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12 December 2017
Project 770638302

Jonathan Sanders
Senior Hazardous Materials Specialist
Alameda County Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502

Subject: Sub-Slab and Indoor Air Sampling and Analysis Work Plan
M&M Property LLC
2800 Broadway
Oakland, California
Case No. RO0003201
Langan Project No. 770638302

Dear Mr. Sanders:

I have read and acknowledge the content, recommendations and/or conclusions contained in the attached document submitted on my behalf to ACDEH's FTP server and the State Water Resources Control Board's GeoTracker website.

Sincerely yours,

Michael Murphy
M&M Property LLC.

LANGAN

Memorandum

555 Montgomery Street, Suite 1300 San Francisco, CA 94111 T: 415.955.5200 F: 415.955.5201

To: Mr. Jonathan Sanders and Ms. Dilan Roe
Alameda County Department of Environmental Health (ACDEH)

CC: Mr. Michael Murphy - M&M Property LLC

From: Peter Cusack, Senior Associate - Langan
Mukta Patil, PE, Project Engineer - Langan
Chelsea Bixel, Staff Scientist - Langan

Date: 12 December 2017

Project: 2800 Broadway, Oakland

Subject: Sub-Slab and Indoor Air Sampling and Analysis Work Plan
2800 Broadway
Oakland, California
Langan Project No.: 770638302

This Sub-Slab and Indoor Air Sampling and Analysis Work Plan (Work Plan) has been prepared at the request of the Alameda County Department of Environmental Health (ACDEH) and on behalf of M&M Property LLC, for the property located at 2800 Broadway in Oakland, California (Site; Figure 1). Previously, Langan prepared a Revised Data Gaps Investigation Work Plan (Revised DGI Work Plan) dated 10 August 2017 to address potential data gaps and to prepare a Site Conceptual Model (SCM) for the Site. The Revised DGI Work Plan was approved by the ACDEH and the implementation work consisting of performing soil, grab groundwater and soil-vapor sampling in September - November 2017. Several chlorinated volatile organic compounds (CVOCs), including trichloroethene (TCE), were detected at concentrations exceeding vapor intrusion screening levels in several of the soil-vapor and groundwater samples collected at the Site. In a project meeting between Langan, M&M Property LLC and ACDEH, conducted on 1 December 2017, the ACDEH reviewed the data collected to date at the Site and recommended performing additional sampling consisting of indoor air and sub-slab vapor sampling to evaluate if chlorinated VOCs, primarily TCE, is migrating from the subsurface into the on-Site building and/or off-Site, adjacent Smog Check facility (288 28th Street) at levels that may pose a risk to Site workers or occupants.

BACKGROUND

Concentrations of TCE in soil-vapor from samples collected from the Site exceed the TCE Vapor Intrusion Trigger Levels for Indoor Air Sampling presented in Table 4-4 of the San Francisco Regional Water Quality Control Board (RWQCB)'s *User Guide: Derivation and Application of Environmental Screening Levels (ESLs) Interim Final* dated 2016. Table 4-4 is presented as Appendix A. Therefore, additional indoor air sampling is proposed to determine if accelerated response action levels (ARALs) or urgent response action levels (URALs), as defined by the California Department of Toxic Substances Control (DTSCs) *Human Health Risk Assessment (HHRA) Note Number 5,* are exceeded. The DTSC HHRA Note Number 5 is presented as Appendix B. A summary of TCE in soil-vapor analytical results from previous environmental

investigations at the Site and nearby properties is presented as Table 1. A summary of TCE in groundwater analytical results from previous environmental investigations at the Site and surrounding properties is presented as Table 2.

The Site is located to the northeast of the intersection between Broadway and 28th Street in Oakland, in an area known as "Auto Row", characterized primarily by commercial and high density residential buildings. The site area is approximately 13,200 square feet and currently contains a one-story warehouse building with a mezzanine which was built in 1916. The building is used for storing vehicles for Premier Hyundai of Oakland and Volkswagen of Oakland, both automobile dealerships. Normal business hours for the 2800 building usage are between 8 AM through 5 PM. Therefore 8-hour commercial exposure is appropriate for evaluating indoor air inhalation risk for building users. It should be noted that there are no occupants working in the building.

The adjacent Broadway Smog Star Station (288 28th Street), a smog check facility, is a one-story, slab-on grade building. Hazardous materials information obtained by the ACDEH for the smog check facility indicates that a vapor degreaser consisting of TCE was historically located along the northern wall and a restroom was located in the southwestern corner of the building.

PROPOSED SCOPE OF WORK

Langan proposes to collect eight indoor air samples and three sub-slab vapor samples at the 2800 Broadway building. Three indoor air samples and three sub-slab vapor sample will be collected from the adjacent Smog Check facility (288 28th Street). Proposed indoor air and sub-slab vapor sample locations in the 2800 building were chosen based upon TCE detections in soil vapor and groundwater beneath the Site, bathroom and utility penetrations, and the building layout. Proposed indoor air and sub-slab vapor sample locations in the Smog Check facility building were chosen based upon the location of historical vapor degreaser, historical restroom and utility penetrations, and the building layout. Proposed sample locations for the Site and adjacent Smog Check facility are shown in Figure 2.

