CALIFORNIA DEPARTMENT OF TOXIC SUBTANCES CONTROL (DTSC)
HUMAN AND ECOLOGICAL RISK OFFICE (HERO)

HUMAN HEALTH RISK ASSESSMENT (HHRA) NOTE

HERO HHRA NOTE NUMBER: 5

ISSUE DATE: August 23, 2014

ISSUE: Health-based Indoor Air Screening Criteria for Trichloroethylene (TCE).

SUMMARY

The U.S. EPA Region 9 released trichloroethylene (TCE) guidance on December 3, 2013 for expanded sample collection in the investigation of the Vapor Intrusion (VI) exposure pathway at specific National Priority List (NPL) sites in the San Francisco, CA South Bay. *Accelerated Response Action Levels* and *Urgent Response Level Action Levels* for indoor air concentrations of TCE under residential, commercial/industrial (8-hour workday), and commercial/industrial (10-hour workday) exposure scenarios were presented in this document.

Use of these Region 9 Interim Action Levels to sites beyond the NPL South Bay sites in San Francisco, California was provided in the June 30, 2014 U.S. EPA Region 9 Regional Toxicologist's memorandum, released under a July 9, 2014 transmittal memorandum from Enrique Manzanilla, Director of the Superfund Division, U.S. EPA Region 9.

Multiple emails have inquired whether HERO is implementing the recommendations contained in this guidance. This notice is a response to those inquiries, specifically on the issues of: 1) applicability to all sites where VI is being evaluated; 2) Interim Measures; and, 3) response actions.

HERO ISSUE CONTACT PERSON(S):	Michael J. Wade, Ph. D., D.A.B.T. Senior Toxicologist 916.255.6653 Voice 916.255.6695 Facsimile Michael.Wade@dtsc.ca.gov
	Kimberly Gettmann, Ph.D. Staff Toxicologist 916.255.6685 Voice 916.255.6695 Facsimile Kimberly.Gettmann@dtsc.ca.gov

SOUTH BAY SUPERFUND SITE RECOMMENDATIONS

The EPA Region 9 December 3, 2013 guidance is directed specifically at a group of NPL 'Superfund' sites under investigation and evaluation by the San Francisco Regional Water Quality Control Board (SFRWQCB) where a significant amount of sampling has been conducted at sites with shallow groundwater (5 feet below ground surface [bgs] to 35 feet bgs) known to be contaminated with trichloroethylene (TCE). At this time, the detailed data gap sampling recommendations and requirements outlined in this guidance are not directed to all sites where VI is under investigation. HERO has discussed the EPA Region 9 recommendations for TCE to clarify the steps recommended for an initial VI investigation as well as potential response actions.

Definition of a groundwater concentration of 5 µg/L TCE as the delimiter of the On-Site and Off-Site Study Area boundary for the South Bay Superfund sites (EPA Region 9 December 2013 memorandum) is based on site-specific characteristics of the South Bay Superfund sites, drinking water Maximum Contaminant Level (MCL) of 5 µg/L, as well as screening-level modeling of the groundwater to indoor air pathway by EPA Region 9. At this time HERO does not recommend eliminating indoor air measurements of TCE based solely on groundwater concentrations less than 5 µg/L at other sites.

INDOOR AIR CONCENTRATIONS OF TRICHLOROETHYLENE (TCE)

The EPA Region 9 identifies the following Interim Action Levels for indoor air concentrations of TCE under differing exposure scenarios:

EPA Region 9 Interim TCE Indoor Air Response Action Levels - Residential and Commercial TCE Inhalation Exposure from Vapor Intrusion

Exposure Scenario	*Accelerated Response Action Level (HQ=1)*	*Urgent Response Action Level (HQ=3)*[4]
Residential *	**2 µg/m^3**	**6 µg/m^3**
Commercial/Industrial ** (8-hour workday)	**8 µg/m^3**	**24 µg/m^3**
Commercial/Industrial ** (10-hour workday)	**7 µg/m^3**	**21 µg/m^3**

* The residential HQ=1 accelerated response action level is equivalent to the inhalation reference concentration (RfC) since exposure is assumed to occur continuously.

** Commercial/Industrial accelerated response action levels are calculated as a time-weighted average from the RfC, based on the length of a workday and rounding to one significant digit (e.g., for an 8-hour workday: Accelerated Response Action Level = (168 hours per week/40 hours per week) x 2 µg/m^3 = 8 µg/m^3). Time-weighted adjustments can be made as needed for workplaces with longer work schedules.

