.02667	1.449	0.3099	0.387	0.039	0.030	1.62	0.103	Sandy Loam

Chemical Properties Lookup Table

CAS No.	Chemical	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Pure component water solubility, S (mg/L)	Henry's law constant H' (unitless)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)	URF extrapolated (X)	RfC extrapolated (X)
56235	Carbon tetrachloride	1.74E+02	7.80E-02	8.80E-06	7.93E+02	1.24E+00	3.03E-02	25	349.90	556.60	7,127	1.5E-05	0.0E+00		
57749	Chlordane	1.20E+05	1.18E-02	4.37E-06	5.60E-02	1.99E-03	4.85E-05	25	624.24	885.73	14,000	1.0E-04	7.0E-04		
58899	gamma-HCH (Lindane)	1.07E+03	1.42E-02	7.34E-06	7.30E+00	5.73E-04	1.40E-05	25	596.55	839.36	15,000	3.7E-04	1.1E-03	X	X
60297	Ethyl ether	5.73E+00	7.82E-02	8.61E-06	5.68E+04	1.35E+00	3.29E-02	25	307.50	466.74	6,338	0.0E+00	7.0E-01		X
60571	Dieldrin	2.14E+04	1.25E-02	4.74E-06	1.95E-01	6.18E-04	1.51E-05	25	613.32	842.25	17,000	4.6E-03	1.8E-04		X
67641	Acetone	5.75E-01	1.24E-01	1.14E-05	1.00E+06	1.59E-03	3.87E-05	25	329.20	508.10	6,955	0.0E+00	3.5E-01		X
67663	Chloroform	3.98E+01	1.04E-01	1.00E-05	7.92E+03	1.50E-01	3.66E-03	25	334.32	536.40	6,988	2.3E-05	0.0E+00		
67721	Hexachloroethane	1.78E+03	2.50E-03	6.80E-06	5.00E+01	1.59E-01	3.88E-03	25	458.00	695.00	9,510	4.0E-06	3.5E-03		X
71432	Benzene	5.89E+01	8.80E-02	9.80E-06	1.79E+03	2.27E-01	5.54E-03	25	353.24	562.16	7,342	7.8E-06	3.0E-02		
71556	1,1,1-Trichloroethane	1.10E+02	7.80E-02	8.80E-06	1.33E+03	7.03E-01	1.72E-02	25	347.24	545.00	7,136	0.0E+00	2.2E+00		
72435	Methoxychlor	9.77E+04	1.56E-02	4.46E-06	1.00E-01	6.46E-04	1.58E-05	25	651.02	848.49	16,000	0.0E+00	1.8E-02		X
72559	DDE	4.47E+06	1.44E-02	5.87E-06	1.20E-01	8.59E-04	2.09E-05	25	636.44	860.38	15,000	9.7E-05	0.0E+00	X	
74839	Methyl bromide	1.05E+01	7.28E-02	1.21E-05	1.52E+04	2.55E-01	6.22E-03	25	276.71	467.00	5,714	0.0E+00	5.0E-03		
74873	Methyl chloride (chloromethane)	2.12E+00	1.26E-01	6.50E-06	5.33E+03	3.61E-01	8.80E-03	25	249.00	416.25	5,115	1.0E-06	9.0E-02		
74908	Hydrogen cyanide	3.80E+00	1.93E-01	2.10E-05	1.00E+06	5.44E-03	1.33E-04	25	299.00	456.70	6,676	0.0E+00	3.0E-03		
74953	Methylene bromide	1.26E+01	4.30E-02	8.44E-06	1.19E+04	3.52E-02	8.59E-04	25	370.00	583.00	7,868	0.0E+00	3.5E-02		X
75003	Chloroethane (ethyl chloride)	4.40E+00	2.71E-01	1.15E-05	5.68E+03	3.61E-01	8.80E-03	25	285.30	460.40	5,879	8.3E-07	1.0E+01	X	
75014	Vinyl chloride (chloroethene)	1.86E+01	1.06E-01	1.23E-05	8.80E+03	1.10E+00	2.69E-02	25	259.25	432.00	5,250	8.8E-06	1.0E-01		
75058	Acetonitrile	4.20E+00	1.28E-01	1.66E-05	1.00E+06	1.42E-03	3.45E-05	25	354.60	545.50	7,110	0.0E+00	6.0E-02		
75070	Acetaldehyde	1.06E+00	1.24E-01	1.41E-05	1.00E+06	3.23E-03	7.87E-05	25	293.10	466.00	6,157	2.2E-06	9.0E-03		
75092	Methylene chloride	1.17E+01	1.01E-01	1.17E-05	1.30E+04	8.96E-02	2.18E-03	25	313.00	510.00	6,706	4.7E-07	3.0E+00		
75150	Carbon disulfide	4.57E+01	1.04E-01	1.00E-05	1.19E+03	1.24E+00	3.02E-02	25	319.00	552.00	6,391	0.0E+00	7.0E-01		
75218	Ethylene oxide	1.33E+00	1.04E-01	1.45E-05	3.04E+05	2.27E-02	5.54E-04	25	283.60	469.00	6,104	1.0E-04	0.0E+00		
75252	Bromoform	8.71E+01	1.49E-02	1.03E-05	3.10E+03	2.41E-02	5.88E-04	25	422.35	696.00	9,479	1.1E-06	7.0E-02		X
75274	Bromodichloromethane	5.50E+01	2.98E-02	1.06E-05	6.74E+03	6.54E-02	1.60E-03	25	363.15	585.85	7,800	1.8E-05	7.0E-02	X	X
75296	2-Chloropropane	9.14E+00	8.88E-02	1.01E-05	3.73E+03	5.93E-01	1.45E-02	25	308.70	485.00	6,286	0.0E+00	1.0E-01		
75343	1,1-Dichloroethane	3.16E+01	7.42E-02	1.05E-05	5.06E+03	2.30E-01	5.61E-03	25	330.55	523.00	6,895	0.0E+00	5.0E-01		
75354	1,1-Dichloroethylene	5.89E+01	9.00E-02	1.04E-05	2.25E+03	1.07E+00	2.60E-02	25	304.75	576.05	6,247	0.0E+00	2.0E-01		
75456	Chlorodifluoromethane	4.79E+01	1.01E-01	1.28E-05	2.00E+00	1.10E+00	2.70E-02	25	232.40	369.30	4,836	0.0E+00	5.0E+01		
75694	Trichlorofluoromethane	4.97E+02	8.70E-02	9.70E-06	1.10E+03	3.97E+00	9.68E-02	25	296.70	471.00	5,999	0.0E+00	7.0E-01		
75718	Dichlorodifluoromethane	4.57E+02	6.65E-02	9.92E-06	2.80E+02	1.40E+01	3.42E-01	25	243.20	384.95	9,421	0.0E+00	2.0E-01		
76131	1,1,2-Trichloro-1,2,2-trifluoroetha	1.11E+04	7.80E-02	8.20E-06	1.70E+02	1.97E+01	4.80E-01	25	320.70	487.30	6,463	0.0E+00	3.0E+01		
76448	Heptachlor	1.41E+06	1.12E-02	5.69E-06	1.80E-01	6.05E+01	1.48E+00	25	603.69	846.31	13,000	1.3E-03	1.8E-03		X
77474	Hexachlorocyclopentadiene	2.00E+05	1.61E-02	7.21E-06	1.80E+00	1.10E+00	2.69E-02	25	512.15	746.00	10,931	0.0E+00	2.0E-04		
78831	Isobutanol	2.59E+00	8.60E-02	9.30E-06	8.50E+04	4.83E-04	1.18E-05	25	381.04	547.78	10,936	0.0E+00	1.1E+00		X
78875	1,2-Dichloropropane	4.37E+01	7.82E-02	8.73E-06	2.80E+03	1.15E-01	2.79E-03	25	369.52	572.00	7,590	1.9E-05	4.0E-03	X	
78933	Methylethylketone (2-butanone)	2.30E+00	8.08E-02	9.80E-06	2.23E+05	2.29E-03	5.58E-05	25	352.50	536.78	7,481	0.0E+00	5.0E+00		
79005	1,1,2-Trichloroethane	5.01E+01	7.80E-02	8.80E-06	4.42E+03	3.73E-02	9.11E-04	25	386.15	602.00	8,322	1.6E-05	1.4E-02		X
79016	Trichloroethylene	1.66E+02	7.90E-02	9.10E-06	1.47E+03	4.21E-01	1.03E-02	25	360.36	544.20	7,505	1.0E-06	0.0E+00		
79209	Methyl acetate	3.26E+00	1.04E-01	1.00E-05	2.00E+03	4.84E-03	1.18E-04	25	329.80	506.70	7,260	0.0E+00	3.5E+00		X
79345	1,1,2,2-Tetrachloroethane	9.33E+01	7.10E-02	7.90E-06	2.96E+03	1.41E-02	3.44E-04	25	419.60	661.15	8,996	5.8E-05	2.1E-01		X
79469	2-Nitropropane	1.17E+01	9.23E-02	1.01E-05	1.70E+04	5.03E-03	1.23E-04	25	393.20	594.00	8,383	2.7E-03	2.0E-02		
80626	Methylmethacrylate	6.98E+00	7.70E-02	8.60E-06	1.50E+04	1.38E-02	3.36E-04	25	373.50	567.00	8,975	0.0E+00	7.0E-01		
83329	Acenaphthene	7.08E+03	4.21E-02	7.69E-06	3.57E+00	6.34E-03	1.55E-04	25	550.54	803.15	12,155	0.0E+00	2.1E-01		X
86737	Fluorene	1.38E+04	3.63E-02	7.88E-06	1.98E+00	2.60E-03	6.34E-05	25	570.44	870.00	12,666	0.0E+00	1.4E-01		X
87683	Hexachloro-1,3-butadiene	5.37E+04	5.61E-02	6.16E-06	3.20E+00	3.33E-01	8.13E-03	25	486.15	738.00	10,206	2.2E-05	7.0E-04		X
88722	o-Nitrotoluene	3.24E+02	5.87E-02	8.67E-06	6.50E+02	5.11E-04	1.25E-05	25	495.00	720.00	12,239	0.0E+00	3.5E-02		X