As recommended by ACDEH during our 1 December 2017 meeting, public notifications will be sent for the adjacent Smog Check facility prior to performing any sampling activities. In addition, prior to sample collection at the adjacent Smog Check facility, property owner approval will be required. A building survey will also be conducted at the Smog Check facility to properly understand the layout, construction type, chemicals used for site operations, ventilation system operation (if any) and also to confirm if the proposed number of samples are sufficient for the building. Because of these requirements prior to sampling, Langan envisions performing indoor air and sub-slab vapor sampling at the 2800 Broadway building prior to sampling at the adjacent building.

INDOOR AIR SAMPLING METHODOLOGY

All indoor air samples will be collected using a 6-liter SIM certified summa canister with an 8-hour flow controller provided by a State of California certified laboratory. The 8-hour sample will be collected from the general breathing zone (i.e., 3 to 5 feet above finished-floor level). Additionally, samples collected from the adjacent Smog Check facility will be collected during normal building operating conditions (i.e. between 6 AM and 7 PM). The 2800 Broadway building is currently not connected to heating, ventilation, and air conditioning (HVAC) system and samples will, therefore, be collected under normal building operating conditions.

Due to the multitude of influences on indoor air quality, one ambient air sample per building will be collected outside the buildings to evaluate potential non-groundwater sources of chemicals in air. The ambient air sample will be collected from an up-wind location following the same methodology outlined for indoor air sampling.

Quality Control Sample Collection

Control samples will be collected from the Site structure and Smog Check facility. The purpose of collecting field quality assurance/quality control (QA/QC) samples is to demonstrate the reliability and defensibility of the data and to assess the consistency of the overall sampling effort, including collection, transport, and analysis. Field QC samples will include field duplicate samples. Field duplicate samples are two samples collected at the same time and from the same location as the associated field sample. Field duplicates are submitted to the project laboratory as separate samples ("blind"). The purpose of submitting blind duplicate samples is to assess the consistency or precision of the laboratory's analytical system. One duplicate indoor air sample will be collected at each building (the Site and Smog Check facility.

SUB-SLAB SAMPLING METHODOLOGY

Considering the potential for cross-contamination between the collection of indoor air sample collection and sub-slab sample collection, Langan proposes that indoor air sampling and sub-slab vapor sampling be conducted separately. Therefore, following indoor air and ambient air sampling, sub-slab vapor samples will be collected from the Site and adjacent Smog Check facility. The proposed sample methodologies, analytical methods, and proposed schedule for sampling activities at the Site and adjacent Smog Check facility are discussed below.

Sample Methodology

Sub-slab samples will be collected using Vapor Pins™ manufactured by and in accordance with Cox-Colvin and Associates Incorporated's Standard Operating Procedure Installation and Extraction of the Vapor Pins™ (Appendix C) and in general accordance with the California Department of Toxic Substances Control's (DTSC) documents titled "Advisory – Active Soil Gas Investigation" dated April 2012 and "Final, Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air" dated October 2011. Vapor Pins™ allow for easy

installation and removal and provide an air-tight seal between the slab and the exterior of the pin.

The sub-slab sampling probes (i.e. Vapor Pins™) will be installed just below the slab and allowed to equilibrate for a period of at least two hours prior to sampling. After the equilibration period, leak testing (using a shroud) and shut-in testing will be performed at each location prior to purging and sample collection. Helium will be used as a tracer gas during field sampling to confirm leakage did not occur during sampling. The sampling system will be sealed within a shroud and a known concentration of helium (typically about 20% by volume) will be added inside the shroud and maintained at this concentration during sampling. Helium concentrations will be tested at the laboratory to verify the quality of the field sampling program. In addition to laboratory testing, field instrumentation will be used to evaluate whether leakage is occurring by testing pre-sample purge gas. If a leak is detected, an adjacent location will be selected for sub-slab vapor sampling prior to sample collection.

One-liter summa canisters will be used for both purging and sample collection along with flow controllers set to a maximum rate of 200 milliliters per minute (mL/min). Sub-slab vapor sampling will be conducted, as follows:

- Drill 5/8-inch hole through slab;
- Clean out drill hole and install the Vapor Pin™;
- Allow at a minimum, a two hour equilibrium time prior to purging and sampling;
- Perform leak testing using a tracer gas (i.e., helium) and a helium detector to test for seal leaks;
- Purge sub-slab sampling location using 1-liter summa canister; and
- Collect sub-slab vapor grab-samples into pre-evacuated 1-liter summa canisters.

Quality Control Sample Collection

Control samples will be collected from the Site, and Smog Check facility. The purpose of collecting field quality assurance/quality control (QA/QC) samples is to demonstrate the reliability and defensibility of the data and to assess the consistency of the overall sampling effort, including collection, transport, and analysis. Field QC samples will include field duplicate samples. Field duplicate samples are two samples collected at the same time and from the same location as the associated field sample. Field duplicates are submitted to the project laboratory as separate samples ("blind"). The purpose of submitting blind duplicate samples is to assess the consistency or precision of the laboratory's analytical system. One duplicate sub-slab vapor sample will be collected at each building (the Site and Smog Check facility).

FIELD DOCUMENTATION

Field activity logs will be completed for each Site visit. Field activity logs shall identify the following: Site name and address, date and time onsite, onsite field personnel, general weather conditions, purpose of site visit, a summary of field activities, and any other important details.

In addition to field activity logs, air sampling logs will be completed to track sampling information. The following information will be included on air sampling logs: sample ID, sample type, sample location, date of sample collection, time of sample collection, sample canister number, flow-controller number, start/stop time, and name of sampler(s).

