Ensuring Occupational Worker Safety At Vapor Intrusion Sites

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DTSC Guidance – Worker protection

Appendix F of DTSC's Vapor Intrusion guidance document states that:

"For sites in California, regardless of whether the exposure scenario is residential, commercial, or industrial, OSHA PELs should not be used as indoor air screening levels for vapor intrusion".

"DTSC regulates chemicals in the subsurface and any human exposure derived from the associated contaminant migration, whereas OSHA regulates workspaces and any associated exposure derived from workplace air contaminants."

Challenges faced when evaluating worker exposures/risks at VI sites

a) Some facilities argue that OSHA PELs apply to ALL workers, regardless of whether VOCs are part of the process.
b) The same types of VOCs that are present in the subsurface contamination are also used as part of daily operations at the facility.
c) Office workers are present on the premises who do not handle VOCs as part of their job.

Background

- We routinely encounter situations where there are high levels of VOCs in the subsurface and there are also indoor workers onsite.
- Typically, these are RCRA facilities, but many are also non-RCRA facilities that have been operating for decades.
- Uncontrolled releases of VOCs into the subsurface occurred in the past when regulations were lax or non-existent.
- Regulations have become more stringent as toxicity data were updated and risk assessment methodologies evolved.
- Today, indoor air levels of VOCs that are considered acceptable, are based on the lead regulatory agency: you may let workers operate (OSHA) or have them evacuate the site (EPA).

OSHA vs. EPA

	Occupational Safety and Health Administration	Environmental Protection Agency
Mission	Provide a safe and health workplace	Protect Public health and the environment
Target population	Healthy Workers	General population
Air concentrations	Permissible Exposure Limits	Screening values for initial evaluation (e.g., RSLs)
Enforceable	Yes	No (risk-based evaluations)
Source of toxicity values	Human data	Primarily animal data
Uncertainty factors	No	Yes
Range of values	ppm (mg/m^3)	ppb ($\mu g/m^3$) range for many of the common VOCs encountered at vapor intrusion sites
When were values developed?	Most PELs were developed prior to the 1970s	Updated frequently

