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LETTER AND U S EPA REGION 1 COMMENTS TO DRAFT DATA GAPS ASSESSMENT REPORT SITE 12 TANK FARM 4 AND SITE 13 TANK FARM 5 NS NEWPORT RI
2/24/2011
U S EPA REGION 1

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, REGION I**
5 Post Office Square, Suite 100
Boston, MA 02109-3912

February 24, 2011

Mr. Roberto Pagtalunan
NAVFAC MIDLANT (Code OPNEEV)
Environmental Restoration
Building Z-144, Room 109
9742 Maryland Avenue
Norfolk, VA 23511-3095

Re: Draft Data Gaps Assessment Report for Installation Restoration for Site 12 (Tank Farm 4) and 13 (Tank Farm 5) Category 1 Areas

Dear Mr. Pagtalunan:

Thank you for the opportunity to review the Draft *Data Gaps Assessment Report for Installation Restoration Site 12 (Tank Farm 4) and 13 (Tank Farm 5) Category 1 Areas* at the Naval Education & Training Center Superfund Site dated January 2011. The document presents the results of the field investigations conducted to collect additional site data, a discussion of the nature and extent of contamination identified, completion of human health and ecological risk assessments, and a summary and conclusions for the investigation. Detailed comments are provided in Attachment A.

Please add an acronym table in the table of contents.

There are a number of grammatical errors that should be corrected (especially in Section 1).

Please refer to the responses to EPA general comments 1 and 2 for the draft final SAP where the Navy stated that it would present the Supplemental Site Investigation data combined with the Data Gap Investigation data in the data gap report and that it would further evaluate the use of previous data for the risk assessment as part of the data gap reporting effort. Note also that the Technical Memorandum for Risk Assessment also identified many samples from the Supplemental Site Investigation that are suitable for inclusion in the risk assessment; however, the Data Gaps Assessment Report has not included any of these Supplemental Site Investigation data either in the report or in the risk assessment. No explanation for this oversight has been provided. Based on the conclusions in the Supplemental Site Investigation Closeout Report (see Section 7.0 of that report) and Navy's prior commitment noted above, this oversight needs to be corrected. If the Supplemental Site Investigation data is not included in the Data Gaps Assessment Report, at a minimum that data will have to be evaluated to determine if it has any impact on the risk assessment conclusions presented in the Data Gaps Assessment Report.

The HHRA approach, receptors, and exposure parameters are appropriate and agree with what was proposed in the Tech Memo for Risk Assessment (January 2008). Screening criteria and toxicity values are acceptable. Similarly, the ERA is basically sound. The approach, screening criteria, receptors, exposure parameters, TRVs, etc. are sound. With the exception of the adequacy of the

data used in the risk assessments, as noted in the previous comment, and a few relatively minor specific comments, the conclusion of both the HHRA and ERA are supported.

I look forward to working with you and the Rhode Island Department of Environmental Management toward the cleanup of the Tank Farms. Please do not hesitate to contact me at (617) 918-1385 should you have any questions.

Sincerely,

Kymberlee Keckler, Remedial Project Manager
Federal Facilities Superfund Section

Attachment

cc: Gary Jablonski, RIDEM, Providence, RI
Deb Moore/Darlene Ward, NETC, Newport, RI
Chau Vu, USEPA, Boston, MA
Todd Finlayson, Gannet Fleming, Honolulu, HI
Steven Parker, Tetra Tech-NUS, Wilmington, MA