Photographs will be taken at each sampling location. A photograph log will be completed to identify the contents of each photo. The field documentation will be kept in the project files.

LABORATORY ANALYTICAL METHODS

Following the collection of the samples, the summa canisters will be delivered to a State of California-certified laboratory for analysis. Samples will be collected and transported to the analytical laboratory following chain of custody (COC) procedures. The COC documents the identity and integrity of the sample from the time of collection through receipt at the laboratory. The COC will be completed as samples are collected, and will include the following information: sample ID, date of sample collection, time of sample collection, sample type, and sampler name(s). Additionally, the starting and ending pressures for the summa canisters will be noted on the COC form.

Indoor air, ambient air, and sub-slab vapor samples will be analyzed for the compounds detected in soil-vapor and groundwater beneath the Site using EPA method TO-15.

DATA EVALUATION AND REPORTING

As discussed previously, following the sample collection and analysis, analytical results will be presented and discussed with M&M Property LLC and ACDEH. We will present the results within 12 hours of receipt. A technical summary report will be prepared within four weeks of receipt of all indoor air, ambient air, and sub-slab analytical data for the Site and adjacent Smog Check facility.

CONTINGENCY PLAN

If indoor air analytical results exceed the URALs, interim mitigation measures will be implemented at the Site and/or Smog Check facility to improve air quality within the affected structures. Such interim measures may include:

- temporary relocating occupants using an Occupant Evacuation Plan;

- Restricting access to the Site;
- the addition of carbon air scrubbers (treating indoor air), where appropriate using an appropriate air purification unit (the likely units for purchase are manufactured by IQAir® (IQAir® GCX Series[1]));
- Increasing the air exchange rate via the addition of industrial fans; and,
- sealing of any potential conduits/cracks in the floor slab using VOC-free epoxy based coatings, Regenisis Retro-Coat system, or similar vapor intrusion mitigation products;
- Installation of a vapor intrusion mitigation barrier.

Any one or a combination of mitigation measures listed above are expected to address potential vapor intrusion issues for the building. If mitigative measures or an Occupant Evacuation Plan is required, Langan will prepare a Vapor Mitigation Plan and/or Occupant Evacuation Plan (if necessary) for the affected properties. The mitigation plan and evacuation plan will include a summary of vapor intrusion investigation activities, proposed mitigation action summary, occupant relocation accommodations (if necessary), a description of proposed long term actions, proposed air monitoring schedule, communication procedures, and the appropriate supplemental documentation including tables and figures, as requested by ACDEH. Following interim mitigation measures, resampling will be performed to evaluate the effectiveness of the mitigation measures implemented.

SCHEDULE

Field work is currently scheduled to begin the week of 11 December 2017 at the Site (2800 Broadway). The anticipated order of activities will be:

1. Indoor air sampling at the Site;
2. Sub-slab sampling at the Site;
3. Building survey of Smog Check facility;
4. Indoor air sampling at Smog Check facility; and,
5. Sub-slab sampling at Smog Check facility.

[1] These units are designed to remove VOCs from the air by mechanically passing air through a granular activated carbon (GAC) filter. Prior to passing through the GAC, the air is filtered by a high efficiency particulate air (HEPA) filter. IQAir® GCX MultiGas contains 22 lbs. of Granulated Activated Carbon & Impregnated Alumina.

Pending property owner and ACDEH approval, the building survey of the Smog Check facility may be conducted concurrently with the collection of indoor air samples and/or the collection of sub-slab sampling at the on-Site building. Sub-slab sampling at the Site and adjacent Smog Check facility will be conducted within approximately two to three days of indoor air sample collection, if feasible.

If you have any questions or require additional information, please give us a call.

Attachments:

Table 1 – TCE in Soil-Vapor Summary Table
Table 2 – TCE in Groundwater Summary Table

Figure 1 – Site Location Map
Figure 2 – Site Map with Proposed Sample Locations
Figure 3 – TCE Concentrations in Groundwater
Figure 4 – TCE Concentrations in Soil-Vapor

Appendix A – RWQCB TCE Vapor Intrusion Trigger Levels for Indoor Air Sampling, Table 4-4
Appendix B – DTSC HHRA, Note Number 5
Appendix C – Standard Operating Procedure for the Installation and Extraction of the Vapor Pins™

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Tables

Table 1
TCE Concentrations in Soil-Vapor
2800 and 2740 Broadway
Oakland, California