91203	Naphthalene	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02	4.82E-04	25	491.14	748.40	10,373	0.0E+00	3.0E-03		
91576	2-Methylnaphthalene	2.81E+03	5.22E-02	7.75E-06	2.46E+01	2.12E-02	5.17E-04	25	514.26	761.00	12,600	0.0E+00	7.0E-02		X
92524	Biphenyl	4.38E+03	4.04E-02	8.15E-06	7.45E+00	1.23E-02	2.99E-04	25	529.10	789.00	10,890	0.0E+00	1.8E-01		X
95476	o-Xylene	3.63E+02	8.70E-02	1.00E-05	1.78E+02	2.12E-01	5.18E-03	25	417.60	630.30	8,661	0.0E+00	1.0E-01		
95501	1,2-Dichlorobenzene	6.17E+02	6.90E-02	7.90E-06	1.56E+02	7.77E-02	1.90E-03	25	453.57	705.00	9,700	0.0E+00	2.0E-01		
95578	2-Chlorophenol	3.88E+02	5.01E-02	9.46E-06	2.20E+04	1.60E-02	3.90E-04	25	447.53	675.00	9,572	0.0E+00	1.8E-02		X
95636	1,2,4-Trimethylbenzene	1.35E+03	6.06E-02	7.92E-06	5.70E+01	2.52E-01	6.14E-03	25	442.30	649.17	9,369	0.0E+00	6.0E-03		
96184	1,2,3-Trichloropropane	2.20E+01	7.10E-02	7.90E-06	1.75E+03	1.67E-02	4.08E-04	25	430.00	652.00	9,171	5.7E-04	4.9E-03	X	
96333	Methyl acrylate	4.53E+00	9.76E-02	1.02E-05	6.00E+04	7.68E-03	1.87E-04	25	353.70	536.00	7,749	0.0E+00	1.1E-01		X
97632	Ethylmethacrylate	2.95E+01	6.53E-02	8.37E-06	3.67E+03	3.44E-02	8.40E-04	25	390.00	571.00	10,957	0.0E+00	3.2E-01		X
98066	tert-Butylbenzene	7.71E+02	5.65E-02	8.02E-06	2.95E+01	4.87E-01	1.19E-02	25	442.10	1220.00	8,980	0.0E+00	1.4E-01		X
98828	Cumene	4.89E+02	6.50E-02	7.10E-06	6.13E+01	4.74E+01	1.46E-02	25	425.56	631.10	10,335	0.0E+00	4.0E-01		
98862	Acetophenone	5.77E+01	6.00E-02	8.73E-06	6.13E+03	4.38E-04	1.07E-05	25	475.00	709.50	11,732	0.0E+00	3.5E-01		X
98953	Nitrobenzene	6.46E+01	7.60E-02	8.60E-06	2.09E+03	9.82E-04	2.39E-05	25	483.95	719.00	10,566	0.0E+00	2.0E-03		
100414	Ethylbenzene	3.63E+02	7.50E-02	7.80E-06	1.69E+02	3.22E-01	7.86E-03	25	409.34	617.20	8,501	0.0E+00	1.0E+00		
100425	Styrene	7.76E+02	7.10E-02	8.00E-06	3.10E+02	1.12E-01	2.74E-03	25	418.31	636.00	8,737	0.0E+00	1.0E+00		
100447	Benzylchloride	6.14E+01	7.50E-02	7.80E-06	5.25E+02	1.70E-02	4.14E-04	25	452.00	685.00	8,773	4.9E-05	0.0E+00	X	
100527	Benzaldehyde	4.59E+01	7.21E-02	9.07E-06	3.30E+03	9.73E-04	2.37E-05	25	452.00	695.00	11,658	0.0E+00	3.5E-01		X
103651	n-Propylbenzene	5.62E+02	6.01E-02	7.83E-06	6.00E+01	4.37E-01	1.07E-02	25	432.20	630.00	9,123	0.0E+00	1.4E-01		X
104518	n-Butylbenzene	1.11E+03	5.70E-02	8.12E-06	2.00E+00	5.38E-01	1.31E-02	25	456.46	660.50	9,290	0.0E+00	1.4E-01		X
106423	p-Xylene	3.89E+02	7.69E-02	8.44E-06	1.85E+02	3.13E-01	7.64E-03	25	411.52	616.20	8,525	0.0E+00	1.0E-01		
106467	1,4-Dichlorobenzene	6.17E+02	6.90E-02	7.90E-06	7.90E+01	9.82E-02	2.39E-03	25	447.21	684.75	9,271	0.0E+00	8.0E-01		
106934	1,2-Dibromoethane (ethylene dib	2.50E+01	2.17E-02	1.19E-05	4.18E+03	3.04E-02	7.41E-04	25	404.60	583.00	8,310	2.2E-04	2.0E-04		
106990	1,3-Butadiene	1.91E+01	2.49E-01	1.08E-05	7.35E+02	3.01E+00	7.34E-02	25	268.60	425.00	5,370	3.0E-02	2.0E-03		
107028	Acrolein	2.76E+00	1.05E-01	1.22E-05	2.13E+05	4.99E-03	1.22E-04	25	325.60	506.00	6,731	0.0E+00	2.0E-05		
107062	1,2-Dichloroethane	1.74E+01	1.04E-01	9.90E-06	8.52E+03	4.00E-02	9.77E-04	25	356.65	561.00	7,643	2.6E-05	0.0E+00		
107131	Acrylonitrile	5.90E+00	1.22E-01	1.34E-05	7.40E+04	4.21E-03	1.03E-04	25	350.30	519.00	7,786	6.8E-05	2.0E-03		
108054	Vinyl acetate	5.25E+00	8.50E-02	9.20E-06	2.00E+04	2.09E-02	5.10E-04	25	345.65	519.13	7,800	0.0E+00	2.0E-01		
108101	Methylisobutylketone (4-methyl-2	9.06E+00	7.50E-02	7.80E-06	1.90E+04	5.64E-03	1.38E-04	25	389.50	571.00	8,243	0.0E+00	3.0E+00		
108383	m-Xylene	4.07E+02	7.00E-02	7.80E-06	1.61E+02	3.00E-01	7.32E-03	25	412.27	617.05	8,523	0.0E+00	1.0E-01		
108678	1,3,5-Trimethylbenzene	1.35E+03	6.02E-02	8.67E-06	2.00E+00	2.41E-01	5.87E-03	25	437.89	637.25	9,321	0.0E+00	6.0E-03		
108872	Methylcyclohexane	7.85E+01	7.35E-02	8.52E-06	1.40E+01	4.22E+00	1.03E-01	25	373.90	572.20	7,474	0.0E+00	3.0E+00		
108883	Toluene	1.82E+02	8.70E-02	8.60E-06	5.26E+02	2.72E-01	6.62E-03	25	383.78	591.79	7,930	0.0E+00	4.0E-01		
108907	Chlorobenzene	2.19E+02	7.30E-02	8.70E-06	4.72E+02	1.51E-01	3.69E-03	25	404.87	632.40	8,410	0.0E+00	6.0E-02		
109693	1-Chlorobutane	1.72E+01	8.26E-02	1.00E-05	1.10E+03	6.93E-01	1.69E-02	25	351.60	542.00	7,263	0.0E+00	1.4E+00		X
110009	Furan	1.86E+01	1.04E-01	1.22E-05	1.00E+04	2.21E-01	5.39E-03	25	304.60	490.20	6,477	0.0E+00	3.5E-03		X
110543	Hexane	4.34E+01	2.00E-01	7.77E-06	1.24E+01	6.82E+01	1.66E+00	25	341.70	508.00	6,895	0.0E+00	2.0E-01		
111444	Bis(2-chloroethyl)ether	1.55E+01	6.92E-02	7.53E-06	1.72E+04	7.36E-04	1.80E-05	25	451.15	659.79	10,803	3.3E-04	0.0E+00		
115297	Endosulfan	2.14E+03	1.15E-02	4.55E-06	5.10E-01	4.58E-04	1.12E-05	25	674.43	942.94	14,000	0.0E+00	2.1E-02		X
118741	Hexachlorobenzene	5.50E+04	5.42E-02	5.91E-06	5.00E-03	5.40E-02	1.32E-03	25	582.55	825.00	14,447	4.6E-04	2.8E-03		X
120821	1,2,4-Trichlorobenzene	1.78E+03	3.00E-02	8.23E-06	4.88E+01	5.81E-02	1.42E-03	25	486.15	725.00	10,471	0.0E+00	4.0E-03		
123739	Crotonaldehyde (2-butenal)	4.82E+00	9.56E-02	1.07E-05	3.69E+04	7.99E-04	1.95E-05	25	375.20	568.00	9	5.4E-04	0.0E+00	X	
124481	Chlorodibromomethane	6.31E+01	1.96E-02	1.05E-05	2.60E+03	3.20E-02	7.81E-04	25	416.14	678.20	5,900	2.4E-05	7.0E-02	X	X
126987	Methacrylonitrile	3.58E+01	1.12E-01	1.32E-05	2.54E+04	1.01E-02	2.46E-04	25	363.30	554.00	7,600	0.0E+00	7.0E-04		
126998	2-Chloro-1,3-butadiene (chloropr	6.73E+01	8.58E-02	1.03E-05	2.12E+03	4.91E-01	1.20E-02	25	332.40	525.00	8,075	0.0E+00	7.0E-03		
127184	Tetrachloroethylene	1.55E+02	7.20E-02	8.20E-06	2.00E+02	7.53E-01	1.84E-02	25	394.40	620.20	8,288	5.9E-06	6.0E-01		
129000	Pyrene	1.05E+05	2.72E-02	7.24E-06	1.35E+00	4.50E-04	1.10E-05	25	667.95	936	14370	0.0E+00	1.1E-01		X
132649	Dibenzofuran	5.15E+03	2.38E-02	6.00E-06	3.10E+00	5.15E-04	1.26E-05	25	560	824	66400	0.0E+00	1.4E-02		X
135988	sec-Butylbenzene	9.66E+02	5.70E-02	8.12E-06	3.94E+00	5.68E-01	1.39E-02	25	446.5	679	88730	0.0E+00	1.4E-01		X
141786	Ethylacetate	6.44E+00	7.32E-02	9.70E-06	8.03E+04	5.64E-03	1.38E-04	25	350.26	523.3	7633.66	0.0E+00	3.2E+00		X
156592	cis-1,2-Dichloroethylene	3.55E+01	7.36E-02	1.13E-05	3.50E+03	1.67E-01	4.07E-03	25	333.65	544	7192	0.0E+00	3.5E-02		X
156605	trans-1,2-Dichloroethylene	5.25E+01	7.07E-02	1.19E-05	6.30E+03	3.84E-01	9.36E-03	25	320.85	516.5	6717	0.0E+00	7.0E-02		X
205992	Benzo(b)fluoranthene	1.23E+06	2.26E-02	5.56E-06	1.50E-03	4.54E-03	1.11E-04	25	715.9	969.27	17000	2.1E-04	0.0E+00	X	
218019	Chrysene	3.98E+05	2.48E-02	6.21E-06	6.30E-03	3.87E-03	9.44E-05	25	714.15	979	16455	2.1E-06	0.0E+00	X	
309002	Aldrin	2.45E+06	1.32E-02	4.86E-06	1.70E-02	6.95E-03	1.70E-04	25	603.01	839.37	15000	4.9E-03	1.1E-04		X
319846	alpha-HCH (alpha-BHC)	1.23E+03	1.42E-02	7.34E-06	2.00E+00	4.34E-04	1.06E-05	25	596.55	839.36	15000	1.8E-03	0.0E+00		
541731	1,3-Dichlorobenzene	1.98E+03	6.92E-02	7.86E-06	1.34E+02	1.27E-01	3.09E-03	25	446	684	9230.18	0.0E+00	1.1E-01		X
542756	1,3-Dichloropropene	4.57E+01	6.26E-02	1.00E-05	2.80E+03	7.24E-01	1.77E-02	25	381.15	587.38	7900	4.0E-06	2.0E-02		
630206	1,1,1,2-Tetrachloroethane	1.16E+02	7.10E-02	7.90E-06	1.10E+03	9.90E-02	2.41E-03	25	403.5	624	9768.282525	7.4E-06	1.1E-01		X
1634044	MTBE	7.26E+00	1.02E-01	1.05E-05	5.10E+04	2.56E-02	6.23E-04	25	328.3	497.1	6677.66	0.0E+00	3.0E+00		
7439976	Mercury (elemental)	5.20E+01	3.07E-02	6.30E-06	2.00E+01	4.40E-01	1.07E-02	25	629.88	1750	14127	0.0E+00	3.0E-04		

GW-SCREEN
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
79016	9.00E+00	Trichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	244	SI	9	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type Lookup Soil Parameters	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
SI			SI	1.35	0.489	0.167

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET - TRICHLOROETHENE - NON-MUTAGENIC

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	3.1E-06	2.0E-03

END

INTERMEDIATE CALCULATIONS SHEET - TRICHLOROETHENE - NON-MUTAGENIC

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm³/cm³)	Vadose zone effective total fluid saturation, S_{te} (cm³/cm³)	Vadose zone soil intrinsic permeability, k_i (cm²)	Vadose zone soil relative air permeability, k_{rg} (cm²)	Vadose zone soil effective vapor permeability, k_v (cm²)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm³/cm³)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm³/cm³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm³/cm³)	Floor-wall seam perimeter, X_{crack} (cm)
229	0.322	0.267	6.73E-09	0.830	5.59E-09	163.04	0.489	0.107	0.382	4,000

Bldg. ventilation rate, $Q_{building}$ (cm³/s)	Area of enclosed space below grade, A_B (cm²)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm²/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm²/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm²/s)
1.69E+04	1.00E+06	4.00E-04	15	8,569	4.52E-03	1.95E-01	1.75E-04	7.59E-03	2.03E-04	2.83E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm³/s)	Crack effective diffusion coefficient, D^{crack} (cm²/s)	Area of crack, A_{crack} (cm²)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m³)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m³)
229	15	1.76E+03	0.10	8.33E+01	7.59E-03	4.00E+02	1.66E+119	7.18E-05	1.26E-01	3.1E-06	2.0E-03