Note: Indoor air TCE exposures corresponding to these accelerated response action levels would pose cancer risks near the lower end of the Superfund target cancer risk range, considering the IRIS toxicity assessment; thus, the health protective risk range for both accelerated response actions and long-term exposures becomes truncated to: 0.5 – 2 µg/m^3 for residential exposures and 3 –8 µg/m^3 for 8-hour/day commercial/industrial exposures.

HERO concurs with the use of the USEPA Region 9 *Accelerated Response Action Level* of 2 µg/m^3 for exposure to TCE under a residential exposure scenario. However, the significance and potential health implications of individual indoor air measurements greater than 2 µg/m^3 of TCE in residential buildings may vary based on site-specific conditions. On

March 27, 2014, the Massachusetts Department of Environmental Protect (MassDEP) released a Fact Sheet "TCE Toxicity Information: Implications for Chronic and Shorter-Term Exposure." For exposure under a residential exposure MassDEP's "Immediate Response Action" is > 6 μg/m^3. MassDEP recommended actions are to reduce TCE to levels below 6 μg/m^3 as soon as possible (within several days if possible). HERO strongly recommends consulting the HERO toxicologist assigned to the site for a case-by-case evaluation and aid in determining the potential immediate risk at residential sites with indoor air concentrations greater than 1 μg/m^3.

HERO concurs with the use of the USEPA Region 9 *Accelerated Response Action Level* of 8 μg/m^3 for exposure to TCE under a commercial/industrial 8-hour workday scenario. The MassDEP "Immediate Response Action under a commercial/industrial 8-hour workday is >24 μg/m^3 and recommends an Immediate Response Action of reducing levels of TCE to less than 24 μg/m^3 as soon as possible (within several days to a week if possible). HERO strongly recommends consulting the HERO toxicologist assigned to the site to review the site indoor air TCE concentrations with respect to site-specific conditions when TCE indoor air concentrations for commercial/industrial use are greater than 3 μg/m^3.

The recommendation for sampling during colder seasons of the year (EPA Region 9 December 2013 memo; Item 3) is directed toward filling the perceived data gap for the South Bay sites without multiple rounds of sampling. Detailed evaluation of some cold weather sites (e.g., Indianapolis, Indiana; Layton, Utah) has shown a factor of ten difference in indoor air concentrations between warm and cold seasons. However, much smaller seasonal variation has been seen in some California sites and some sites in Hawaii. Sites where multiple rounds of indoor air sampling are planned should include both late summer/early autumn and late winter/early spring sampling (DTSC, 2011; EPA 2012) until the issue of seasonal variance for California sites is resolved.

The EPA Region 9 July 9, 2014 inclusion of long-term passive sampling of indoor air (EPA Region 9 July 2014 memorandum; Sampling Considerations) is based on experience with passive air samplers similar to the Radiello© brand of passive air sampler [http://www.sigmaaldrich.com/analytical-chromatography/air-monitoring/radiello/learning-center/what-is-radiello.html]. Conceptually, it would seem reasonable to deploy long-term passive air samplers in addition to TO-15 evacuated canister (e.g., Summa canister) sampling to decrease inter-sample variance and obtain long-term averaged samples of indoor air concentrations. However, more experience has been developed for TO-15 canister sampling and passive air sampler deployment should be a site-specific decision.

For sites with TCE contamination of groundwater or soil deemed to be of concern due to potential migration into indoor air, HERO recommends at least two indoor air samples in both warm and cool season regardless of the concentration detected in the first sample. If the first sample detects a 'relatively elevated' concentration a second sample should be obtained more quickly than delaying for a seasonal change to occur. HERO would consider a sample result between 0.48 μg/m^3 and 2.0 μg/m^3 'relatively elevated'. A sample concentration of 0.48 μg/m^3 is 3 times greater than the 90th percentile TCE concentration the CARB detected over the last 5 years (Attachment A). The speed with which the second sample should be taken should be dictated by the concentration of the first sample. <u>HERO recommends that a second indoor air sample be taken immediately where the first sample concentration is at or above 2.0 μg/m^3 for a residential exposure scenario and above 8 μg/m^3 for a commercial/industrial scenario, as a reasonable precaution.</u>

EPA Region 9 recommends indoor air sampling with the HVAC off for a period of 36 hours as part of the data to be developed for the South Bay NPL sites (EPA Region 9 December 2013 memorandum; Item 4). HERO recommends HVAC-off sampling on a site-specific basis, for example: 1) where there is a third shift night crew working with the HVAC shut off; 2) to determine an upper bound air concentrations where sampling with HVAC in operation indicates air

concentrations of concern; or, 3) to determine the upper bound air concentrations when developing design specifications for VI mitigation systems.