## ATTACHMENT A

| Page | Comment |
|---|---|
| p. 1-2, §1.2 | The description of the Category 3 Decision Unit (DU) as a non-CERCLA DU although this DU contains CERCLA contaminants released at an NPL site does not make sense. Any area where CERCLA contaminants have been released must be evaluated under CERCLA. Not being able to document the release is not relevant if chemical concentrations exceed background and risk concentrations. |
| p. 1-3, §1.3.2 | a) Please edit the third sentence to clarify the limitations of the removal action performed by inserting *much of the* before *soil.*<br><br>b) Please add the following to the end of the last sentence: "… because the Navy stopped funding the removal action before the nature and extent of contamination had been determined." |
| p. 1-3, §1.3.3 | In the last sentence, please insert *contaminated* before *soil.* |
| p. 1-5, §1.4.3 | a) The work described in this section apparently refers to the Supplemental Site Investigation and associated removal actions. Please note that this fieldwork was conducted from late 2004 to mid-2006. The reference to 2003 and 2004 is not correct for the work described.<br><br>b) The third sentence states that the affected soil and sediment was removed from the site. This is not completely correct because, due to a lack of funding, contaminated soil and sediment was left in place at both tank farms. Please reword this sentence to eliminate the incorrect implication.<br><br>c) Please expand the discussion to better describe the scope of the work performed for the Supplemental Site Investigation and associated removal actions. |
| p. 2-1, §2.0 | Please supplement this section with a discussion/compilation of all deviations from the SAP requirements. |
| p. 2-8, §2.3 | In the second sentence, nine surface water samples are referred to however ten sample locations are included within the parentheses. Please correct. |
| p. 3-1, §3.1.1 | In the second sentence of the second paragraph, please correct the flow direction from *northeasterly* to *northwesterly*. |
| p. 4-7, §4.1.1.3 | Please revise the last sentence to read: "This location is over 300 feet south of Ruin 1 in a location that could potentially be impacted by discharges from Ruin 1 based on the site topography." |
| p. 4-8, §4.1.1.5 | Correct typo in table to "Selenium." |

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| p. 4-11, §4.1.1.8 | In the last sentence please change *west* to *east*. |
| p. 4-12, §4.1.1.9 | Please revise the last sentence to read: "Although this sample station is located in the wetland adjacent to the west side of Normans Brook, the topography suggests that it could have been impacted from discharges from either Ruin 1 or Ruin 2 during very wet or flooding conditions." |
| p. 4-13, §4.1.1.11 | Correct typo in table to "Selenium." |
| p. 4-19, §4.1.3.5 | Please correct the industrial RSL for manganese in the table. It should be 23,000 not 2,300. |
| p. 4-37, §4.2.3.5 | a) In the table, please correct the frequency of detection for silver, it should be 2/12 not 12/12.<br><br>b) Please correct the last sentence in the first full paragraph to read: "… arsenic and chromium were detected above industrial RSLs in all 12 samples collected." |
| p. 4-40, §4.3, ¶1 | The discussion in the third and fourth sentences misrepresents the contaminant distribution. The elevated PAH concentrations in surface soil are clearly located in the area downgradient of Ruin 1. The other PAH detections referred to in the discussion, which are in areas not expected to have been impacted by Ruin 1, have PAH concentrations approximately an order of magnitude less than the downgradient locations. Please revise. |
| p. 5-1, §5.0 | Please correct the first sentence in the second paragraph to read: "… have already been identified and controlled; however, funding limitations at the time interrupted the removal action before all impacted soil could be removed and potentially-impacted areas investigated. Consequently, some areas with known contamination and areas potentially impacted by the releases still remain." |
| p. 5-3, §5.1.3 | Please correct the reference in the second sentence from 2008 to 2008a. |
| p. 5-6, §5.2.2 | The discussion in the first paragraph is incomplete and therefore the conclusion not accepted by EPA. Burning of tank sludge in the burn chamber would have released chemicals to the atmosphere including dioxins, which would reasonably account for the distribution of dioxins across the site. This is a more realistic conceptual model for the dioxin distribution given the site history, although some contribution from anthropogenic sources cannot be dismissed. Also, when samples from the Supplemental Site Investigation are considered, elevated dioxin concentrations are associated with the burn facility components. The discussion needs to be re-written to address these facts. |