RESULTS SHEET - TRICHLOROETHENE - NON-MUTAGENIC

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.47E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.6E-07	6.1E-02

MESSAGE SUMMARY BELOW:

END

]

Soil Properties Lookup Table

SCS Soil Type	K_s (cm/h)	α_1 (1/cm)	N (unitless)	M (unitless)	n (cm^3/cm^3)	θ_r (cm^3/cm^3)	Mean Grain Diameter (cm)	Bulk Density (g/cm^3)	θ_w (cm^3/cm^3)	SCS Soil Name
C	0.61	0.01496	1.253	0.2019	0.459	0.098	0.0092	1.43	0.215	Clay
CL	0.34	0.01581	1.416	0.2938	0.442	0.079	0.016	1.48	0.168	Clay Loam
L	0.50	0.01112	1.472	0.3207	0.399	0.061	0.020	1.59	0.148	Loam
LS	4.38	0.03475	1.746	0.4273	0.390	0.049	0.040	1.62	0.076	Loamy Sand
S	26.78	0.03524	3.177	0.6852	0.375	0.053	0.044	1.66	0.054	Sand
SC	0.47	0.03342	1.208	0.1722	0.385	0.117	0.025	1.63	0.197	Sandy Clay
SCL	0.55	0.02109	1.330	0.2481	0.384	0.063	0.029	1.63	0.146	Sandy Clay Loam
SI	1.82	0.00658	1.679	0.4044	0.489	0.050	0.0046	1.35	0.167	Silt
SIC	0.40	0.01622	1.321	0.2430	0.481	0.111	0.0039	1.38	0.216	Silty Clay
SICL	0.46	0.00839	1.521	0.3425	0.482	0.090	0.0056	1.37	0.198	Silty Clay Loam
SIL	0.76	0.00506	1.663	0.3987	0.439	0.065	0.011	1.49	0.180	Silt Loam
SL	1.60	0.02667	1.449	0.3099	0.387	0.039	0.030	1.62	0.103	Sandy Loam

Chemical Properties Lookup Table

CAS No.	Chemical	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Pure component water solubility, S (mg/L)	Henry's law constant H' (unitless)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)	URF extrapolated (X)	RfC extrapolated (X)
56235	Carbon tetrachloride	1.74E+02	7.80E-02	8.80E-06	7.93E+02	1.24E+00	3.03E-02	25	349.90	556.60	7,127	1.5E-05	0.0E+00		
57749	Chlordane	1.20E+05	1.18E-02	4.37E-06	5.60E-02	1.99E-03	4.85E-05	25	624.24	885.73	14,000	1.0E-04	7.0E-04		
58899	gamma-HCH (Lindane)	1.07E+03	1.42E-02	7.34E-06	7.30E+00	5.73E-04	1.40E-05	25	596.55	839.36	15,000	3.7E-04	1.1E-03	X	X
60297	Ethyl ether	5.73E+00	7.82E-02	8.61E-06	5.68E+04	1.35E+00	3.29E-02	25	307.50	466.74	6,338	0.0E+00	7.0E-01		X
60571	Dieldrin	2.14E+04	1.25E-02	4.74E-06	1.95E-01	6.18E-04	1.51E-05	25	613.32	842.25	17,000	4.6E-03	1.8E-04		X
67641	Acetone	5.75E-01	1.24E-01	1.14E-05	1.00E+06	1.59E-03	3.87E-05	25	329.20	508.10	6,955	0.0E+00	3.5E-01		X
67663	Chloroform	3.98E+01	1.04E-01	1.00E-05	7.92E+03	1.50E-01	3.66E-03	25	334.32	536.40	6,988	2.3E-05	0.0E+00		
67721	Hexachloroethane	1.78E+03	2.50E-03	6.80E-06	5.00E+01	1.59E-01	3.88E-03	25	458.00	695.00	9,510	4.0E-06	3.5E-03		X
71432	Benzene	5.89E+01	8.80E-02	9.80E-06	1.79E+03	2.27E-01	5.54E-03	25	353.24	562.16	7,342	7.8E-06	3.0E-02		
71556	1,1,1-Trichloroethane	1.10E+02	7.80E-02	8.80E-06	1.33E+03	7.03E-01	1.72E-02	25	347.24	545.00	7,136	0.0E+00	2.2E+00		
72435	Methoxychlor	9.77E+04	1.56E-02	4.46E-06	1.00E-01	6.46E-04	1.58E-05	25	651.02	848.49	16,000	0.0E+00	1.8E-02		X
72559	DDE	4.47E+06	1.44E-02	5.87E-06	1.20E-01	8.59E-04	2.09E-05	25	636.44	860.38	15,000	9.7E-05	0.0E+00	X	
74839	Methyl bromide	1.05E+01	7.28E-02	1.21E-05	1.52E+04	2.55E-01	6.22E-03	25	276.71	467.00	5,714	0.0E+00	5.0E-03		
74873	Methyl chloride (chloromethane)	2.12E+00	1.26E-01	6.50E-06	5.33E+03	3.61E-01	8.80E-03	25	249.00	416.25	5,115	1.0E-06	9.0E-02		
74908	Hydrogen cyanide	3.80E+00	1.93E-01	2.10E-05	1.00E+06	5.44E-03	1.33E-04	25	299.00	456.70	6,676	0.0E+00	3.0E-03		
74953	Methylene bromide	1.26E+01	4.30E-02	8.44E-06	1.19E+04	3.52E-02	8.59E-04	25	370.00	583.00	7,868	0.0E+00	3.5E-02		X
75003	Chloroethane (ethyl chloride)	4.40E+00	2.71E-01	1.15E-05	5.68E+03	3.61E-01	8.80E-03	25	285.30	460.40	5,879	8.3E-07	1.0E+01	X	
75014	Vinyl chloride (chloroethene)	1.86E+01	1.06E-01	1.23E-05	8.80E+03	1.10E+00	2.69E-02	25	259.25	432.00	5,250	8.8E-06	1.0E-01		
75058	Acetonitrile	4.20E+00	1.28E-01	1.66E-05	1.00E+06	1.42E-03	3.45E-05	25	354.60	545.50	7,110	0.0E+00	6.0E-02		
75070	Acetaldehyde	1.06E+00	1.24E-01	1.41E-05	1.00E+06	3.23E-03	7.87E-05	25	293.10	466.00	6,157	2.2E-06	9.0E-03		
75092	Methylene chloride	1.17E+01	1.01E-01	1.17E-05	1.30E+04	8.96E-02	2.18E-03	25	313.00	510.00	6,706	4.7E-07	3.0E+00		
75150	Carbon disulfide	4.57E+01	1.04E-01	1.00E-05	1.19E+03	1.24E+00	3.02E-02	25	319.00	552.00	6,391	0.0E+00	7.0E-01		
75218	Ethylene oxide	1.33E+00	1.04E-01	1.45E-05	3.04E+05	2.27E-02	5.54E-04	25	283.60	469.00	6,104	1.0E-04	0.0E+00		
75252	Bromoform	8.71E+01	1.49E-02	1.03E-05	3.10E+03	2.41E-02	5.88E-04	25	422.35	696.00	9,479	1.1E-06	7.0E-02		X
75274	Bromodichloromethane	5.50E+01	2.98E-02	1.06E-05	6.74E+03	6.54E-02	1.60E-03	25	363.15	585.85	7,800	1.8E-05	7.0E-02	X	X
75296	2-Chloropropane	9.14E+00	8.88E-02	1.01E-05	3.73E+03	5.93E-01	1.45E-02	25	308.70	485.00	6,286	0.0E+00	1.0E-01		
75343	1,1-Dichloroethane	3.16E+01	7.42E-02	1.05E-05	5.06E+03	2.30E-01	5.61E-03	25	330.55	523.00	6,895	0.0E+00	5.0E-01		
75354	1,1-Dichloroethylene	5.89E+01	9.00E-02	1.04E-05	2.25E+03	1.07E+00	2.60E-02	25	304.75	576.05	6,247	0.0E+00	2.0E-01		
75456	Chlorodifluoromethane	4.79E+01	1.01E-01	1.28E-05	2.00E+00	1.10E+00	2.70E-02	25	232.40	369.30	4,836	0.0E+00	5.0E+01		
75694	Trichlorofluoromethane	4.97E+02	8.70E-02	9.70E-06	1.10E+03	3.97E+00	9.68E-02	25	296.70	471.00	5,999	0.0E+00	7.0E-01		
75718	Dichlorodifluoromethane	4.57E+02	6.65E-02	9.92E-06	2.80E+02	1.40E+01	3.42E-01	25	243.20	384.95	9,421	0.0E+00	2.0E-01		
76131	1,1,2-Trichloro-1,2,2-trifluoroetha	1.11E+04	7.80E-02	8.20E-06	1.70E+02	1.97E+01	4.80E-01	25	320.70	487.30	6,463	0.0E+00	3.0E+01		
76448	Heptachlor	1.41E+06	1.12E-02	5.69E-06	1.80E-01	6.05E+01	1.48E+00	25	603.69	846.31	13,000	1.3E-03	1.8E-03		X
77474	Hexachlorocyclopentadiene	2.00E+05	1.61E-02	7.21E-06	1.80E+00	1.10E+00	2.69E-02	25	512.15	746.00	10,931	0.0E+00	2.0E-04		
78831	Isobutanol	2.59E+00	8.60E-02	9.30E-06	8.50E+04	4.83E-04	1.18E-05	25	381.04	547.78	10,936	0.0E+00	1.1E+00		X
78875	1,2-Dichloropropane	4.37E+01	7.82E-02	8.73E-06	2.80E+03	1.15E-01	2.79E-03	25	369.52	572.00	7,590	1.9E-05	4.0E-03	X	
78933	Methylethylketone (2-butanone)	2.30E+00	8.08E-02	9.80E-06	2.23E+05	2.29E-03	5.58E-05	25	352.50	536.78	7,481	0.0E+00	5.0E+00		
79005	1,1,2-Trichloroethane	5.01E+01	7.80E-02	8.80E-06	4.42E+03	3.73E-02	9.11E-04	25	386.15	602.00	8,322	1.6E-05	1.4E-02		X
79016	Trichloroethylene	1.66E+02	7.90E-02	9.10E-06	1.47E+03	4.21E-01	1.03E-02	25	360.36	544.20	7,505	3.1E-06	2.0E-03		
79209	Methyl acetate	3.26E+00	1.04E-01	1.00E-05	2.00E+03	4.84E-03	1.18E-04	25	329.80	506.70	7,260	0.0E+00	3.5E+00		X
79345	1,1,2,2-Tetrachloroethane	9.33E+01	7.10E-02	7.90E-06	2.96E+03	1.41E-02	3.44E-04	25	419.60	661.15	8,996	5.8E-05	2.1E-01		X
79469	2-Nitropropane	1.17E+01	9.23E-02	1.01E-05	1.70E+04	5.03E-03	1.23E-04	25	393.20	594.00	8,383	2.7E-03	2.0E-02		
80626	Methylmethacrylate	6.98E+00	7.70E-02	8.60E-06	1.50E+04	1.38E-02	3.36E-04	25	373.50	567.00	8,975	0.0E+00	7.0E-01		
83329	Acenaphthene	7.08E+03	4.21E-02	7.69E-06	3.57E+00	6.34E-03	1.55E-04	25	550.54	803.15	12,155	0.0E+00	2.1E-01		X
86737	Fluorene	1.38E+04	3.63E-02	7.88E-06	1.98E+00	2.60E-03	6.34E-05	25	570.44	870.00	12,666	0.0E+00	1.4E-01		X
87683	Hexachloro-1,3-butadiene	5.37E+04	5.61E-02	6.16E-06	3.20E+00	3.33E-01	8.13E-03	25	486.15	738.00	10,206	2.2E-05	7.0E-04		X
88722	o-Nitrotoluene	3.24E+02	5.87E-02	8.67E-06	6.50E+02	5.11E-04	1.25E-05	25	495.00	720.00	12,239	0.0E+00	3.5E-02		X