Case Study: Waste Oil Recycling Facility

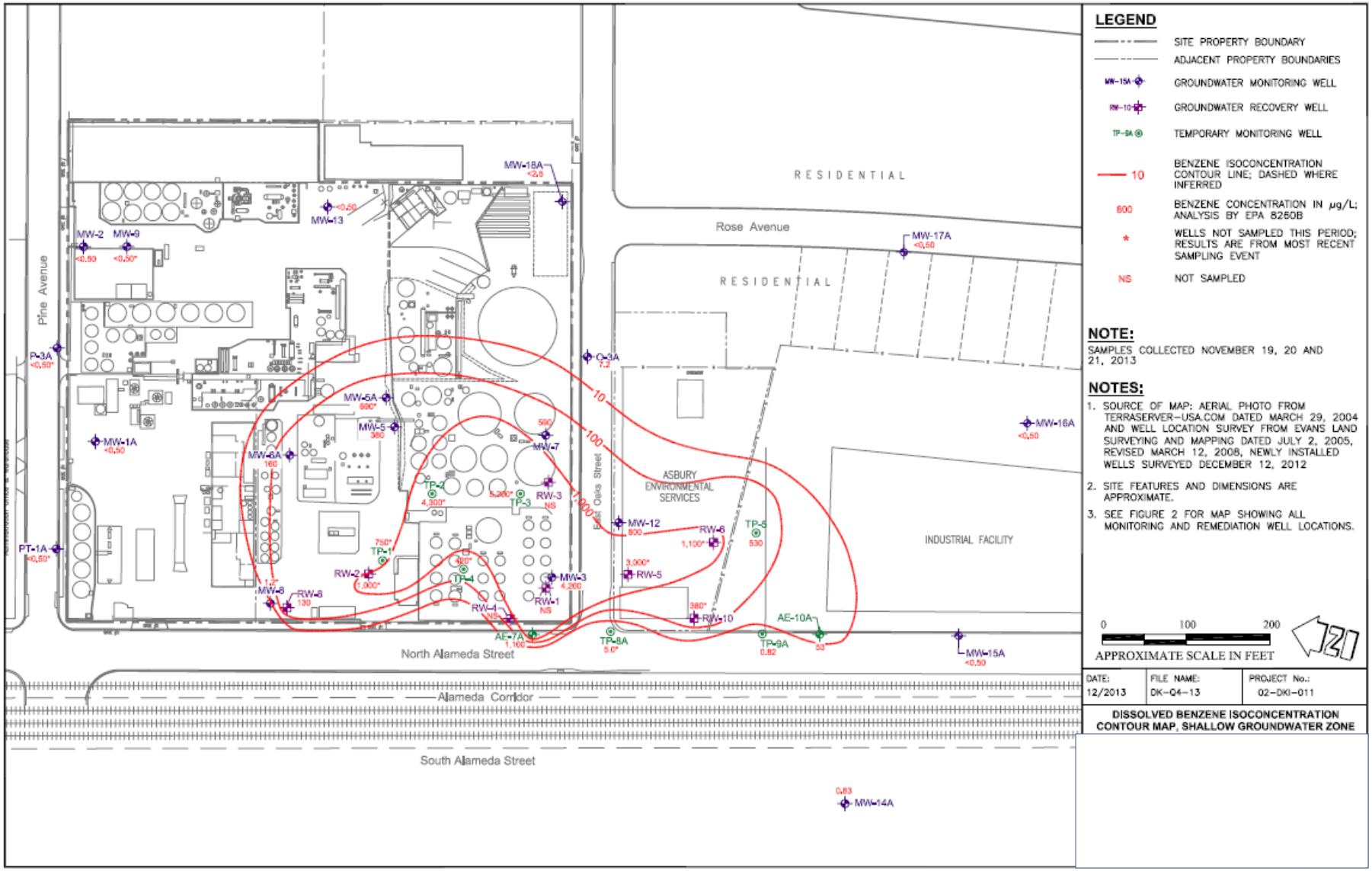
- 13 acre site located in a heavily industrial area, residences adjacent and schools close by
- Facility formerly used as an Oil Refinery (manufactured petroleum products such as greases, soluble oils, quenching oils, transformer oil and other petroleum products)
- Currently, it is a waste oil recycling facility (waste oil, oily water, waste gasoline, used oil filters, used antifreeze). These materials are processed into useable products and sold to industry.
- Operates 24/7; facility is currently paved ; GW at 27-30 feet

Site Investigations

- Light non-aqueous phase liquid (LNAPL) detected in several monitoring wells
- High concentrations of VOCs in groundwater (8,200 ug/L vinyl chloride, 1,000 ug/L of benzene)
- Methane detected up to 165,000 ppmv

- **Interim remedial measures:** Over the last 15 years
  - Operating a liquid phase hydrocarbon (LPH): > 17,500 gallons of LPH extracted
  - Groundwater recovery system: 29,000,000 gallons of affected groundwater removed
  - > 26,000 lbs of VOC removed via vapor extraction treatment (VET) since 2011

Groundwater Benzene Plume



LEGEND

- SITE PROPERTY BOUNDARY
- ADJACENT PROPERTY BOUNDARIES
- MW-15A — GROUNDWATER MONITORING WELL
- RW-10 — GROUNDWATER RECOVERY WELL
- TP-9A — TEMPORARY MONITORING WELL
- 10 — BENZENE ISOCONCENTRATION CONTOUR LINE; DASHED WHERE INFERRED
- 800 — BENZENE CONCENTRATION IN µg/L; ANALYSIS BY EPA 8260B
- * — WELLS NOT SAMPLED THIS PERIOD; RESULTS ARE FROM MOST RECENT SAMPLING EVENT
- NS — NOT SAMPLED

NOTE:

SAMPLES COLLECTED NOVEMBER 19, 20 AND 21, 2013

NOTES:

1. SOURCE OF MAP: AERIAL PHOTO FROM TERRASERVER-USA.COM DATED MARCH 29, 2004 AND WELL LOCATION SURVEY FROM EVANS LAND SURVEYING AND MAPPING DATED JULY 2, 2005, REVISED MARCH 12, 2008, NEWLY INSTALLED WELLS SURVEYED DECEMBER 12, 2012
2. SITE FEATURES AND DIMENSIONS ARE APPROXIMATE.
3. SEE FIGURE 2 FOR MAP SHOWING ALL MONITORING AND REMEDIATION WELL LOCATIONS.