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| p. 6-8, §6.1.3 | In the second last sentence of the first paragraph, please change Table 6-23 to Table 6-19, which is where the COPCs are presented. |
| p. 6-8, §6.1.3.1 | a) The discussion does not consider sample data from the Supplemental Site Investigation. Except for lead detected in surface soil along the fence line, the list of chemicals may include all of those detected in surface soil during the Supplemental Site Investigation. Please confirm.<br><br>b) The list of chemicals exceeding leaching criteria does not include 2,3,7,8-TCDD that exceeded the criterion in Supplemental Site Investigation surface soil sampling. |
| p. 6-30, §6.2.4.6 | It has been EPA's practice to use the Andelman equation in RAGS Part B to quantify inhalation risk from a showering exposure instead of qualitatively assuming that this risk is equivalent to the risk from ingestion of two liters of water. In lieu of final guidance or policy to document this approach, the old Region 1's Risk Update (1999) allows the qualitative approach instead of using the Andelman equation and the Navy cited it here. This could increase the total risks to hypothetical residents (the only receptor with this exposure). As of now, the groundwater risks for resident already exceed 1E-4, so the FS would have to address this medium. Since revisions to the risk assessment would still result in addressing GW in the FS, EPA believes that the report should note that actual risks may differ from what is reported. |
| p. 7-5, §7.2.4 | The text states that the wildlife measurement endpoints were based on NOAELs. For each appropriate endpoint description, it should be noted that risk was determined for both NOAELs and LOAELs. |
| p. 7-6, §7.2.4 | In the discussion about why large carnivorous birds and mammals were not evaluated in this ecological risk assessment, please discuss the quality of habitat surrounding the decision units. If the decision units were more isolated from other areas with good habitat, large animals could spend an unequal proportion of foraging time there in spite of the size of the area. The argument presented is valid but should be supported with a description of the habitat value of the site relative to that of the surrounding areas. |
| p. 7-20, §7.3.4.5.1 | The text states that seven inorganics were initially selected as COPC for the shrew. Only six COPC are identified in Table 7-7. Please correct. |
| p. 7-39, §7.4.3.2.1 | The discussion for DDE, DDT and total DDT uses frequency of detection as a line of evidence for eliminating these pesticides as COC. The frequency of detection is too high and does not support the argument. The sentence should be deleted. Given that the TEC-based EEQs are in the low single digits and concentrations are much lower than the PECs, DDE, DDT and total DDT are not likely to pose risk to sediment dwelling biota. |
| p. 7-47, §7.4.5.2 | The second paragraph states that none of the LOAEL EEQs for the mink or heron at DU 4-1 were greater than 1.0. This is not accurate. The LOAEL |

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| | EEQ were greater than one for several chemicals (*e.g.,* aluminum, nickel, and vanadium for the heron and aluminum, manganese, nickel, and thallium for the mink). Please correct. |
| p. 7-47, §7.4.5.1.2 | To further support the elimination of aluminum as a COPC for wildlife, please state that the form of aluminum generally found in nature is not the same as that used in laboratory toxicity tests on which TRVs were based. This should be included for all receptors for which the aluminum EEQ was greater than 1.0. |
| p. 7-52, §7.6 | At the top of the page, the text states: "The closest samples to the north, east, and south [of sample TF4-SB-934-0001] are about 150 to 200 feet away, so the extent of contamination on those directions cannot be better bounded." Should this state "needs to be better bounded" instead? |
| p. 8-1, §8.1 | Please edit the last sentence to read: "… receptors, so that *the best* path forward …." |
| p. 8-1, §8.2 | Please correct the tank identifier in the last sentence in the first paragraph from Tank 4 to Tank 41. |
| Table 2-2 | a) For well 914, please correct the formatting for the location discussion as some of the text appears to have been hidden.<br><br>b) For wells 912, 913, and 919 please delete the reference to former burn chamber because Ruin 2 was not a former burn chamber. For wells 915 and 916 please include the reference to the former burn chamber as was done for wells 917, 924, and 923 because the oil water separator at Tank Farm 5 was a former burn chamber. |
| Table 2-5 | Please correct the rationale description for station TF5-SW/SD-913 by replacing *OWS* with *A-18 chamber*. Also this may not be a *former* drainage pipe. Please confirm. |
| Table 2-6 | Please edit the table to indicate which well Table Note #1 is applicable. Also, Note 3 was not used. |
| Table 4-1 | In the last column, please change EAP to EPA. Also note that copper and lead have action levels not MCLs. Please make this correction throughout the report. |
| Table 4-1 | Correct typo in title of the last column to "EPA MCL (aqueous)." |
| Table 4-2 | Please add the RSLs for 2,3,7,8-TCD: 4.5 for residential and 18 for industrial. Please make this correction throughout the report. |
| Table 6-1 | This table and subsequent screening tables use 0.39 mg/kg as the RSL for chromium (hexavalent); however, the correct RSL is 0.29 mg/kg. Please correct throughout. |