91203	Naphthalene	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02	4.82E-04	25	491.14	748.40	10,373	0.0E+00	3.0E-03		
91576	2-Methylnaphthalene	2.81E+03	5.22E-02	7.75E-06	2.46E+01	2.12E-02	5.17E-04	25	514.26	761.00	12,600	0.0E+00	7.0E-02		X
92524	Biphenyl	4.38E+03	4.04E-02	8.15E-06	7.45E+00	1.23E-02	2.99E-04	25	529.10	789.00	10,890	0.0E+00	1.8E-01		X
95476	o-Xylene	3.63E+02	8.70E-02	1.00E-05	1.78E+02	2.12E-01	5.18E-03	25	417.60	630.30	8,661	0.0E+00	1.0E-01		
95501	1,2-Dichlorobenzene	6.17E+02	6.90E-02	7.90E-06	1.56E+02	7.77E-02	1.90E-03	25	453.57	705.00	9,700	0.0E+00	2.0E-01		
95578	2-Chlorophenol	3.88E+02	5.01E-02	9.46E-06	2.20E+04	1.60E-02	3.90E-04	25	447.53	675.00	9,572	0.0E+00	1.8E-02		X
95636	1,2,4-Trimethylbenzene	1.35E+03	6.06E-02	7.92E-06	5.70E+01	2.52E-01	6.14E-03	25	442.30	649.17	9,369	0.0E+00	6.0E-03		
96184	1,2,3-Trichloropropane	2.20E+01	7.10E-02	7.90E-06	1.75E+03	1.67E-02	4.08E-04	25	430.00	652.00	9,171	5.7E-04	4.9E-03	X	
96333	Methyl acrylate	4.53E+00	9.76E-02	1.02E-05	6.00E+04	7.68E-03	1.87E-04	25	353.70	536.00	7,749	0.0E+00	1.1E-01		X
97632	Ethylmethacrylate	2.95E+01	6.53E-02	8.37E-06	3.67E+03	3.44E-02	8.40E-04	25	390.00	571.00	10,957	0.0E+00	3.2E-01		X
98066	tert-Butylbenzene	7.71E+02	5.65E-02	8.02E-06	2.95E+01	4.87E-01	1.19E-02	25	442.10	1220.00	8,980	0.0E+00	1.4E-01		X
98828	Cumene	4.89E+02	6.50E-02	7.10E-06	6.13E+01	4.74E+01	1.46E-02	25	425.56	631.10	10,335	0.0E+00	4.0E-01		
98862	Acetophenone	5.77E+01	6.00E-02	8.73E-06	6.13E+03	4.38E-04	1.07E-05	25	475.00	709.50	11,732	0.0E+00	3.5E-01		X
98953	Nitrobenzene	6.46E+01	7.60E-02	8.60E-06	2.09E+03	9.82E-04	2.39E-05	25	483.95	719.00	10,566	0.0E+00	2.0E-03		
100414	Ethylbenzene	3.63E+02	7.50E-02	7.80E-06	1.69E+02	3.22E-01	7.86E-03	25	409.34	617.20	8,501	0.0E+00	1.0E+00		
100425	Styrene	7.76E+02	7.10E-02	8.00E-06	3.10E+02	1.12E-01	2.74E-03	25	418.31	636.00	8,737	0.0E+00	1.0E+00		
100447	Benzylchloride	6.14E+01	7.50E-02	7.80E-06	5.25E+02	1.70E-02	4.14E-04	25	452.00	685.00	8,773	4.9E-05	0.0E+00	X	
100527	Benzaldehyde	4.59E+01	7.21E-02	9.07E-06	3.30E+03	9.73E-04	2.37E-05	25	452.00	695.00	11,658	0.0E+00	3.5E-01		X
103651	n-Propylbenzene	5.62E+02	6.01E-02	7.83E-06	6.00E+01	4.37E-01	1.07E-02	25	432.20	630.00	9,123	0.0E+00	1.4E-01		X
104518	n-Butylbenzene	1.11E+03	5.70E-02	8.12E-06	2.00E+00	5.38E-01	1.31E-02	25	456.46	660.50	9,290	0.0E+00	1.4E-01		X
106423	p-Xylene	3.89E+02	7.69E-02	8.44E-06	1.85E+02	3.13E-01	7.64E-03	25	411.52	616.20	8,525	0.0E+00	1.0E-01		
106467	1,4-Dichlorobenzene	6.17E+02	6.90E-02	7.90E-06	7.90E+01	9.82E-02	2.39E-03	25	447.21	684.75	9,271	0.0E+00	8.0E-01		
106934	1,2-Dibromoethane (ethylene dib	2.50E+01	2.17E-02	1.19E-05	4.18E+03	3.04E-02	7.41E-04	25	404.60	583.00	8,310	2.2E-04	2.0E-04		
106990	1,3-Butadiene	1.91E+01	2.49E-01	1.08E-05	7.35E+02	3.01E+00	7.34E-02	25	268.60	425.00	5,370	3.0E-02	2.0E-03		
107028	Acrolein	2.76E+00	1.05E-01	1.22E-05	2.13E+05	4.99E-03	1.22E-04	25	325.60	506.00	6,731	0.0E+00	2.0E-05		
107062	1,2-Dichloroethane	1.74E+01	1.04E-01	9.90E-06	8.52E+03	4.00E-02	9.77E-04	25	356.65	561.00	7,643	2.6E-05	0.0E+00		
107131	Acrylonitrile	5.90E+00	1.22E-01	1.34E-05	7.40E+04	4.21E-03	1.03E-04	25	350.30	519.00	7,786	6.8E-05	2.0E-03		
108054	Vinyl acetate	5.25E+00	8.50E-02	9.20E-06	2.00E+04	2.09E-02	5.10E-04	25	345.65	519.13	7,800	0.0E+00	2.0E-01		
108101	Methylisobutylketone (4-methyl-2	9.06E+00	7.50E-02	7.80E-06	1.90E+04	5.64E-03	1.38E-04	25	389.50	571.00	8,243	0.0E+00	3.0E+00		
108383	m-Xylene	4.07E+02	7.00E-02	7.80E-06	1.61E+02	3.00E-01	7.32E-03	25	412.27	617.05	8,523	0.0E+00	1.0E-01		
108678	1,3,5-Trimethylbenzene	1.35E+03	6.02E-02	8.67E-06	2.00E+00	2.41E-01	5.87E-03	25	437.89	637.25	9,321	0.0E+00	6.0E-03		
108872	Methylcyclohexane	7.85E+01	7.35E-02	8.52E-06	1.40E+01	4.22E+00	1.03E-01	25	373.90	572.20	7,474	0.0E+00	3.0E+00		
108883	Toluene	1.82E+02	8.70E-02	8.60E-06	5.26E+02	2.72E-01	6.62E-03	25	383.78	591.79	7,930	0.0E+00	4.0E-01		
108907	Chlorobenzene	2.19E+02	7.30E-02	8.70E-06	4.72E+02	1.51E-01	3.69E-03	25	404.87	632.40	8,410	0.0E+00	6.0E-02		
109693	1-Chlorobutane	1.72E+01	8.26E-02	1.00E-05	1.10E+03	6.93E-01	1.69E-02	25	351.60	542.00	7,263	0.0E+00	1.4E+00		X
110009	Furan	1.86E+01	1.04E-01	1.22E-05	1.00E+04	2.21E-01	5.39E-03	25	304.60	490.20	6,477	0.0E+00	3.5E-03		X
110543	Hexane	4.34E+01	2.00E-01	7.77E-06	1.24E+01	6.82E+01	1.66E+00	25	341.70	508.00	6,895	0.0E+00	2.0E-01		
111444	Bis(2-chloroethyl)ether	1.55E+01	6.92E-02	7.53E-06	1.72E+04	7.36E-04	1.80E-05	25	451.15	659.79	10,803	3.3E-04	0.0E+00		
115297	Endosulfan	2.14E+03	1.15E-02	4.55E-06	5.10E-01	4.58E-04	1.12E-05	25	674.43	942.94	14,000	0.0E+00	2.1E-02		X
118741	Hexachlorobenzene	5.50E+04	5.42E-02	5.91E-06	5.00E-03	5.40E-02	1.32E-03	25	582.55	825.00	14,447	4.6E-04	2.8E-03		X
120821	1,2,4-Trichlorobenzene	1.78E+03	3.00E-02	8.23E-06	4.88E+01	5.81E-02	1.42E-03	25	486.15	725.00	10,471	0.0E+00	4.0E-03		
123739	Crotonaldehyde (2-butenal)	4.82E+00	9.56E-02	1.07E-05	3.69E+04	7.99E-04	1.95E-05	25	375.20	568.00	9	5.4E-04	0.0E+00	X	
124481	Chlorodibromomethane	6.31E+01	1.96E-02	1.05E-05	2.60E+03	3.20E-02	7.81E-04	25	416.14	678.20	5,900	2.4E-05	7.0E-02	X	X
126987	Methacrylonitrile	3.58E+01	1.12E-01	1.32E-05	2.54E+04	1.01E-02	2.46E-04	25	363.30	554.00	7,600	0.0E+00	7.0E-04		
126998	2-Chloro-1,3-butadiene (chloropr	6.73E+01	8.58E-02	1.03E-05	2.12E+03	4.91E-01	1.20E-02	25	332.40	525.00	8,075	0.0E+00	7.0E-03		
127184	Tetrachloroethylene	1.55E+02	7.20E-02	8.20E-06	2.00E+02	7.53E-01	1.84E-02	25	394.40	620.20	8,288	5.9E-06	6.0E-01		
129000	Pyrene	1.05E+05	2.72E-02	7.24E-06	1.35E+00	4.50E-04	1.10E-05	25	667.95	936	14370	0.0E+00	1.1E-01		X
132649	Dibenzofuran	5.15E+03	2.38E-02	6.00E-06	3.10E+00	5.15E-04	1.26E-05	25	560	824	66400	0.0E+00	1.4E-02		X
135988	sec-Butylbenzene	9.66E+02	5.70E-02	8.12E-06	3.94E+00	5.68E-01	1.39E-02	25	446.5	679	88730	0.0E+00	1.4E-01		X
141786	Ethylacetate	6.44E+00	7.32E-02	9.70E-06	8.03E+04	5.64E-03	1.38E-04	25	350.26	523.3	7633.66	0.0E+00	3.2E+00		X
156592	cis-1,2-Dichloroethylene	3.55E+01	7.36E-02	1.13E-05	3.50E+03	1.67E-01	4.07E-03	25	333.65	544	7192	0.0E+00	3.5E-02		X
156605	trans-1,2-Dichloroethylene	5.25E+01	7.07E-02	1.19E-05	6.30E+03	3.84E-01	9.36E-03	25	320.85	516.5	6717	0.0E+00	7.0E-02		X
205992	Benzo(b)fluoranthene	1.23E+06	2.26E-02	5.56E-06	1.50E-03	4.54E-03	1.11E-04	25	715.9	969.27	17000	2.1E-04	0.0E+00	X	
218019	Chrysene	3.98E+05	2.48E-02	6.21E-06	6.30E-03	3.87E-03	9.44E-05	25	714.15	979	16455	2.1E-06	0.0E+00	X	
309002	Aldrin	2.45E+06	1.32E-02	4.86E-06	1.70E-02	6.95E-03	1.70E-04	25	603.01	839.37	15000	4.9E-03	1.1E-04		X
319846	alpha-HCH (alpha-BHC)	1.23E+03	1.42E-02	7.34E-06	2.00E+00	4.34E-04	1.06E-05	25	596.55	839.36	15000	1.8E-03	0.0E+00		
541731	1,3-Dichlorobenzene	1.98E+03	6.92E-02	7.86E-06	1.34E+02	1.27E-01	3.09E-03	25	446	684	9230.18	0.0E+00	1.1E-01		X
542756	1,3-Dichloropropene	4.57E+01	6.26E-02	1.00E-05	2.80E+03	7.24E-01	1.77E-02	25	381.15	587.38	7900	4.0E-06	2.0E-02		
630206	1,1,1,2-Tetrachloroethane	1.16E+02	7.10E-02	7.90E-06	1.10E+03	9.90E-02	2.41E-03	25	403.5	624	9768.282525	7.4E-06	1.1E-01		X
1634044	MTBE	7.26E+00	1.02E-01	1.05E-05	5.10E+04	2.56E-02	6.23E-04	25	328.3	497.1	6677.66	0.0E+00	3.0E+00		
7439976	Mercury (elemental)	5.20E+01	3.07E-02	6.30E-06	2.00E+01	4.40E-01	1.07E-02	25	629.88	1750	14127	0.0E+00	3.0E-04		