INTERIM MEASURES

The EPA Region 9 July 9, 2014 memorandum recommends the following interim measures to reduce TCE exposure where indoor air concentrations indicate interim steps to reduce exposure are prudent:

- Increasing building pressurization and/or ventilation
- Sealing potential conduits where vapors may be entering the building
- Treating indoor air (carbon filtration, air purifiers)
- Installing and operating engineered exposure controls (sub-slab/crawlspace, depressurization systems)
- Temporary relocating occupants

DTSC has successfully used stand-alone air purifiers, with carbon filter units and built-in air circulation fans (e.g., Electrocorp Air Rhino, AirMedic Vocarb), to immediately reduce air concentrations at sites with elevated indoor air concentrations of TCE and other Volatile Organic Compounds (VOCs).

RESPONSE

HERO concurs, in general, with the concentration-based tiered response actions outline in the July 8, 2014 EPA Region 9 memorandum for elevated concentrations, specifically:

- Where Indoor air concentrations in a first sample are greater than 0.48 µg/m^3 but less than the applicable *Accelerated Response Action Level* a second sample should be obtained more quickly than delaying for a seasonal change to occur.
- Indoor air concentrations greater than the applicable *Accelerated Response Action Level* should lead to evaluation and potential implementation of interim measures. The effectiveness of any interim action should be evaluated based on resampling performed within a few weeks.
- Indoor air concentrations greater than the applicable *Urgent Response Action Level* should lead to immediate mitigation measures within a few days. The effectiveness of the mitigation measures should be evaluated based on resampling performed within a few days.

REFERENCES

DTSC 2011. Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance). October, 2011. http://www.dtsc.ca.gov/AssessingRisk/upload/Final_VIG_Oct_2011.pdf.

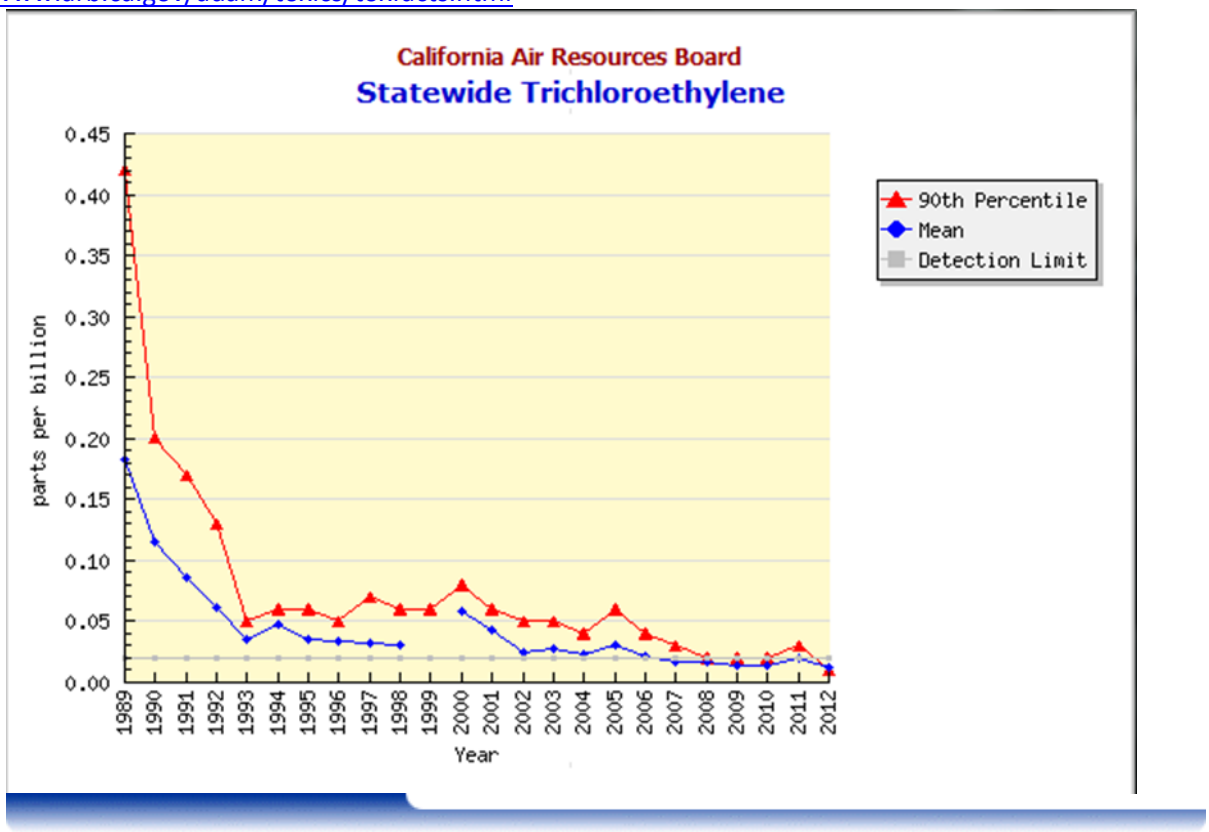
Massachusetts Department of Environmental Protect (MassDEP). Fact Sheet, TCE Toxicity Information: Implications for Chronic and Shorter-Term Exposure. March 27, 2014.