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| Table 6-5 | For Aroclor 1254, the non-carcinogenic screening value listed in the RSL table is 1.1 mg/kg; therefore 10% of that (HI=0.1) is 110 µg/kg. However, this table lists 11 µg/kg as the screening value. Please explain. |
| Tables 6-8 & 6-16 & Appendix H.2 | The Navy developed their own target groundwater concentrations corresponding to target indoor air concentrations for screening vapor intrusion pathway using EPA's methods and requirements (target cancer risk of 1E-6 and target non-cancer HI=1 as stated in the Appendix and these tables). The screening levels that EPA uses are available in Table 2c of the EPA's 2002 Draft Vapor Intrusion Guidance (attached). The values that the Navy developed differ from EPA's values for many chemicals, in some cases by orders of magnitude. Although EPA believes that this discrepancy should be corrected, it might not significantly affect the site because there are only a few VOCs and SVOCs identified as volatile for this pathway. For these VOCs and SVOCs, either there is no screening level or the Navy's values are more stringent than EPA's values. |
| Table 6-19 | The *Technical Memorandum for Data Summary and Plan for Risk Assessment* states (p. 5-4) that "All aroclors will be accepted as COPCs if at least one aroclor is detected at maximum concentrations exceeding COPC screening levels." However, this table identifies only Aroclors 1248 and 1254 as COPCs. Please clarify. |
| Table 6-22 | The exposure point concentrations may need to be revised when the Supplemental Site Investigation data are considered, as addressed in the General Comments. |
| Table 6-28 | For dioxin, EPA recommends use the oral CSF of 1.56E+5 per mg/kg-day from 1985 EPA Office of Health and Environmental Assessment instead of the CSF of 1.3E+5 per mg/kg-day from California EPA. Please revise the risk calculation accordingly. |
| Table 6-36 | Correct the HIs for construction workers under RME scenario to four for Total All Soil and Groundwater (Site Totals) and three for Total Surface Soil and Groundwater (Site and Background Totals). |
| Table 6-37 | Correct the HI for child residents under RME scenario to 24 for Total Surface Soil and Groundwater (Site and Background Totals). |
| Table 6-39 | This table indicates that no COCs have been retained for surface soil at Tank Farm 5; however, some samples from the Supplemental Site Investigation had carcinogenic PAH, arsenic, and manganese concentrations significantly greater than the exposure point concentrations used to evaluate risk at Tank Farm 5. Please consider the data from the Supplemental Site Investigation and re-evaluate risk and COCs for both tank farms. Provide supporting documentation for the evaluation of the Supplemental Site Investigation data. |
| Figure 2-1 | For this and subsequent DU 4-1 figures, the discharge piping for Ruin 1 does |

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| | not properly align with the Ruin. Please review the locations presented for Ruin1 and the pipelines and correct as appropriate using available GPS data. |
| Figure 3-6 | The 10-foot groundwater contour should apparently be to the west of MW-919 based on the water level measured in that well. Please correct. |
| Figure 4-6 | This figure is supposed to show the Tank Farm 5 surface soil sampling locations; however, it mistakenly depicts the Tank Farm 5 sediment sampling locations. Please correct. |
| Appendix A, Figure 6 | Please confirm that the information presented in this figure is consistent with the Supplemental Site Investigation Closeout Report (specifically, see Section 7.0 of that report). |
| Appendix A, Figure 7 | The Tank 41 discharge line has not been investigated, has not been closed, and was found to be leaking during the Supplemental Site Investigation. As evidenced by the large amount of petroleum product found in Ruin 2 during the Supplemental Site Investigation, this pipe may still be a source of contamination. Further action is required to address the Tank 41 discharge line. |
| Appendix A, Figure 8 | This figure should include the exceeding elevated lead contamination found in soil along the fence lines at both tank farms. As noted in the Supplemental Site Investigation Closeout Report, this issue has not been resolved because EPA believes this is a release that needs to be addressed. |