RTCS GENERAL COMMENT #1, & SPECIFIC COMMENTS #6, #7, #10a, #10d, #49

RISK ASSESSMENT SPREADSHEET - CLEANUP LEVELS (PAGE ONE OF THREE)

SITE NAME: NAS SOUTH WEYMOUTH, WEYMOUTH, MASSACHUSETTS
LOCATION: BUILDING 82
EXPOSURE SCENARIO: LIFELONG RESIDENT
MEDIA: GROUNDWATER
DATE: MAY 21, 2012

THIS SPREADSHEET CALCULATES CLEANUP LEVELS FOR EXPOSURES TO GROUNDWATER
VIA INGESTION, DERMAL CONTACT, AND INHALATION

RELEVANT EQUATIONS:

$$PRG_{GW} = \frac{TCR}{Intake_{ing} \cdot CSF_{oral} + Intake_{derm} \cdot CSF_{derm} + Intake_{inh} \cdot IUR}$$

$$PRG_{GW} = \frac{THI}{\left(\frac{Intake_{ing}}{RfD_{oral}}\right) + \left(\frac{Intake_{derm}}{RfD_{derm}}\right) + \left(\frac{Intake_{inh}}{RfC}\right)}$$

$$Intake_{ing} = \frac{IR \times EF \times ED}{BW \times AT}$$

$$Intake_{derm} = \frac{DA_{Event} \times EV \times ED \times EF \times SA}{BW \times AT}$$

$$Intake_{inh} = \frac{K \times ET \times EF \times ED}{AT \times 24 \text{ hrs/day}}$$

For Inorganics DAevent = Kp x CF x tevent

For Organics

$$\text{If } tevent \le t^*, \text{ then : } DAevent = 2 \times Kp \times FA \times CF \times \sqrt{\frac{6 \times tau \times tevent}{\pi}}$$

$$\text{If } tevent > t^*, \text{ then : } DAevent = Kp \times FA \times CF \times \left[\frac{tevent}{1+B} + 2 \times tau \times \left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

Where:

Parameter	Child	Adult	Definition
TCR = :	1.0E-06	1.0E-06	Target Cancer Risk
THI = :	1	1	Target Hazard Index
IR = :	1.5	2	Ingestion rate (L/day)
SA = :	6,600	18,000	Skin surface available for contact (cm^2)
DAevent = :	Chemical Specific		Absorbed dose per event (mg/cm^2-event)
EV = :	1	1	Event frequency (events/days)
EF = :	350	350	Exposure frequency (days/year)
ED = :	6	24	Exposure duration (years)
ET = :	0	0	Exposure time (hrs/day)
BW = :	15	70	Body weight (kg)
ATc = :	25,550	25,550	Averaging time for carcinogenic exposures (days)
ATn = :	2,190	8,760	Averaging time for noncarcinogenic exposures (days)
CF = :	0.001	0.001	Conversion Factor (L/m^3)
Kp =:	Chemical Specific		Permeability coefficient (cm/hr)
Cw = :	Chemical Specific		Concentration of chemical in water (mg/L)
tevent = :	1	0.58	duration of event (hr/event)
K = :	0.5	0.5	Volatilization Factor (L/m3)
tau = :	Chemical Specific		Lag time (hr)
t* = :	Chemical Specific		Time it takes to reach steady state (hr)
B = :	Chemical Specific		Dimensionless constant
FA = :	Chemical Specific		Fraction absorbed (dimensionless)

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH GROUNDWATER (PAGE TWO OF THREE)

SITE NAME: NAS SOUTH WEYMOUTH, WEYMOUTH, MASSACHUSETTS
LOCATION: BUILDING 82
EXPOSURE SCENARIO: LIFELONG RESIDENT
MEDIA: GROUNDWATER
DATE: MAY 21, 2012

CHEMICAL	Organic or Inorganic	Estimated Kp (cm/hr)	FA	tau-event (hr)	B	t* (hr)	DAevent (L/cm^2- event)	
							Child	Adult
Benzene	Organic	1.49E-02	1	2.92E-01	5.05E-02	7.00E-01	2.33E-05	1.69E-05
Chloroform	Organic	6.83E-03	1	4.98E-01	2.87E-02	1.19E+00	1.33E-05	1.01E-05
Tetrachloroethene	Organic	3.34E-02	1	9.06E-01	1.66E-01	2.18E+00	8.80E-05	6.70E-05
Trichloroethene - Mutagenic	Organic	1.16E-02	1	5.81E-01	5.13E-02	1.39E+00	2.45E-05	1.87E-05
Trichloroethene - Nonmutagenic	Organic	1.16E-02	1	5.81E-01	5.13E-02	1.39E+00	2.45E-05	1.87E-05
Heptachlor Epoxide	Organic	2.03E-02	1	1.59E+01	1.54E-01	3.82E+01	2.23E-04	1.70E-04
Arsenic	Inorganic	1.00E-03	1	NA	NA	NA	1.00E-06	1.00E-06

CHEMICAL	Cancer Slope Factor			Reference Dose			Volatile Yes or No
	Oral $(mg/kg/day)^{-1}$	Dermal $(mg/kg/day)^{-1}$	Inhalation $(ug/m^3)^{-1}$	Oral (mg/kg/day)	Dermal (mg/kg/day)	Inhalation (mg/m^3)	
Benzene	5.50E-02	5.50E-02	7.80E-06	4.00E-03	4.00E-03	3.00E-02	Yes
Chloroform	3.1E-02	3.1E-02	2.3E-05	1.00E-02	1.00E-02	9.80E-02	Yes
Tetrachloroethene	2.10E-03	2.10E-03	2.60E-07	6.00E-03	6.00E-03	4.00E-02	Yes
Trichloroethene - Mutagenic	9.3E-03	9.3E-03	1.0E-06	NA	NA	NA	Yes
Trichloroethene - Nonmutagenic	3.7E-02	3.7E-02	3.1E-06	5.00E-04	5.00E-04	2.00E-03	Yes
Heptachlor Epoxide	9.1E+00	9.1E+00	2.6E-03	1.30E-05	1.30E-05	NA	No
Arsenic	1.50E+00	1.50E+00	4.30E-03	3.00E-04	3.00E-04	1.50E-05	No

CHEMICAL	Carcinogenic Intakes			Noncarcinogenic Intakes		
	Ingestion (L/kg/day)	Dermal (L/kg/day)	Inhalation (L/m^3)	Ingestion (L/kg/day)	Dermal (L/kg/day)	Inhalation (L/m^3)
Benzene	6.11E-02	7.11E-03	0.00E+00	9.59E-02	9.82E-03	0.00E+00
Chloroform	6.11E-02	4.14E-03	0.00E+00	9.59E-02	5.62E-03	0.00E+00
Tetrachloroethene	6.11E-02	2.73E-02	0.00E+00	9.59E-02	3.71E-02	0.00E+00
Trichloroethene - Mutagenic	6.11E-02	7.62E-03	0.00E+00	9.59E-02	1.03E-02	0.00E+00
Trichloroethene - Nonmutagenic	1.76E-02	2.47E-03	0.00E+00	9.59E-02	1.03E-02	0.00E+00
Heptachlor Epoxide	1.76E-02	2.24E-02	0.00E+00	9.59E-02	9.42E-02	0.00E+00
Arsenic	1.76E-02	1.21E-04	0.00E+00	9.59E-02	4.22E-04	0.00E+00

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH GROUNDWATER (PAGE THREE OF THREE)

SITE NAME: NAS SOUTH WEYMOUTH, WEYMOUTH, MASSACHUSETTS
LOCATION: BUILDING 82
EXPOSURE SCENARIO: LIFELONG RESIDENT
MEDIA: GROUNDWATER
DATE: MAY 21, 2012

CHEMICAL	Groundwater Concentration	
	Carcinogenic (ug/L)	Noncarcinogenic[(1)] (ug/L)
Benzene	0.27	37.8
Chloroform	0.49	99
Tetrachloroethene	5.4	45.1
Trichloroethene - Mutagenic	1.6	NA
Trichloroethene - Nonmutagenic	1.3	4.7
Heptachlor Epoxide	0.0027	0.07
Arsenic	0.038	3.1

TCE = 1/1/Mutagenic + 1/nonmutagenic)
= 1/(1/1.6 + 1/1.3)
= 0.72

1 - Noncarcinogenic PRG based on the child resident receptor.

TABLE 2-3

SELECTION OF HUMAN HEALTH RISK-BASED PRGS
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Contaminant of Concern	Units	Cancer Risk-Based[1]		Non-Cancer Risk-Based[2]	Proposed Human Health Risk-Based PRG[3]	Selection Basis
		PRG based on CR=10-6	PRG based on CR=10-5	PRG based on HI=1		
Groundwater						
1,1-DCA	µg/L	2.4	24	2,900	24	cancer risk
NNPA	µg/L	0.0093	0.093	NA	0.093	cancer risk
TCE	µg/L	0.72	7.2	4.7	4.7	noncancer risk
Manganese	µg/L	NA	NA	320	320	noncancer risk
1,1,1-TCA	µg/L	NA	NA	7,500	7,500	noncancer risk
cis-1,2-DCE [4]	µg/L	NA	NA	28	28	noncancer risk
Vinyl chloride [4]	µg/L	0.015	0.15	36	0.15	cancer risk
Arsenic[5]	µg/L	0.038	0.38	3.1	0.38	cancer risk
Benzene[5]	µg/L	0.27	2.7	38	2.7	cancer risk
Chloroform[5]	µg/L	0.49	4.9	99	4.9	cancer risk
PCE[5]	µg/L	5.4	54	45	45	noncancer risk
Heptaclor Epoxide[5]	µg/L	0.0027	0.027	0.07	0.027	cancer risk

1. Human health risk-based PRG based on cancer risk (CR) of $1x10^{-5}$ and $1x10^{-6}$.
2. Human health risk-based PRGs based on hazard index (HI) of 1 for non-carcinogenic effects.
3. Proposed human health risk-based PRG is the lower of the values for HI=1 and $CR=10^{-5}$.
4. Compound of Interest. Note that chloroethane is also a daughter product of TCA. However there are no cancer or non-cancer risk-based values for this chemical.
5. Concentrations of these COCs were less than MCLs.

CR - Cancer risk.
HI - Hazard Index.
NNPA - n-nitroso-di-n-propylamine.
PRG - Preliminary Remediation Goal.
DCA - Dichloroethane.
DCE - Dichloroethene
TCA - Trichloroethane
TCE - Trichloroethene
PCE - Tetrachloroethene
µg/L - Micrograms per liter.