Sample ID	Sample Location	Sample Date	TCE ($\mu g/m^3$)
SV-1-5'	2800 Broadway	9/8/2017	< 5.37
SV-1-10'	2800 Broadway	9/8/2017	< 5.37
SV-2-5'	2800 Broadway	9/8/2017	3,340
SV-2-10'	2800 Broadway	9/8/2017	3,180
SV-3-5'	2800 Broadway	9/8/2017	2,740
SV-3-10'	2800 Broadway	9/8/2017	63,300
SV-4-5'	2800 Broadway	9/8/2017	54,800
SV-5-5'	2800 Broadway	9/8/2017	20,000
SV-6-5'	2800 Broadway	9/8/2017	811
VW-4	2740 Broadway	2/17/2014	< 6.2
VW-5	2740 Broadway	2/13/2014	< 5.4
VW-6	2740 Broadway	2/13/2014	< 5.6
SS-SV-1	2740 Broadway	2/13/2014	< 5.7
SS-SV-2	2740 Broadway	2/13/2014	< 7.2
SS-SV-3	2740 Broadway	2/13/2014	< 6.8
SS-SV-4	2740 Broadway	2/17/2014	< 6.6
SS-SV-5	2740 Broadway	2/17/2014	< 6.7
EPA Residential Indoor Air (IA) ARAL[1]			2
EPA Residential Indoor Air (IA) URAL[1]			6
EPA Commercial/Industrial Indoor Air (IA) 8-Hr ARAL[1]			8
EPA Commercial/Industrial Indoor Air (IA) 8-Hr URAL[1]			24
EPA Commercial/Industrial Indoor Air (IA) 10-Hr ARAL[1]			7
EPA Commercial/Industrial Indoor Air (IA) 10-Hr URAL[1]			21
Residential: Indoor Air (IA) ARAL[2]			2
Residential: Sub-slab/Soil Gas Action Level[2]			1,100
Commercial/Industrial: Indoor Air (IA) URAL[2]			8.8
Commercial/Industrial: Sub-slab/Soil Gas Action Level[2]			8,800
Sub-slab/Soil Gas Commercial/Industrial ESLs[3]			3,000
Sub-slab/Soil Gas Residential Soil Gas ESLs[3]			239
Indoor Air Commecial/Industrial ESLs			3
Indoor Air Residential ESLs			0.5

Notes:
$\mu g/m^3$ - Micrograms per cubic meter
TCE - Trichloroethene
< - Analyte not detected at or above laboratory detection limit
ESL - Environmental Screening Level(s)
[1] - California Department of Toxic Substances Control, Note Number 5: EPA Region 9 Iterim TCE Indoor Air Response Action Levels - Residential and Commcerial TCE Inhalation Exposure from Vapor Intrusion

[2] - San Francisco Regional Water Quality Control Board, User's Guide: Derivation and Application of Environmental Screening Levels (ESLs) Interim Final, Table 4-4

[3] - San Francisco Bay Regional Water Quality Control Board's Environmental Screening Levels, Summary of Vapor ESLs, February 2016 [Rev. 3]

Table 2
TCE Concentrations in Groundwater
2800, 2820, 2855, and 2740 Broadway
Oakland, California

Sample ID	Sample Location	Date Sample	TCE (µg/L)
L-SB-1-GW	2800 Broadway	10/19/2017	150
L-SB-2-GW	2800 Broadway	10/19/2017	3,000
L-SB-3-GW	2800 Broadway	11/3/2017	120
L-SB-4-GW	2800 Broadway	11/3/2017	< 25
L-SB-5-GW	2800 Broadway	11/3/2017	< 50
L-SB-6-GW	2800 Broadway	11/3/2017	280
L-SB-7-GW	2800 Broadway	10/19/2017	12,000
L-SB-9-GW	2800 Broadway	10/20/2017	< 0.50
B4	2800 Broadway	10/4/015	4,400
B5	2800 Broadway	10/4/2015	14,000
B6	2800 Broadway	10/4/2015	340
B7	2800 Broadway	10/4/2015	460
B8	2800 Broadway	10/4/2015	1,900
B9	2800 Broadway	10/4/2015	36
B10	2800 Broadway	10/4/2015	17
B12	2800 Broadway	10/10/2015	121
B13	2800 Broadway	10/10/2015	2,800
B14	2800 Broadway	10/10/2015	6,160
B2-W	2800 Broadway	9/19/2015	14,000
B1-W	2820 Broadway	9/19/2015	< 0.50
B3-W	2820 Broadway	9/19/2015	32
B17	2820 Broadway	11/5/2015	< 0.50
B18	2820 Broadway	11/5/2015	< 0.50
B19	2820 Broadway	11/6/2015	7.9
B20	2820 Broadway	11/6/2015	14
B21	2820 Broadway	11/6/2015	28
B22	2820 Broadway	11/6/2015	39
B23	2820 Broadway	11/6/2015	70
B11	2855 Broadway	10/4/2015	< 0.50
B15	2855 Broadway	11/5/2015	< 0.50
B16	2855 Broadway	11/5/2015	< 0.50
MW-1*	2740 Broadway	12/10/2013	52
MW-2*	2740 Broadway	1/21/1989	N/A

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Table 2
TCE Concentrations in Groundwater
2800, 2820, 2855, and 2740 Broadway
Oakland, California

Sample ID	Sample Location	Date Sample	TCE (µg/L)
MW-3*	2740 Broadway	12/10/2013	< 0.5
MW-4*	2740 Broadway	7/13/1993	550
MW-5*	2740 Broadway	7/13/1993	530
MW-6*	2740 Broadway	7/13/1993	2,100
MW-7*	2740 Broadway	12/10/2013	3.8
MW-8*	2740 Broadway	12/10/2013	4.3
MW-9*	2740 Broadway	12/10/2013	< 6.3
VW-1*	2740 Broadway	12/10/2013	< 0.50
VW-2*	2740 Broadway	12/10/2013	< 0.50
VW-3*	2740 Broadway	12/10/2013	< 1.3
MIP-1*	2740 Broadway	4/5/2013	18
MIP-2*	2740 Broadway	4/5/2013	42
MIP-3*	2740 Broadway	4/5/2015	270
MIP-4*	2740 Broadway	4/5/2015	960
MIP-5*	2740 Broadway	4/5/2015	170
Residential: Deep Groundwater: Fine-Coarse Scenario[1]			520
Commercial/Industrial: Deep Groundwater: Fine-Coarse Scenario[1]			4,400
HHR Screening Levels, Residential: Deep Groundwater - Fine-Coarse Scenario[2]			170
HHR Screening Levels, Commercial/Industrial: Deep Groundwater - Fine-Coarse Scenario[2]			1,500