Risk-Based Vapor Intrusion Target Concentrations in Groundwater for Chemicals with MCLs

| Chemical | MCL (ug/L) | Vapor Intrusion Target Concentration in Groundwater For Residents (ug/L) | Vapor Intrusion Target Concentration in Groundwater For Workers (ug/L) | Risk Basis for Target Concentration | |
|---|---|---|---|---|---|
| | | | | ILCR | HQ |
| Benzene | 5 | 1.36 | 6.9 | 1.00E-06 | |
| Carbon tetrachloride | 5 | 0.135 | 0.7 | 1.00E-06 | |
| Chloroform [a] | 80 | 0.705 | 3.6 | 1.00E-06 | |
| 1,2-Dichloroethane | 5 | 2.34 | 11.8 | 1.00E-06 | |
| Ethylbenzene | 700 | 3.04 | 15.3 | 1.00E-06 | |
| Heptachlor | 0.4 | 0.0419 | 0.2 | 1.00E-06 | |
| Hexachlorobenzene | 1 | 0.0978 | 0.5 | 1.00E-06 | |
| Hexachlorocyclopentadiene | 50 | 0.18 | 0.9 | | 1 |
| Tetrachloroethylene | 5 | 0.55 | 2.8 | 1.00E-06 | |
| 1,1,2-Trichloroethane | 5 | 4.11 | 20.7 | 1.00E-06 | |
| Trichloroethylene | 5 | 2.89 | 14.6 | 1.00E-06 | |
| Vinyl chloride | 2 | 0.145 | 0.7 | 1.00E-06 | |

[a] The MCL for chloroform is the MCL for Total Trihalomethanes
MCL = Maximum Contaminant Level
ILCR = Incremental Lifetime Cancer Risk
HQ = Hazard Quotient
Screening level is 5 times higher for workers than for residents due to:
shorter exposure frequency (250 vs 350 days), shorter exposure duration (25 vs. 30 years), and shorter exposure time (8 vs 24 hours)

**Table 1: Comparative Generic Vapor Intrusion Screening Criteria Corresponding to Target Indoor Air Concentrations and Target Groundwater Concentrations for Chemicals Truncated at the MCL, Target Risk = 1E-06**