TABLE 2-4

SELECTION OF PRGs
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Contaminant of Concern	Units	Risk-Based PRG[1]	Federal ARAR/TBC[2]	MMCL/ORSG[3]	95% UPL Background Concentrations[4]	Selected PRG[5]	Selection Basis[6]
Groundwater							
1,1-DCA	μg/L	24	NA	70	NA	70	ARAR-Mass MCL
NNPA	μg/L	0.093	NA	NA	NA	0.073	HH PRG
TCE	μg/L	4.7	5/0	5	NA	5	ARAR-MCL
Manganese	μg/L	320	300 [8]	NA	2,680	300	ARAR-Health Advisory
1,1,1-TCA	μg/L	7,500	200/200	200	NA	200	ARAR-MCL/MCLG
cis-1,2-DCE [7]	μg/L	28	70/70	70	NA	70	ARAR-MCL/MCLG
Vinyl chloride [7]	μg/L	0.15	2	2	NA	2	ARAR-MCL
Arsenic[10]	μg/L	0.38	10	10	NA	10	ARAR-MCL
Benzene[10]	μg/L	2.7	5	5	NA	5	ARAR-MCL
Chloroform[10]	μg/L	4.9	80[9]/70	70 (ORSG)	NA	70	ARAR-MCLG
PCE[10]	μg/L	45	5	5	NA	5	ARAR-MCL
Heptachlor Expoxide[10]	μg/L	0.027	0.2	0.2	NA	0.2	ARAR-MCL

NOTES:

1. From Table 2-3.
2. Available ARARs/TBCs (Applicable or Relevant and Appropriate Requirements/To Be Considered criteria). MCL/MCLG
3. Massachusetts Drinking Water Guidelines, 310 CMR 22. ORSG - Office of Research and Standards Guideline.
4. 95% Upper Prediction Limit (UPL) Background Concentrations - Basewide background concentrations calculated in the Final Summary Report of Background Data Summary Statistics for NAS South Weymouth (Stone & Webster, February 2000) and the Supplement to the Final Summary Report of Background Data Summary Statistics for NAS South Weymouth (Stone & Webster, November 2002).
5. PRG selection rationale:
   Selected PRG is the ARAR (if available and sufficiently protective) or the lowest of the risk-based values.
6. Selection Basis:
   HH - Human health risk.
   Bkgd - background concentration.
   ARAR - Applicable or Relevant and Appropriate Requirement.
   MCL - Maximum Contaminant Level.
   MCLG - Maximum Contaminant Level Goal.
7. Compound of Interest. Note that chloroethane is also a daughter product of TCA. However there are no cancer or non-cancer risk-based values to develop a PRG for this chemical.
8. USEPA Drinking Water Health Advisory, 2004
9. MCL for Total Trihalomethanes.
10. Concentrations of these COCs were less than MCLs.

TABLE 2-4

SELECTION OF PRGs
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

NNPA - n-nitroso-di-n-propylamine.
PRG - Preliminary Remediation Goal.
DCA - Dichloroethane.
DCE - Dichloroethene
TCA - Trichloroethane
TCE - Trichloroethene
PCE - Tetrachlorothene
µg/L - Micrograms per liter.

RTC SC#33, #34

TABLE 4-2

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-2
BUILDING 82 FEASIBILITY STUDY
NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Federal				
Cancer Slope Factors (CSFs)	US EPA, Integrated Risk Information System	To Be Considered	Guidance used to compute individual incremental cancer risk resulting from exposure to carcinogenic contaminants in site media	This alternative will meet the risk-based cleanup goals developed through the use of this guidance since treating groundwater that poses potential carcinogenic risks through chemical oxidation combined with natural attenuation will address long-term risk, while land use controls will prevent short-term exposure to COCs in groundwater until risk-based cleanup goals are achieved.
Reference Doses (RfDs)	US EPA, Integrated Risk Information System	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media	This alternative will meet the risk-based cleanup goals developed through the use of this guidance since treating groundwater that poses potential non-carcinogenic risks through chemical oxidation combined with natural attenuation will address long-term risk, while land use controls will prevent short-term exposure to COCs in groundwater until risk-based cleanup goals are achieved.

TABLE 4-2

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-2
BUILDING 82 FEASIBILITY STUDY
NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Federal (Continued)				
Guidelines for Carcinogen Risk Assessment	EPA/630/p-03/001F March 2005	To Be Considered	Guidelines for assessing cancer risk	This alternative will meet the risk-based cleanup goals developed through the use of this guidance since treating groundwater that poses potential carcinogenic risks through chemical oxidation combined with natural attenuation will address long-term risk, while land use controls will prevent short-term exposure to COCs in groundwater until risk-based cleanup goals are achieved.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA.630/r-03/003F March 2005	To Be Considered	Guidance for assessing cancer risks in children	This alternative will meet the risk-based cleanup goals developed through the use of this guidance since treating groundwater that poses potential carcinogenic risks to children through chemical oxidation combined with natural attenuation will address long-term risk, while land use controls will prevent short-term exposure to COCs in groundwater until risk-based cleanup goals are achieved.

TABLE 4-2

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-2
BUILDING 82 FEASIBILITY STUDY
NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Federal (Continued)				
Safe Drinking Water Act; National Primary Drinking Water Regulations, Maximum Contaminant Levels	42 USC § 300f *et seq.;* 40 CFR 141, Subpart B	Relevant and Appropriate	Establishes maximum contaminant levels (MCLs) for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	This alternative will achieve MCL standards through treatment of groundwater by chemical oxidation combined with natural attenuation. Land use controls will prevent short-term exposure until MCL standards are reached.
Safe Drinking Water Act; National Primary Drinking Water Regulations, Maximum Contaminant Level Goals	42 USC § 300f *et seq.;* 40 CF. 141, Subpart F	Relevant and Appropriate for non-zero MCLGs only	Establishes maximum contaminant level goals (MCLGs) for public water supplies. Non-zero MCLGs are health goals for public drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds. MCLGs are set at levels that would result in no known or expected adverse health effects with an adequate margin of safety. Non-zero MCLGs are to be used as cleanup goals when MCLs have not been established for a particular COC.	This alternative will achieve MCLG standards through treatment of groundwater by chemical oxidation combined with natural attenuation. Land use controls will prevent short-term exposure until MCLG standards are reached.

RTC SC#33, #34

TABLE 4-2

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-2
BUILDING 82 FEASIBILITY STUDY
NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Health Advisories	EPA Office of Drinking Water, EPA-822-R-04-003, January, 2004	TBC	Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider non-carcinogenic effects only. To be considered for contaminants which do not have chemical-specific ARARs where groundwater may be used for drinking water. The non-enforceable federal guideline Health Advisory for manganese is 0.3 mg/l.	This alternative will achieve these guidelines since non-carcinogenic risk resulting from exposure to compounds identified in the Health Advisory (e.g., manganese) will be addressed by natural attenuation. Land use controls will prevent short-term exposure until protective levels are reached. Would not be considered where background concentration is greater than HA value.
State				
Massachusetts Drinking Water Regulations	310 CMR 22.00	Relevant and Appropriate	Establish enforceable state MCLs for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water systems. Will be used where state standard is more stringent than federal standard. Also establishes state MCLGs which are non-enforceable health goals for public drinking water systems.	This alternative will achieve state MCL and MCLG standards through treatment of groundwater by chemical oxidation combined with natural attenuation. Land use controls will prevent short-term exposure until state MCL and MCLG standards are reached.
Massachusetts Surface Water Quality Standards	314 CMR 4.00	To Be Considered	Establishes enforceable water quality standards for surface water.	Surface water monitoring will be performed for this alternative to ensure protection to surface water.

RTC SC#35

TABLE 4-4

FEDERAL AND STATE ACTION-SPECIFIC ARARs – ALTERNATIVE G-2
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Federal				
Resource Conservation and Recovery Act (RCRA)	42 USC § 6901 *et seq*.	Applicable	Federal standards used to identify, manage, and dispose of hazardous waste. Massachusetts has been delegated the authority to administer the RCRA standards through its state hazardous waste management regulations.	Specific state hazardous waste standards authorized under the Act would apply when determining whether or not a solid waste is hazardous, either by being listed or by exhibiting a hazardous characteristic, such as contaminated purge water from groundwater sampling or contaminated material generated from well installation or maintenance. Existing data do not indicate that any wastes will be hazardous.
Underground Injection Control	40 CFR 144, 146, 147.1100	Relevant and Appropriate	These regulations address the discharge of wastes, chemicals or other substances into the subsurface. The federal UIC program designates injection wells incidental to aquifer remediation and experimental technologies as Class V wells authorized by rule that do not require a separate UIC permit. State requirements apply in this case; see 310 CMR 27.00 below.	These standards regulate the injection of chemical substances into the groundwater. In-situ treatment using chemical oxidation will be conducted in compliance with these standards.
Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites	OSWER Directive 9200.4-17P (April 21, 1999)	To Be Considered	EPA guidance regarding the use of monitored natural attenuation for the cleanup of contaminated soil and groundwater. In particular, a reasonable time frame for achieving cleanup standard through monitored attenuation would be comparable to that which could	This monitored natural attenuation component will only meet these standards if natural attenuation will attain all groundwater cleanup standards within a reasonable time frame, estimated to be 20 to 25 years.

RTC SC#35

FEDERAL AND STATE ACTION-SPECIFIC ARARs – ALTERNATIVE G-2
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
			be achieved through active restoration.	
State				
Hazardous Waste Rules for Identification and Listing of Hazardous Wastes	310 CMR 30.100	Applicable	Establish requirements for determining whether wastes are hazardous. Defines listed and characteristic hazardous wastes.	These regulations would apply when determining whether or not a solid waste that is generated as part of this remedial action is classified as hazardous, either by being listed or by exhibiting a hazardous characteristic, such as contaminated purge water from groundwater sampling or contaminated material generated from well installation or maintenance. Existing data do not indicate that any wastes will be hazardous.
Management Procedures for Remedial Wastewater and Remedial Additives	310 CMR 40.0040	Applicable	Establishes requirements and procedures for the management of remedial wastewater and/or remedial additives, and for the construction, installation, modification, operation and maintenance of treatment works for the management of remedial wastewater and/or remedial additives.	These regulations would apply to remedial actions involve underground injection, such as an oxidizer for in-situ chemical oxidation. To ensure that the remedial action complies with the substantive requirements of these regulations, the proposed quantities to be injected will be included in the design and submitted to EPA and MassDEP for comment and concurrence and the groundwater monitoring program will assess the impact of the injected compounds.

RTC SC#35

FEDERAL AND STATE ACTION-SPECIFIC ARARs – ALTERNATIVE G-2
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
State (Continued)				
Hazardous Waste Management Rules – Requirements for Generators	310 CMR 30.300	Applicable	These regulations contain requirements for generators of hazardous waste. The regulations apply to generators of sampling waste and to the accumulation of waste prior to off-site disposal.	Wastes generated during remedial actions that are determined to be hazardous will be handled in compliance with the substantive requirements of these regulations.
Underground Injection Control Program	310 CMR 27.00	Applicable	The federal Underground Injection Control program under the Safe Drinking Water Act has been delegated to the Commonwealth of Massachusetts. Establishes a State Underground Injection Control Program consistent with federal requirements to protect underground sources of drinking water.	The regulations apply to remedial actions involving underground injection, including use of an oxidizer for in-situ chemical oxidation. To ensure that the remedial action complies with the substantive requirements of these regulations, the proposed quantities to be injected will be included in the design and submitted to EPA and MassDEP for comment and concurrence and the groundwater monitoring program will assess the impact of the injected compounds.
Certification of Well Drillers and Filing of Well Completion Reports	313 CMR 3.03 (predecessor regulations); 310 CMR 46	Applicable	Requirements relating to well abandonment	Well drillers will follow all regulatory requirements for drilling and decommissioning of wells.
Standard References for Monitoring Wells	WSC-310-91 MADEP April 1991	To Be Considered	This guidance describes the technical requirements for locating, drilling, installing, sampling and decommissioning monitoring wells.	Applies to wells installed for monitoring and/or groundwater treatment.

RTC SC#35

FEDERAL AND STATE ACTION-SPECIFIC ARARs – ALTERNATIVE G-2
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
State (Continued)				
Erosion and Sediment Control Guidance	-	To Be Considered	This guidance includes standards for preventing erosion and sedimentation.	Remedial actions, particularly installation and maintenance of wells and other components of the remedy, will be managed to control erosion and sedimentation.

RTC SC#37, #39

TABLE 4-8

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-3
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Federal				
Cancer Slope Factors (CSFs)	US EPA, Integrated Risk Information System	To Be Considered	Guidance used to compute individual incremental cancer risk resulting from exposure to carcinogenic contaminants in site media	This alternative will meet the risk-based cleanup goals developed through the use of this guidance since treating groundwater that poses potential carcinogenic risks through bioremediation combined with natural attenuation will address long-term risk, while land use control will prevent short-term exposure until risk-based cleanup goals are achieved.
Reference Doses (RfDs)	US EPA, Integrated Risk Information System	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media	This alternative will meet the risk-based cleanup goals developed through the use of this guidance since treating groundwater that poses potential non-carcinogenic risks through bioremediation combined with natural attenuation will address long-term risk, while land use controls will prevent short-term exposure until risk-based cleanup goals are achieved.