Notes:
µg/L - micrograms per liter
TCE - Trichloroethylene
< - Analyte not detected at or above laboratory detection limit
ESL - Environmental Screening Level(s)
*Analytical result from the most recent sampling event
[1] - San Francisco Regional Water Quality Control Board, User's Guide: Derivation and Application of Environmental Screening Levels (ESLs) Interim Final, Table 4-4
[2] - San Francisco Bay Regional Water Quality Control Board's Environmental Screening Levels, Groundwater Vapor Intrusion Human Health Risk Screening Levels (Volatile Chemicals Only), February 2016 [Rev. 3]

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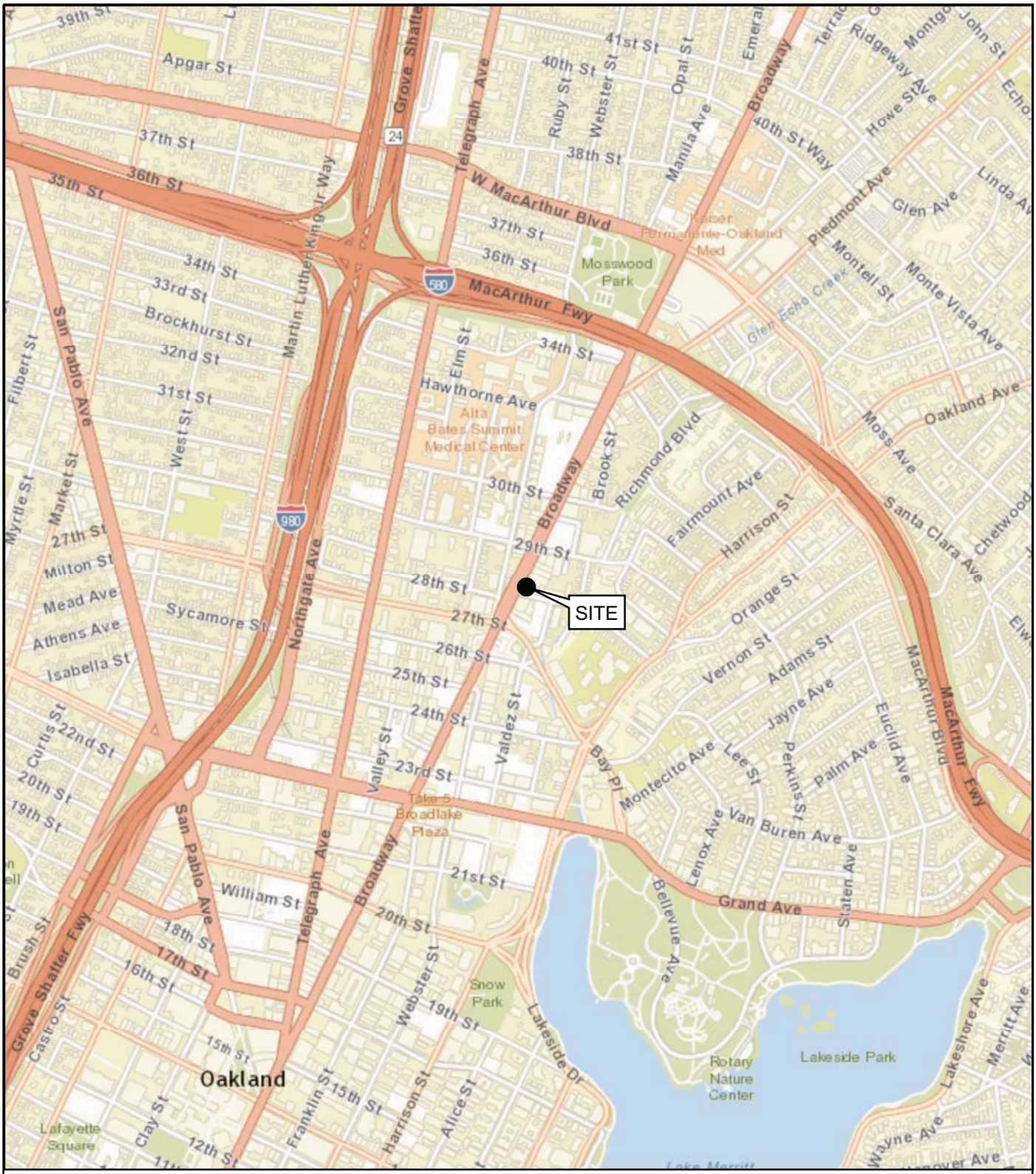
Figures



NOTES:

0 1,000 2,000

Feet

N W E S

World street basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online.
Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN.