USEPA. 2012. Superfund Vapor Intrusion FAQs.
http://www.epa.gov/superfund/sites/npl/Vapor_Intrusion_FAQs_Feb2012.pdf

USEPA. 2013. EPA Region 9 Guidelines and Supplemental Information Needed for Vapor Intrusion Evaluations at the South Bay National Priorities List (NPL) Sites. EPA Region 9 Memorandum, December 3, 2013.

USEPA. 2014. EPA Region 9 Response Action Levels and Recommendations to Address Near-Term Inhalation Exposures to TCE in Air from Subsurface Vapor Intrusion. EPA Region 9 Superfund Program Memorandum, July 9, 2014.

Attachment A. California Air Resources Board 'Ambient' TCE by year collected over a 24-hour period (midnight to midnight) every 12 days at 18 sites (20 sites before July 1995, 21 sites from July 1995 through July 2000) throughout California. http://www.arb.ca.gov/adam/toxics/statepages/tcestate.html . Data description at http://www.arb.ca.gov/adam/toxics/toxfacts.html



Year	Months Present	Minimum	Median	Mean	90th Percentile	Maximum	Standard Deviation	Number of Observations	Detection Limit
2012	------------	0.01	0.01	0.013	0.01	0.19	0.013	467	0.02
2011	------------	0.01	0.01	0.020	0.03	0.75	0.058	490	0.02
2010	------------	0.01	0.01	0.014	0.02	0.22	0.015	473	0.02
2009	------------	0.01	0.01	0.014	0.02	0.18	0.013	522	0.02
2008	------------	0.01	0.01	0.017	0.02	1.1	0.050	518	0.02
2007	------------	0.01	0.01	0.017	0.03	0.18	0.018	495	0.02
2006	------------	0.01	0.01	0.021	0.04	0.34	0.029	504	0.02
2005	------------	0.01	0.01	0.030	0.06	0.87	0.063	510	0.02
2004	------------	0.01	0.01	0.023	0.04	0.60	0.039	503	0.02
2003	------------	0.01	0.01	0.027	0.05	0.58	0.041	503	0.02
2002	------------	0.01	0.01	0.025	0.05	0.23	0.028	459	0.02
2001	------------	0.01	0.01	0.043	0.06	1.7	0.113	499	0.02
2000	------------	0.01	0.02	0.058	0.08	2.4	0.155	497	0.02
1999	---▮-------	0.01	0.01	*	0.06	5.0	0.307	429	0.02
1998	------------	0.01	0.01	0.031	0.06	1.3	0.073	520	0.02
1997	------------	0.01	0.01	0.033	0.07	1.1	0.077	557	0.02
1996	------------	0.01	0.01	0.034	0.05	2.5	0.119	626	0.02
1995	------------	0.01	0.01	0.035	0.06	2.4	0.113	616	0.02
1994	------------	0.01	0.01	0.047	0.06	8.7	0.361	607	0.02
1993	------------	0.01	0.01	0.036	0.05	0.84	0.067	589	0.02
1992	------------	0.01	0.03	0.061	0.13	1.3	0.105	598	0.02
1991	------------	0.01	0.05	0.086	0.17	4.2	0.210	566	0.02
1990	------------	0.01	0.05	0.115	0.20	11	0.518	570	0.02
1989	------------	0.01	0.10	0.183	0.42	2.7	0.270	442	0.02