| | | | | | | | Target Indoor Air Concentration to Satisfy the Prescribed Risk Level (TR=1E-06 or THQ=1) | | Target Soil Gas Concentration Corresponding to Target Indoor Air Concentration where the Soil Gas to Indoor Air Attenuation Factor (α) = 0.1 | | | Target Groundwater Concentration Corresponding to Target Indoor Air Concentration where the Soil Gas to Indoor Air Attenuation Factor (α) = 0.001 and Partitioning across the Water Table Obeys Henry's Law | MCL | VI Risk at MCL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAS No. | Chemical | Molecular Weight | Basis of Target Concentration G=Cancer Risk; N/C=Non cancer Risk | Inhalation Unit Risk $(\mu g/m^3)^{-1}$ | | Reference Concentration $(\mu g/m^3)$ | | $\mu g/m^3$ | ppbv | $\mu g/m^3$ | ppbv | Dimensionless Henry's Law Constant (unitless) | µg/L | ppb | unitless |
| 71432 | Benzene | 78 | G | 7.80E-06 | I | 3.00E+01 | I | 3.12E-01 | 9.8E-02 | 3.12E+00 | 9.8E-01 | 2.30E-01 | 1.36E+00 | 5.00E+00 | 3.70E-05 |
| 56235 | Carbon tetrachloride | 154 | C | 1.50E-05 | I | 1.90E+02 | A | 1.92E-01 | 2.6E-02 | 1.92E+00 | 2.6E-01 | 1.20E+00 | 1.35E-01 | 5.00E+00 | 3.70E-05 |
| 67663 | Chloroform | 119 | C | 2.30E-05 | I | 9.80E+03 | A | 1.06E-01 | 2.2E-02 | 1.06E+00 | 2.2E-01 | 1.50E-01 | 7.05E-01 | 8.00E+01 | 1.10E-04 |
| 107062 | 1,2-Dichloroethane | 99 | C | 2.60E-05 | I | 2.40E+03 | A | 9.36E-02 | 2.3E-02 | 9.36E-01 | 2.3E-01 | 4.00E-02 | 2.34E+00 | 5.00E+00 | 2.10E-05 |
| 100414 | Ethylbenzene | 106 | G | 2.50E-06 | G | 1.00E+03 | I | 9.73E-01 | 2.2E-01 | 9.73E+00 | 2.2E+00 | 3.20E-01 | 3.04E+00 | 7.00E+02 | 2.30E-04 |
| 76448 | Heptachlor | 374 | G | 1.30E-03 | I | NA | | 1.87E-03 | 1.2E-04 | 1.87E-02 | 1.2E-03 | 4.47E-02 | 4.19E-02 | 4.00E-01 | 9.50E-06 |
| 118741 | Hexachlorobenzene | 285 | G | 4.60E-04 | I | NA | | 5.29E-03 | 4.5E-04 | 5.29E-02 | 4.5E-03 | 5.41E-02 | 9.78E-02 | 1.00E+00 | 1.00E-05 |
| 77474 | Hexachlorocyclopentadiene | 273 | N/C | NA | | 2.00E-01 | I | 2.00E-01 | 1.8E-02 | 2.00E+00 | 1.8E-01 | 1.11E+00 | 1.80E-01 | 5.00E+01 | HQ=278 |
| 127184 | Tetrachloroethylene (PCE) | 166 | G | 5.90E-06 | G | 2.70E+02 | A | 4.12E-01 | 6.1E-02 | 4.12E+00 | 6.1E-01 | 7.50E-01 | 5.50E-01 | 5.00E+00 | 9.10E-06 |
| 79005 | 1,1,2-Trichloroethane | 133 | C | 1.60E-05 | I | NA | | 1.52E-01 | 2.8E-02 | 1.52E+00 | 2.8E-01 | 3.70E-02 | 4.11E+00 | 5.00E+00 | 1.20E-05 |
| 79016 | Trichloroethylene (TCE) | 132 | G | 2.00E-06 | G | | | 1.22E+00 | 2.3E-01 | 1.22E+01 | 2.3E+00 | 4.21E-01 | 2.89E+00 | 5.00E+00 | 1.70E-05 |
| 79016 | Trichloroethylene (TCE) | 132 | N/C | | | 1.00E+01 | N | 1.00E+00 | 1.9E+00 | 1.00E+02 | 1.9E+01 | 4.21E-01 | 2.50E+01 | 5.00E+00 | 1.70E-05 |
| 75014 | Vinyl chloride* | 63 | G | 4.40E-06 | I | 1.00E+02 | I | 1.60E-01 | 6.3E-02 | 1.60E+00 | 6.3E-01 | 1.10E+00 | 1.45E-01 | 2.00E+00 | 4.00E-05 |

Notes: I = IRIS, A = ATSDR, C = CalEPA, N = NYSDOH

Carcinogenic Target Indoor Air $(\mu g/m^3)$ = Target Cancer Risk x $AT_c$ / (EF x ED x IUR)

where:

Target Cancer Risk = 1E-06, 1E-05, or 1E-04

$AT_c$ = averaging time, carcinogens (25,550 days)

EF = exposure frequency for a resident (350 days/year)

ED = exposure duration for a resident (30 years)

IUR = inhalation unit risk $(ug/m^3)^{-1}$

Non-cancer Target Indoor Air $(\mu g/m^3)$ = Target Hazard Quotient (THQ) x RfC

where:

THQ = 1

RfC = Reference Concentration $(\mu g/m^3)$

Concentrations in ppbv (conversion from $\mu g/m^3$ to ppbv) = $C(\mu g/m^3) \times 10^{-6}(g/\mu g) \times 10^{-3}(m^3/L) \times R \times T/(MW \times 10^{-6}(\mu g/g))$

where:

R = gas constant (0.0821 L-atm/mole-K)

T = absolute temperature (298K)

MW = molecular weight (g/mole)

Target Soil Gas $(\mu g/m^3)$ = Target Indoor Air / α

where α = soil gas to indoor air attenuation factor (0.1 for target soil gas)

The soil gas to indoor air attenuation factor of α = 0.1 is used for all soil gas. Hence, screening values are for all soil gas.

Target Groundwater (µg/L) = Target Indoor Air x $10^3$ $m^3/L$ / (H x α)

where α = soil gas to indoor air attenuation factor (0.001 and partitioning across the water table obeys Henry's Law)

*Early-life exposure is accounted for in the calculation

Equation can be found on the RSL User's Guide.