TABLE 4-8

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-3
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Guidelines for Carcinogen Risk Assessment	EPA/630/p-03/001F March 2005	To Be Considered	Guidelines for assessing cancer risk	This alternative will meet the risk-based cleanup goals developed through the use of this guidance since treating groundwater that poses potential carcinogenic risks through bioremediation combined with natural attenuation will address long-term risk, while land use controls will prevent short-term exposure until risk-based cleanup goals are achieved.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA.630/r-03/003F March 2005	To Be Considered	Guidance for assessing cancer risks in children	This alternative will meet the risk-based cleanup goals developed through the use of this guidance since treating groundwater that poses potential carcinogenic risks to children through bioremediation combined with natural attenuation will address long-term risk, while land use controls will prevent short-term exposure until risk-based cleanup goals are achieved.
Safe Drinking Water Act; National Primary Drinking Water Regulations, Maximum Contaminant Levels	42 USC § 300f *et seq.;* 40 CFR 141, Subpart B	Relevant and Appropriate	Establishes maximum contaminant levels (MCLs) for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	This alternative will achieve MCL standards through treatment of groundwater by bioremediation combined with natural attenuation. Land use controls will prevent short-term exposure until MCL standards are reached.

TABLE 4-8

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-3
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Health Advisories	EPA Office of Drinking Water, EPA-822-R-04-003, January, 2004	TBC	Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider non-carcinogenic effects only. To be considered for contaminants which do not have chemical-specific ARARs where groundwater may be used for drinking water. The non-enforceable federal guideline Health Advisory for manganese is 0.3 mg/l.	This alternative will achieve these guidelines since non-carcinogenic risk resulting from exposure to compounds identified in the Health Advisory (e.g., manganese) will be addressed by natural attenuation. Land use controls will prevent short-term exposure until protective levels are reached. Would not be considered where background concentration is greater than HA value.
Safe Drinking Water Act; National Primary Drinking Water Regulations, Maximum Contaminant Level Goals	42 USC § 300f *et seq.;* 40 CFR 141, Subpart F	Relevant and Appropriate for non-zero MCLGs only;	Establishes maximum contaminant level goals (MCLGs) for public water supplies. Non-zero MCLGs are health goals for public drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds. MCLGs are set at levels that would result in no known or expected adverse health effects with an adequate margin of safety. Non-zero MCLGs are to be used as cleanup goals when MCLs have not been established for a particular COC.	This alternative will achieve MCLG standards through treatment of groundwater by bioremediation combined with natural attenuation. Land use controls will prevent short-term exposure until MCLG standards are reached.

RTC SC#37, #39

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-3
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
State				
Massachusetts Drinking Water Regulations	310 CMR 22.00	Relevant and Appropriate	Establish enforceable state MCLs for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water systems. Will be used where state standard is more stringent than federal standard. Also establishes state MCLGs which are non-enforceable health goals for public drinking water systems.	This alternative will achieve state MCL and MCLG standards, which are more stringent than federal standards through treatment of groundwater by bioremediation combined with natural attenuation. Land use controls will prevent short-term exposure until state MCL and MCLG standards are reached.
Massachusetts Surface Water Quality Standards	314 CMR 4.00	To Be Considered	Establishes enforceable water quality standards for surface water.	Surface water monitoring will be performed for this alternative to ensure protection to surface water.

RTC SC#38

TABLE 4-5

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-2A
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Federal				
Cancer Slope Factors (CSFs)	US EPA, Integrated Risk Information System	To Be Considered	Guidance used to compute individual incremental cancer risk resulting from exposure to carcinogenic contaminants in site media	This alternative will meet the risk-based cleanup goals developed through the use of this guidance since treating groundwater that poses potential carcinogenic risks through chemical oxidation will address long-term risk, while land use controls will prevent short-term exposure to COCs in groundwater until risk-based cleanup goals are achieved.
Reference Doses (RfDs)	US EPA, Integrated Risk Information System	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media	This alternative will meet the risk-based cleanup goals developed through the use of this guidance since treating groundwater that poses potential non-carcinogenic risks through chemical oxidation will address long-term risk, while land use controls will prevent short-term exposure to COCs in groundwater until risk-based cleanup goals are achieved.

RTC SC#38

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-2A
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Federal (Continued)				
Guidelines for Carcinogen Risk Assessment	EPA/630/p-03/001F March 2005	To Be Considered	Guidelines for assessing cancer risk	This alternative will meet the risk-based cleanup goals developed through the use of this guidance since treating groundwater that poses potential carcinogenic risks through chemical oxidation will address long-term risk, while land use controls will prevent short-term exposure to COCs in groundwater until risk-based cleanup goals are achieved.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA.630/r-03/003F March 2005	To Be Considered	Guidance for assessing cancer risks in children	This alternative will meet the risk-based cleanup goals developed through the use of this guidance since treating groundwater that poses potential carcinogenic risks to children through chemical oxidation will address long-term risk, while land use controls will prevent short-term exposure to COCs in groundwater until risk-based cleanup goals are achieved.

RTC SC#38

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-2A
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Federal (Continued)				
Safe Drinking Water Act; National Primary Drinking Water Regulations, Maximum Contaminant Levels	42 USC § 300f *et seq.;* 40 CFR 141, Subpart B	Relevant and Appropriate	Establishes maximum contaminant levels (MCLs) for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	This alternative will achieve MCL standards through treatment of groundwater by chemical oxidation. Land use controls will prevent short-term exposure until MCL standards are reached.
Safe Drinking Water Act; National Primary Drinking Water Regulations, Maximum Contaminant Level Goals	42 USC § 300f *et seq.;* 40 CFR 141, Subpart F	Relevant and Appropriate for non-zero MCLGs only	Establishes maximum contaminant level goals (MCLGs) for public water supplies. Non-zero MCLGs are health goals for public drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds. MCLGs are set at levels that would result in no known or expected adverse health effects with an adequate margin of safety. Non-zero MCLGs are to be used as cleanup goals when MCLs have not been established for a particular COC.	This alternative will achieve MCLG standards through treatment of groundwater by chemical oxidation. Land use controls will prevent short-term exposure until MCLG standards are reached.

TABLE 4-5

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-2A
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Health Advisories	EPA Office of Drinking Water, EPA-822-R-04-003, January, 2004	TBC	Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider non-carcinogenic effects only. To be considered for contaminants which do not have chemical-specific ARARs where groundwater may be used for drinking water. The non-enforceable federal guideline Health Advisory for manganese is 0.3 mg/l.	This alternative will achieve these guidelines since non-carcinogenic risk resulting from exposure to compounds identified in the Health Advisory (e.g., manganese) will be addressed by natural attenuation. Land use controls will prevent short-term exposure until protective levels are reached. Would not be considered where background concentration is greater than HA value.
State				
Massachusetts Drinking Water Regulations	310 CMR 22.00	Relevant and Appropriate	Establish enforceable state MCLs for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water systems. Will be used where state standard is more stringent than federal standard. Also establishes state MCLGs which are non-enforceable health goals for public drinking water systems.	This alternative will achieve state MCL and MCLG standards through treatment of groundwater by chemical oxidation. Land use controls will prevent short-term exposure until state MCL and MCLG standards are reached.
Massachusetts Surface Water Quality Standards	314 CMR 4.00	To Be Considered	Establishes enforceable water quality standards for surface water.	Surface water monitoring will be performed for this alternative to ensure protection to surface water.

RTC SC#40

TABLE 4-10

FEDERAL AND STATE ACTION-SPECIFIC ARARs – ALTERNATIVE G-3
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Federal				
Resource Conservation and Recovery Act (RCRA)	42 USC § 6901 *et seq*.	Applicable	Federal standards used to identify, manage, and dispose of hazardous waste. Massachusetts has been delegated the authority to administer the RCRA standards through its state hazardous waste management regulations.	Specific state hazardous waste standards authorized under the Act would apply when determining whether or not a solid waste is hazardous, either by being listed or by exhibiting a hazardous characteristic, such as contaminated purge water from groundwater sampling or contaminated material generated from well installation or maintenance. Existing data do not indicate that any wastes will be hazardous.
Underground Injection Control	40 CFR 144, 146, 147.1100	Relevant and Appropriate	These regulations address the discharge of wastes, chemicals or other substances into the subsurface. The federal UIC program designates injection wells incidental to aquifer remediation and experimental technologies as Class V wells authorized by rule that do not require a separate UIC permit. State requirements apply in this case; see 310 CMR 27.00 below.	These standards regulate the injection of biological or chemical substances into the groundwater. In-situ treatment using bioremediation and chemical oxidation will be conducted in compliance with these standards.

TABLE 4-10

FEDERAL AND STATE ACTION-SPECIFIC ARARs – ALTERNATIVE G-3
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Federal (Continued)				
Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites	OSWER Directive 9200.4-17P (April 21, 1999)	To Be Considered	EPA guidance regarding the use of monitored natural attenuation for the cleanup of contaminated soil and groundwater. In particular, a reasonable time frame for achieving cleanup standard through monitored attenuation would be comparable to that which could be achieved through active restoration.	This monitored natural attenuation alternative will only meet these standards if natural attenuation will attain all groundwater cleanup standards within a reasonable time frame, estimated to be 20 to 25 years.
State				
Hazardous Waste Rules for Identification and Listing of Hazardous Wastes	310 CMR 30.100	Applicable	Establish requirements for determining whether wastes are hazardous. Defines listed and characteristic hazardous wastes.	These regulations would apply when determining whether or not a solid waste generated as part of this remedial action is classified as hazardous, either by being listed or by exhibiting a hazardous characteristic, such as contaminated purge water from groundwater sampling or contaminated material generated from well installation or maintenance. Existing data do not indicate that any wastes will be hazardous.

RTC SC#40

TABLE 4-10

FEDERAL AND STATE ACTION-SPECIFIC ARARs – ALTERNATIVE G-3
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
State (Continued)				
Management Procedures for Remedial Wastewater and Remedial Additives	310 CMR 40.0040	Applicable	Establishes requirements and procedures for the management of remedial wastewater and/or remedial additives, and for the construction, installation, modification, operation and maintenance of treatment works for the management of remedial wastewater and/or remedial additives.	These regulations would apply to remedial actions involve underground injection, such as an electron donor for bioremediation. To ensure that the remedial action complies with the substantive requirements of these regulations, the proposed quantities to be injected will be included in the design and submitted to EPA and MassDEP for comment and concurrence and the groundwater monitoring program will assess the impact of the injected compounds.
Hazardous Waste Management Rules – Requirements for Generators	310 CMR30.300	Applicable	These regulations contain requirements for generators of hazardous waste. The regulations apply to generators of sampling waste and also apply to the accumulation of waste prior to off-site disposal.	Hazardous wastes generated as part of the remedial action will be handled in compliance with the requirements of these regulations.

RTC SC#40

TABLE 4-10

FEDERAL AND STATE ACTION-SPECIFIC ARARs – ALTERNATIVE G-3
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
State (Continued)				
Underground Injection Control Program	310 CMR 27.00	Applicable	The federal Underground Injection Control program under the Safe Drinking Water Act has been delegated to the Commonwealth of Massachusetts. Establishes a State Underground Injection Control Program consistent with federal requirements to protect underground sources of drinking water.	The regulations apply to remedial actions involving underground injection, including use of bioremediation agents and oxidizers for in-situ chemical oxidation. To ensure that the remedial action complies with the substantive requirements of these regulations, the proposed quantities to be injected will be included in the design and submitted to EPA and MassDEP for comment and concurrence and the groundwater monitoring program will assess the impact of the injected compounds.
Certification of Well Drillers and Filing of Well Completion Reports	313 CMR 3.03 (predecessor regulations); 310 CMR 46	Applicable	Requirements relating to well abandonment	Well drillers will follow all regulatory requirements for drilling and decommissioning of wells.
Standard References for Monitoring Wells	WSC-310-91 MADEP April 1991	To Be Considered	This guidance describes the technical requirements for locating, drilling, installing, sampling and decommissioning monitoring wells.	Applies to wells installed for monitoring and/or groundwater treatment.
Erosion and Sediment Control Guidance	-	To Be Considered	This guidance includes standards for preventing erosion and sedimentation.	Remedial actions, particularly installation and maintenance of wells and other components of the remedy, will be managed to control erosion and sedimentation.