2800 BROADWAY
Oakland, California

SITE LOCATION MAP

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Date 11/05/17	Project No. 770638302	Figure 1

Reference: © 2017 Microsoft Corporation, Bing

EXPLANATION

- Approximate location of proposed indoor and ambient air sample location by Langan
- Approximate location of proposed sub-slab sample location by Langan
- L-SB — Approximate location of proposed soil boring by Langan
- L-MIP — Approximate location of proposed MIP boring by Langan
- L-SV — Approximate location of proposed soil-vapor probe by Langan
- L-MW — Approximate location of proposed groundwater monitoring well by Langan
- B-1 — Approximate location of boring by ATC Cardno, September and November 2015
- SB-4 — Approximate location of boring by AEI, April 2015
- MIP-1 — Approximate location of boring by Arcadis, April 2013
- MW-9 — Approximate location of monitoring well by Arcadis (Abandoned in April 2015)
- VW-1 — Approximate location of vapor extraction monitoring well by Arcadis (Abandoned in April 2015)
- SS-SV-1 — Approximate location of sub-slab soil vapor probe by Arcadis (Abandoned in April 2015)
- Sewer Utility Line (based on historical reports)
- Site boundary

N

0 20 Feet

Approximate scale

2800 BROADWAY
Oakland, California

SITE PLAN WITH PROPOSED SAMPLING LOCATIONS

Date 12/05/17	Project No. 770638301	Figure 2

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Reference: © 2017 Microsoft Corporation, Bing

EXPLANATION

- **L-SB** — Approximate location of proposed soil boring by Langan
- **L-MIP** — Approximate location of proposed MIP boring by Langan
- **L-SV** — Approximate location of proposed soil-vapor probe by Langan
- **L-MW** — Approximate location of proposed groundwater monitoring well by Langan
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- **MIP-1** — Approximate location of boring by Arcadis, April 2013
- **MW-9** — Approximate location of monitoring well by Arcadis (Abandoned in April 2015)
- **VW-1** — Approximate location of vapor extraction monitoring well by Arcadis (Abandoned in April 2015)
- **SS-SV-1** — Approximate location of sub-slab soil vapor probe by Arcadis (Abandoned in April 2015)
- Sewer Utility Line (based on historical reports)
- Site boundary
- **150** — TCE concentration (µg/L)

N

0 30 Feet

Approximate scale

2800 BROADWAY
Oakland, California

TCE CONCENTRATIONS IN GROUNDWATER

Date 12/05/17	Project No. 770638301	Figure 3

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L-MIP-9
L-SB-9
BROADWAY
<5.37
L-SV-1-5'
L-SV-1-10'
<5.37
B-19
B-10
L-SV-6-5'
811
B-9
20,000
L-SV-5-5'
3,340
L-SV-2-5'
3,180
L-SV-2-10'
L-SB-1
L-SB-8
L-MW-1
L-MIP-1
SB-6
L-MIP-8
B-8
54,800
L-SV-4-5'
B-6
B-7
B-13
B-14
L-MW-2
L-MIP-7
L-SB-7
SB-4
L-MIP-2
L-SB-2
MIP-1
L-MW-6
B-5
B-4
B-2
SB-5
2,740
L-SV-3-5'
L-SV-3-10'
MW-8
MIP-2
MW-5
L-MW-4
MIP-3
63,300
B-12
L-MIP-4
L-SB-4
MIP-4
MW-6
VW-1
L-MIP-6
L-SB-6
L-MW-3
MW-9
MW-3
L-SB-3
L-MIP-3
28TH STREET
VW-2
L-MW-5
VW-3
L-MIP-5
L-SB-5
<7.2
SS-SV-2
MW-1
VW-4
<6.2
<5.7
SS-SV-1
SS-SV-3
<6.8
SS-SV-4
<6.6
SS-SV-5
<6.7
VW-6
<5.6
MIP-5
MW-4
VW-5
<5.4

Reference: © 2017 Microsoft Corporation, Bing

EXPLANATION

- L-SB — Approximate location of proposed soil boring by Langan
- L-MIP — Approximate location of proposed MIP boring by Langan
- L-SV — Approximate location of proposed soil-vapor probe by Langan
- L-MW — Approximate location of proposed groundwater monitoring well by Langan
- B-1 — Approximate location of boring by ATC Cardno, September and November 2015
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- SS-SV-1 — Approximate location of sub-slab soil vapor probe by Arcadis (Abandoned in April 2015)
- Sewer Utility Line (based on historical reports)
- Site boundary
- 811 — TCE concentration ($\mu g/m^3$)

0 20 Feet
Approximate scale

2800 BROADWAY
Oakland, California

TCE CONCENTRATIONS IN SOIL VAPOR

Date 12/05/17	Project No. 770638301	Figure 4

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Appendix A
RWQCB TCE Vapor Intrusion Trigger Levels for Indoor Air Sampling, Table 4-4

Table 4-4 – TCE ESLs, Action Levels for Indoor Air (Response), and Groundwater and Soil Gas Trigger Levels (Sample Indoor Air)								
Medium	Residential				Commercial/Industrial			
	Cancer Risk ESL	Noncancer Hazard ESL	Lowest ESL	Trigger and Action Levels	Cancer Risk ESL	Noncancer Hazard ESL	Lowest ESL	Trigger and Action Levels
Indoor Air (IA) (µg/m^3)	0.68	2.1	0.68	2.0 Accelerated Response[1]	3.0	8.8	3.0	8.0 Urgent Response[1]
Subslab/ Soil Gas* (µg/m^3)	300	1,100	300	1,000 Sample IA	3,000	8,800	3,000	8,000 Sample IA
Shallow GW (µg/L) Sand Scenario[2]	5.6	17	5.6	17 Sample IA	49	140	49	140 Sample IA
Deep GW (µg/L) Sand Scenario[3]	6.9	21	6.9	21 Sample IA	60	180	60	180 Sample IA
Deep GW (µg/L) Fine-Coarse Scenario[4]	170	520	170	520 Sample IA	1,500	4,400	1,500	4,400 Sample IA