**Table 2: Comparative Generic Vapor Intrusion Screening Criteria Corresponding to Target Indoor Air Concentrations and Target Groundwater Concentrations for Chemicals Truncated at the MCL, Target Risk = 1E-05**

| | | | | | | | | Target Indoor Air Concentration to Satisfy the Prescribed Risk Level (TR=1E-05 or THQ=1) | | Target Soil Gas Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor (α) = 0.1 | | | Target Groundwater Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor (α) is 0.001 and Partitioning across the Water Table Obeys Henry's Law | MCL | VI Risk at MCL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAS No. | Chemical | Molecular Weight | Basis of Target Concentration C=Cancer Risk; N/C=Non cancer Risk | Inhalation Unit Risk ($\mu g/m^3$) | | Reference Concentration ($\mu g/m^3$) | | $\mu g/m^3$ | ppbv | $\mu g/m^3$ | ppbv | Dimensionless Henry's Law Constant (unitless) | µg/L | µg/L | unitless |
| 56235 | Carbon tetrachloride | 154 | C | 1.50E-05 | I | 1.90E+02 | A | 1.62E+00 | 2.6E-01 | 1.62E+01 | 2.6E+00 | 1.20E+00 | 1.35E+00 | 5.00E+00 | 3.70E-05 |
| 67663 | Chloroform | 119 | C | 2.30E-05 | I | 9.80E+01 | A | 1.06E+00 | 2.2E-01 | 1.06E+01 | 2.2E+00 | 1.50E-01 | 7.05E+00 | 8.00E+01 | 1.10E-04 |
| 100414 | Ethylbenzene | 106 | C | 2.50E-06 | C | 1.00E+03 | I | 9.73E+00 | 2.2E+00 | 9.73E+01 | 2.2E+01 | 3.20E-01 | 3.04E+01 | 7.00E+02 | 2.30E-04 |
| 76448 | Heptachlor | 374 | C | 1.30E-03 | I | NA | | 1.87E-02 | 1.2E-03 | 1.87E-01 | 1.2E-02 | 4.47E-02 | 4.19E-01 | 4.00E-01 | 9.50E-06 |
| 118741 | Hexachlorobenzene | 285 | C | 4.60E-04 | I | NA | | 5.29E-02 | 4.5E-03 | 5.29E-01 | 4.5E-02 | 5.41E-02 | 9.78E-01 | 1.00E+00 | 1.00E-05 |
| 77474 | Hexachlorocyclopentadiene | 273 | N/C | NA | | 2.00E-01 | I | 2.00E-01 | 1.8E-02 | 2.00E+00 | 1.8E-01 | 1.11E+00 | 1.80E-01 | 5.00E+01 | HQ=278 |
| 79016 | Trichloroethylene (TCE) | 132 | C | 2.00E-06 | C | | | 1.22E+01 | 2.3E+00 | 1.22E+02 | 2.3E+01 | 4.21E-01 | 2.89E+01 | 5.00E+00 | 1.70E-06 |
| 79016 | Trichloroethene | 132 | N/C | | | 1.00E+01 | N | 1.00E+01 | 1.9E+00 | 1.00E+02 | 1.9E+01 | 4.21E-01 | 2.38E+01 | 5.00E+00 | 1.70E-06 |

Notes: I = IRIS, A = ATSDR, C = CalEPA, N = NYSDOH

Carcinogenic Target Indoor Air ($\mu g/m^3$) = Target Cancer Risk x $AT_c$ / (EF x ED x IUR)

where:

Target Cancer Risk = 1E-06, 1E-05, or 1E-04

$AT_c$ = averaging time, carcinogens (25,550 days)

EF = exposure frequency for a resident (350 days/year)

ED = exposure duration for a resident (30 years)

IUR = inhalation unit risk $(ug/m^3)^{-1}$

Non-cancer Target Indoor Air ($\mu g/m^3$) =Target Hazard Quotient (THQ) x RfC

where:

THQ = 1

RfC = Reference Concentration ($\mu g/m^3$)

Concentrations in ppbv (conversion from

$\mu g/m^3$ to ppbv) = C($\mu g/m^3$) x $10^9$(ppb/atm) x $10^{-3}$($m^3$/L) x R x T/(MW x $10^6$[µg/g])

where:

R = gas constant (0.0821 L-atm/mole-K)

T = absolute temperature (298K)

MW = molecular weight (g/mole)

Target Soil Gas ($\mu g/m^3$) = Target Indoor Air /α

where α = soil gas to indoor air attenuation factor (0.10 for target soil gas)

The soil gas to indoor air attenuation factor of α = 0.1 is used for all soil gas. Hence, screening values are for all soil gas.