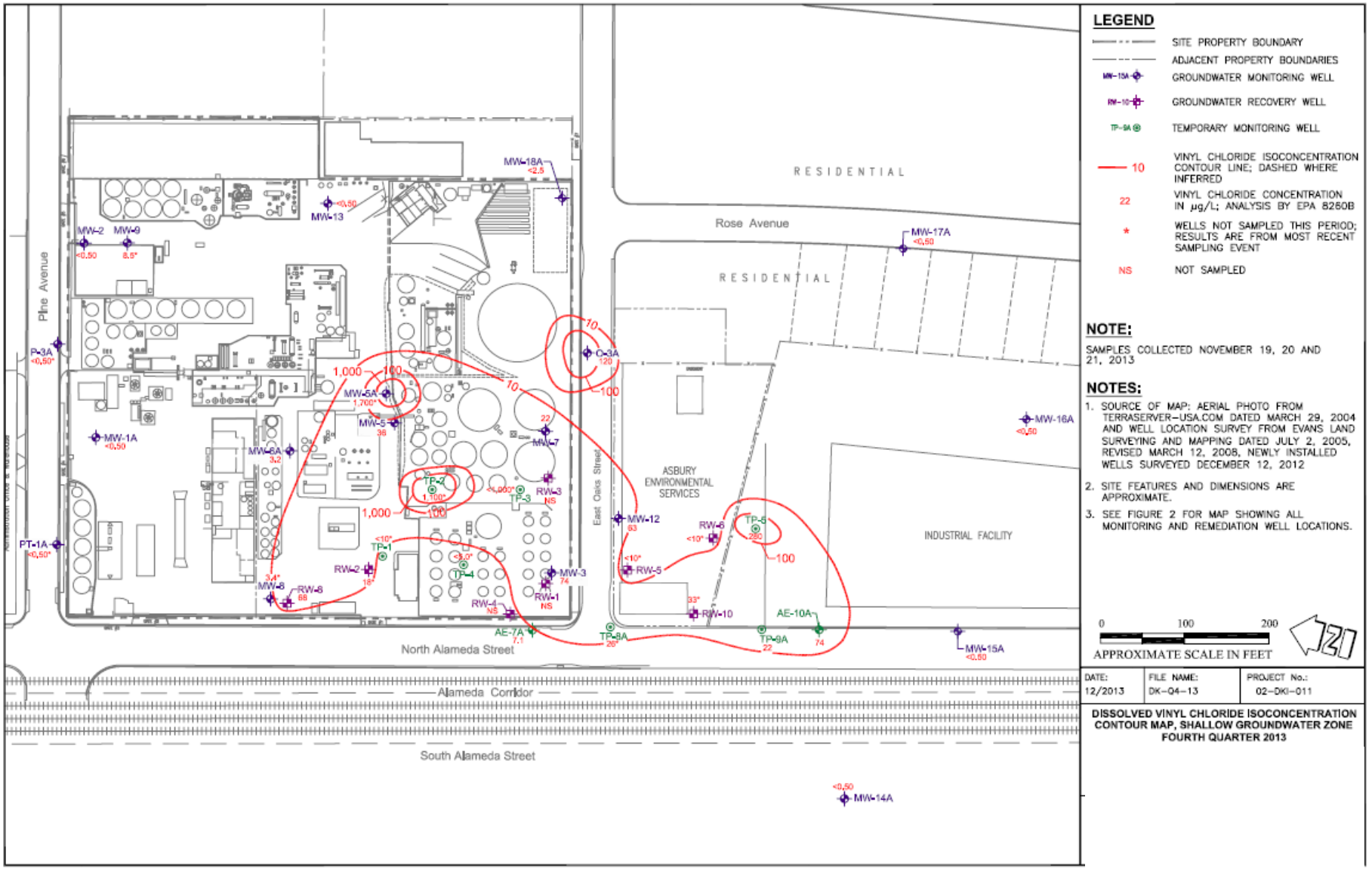
0 100 200

APPROXIMATE SCALE IN FEET