Notes:

1 – Response Action Levels – The Accelerated Response Action Levels (ARALs) and Urgent Response Action Levels (URALs) are USEPA-specified concentrations in indoor air that prompt immediate response actions to reduce exposure (for information on response actions and timing of responses see the Interim Framework for Assessment of Vapor Intrusion at TCE-Contaminated Sites in the San Francisco Bay Region; Regional Water Board October 2014).

2 – Shallow Sand Scenario – Use if first groundwater is shallow (≤10 feet bgs) and predominantly coarse-grained soils or if high likelihood of preferential pathways (manmade or natural). This scenario is the default Tier 1 scenario.

3 – Deep Sand Scenario – Use if first groundwater is deep (>10 feet bgs) and predominantly coarse-grained soils and lower likelihood of preferential pathways.

4 – Fine-Coarse Scenario – Use if first groundwater is deep (>10 feet bgs) and there is a continuous fine-grained soil layer(s) at the water table with a low likelihood of preferential pathways. This scenario can also be used for sites with predominantly fine-grained soils or layers if consistent with the CSM.

* – ESLs and Trigger Levels for soil gas vary slightly due to different exposure factors with the USEPA ARALs/URALs and the ESLs.

Appendix B
DTSC HHRA, Note Number 5

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.

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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.

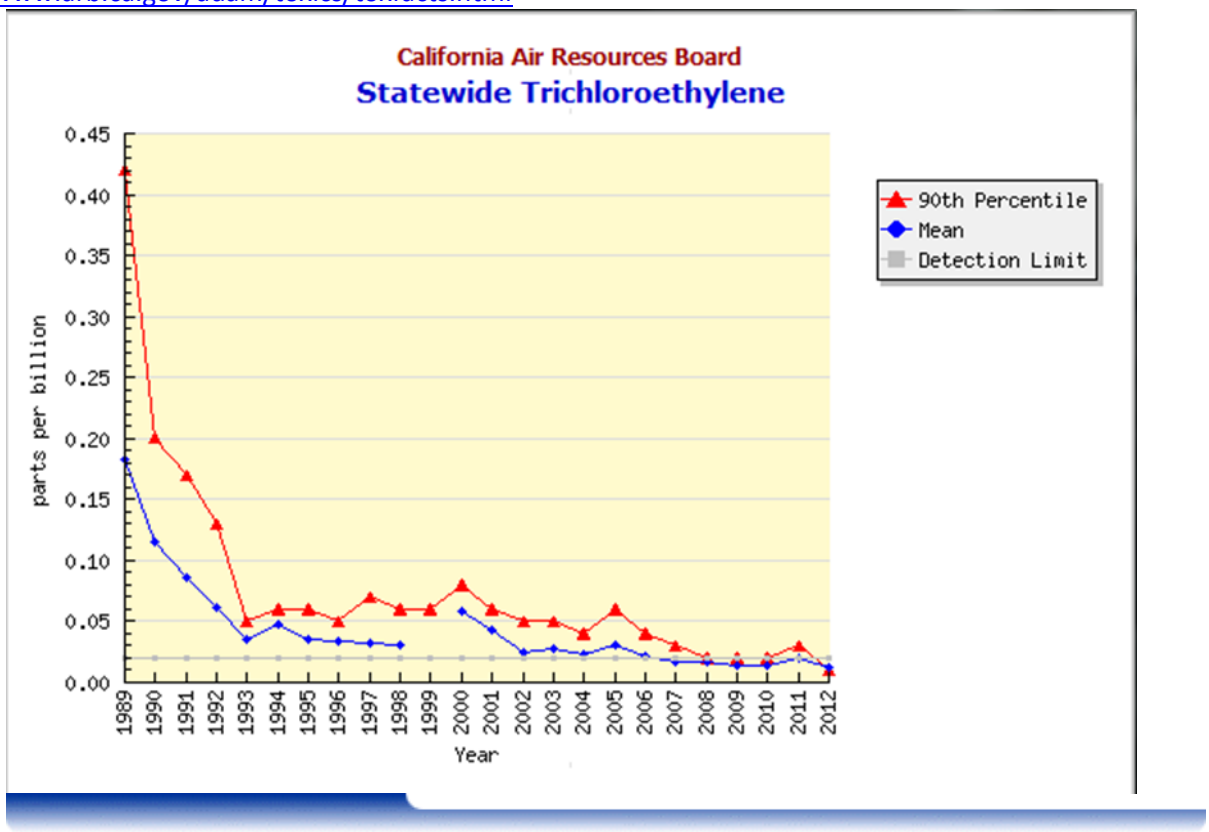
Massachusetts Department of Environmental Protect (MassDEP). Fact Sheet, TCE Toxicity Information: Implications for Chronic and Shorter-Term Exposure. March 27, 2014.