Target Groundwater (µg/L) = Target Indoor Air x $10^3$ $m^3$/L / (H x α)

where α = soil gas to indoor air attenuation factor (0.001 and partitioning across the water table obeys Henry's Law)

**Table 3: Comparative Generic Vapor Intrusion Screening Criteria Corresponding to Target Indoor Air Concentrations and Target Groundwater Concentrations for Chemicals Truncated at the MCL, Target Risk = 1E-04**

| | | | | | | | Target Indoor Air Concentration to Satisfy the Prescribed Risk Level (TR=1E-04) | | Target Soil Gas Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor (α) = 0.1 | | | Target Groundwater Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor (α) is 0.001 and Partitioning across the Water Table Obeys Henry's Law | MCL | VI Risk at MCL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAS No. | Chemical | Molecular Weight | Basis of Target Concentration C=Cancer Risk; NC=Non cancer Risk | Inhalation Unit Risk (µg/m³) | | Reference Concentration (µg/m³) | µg/m³ | ppbv | µg/m³ | ppbv | Dimensionless Henry's Law Constant (unitless) | µg/L | µg/L | unitless |
| 67663 | Chloroform | 119 | C | 2.30E-05 | I | 9.80E+01 A | 1.06E+01 | 2.2E+00 | 1.06E+02 | 2.2E+01 | 1.50E-01 | 7.05E+01 | 8.00E+01 | 1.10E-04 |
| 100414 | Ethylbenzene | 106 | C | 2.50E-06 | C | 1.00E+03 I | 9.73E+01 | 2.2E+01 | 9.73E+02 | 2.2E+02 | 3.20E-01 | 3.04E+02 | 7.00E+02 | 2.30E-04 |
| 76448 | Heptachlor | 374 | C | 1.30E-03 | I | NA | 1.87E-01 | 1.2E-02 | 1.87E+00 | 1.2E-01 | 4.47E-02 | 4.19E+00 | 4.00E-01 | 9.60E-06 |
| 77474 | Hexachlorocyclopentadiene | 273 | NC | NA | | 2.00E-01 I | 2.00E-01 | 1.8E-02 | 2.00E+00 | 1.8E-01 | 1.11E+00 | 1.80E-01 | 5.00E+01 | HQ=273 |

Notes: I = IRIS; A = ATSDR; C = CalEPA; N = NYSDOH

Carcinogenic Target Indoor Air (µg/m³) = Target Cancer Risk x $AT_c$ / (EF x ED x IUR)

where:

Target Cancer Risk = 1E-06, 1E-05, or 1E-04

$AT_c$ = averaging time, carcinogens (25,550 days)

EF = exposure frequency for a resident (350 days/year)

ED = exposure duration for a resident (30 years)

IUR = inhalation unit risk $(ug/m^3)^{-1}$

Non-cancer Target Indoor Air (µg/m³) = Target Hazard Quotient (THQ) x RfC

where:

THQ = 1

RfC = Reference Concentration (µg/m³)

Concentrations in ppbv (conversion from

µg/m³ to ppbv) = C(µg/m³) x $10^6$(ppb/ppm) x $10^{-3}$(m³/L) x R x T/(MW x $10^6$(µg/g))

where:

R = gas constant (0.0821 L-atm/mole-K)

T = absolute temperature (298K)

MW = molecular weight (g/mole)

Target Soil Gas (µg/m³) = Target Indoor Air / α

where α = soil gas to indoor air attenuation factor (0.1 for target soil gas)

The soil gas to indoor air attenuation factor of α = 0.1 is used for all soil gas. Hence, screening values are for all soil gas.

Target Groundwater (µg/L) = Target Indoor Air x $10^3$ m³/L / (H x α)

where α = soil gas to indoor air attenuation factor (0.001 and partitioning across the water table obeys Henry's Law)