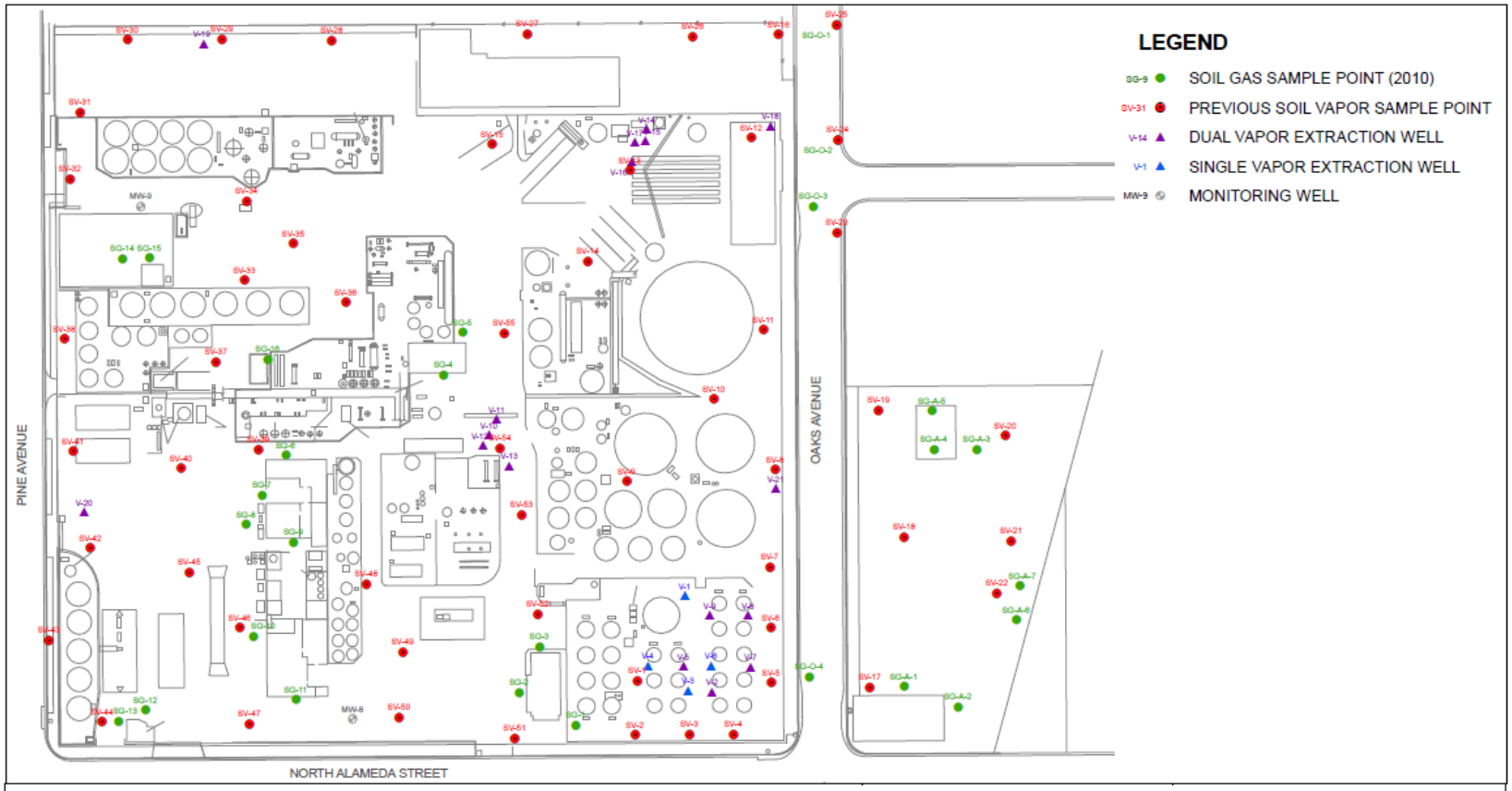
DATE:	FILE NAME:	PROJECT No.:
12/2013	DK-04-13	02-DKI-011