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

Appendix C
Standard Operating Procedure for the Installation and Extraction of the Vapor Pins™

LANGAN

Standard Operating Procedure Installation and Extraction of the Vapor Pin™

March 16, 2012

Scope:

This standard operating procedure describes the installation and extraction of the Vapor Pin™[1] for use in sub-slab soil-gas sampling.

Purpose:

The purpose of this procedure is to assure good quality control in field operations and uniformity between field personnel in the use of the Vapor Pin™ for the collection of sub-slab soil-gas samples.

Equipment Needed:

- Assembled Vapor Pin™ [Vapor Pin™ and silicone sleeve (Figure 1)] - Because of sharp edges, gloves are recommended for sleeve installation;
- Hammer drill;
- 5/8-inch diameter hammer bit (Hilti™ TE-YX 5/8" x 22" #00206514 or equivalent);
- 1½-inch diameter hammer bit (Hilti™ TE-YX 1½" x 23" #00293032 or equivalent) for flush mount applications;
- ¾-inch diameter bottle brush;
- Wet/dry vacuum with HEPA filter (optional);
- Vapor Pin™ installation/extraction tool;
- Dead blow hammer;
- Vapor Pin™ flush mount cover, as necessary;
- Vapor Pin™ protective cap; and
- VOC-free hole patching material (hydraulic cement) and putty knife or trowel.

Figure 1. Assembled Vapor Pin™.

Installation Procedure:

1) Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding.

2) Set up wet/dry vacuum to collect drill cuttings.

3) If a flush mount installation is required, drill a 1½-inch diameter hole at least 1¾-inches into the slab.

4) Drill a 5/8-inch diameter hole through the slab and approximately 1-inch into the underlying soil to form a void.

5) Remove the drill bit, brush the hole with the bottle brush, and remove the loose cuttings with the vacuum.

6) Place the lower end of Vapor Pin™ assembly into the drilled hole. Place the small hole located in the handle of the extraction/installation tool over the Vapor

[1] Cox-Colvin & Associates, Inc., designed and developed the Vapor Pin™; a patent is pending.

Pin™ to protect the barb fitting and cap, and tap the Vapor Pin™ into place using a dead blow hammer (Figure 2). Make sure the extraction/installation tool is aligned

Figure 2. Installing the Vapor Pin™.

parallel to the Vapor Pin™ to avoid damaging the barb fitting.

For flush mount installations, unscrew the threaded coupling from the installation/extraction handle and use the

Figure 3. Flush-mount installation.

hole in the end of the tool to assist with the installation (Figure 3).

During installation, the silicone sleeve will form a slight bulge between the slab and the Vapor Pin™ shoulder. Place the protective cap on Vapor Pin™ to prevent vapor loss prior to sampling (Figure 4).

Figure 4. Installed Vapor Pin™.

7) For flush mount installations, cover the Vapor Pin™ with a flush mount cover.

8) Allow 20 minutes or more (consult applicable guidance for your situation) for the sub-slab soil-gas conditions to equilibrate prior to sampling.

9) Remove protective cap and connect sample tubing to the barb fitting of the Vapor Pin™ (Figure 5).

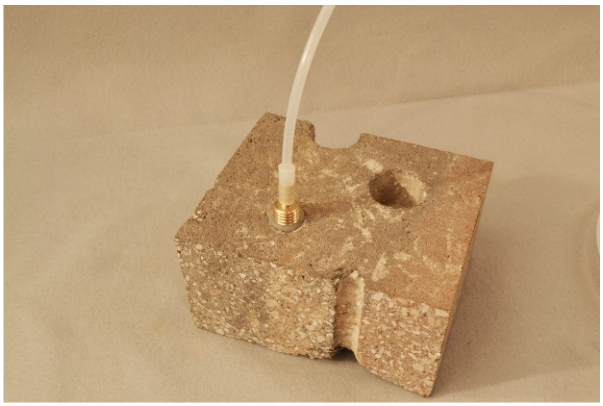


Figure 5. Vapor Pin™ sample connection.

10) Conduct leak tests [(e.g., real-time

monitoring of oxygen levels on extracted sub-slab soil gas, or placement of a water dam around the Vapor Pin™) Figure 6].

Figure 6. Water dam used for leak detection.

Consult your local guidance for possible tests.

11) Collect sub-slab soil gas sample. When finished sampling, replace the protective cap and flush mount cover until the next sampling event. If the sampling is complete, extract the Vapor Pin™.

Extraction Procedure:

1) Remove the protective cap, and thread the installation/extraction tool onto the barrel of the Vapor Pin™ (Figure 7). Continue turning the tool to assist in extraction, then pull the Vapor Pin™ from the hole (Figure 8).

Figure 7. Removing the Vapor Pin™.

Figure 8. Extracted Vapor Pin™.

2) Fill the void with hydraulic cement and smooth with the trowel or putty knife.

3) Prior to reuse, remove the silicone sleeve and discard. Decontaminate the Vapor Pin™ in a hot water and Alconox® wash, then heat in an oven to a temperature of 130° C.

The Vapor Pin™ to designed be used repeatedly; however, replacement parts and supplies will be required periodically. These parts are available on-line at www.CoxColvin.com.

Replacement Parts:

Vapor Pin™ Kit Case - VPC001
Vapor Pins™ - VPIN0522
Silicone Sleeves - VPTS077
Installation/Extraction Tool - VPIE023
Protective Caps - VPPC010
Flush Mount Covers - VPFM050
Water Dam - VPWD004
Brush - VPB026