RTC SC#40

TABLE 4-13

FEDERAL AND STATE ACTION-SPECIFIC ARARs – ALTERNATIVE G-4
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Federal				
Resource Conservation and Recovery Act (RCRA)	42 USC § 6901 *et seq*.	Applicable	Federal standards used to identify, manage, and dispose of hazardous waste. Massachusetts has been delegated the authority to administer the RCRA standards through its state hazardous waste management regulations	Specific state hazardous waste standards authorized under the Act would apply when determining whether or not a solid waste is hazardous, either by being listed or by exhibiting a hazardous characteristic, such as contaminated purge water from groundwater sampling or contaminated material generated from well installation or maintenance. Existing data do not indicate that any wastes will be hazardous.
Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites	OSWER Directive 9200.4-17P (April 21, 1999)	To Be Considered	EPA guidance regarding the use of monitored natural attenuation for the cleanup of contaminated soil and groundwater. In particular, a reasonable time frame for achieving cleanup standard through monitored attenuation would be comparable to that which could be achieved through active restoration.	This monitored natural attenuation alternative will only meet these standards if natural attenuation will attain all groundwater cleanup standards within a reasonable time frame. It is estimated that all cleanup standards will be achieved in 40-60 years.

RTC SC#40

TABLE 4-13

FEDERAL AND STATE ACTION-SPECIFIC ARARs – ALTERNATIVE G-4
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
State				
Hazardous Waste Rules for Identification and Listing of Hazardous Wastes	310 CMR 30.100	Applicable	Establish requirements for determining whether wastes are hazardous. Defines listed and characteristic hazardous wastes.	These regulations would apply when determining whether or not a solid waste generated as part of this remedial action is classified as hazardous, either by being listed or by exhibiting a hazardous characteristic, such as contaminated purge water from groundwater sampling or contaminated material generated from well installation or maintenance. Existing data do not indicate that any wastes will be hazardous.
Hazardous Waste Management Rules – Requirements for Generators	310 CMR30.300	Applicable	These regulations contain requirements for generators of hazardous waste. The regulations apply to generators of sampling waste and to the accumulation of waste prior to off-site disposal.	Wastes generated during remedial actions that are determined to be hazardous will be handled in compliance with the substantive requirements of these regulations.
Certification of Well Drillers and Filing of Well Completion Reports	313 CMR 3.03 (predecessor regulations); 310 CMR 46	Applicable	Requirements relating to well abandonment	Well drillers will follow all regulatory requirements for drilling and decommissioning of wells.
Standard References for Monitoring Wells	WSC-310-91 MADEP April 1991	To Be Considered	This guidance describes the technical requirements for locating, drilling, installing, sampling and decommissioning monitoring wells.	Applies to wells installed for monitoring and/or groundwater treatment.

TABLE 4-13

FEDERAL AND STATE ACTION-SPECIFIC ARARs – ALTERNATIVE G-4
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
State (Continued)				
Erosion and Sediment Control Guidance	-	To Be Considered	This guidance includes standards for preventing erosion and sedimentation.	Remedial actions, particularly installation and maintenance of wells and other components of the remedy, will be managed to control erosion and sedimentation.

RTC SC#42

TABLE 4-11

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-4
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Federal				
Cancer Slope Factors (CSFs)	US EPA, Integrated Risk Information System	To Be Considered	Guidance used to compute individual incremental cancer risk resulting from exposure to carcinogenic contaminants in site media	This alternative will only meet the standard developed through the use of this guidance if the COCs in groundwater that pose potential carcinogenic risks naturally attenuate within a reasonable period of time. Land use controls will prevent short-term exposure to COCs in groundwater until risk-based standards are achieved.
Reference Doses (RfDs)	US EPA, Integrated Risk Information System	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media	This alternative will only meet the standard developed through the use of this guidance if the COCs in groundwater that pose potential carcinogenic risks naturally attenuate within a reasonable period of time. Land use controls will prevent short-term exposure to COCs in groundwater until risk-based standards are achieved.
Guidelines for Carcinogen Risk Assessment	EPA/630/p-03/001F March 2005	To Be Considered	Guidelines for assessing cancer risk	This alternative will only meet the standard developed through the use of this guidance if the COCs in groundwater that pose potential carcinogenic risks naturally attenuate within a reasonable period of time. Land use controls will prevent short-term exposure to COCs in groundwater until risk-based standards are achieved.

TABLE 4-11

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-4
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Health Advisories	EPA Office of Drinking Water, EPA-822-R-04-003, January, 2004	TBC	Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider non-carcinogenic effects only. To be considered for contaminants which do not have chemical-specific ARARs where groundwater may be used for drinking water. The non-enforceable federal guideline Health Advisory for manganese is 0.3 mg/l.	This alternative will achieve these guidelines since non-carcinogenic risk resulting from exposure to compounds identified in the Health Advisory (e.g., manganese) will be addressed by natural attenuation. Land use controls will prevent short-term exposure until protective levels are reached. Would not be considered where background concentration is greater than HA value.
Federal (Continued)				
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA.630/r-03/003F March 2005	To Be Considered	Guidance for assessing cancer risks in children	This alternative will only meet this standard if groundwater that poses potential carcinogenic risks to children will naturally attenuate within a reasonable period of time. Land use controls will prevent short-term exposure until risk-based standards are achieved.

RTC SC#42

TABLE 4-11

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-4
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Safe Drinking Water Act; National Primary Drinking Water Regulations, Maximum Contaminant Levels	42 USC § 300f *et seq.;* 40 CFR 141, Subpart B	Relevant and Appropriate	Establishes maximum contaminant levels (MCLs) for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources	This alternative will only meet this standard if groundwater naturally attenuates and meets MCL standards within a reasonable time frame. Land use controls will prevent short-term exposure until MCL standards are reached.
Federal (Continued)				
Safe Drinking Water Act; National Primary Drinking Water Regulations, Maximum Contaminant Level Goals	42 USC § 300f *et seq.;* 40 CFR 141, Subpart F	Relevant and Appropriate for non-zero MCLGs only.	Establishes maximum contaminant level goals (MCLGs) for public water supplies. Non-zero MCLGs are health goals for public drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds. MCLGs are set at levels that would result in no known or expected adverse health effects with an adequate margin of safety. Non-zero MCLGs are to be used as cleanup goals when MCLs have not been established for a particular COC.	This alternative will only meet this standard if groundwater naturally attenuates and meets MCLG standards within a reasonable time frame. Land use controls will prevent short-term exposure until MCLG standards are reached.

RTC SC#42

TABLE 4-11

FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs – ALTERNATIVE G-4
BUILDING 82 FEASIBILITY STUDY
FORMER NAVAL AIR STATION SOUTH WEYMOUTH
WEYMOUTH, MASSACHUSETTS

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
State				
Massachusetts Drinking Water Regulations	310 CMR 22.00	Relevant and Appropriate	Establish enforceable state MCLs for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water systems. Will be used where state standard is more stringent than federal standard. Also establishes state MCLGs which are non-enforceable health goals for public drinking water systems.	This alternative will only meet this standard if groundwater naturally attenuates and meets state MCL and MCLG standards within a reasonable time frame. Land use controls will prevent short-term exposure until state MCL and MCLG standards are reached.
Massachusetts Surface Water Quality Standards	314 CMR 4.00	To Be Considered	Establishes enforceable water quality standards for surface water.	Surface water monitoring will be performed for this alternative to ensure protection to surface water.

**NAVY RESPONSES TO MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION (MASSDEP) COMMENTS DATED APRIL 20, 2012
REVISED DRAFT FINAL FEASIBILITY STUDY – BUILDING 82
FORMER NAVAL AIR STATION (NAS) SOUTH WEYMOUTH, MASSACHUSETTS**

The Navy's responses to the MassDEP comments on the Building 82 Revised Draft Final Feasibility Study (dated March 2012) are presented below. The MassDEP's comments are presented first (in italics) followed by Navy's responses.

Comment 1, Sections 2.4.4 and 2.6.1: *The PRG for 1,1-DCA should be corrected to 70 ug/L (refer to Table 2.5).*

Response: The PRG reference in Section 2.4.4 will be corrected to 70 µg/L. Section 2.6.1, 1st paragraph, 2nd sentence will be revised as follows: "1,1-DCA was detected in shallow groundwater at a maximum concentration (99 µg/L) slightly exceeding the PRG of 70 µg/L at one location, GP-A01."

The first two sentences which discuss 1,1-DCA in Section 2.6.1, 2nd bullet will be revised as follows:

"A plume (defined by an isoconcentration line of 50 µg/L 1,1-DCA) surrounding GP-A01 was assumed to have an area of 300 ft^2 and a thickness of 10 feet. The maximum concentration of 1,1 DCA of 99 µg/L is slightly greater than the PRG of 70 µg/L, so a contour of approximately 50 µg/L was selected for the purposes of estimating areas for treatment."

In addition, the narrative for the calculation in Appendix C will be similarly revised:

"The 1,1-DCA plume was identified in the shallow interval as shown on Figure 2-1. The PRG is 70 µg/L, and a 50 µg/L contour was estimated. The geometric mean of the maximum (99 µg/L) and 50 µg/L was used as the mean concentration of the plume. The sorbed 1,1-DCA mass was calculated by using partition coefficients from literature, and the value for fractional organic carbon."

Comment 2, Section 4.2.2.1, Component 2: LUCs:

- *Rather than requiring USEPA and MassDEP to approve construction dewatering plans, the interim LUCs should require construction project proponents to obtain USEPA and MassDEP approval of construction dewatering plans.*

- *Annual LUC inspections should be conducted for as long as the interim LUCs are required to prevent unacceptable exposure.*

- *The description of the interim LUCs should indicate that the Navy, subject to USEPA approval and MassDEP comment, would be responsible for terminating the interim LUCs after sufficient cleanup has been completed to allow the prohibited uses.*

Response: Please note that the comment suggests changes to wording developed cooperatively between Navy, EPA, MassDEP, SSTTDC and LNR. All parties concurred on the precise wording of the LUCs in late 2011 prior to the closing.

Bullet 1: The description of the interim LUC will be revised as follows: "(2) require that USEPA and MassDEP approval of construction dewatering plans be obtained prior to conducting …"

Bullet 2: Agreed. This is stated in the 1st sentence of the 2nd paragraph.

Bullet 3: Agreed. This will be clearly stated in the LUC Remedial Design.

__Comment 3. Figures 1-1, 2-1, 2-2, 2-3, 4-1, 4-2, and 4-3:__ *The site boundary should be revised to enclose the full extent of the TCE plume because the Building 82 site was expanded to include the TCE plume (refer to page 1-14).*

__Response:__ The legend on all seven figures will be changed from “Site Boundary” to “Building 82 Operations Area.” The shape on these figures represents the historical area of aircraft hangar operations. The defined extent of contamination based on the RI and RI Addendum and shown on Figure 2-4 is the basis for the conceptual layout of groundwater remedial alternatives described and evaluated in Section 4.0 of the FS.

__Comment 4, Figure 1-4:__ *While not essential to the completion of the feasibility study, a geologic cross section depicting conditions along the approximate axis of the TCE plume should be prepared to support the remedial design.*

__Response:__ Comment noted. Previous EPA comments on both the FS and the RI Addendum included a similar suggestion. The Navy reiterates the response to the referenced EPA comments that additional monitoring wells are expected to be installed as part of any remedy for Building 82, and a cross-section of those wells is recommended at that time. Few stratigraphic details are available from the groundwater profiling points from which groundwater samples were collected to delineate the TCE plume as part of the RI Addendum.