DISSOLVED BENZENE ISOCONCENTRATION CONTOUR MAP, SHALLOW GROUNDWATER ZONE

Groundwater Vinyl Chloride Plume



Soil Gas Investigations



Soil Gas VOC Concentrations

VOC	5 feet soil gas data (ug/L)		15 feet soil gas data (ug/L)	
	Minimum	Maximum	Minimum	Maximum
Benzene	0.17	109.00	0.25	861.00
Ethylbenzene	0.49	184.00	0.08	1,120.00
Toluene	0.93	409.00	0.15	3,900.00
1,2,4-Trimethylbenzene	0.79	190.00	0.03	404.00
Trichloroethylene	0.49	16.00	0.19	4.00
Tetrachloroethylene	0.19	10.00	0.49	8.50
Vinyl Chloride	0.12	35.00	1.1	71.00
Xylene	2.3	671.00	1.2	3,540.00
Gasoline	26.5	6,060.00	16	32,800.00

Predicted Indoor Air VOC Concentrations

VOC	Based on 5 feet bgs data (ug/m^3)		Based on 15 feet bgs data (ug/m^3)		Air Screening Levels (ug/m^3)	CalOSHA PEL (ug/m^3)
	Min.	Max.	Min.	Max.		
Benzene	0.09	**59.00**	0.06	**210.00**	0.42 (DTSC)	3,194
Ethylbenzene	0.23	**85.00**	0.02	**220.00**	4.9 (USEPA)	22,000
Toluene	0.46	210.00	0.03	840.00	1,300 (DTSC)	37,000
1,2,4-Trimethylbenzene	0.34	**81.00**	0.01	**71.00**	31 (USEPA)	125,000
Trichloroethylene	0.23	**7.40**	0.04	0.78	3.0 (USEPA)	135,000
Tetrachloroethylene	0.092	**3.80**	0.07	1.30	2.1 (DTSC)	170,000
Vinyl Chloride	0.07	**21.00**	0.31	**20.00**	0.16 (DTSC)	2,556
Xylene	1.10	310.00	0.23	**690.00**	440 (USEPA)	435,000

Values exceeding DTSC air screening levels for VOCs.

Predicted Cancer Risks and Non-Cancer Hazards

	Predicted Cancer Risk (per million)				Predicted non-cancer hazard			
VOC	5 feet soil gas data		15 feet soil gas data		5 feet soil gas data		15 feet soil gas data	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Benzene	0.22	**140**	0.14	**490**	0.0007	0.45	0.00046	**1.6**
Ethylbenzene	0.046	**17**	0.003	**44**	0.00005	0.019	0.000003	0.05
Toluene					0.00035	0.17	0.00002	0.64
1,2,4-Trimethylbenzene					0.011	**2.6**	0.00017	**2.3**
Trichloroethylene	.075	**2.5**	0.012	0.26	.026	0.84	0.0043	0.089
Tetrachloroethylene	0.025	**1.8**	0.035	0.61	0.00047	0.025	0.00048	0.0083
Vinyl Chloride	0.45	**130**	2.0	**130**	0.00016	0.047	0.0007	0.045
Xylene					0.0024	0.71	0.00053	**1.6**

Indoor air sampling?

- Based on predicted indoor air concentrations, DTSC asked for specific information such as (a) types of workers (b) identity of buildings with workers (c) documentation showing that all workers are appropriately trained and monitored.

- Facility stated that predicted levels are well below OSHA PELs and that ALL workers, including office workers, are covered under OSHA, in any operating facility. Not under DTSC's jurisdiction.

- DTSC contacted California OSHA to determine agency involvement in facility oversight.

- CalOSHA stated that they only investigate instances of complaints or injury at workplaces and it is the lead agency's responsibility to ensure that the facility is monitoring its workers appropriately.

Next Steps

- DTSC asked the facility to show records demonstrating compliance.
- Facility provided the site Health and Safety Plan (H&SP) and methane monitoring data for review by DTSC's Health and Safety Program.
- DTSC found the H&SP to be inadequate and recommended collection of personal air samples for the various types of employees at the facility.
- Facility prepared Work Plan for Employee Air Monitoring.

Employee Air Monitoring

- Eight employees (1 office employee, one laboratory employee, one control room employee, two laborers, three drum handlers)

- Mini-Summa canisters – laboratory certified Mini-Cans from ALS with flow controllers. Analyzed for full suite of VOCs in TO-15 list

Employee Monitoring Data (Indoor Employees)

VOC	Laboratory Worker	Office Staff	Control Room Employee	Air Screening Levels (ug/m^3)	CalOSHA PEL (ug/m^3)
Benzene	**1.7**	**4.4**	**4.8**	0.42 (DTSC)	3,194
Ethylbenzene	2.04	1.8	**6.5**	4.9 (DTSC)	22,000
Methylene Chloride	**3821**	**52.1**	**55.6**	12 (DTSC)	86,850.72
Toluene	32.0	15.5	37.7	1,300 (DTSC)	37,000
1,2,4-trimethylbenzene	2.8	2.9	nd	31 (USEPA)	125,000
Trichloroethylene	nd	nd	nd	3.0 (USEPA)	135,000
Tetrachloroethylene	4.1	nd	nd	2.1 (DTSC)	170,000
Vinyl Chloride	nd	nd	nd	0.16 (DTSC)	2,556
Xylene	9.1	2.7	12.59	438 (USEPA)	435,000

Note: Other VOCs detected were acetone, cyclohexane, dichlorodifluoromethane, heptane, MEK, hexane, Freon 11.

Employee Monitoring Data (Outdoor Employees)

VOC	Drum Handler (ug/m^3)	Laborer (ug/m^3)	Outdoor Sample (ug/m^3)	Air Screening Levels (ug/m^3)	CalOSHA PEL (ug/m^3)
	Maximum				
Benzene	6.7	11.5	3.5	0.42 (DTSC)	3,194
Ethylbenzene	25.2	5.21	4.8	4.9 (DTSC)	22,000
Methylene Chloride	6948.0	90.3	4.5	12 (DTSC)	86,850.72
Toluene	211.0	67.8	19.6	1,300 (DTSC)	37,000
1,2,4-trimethylbenzene	11.3	5.9	5.9	31 (USEPA)	125,000
Trichloroethylene	nd	2.42	nd	3.0 (USEPA)	135,000
Tetrachloroethylene	nd	55.6	nd	2.1 (DTSC)	170,000
Vinyl Chloride	nd	nd	nd	0.16 (DTSC)	2,556
Xylene	27.4	5.7	2.74	438 (USEPA)	435,000

Conclusions

- VOCs detected in indoor and ambient air are well below CalOSHA PELs.
- Indoor workers at the facility do not appear to be exposed to unacceptable levels of VOCs *originating from the subsurface*, under DTSC's criteria.
- Methylene chloride and other VOCs detected as part of the monitoring program for all workers, are originating from facility operations at the site.
- Employees will be monitored annually using procedures that are acceptable to DTSC.

Recommendations

- Don’t assume that OSHA is overseeing workers safety at these facilities.
- Get Industrial Hygienist involved; check H&SP.
- Make sure workers are:
  - appropriately trained (HAZWOPER)
  - know how to use PPE
  - cognizant of the risks (Proposition 65)