

DRAFT Table O.1(a). Construction Worker Inhalation Risk from VOCs in Groundwater During Field House Construction

Compound	Excavation Air conc (mg/m3) (1)	Exposure Frequency (events/yr)	Exposure Duration (hrs/event)	Exposure Period (yrs)	Averaging Period (yrs)	Average Daily Exposure (mg/m3)	Unit Risk (mg/m3)-1	ELCR	RfC (mg/m3)	Hazard Index
<i>Carcinogens</i>										
Trichloroethene	3.05E-04	30	8	1	70	1.11E-07	1.10E-04	1.2E-11		
Teterachloroethene	4.99E-03	30	8	1	70	1.82E-06	5.52E-05	1.0E-10		
Chloroform	6.76E-03	30	8	1	70	2.47E-06	2.30E-02	5.7E-08		
<i>Noncarcinogens</i>										
Trichloroethene	3.05E-04	30	8	1	1	8.34E-06			4.00E-02	2.1E-04
Napthalene	3.30E-05	30	8	1	1	9.04E-07			3	3.0E-07
Chloroform	6.76E-03	30	8	1	1	1.85E-04			0.66	2.8E-04
MTBE	2.71E-04	30	8	1	1	7.43E-06			3	2.5E-06
TOTAL RISK								5.7E-08		4.9E-04

1. Ambient air concentrations are calculated from the RTI model for estimating emissions from lagoons.
2. cis-1,2-DCE has no RfC or UR for inhalation exposure.

DRAFT Table O.1(b). Trench model for volatilization of contaminants from groundwater during excavation activities.

Compound	C	SA	Excavation Dimensions			H	M	kg	kl	K	E	Q	A	Estimated Trench Air Concentration (mg/m ³)
	Groundwater Concentration (mg/l)	Liquid Surface Area (m ²)	(L) Length (m)	(W) Width (m)	(D) Depth (m)	Henry's Law Constant (m ³ .atm/mol.K)	Molecular Weight (g/mole)	Phase Exchange Coefficient - Gas (m/hr)	Phase Exchange Coefficient - Liquid (m/hr)	Overall Mass Transfer Coefficient (m/sec)	Emission Rate (g/s)	Wind Speed (m/s)	Cross-sectional Area of Trench (m ²)	
<i>Volatile Organic Compounds</i>														
Tetrachloroethene	0.47	242.0	37.0	28.9	4.0	2.90E-02	165.83	9.88E+00	1.03E-01	2.837E-05	3.23E-03	5.6	115.4	4.99E-03
Trichloroethene	0.03	242.0	37.0	28.9	4.0	9.10E-03	131.4	1.11E+01	1.16E-01	3.127E-05	1.97E-04	5.6	115.4	3.05E-04
Napthalene	0.00	242.0	37.0	28.9	4.0	4.82E-04	128.16	1.12E+01	1.17E-01	2.129E-05	1.29E-05	5.6	115.4	1.99E-05
Chloroform	0.47	242.0	37.0	28.9	4.0	3.66E-03	80.52	1.42E+01	1.48E-01	3.839E-05	4.37E-03	5.6	115.4	6.76E-03
MBTE	0.03	242.0	37.0	28.9	4.0	6.23E-04	88.15	1.36E+01	1.41E-01	2.785E-05	1.75E-04	5.6	115.4	2.71E-04
cis-1,2-DCE	0.0025	242.0	37.0	28.9	4.0	4.07E-03	96.95	1.29E+01	1.35E-01	3.522E-05	2.13E-05	5.6	115.4	3.30E-05

Notes

1. US EPA Office of Water Quality Planning and Standards, Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF) Air Emissions Models, July 1990.
2. Groundwater concentration is based on the maximum concentrations of VOCs detected in groundwater samples.
3. Liquid surface area was calculated as the length times the width of the proposed construction area. The excavation area will be de-watered during construction, however the area will contain some standing water, we have assumed 50 percent to account for volatilization from two other transport mechanisms (i.e., from groundwater to soil gas to air and from soil to air). Therefore, a factor of 0.5 was applied to the liquid surface area.
4. Dimensions of the new field house are approximately 37m x 29m.
5. The depth of the excavation was assumed to be 4m. Depth of trench is the surrogate parameter for mixing height. The actual excavations will range from 4-5ft deep for the field house to 3ft deep for the utility trenches. Given these depths of excavations, the mixing heights are much greater than the depth of the excavation; 4m is considered a conservative estimate of mixing height, as the actual mixing height is likely to be many times that value.
6. Molecular weight and Henry's Law Constant were obtained from MADEP, Background Documentation for the Development of the MCP Numerical Standards, April 1994; "Controlling Volatile Emissions at Hazardous Waste Sites," Appendix E, Diffusion Coefficients in Air and Water for RCRA Wastes Identified as Highly Volatile from Water; or USEPA, Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF) Air Emission Models, December 1987, and Revisions to the Massachusetts Contingency Plan, 310 CMR 40.0000, Public Hearing Draft, January 17, 1997.
7. Windspeed of air moving through the trench was based on Gas Research Institute (GRI) Management of Manufactured Gas Plant Sites, Volume III (Risk Assessment), Appendix B. The mean wind speed for Boston, Massachusetts of 5.6 m/s was used to represent the windspeed of air moving across the excavated area.
8. The cross-sectional area of the excavation area is based on the field house and trenches. It was assumed that trenches 2m wide and totalling 100m in length would be excavated. It was assumed that 50% of the excavated areas would have standing water.

DRAFT Table O.4(a). Field House Adult Resident Risk

This spread sheet is the final calculation of risk from indoor air exposure in the field house.

Air concentrations are a time weighted average - see last sheet for calculation.

In accordance with MADEP guidance, the average daily exposure is scaled from the indoor air concentration based on the site specific exposure parameters. Exposure period is set to 30 years for the adult resident.

Compound	Indoor Air conc (ug/m3) (1)	Exposure Frequency (events/yr)	Exposure Duration (hrs/event)	Exposure Period (yrs)	Averaging Period (yrs)	Average Daily Exposure (ug/m3)	Unit Risk (ug/m3)-1	ECLR	RfC (mg/m3)	Hazard Index
<i>Carcinogens</i>										
Trichloroethene	8.48E-02	48	4	30	70	7.44E-04	1.10E-04	8.2E-08		
Teterachloroethene	2.37E+00	48	4	30	70	2.08E-02	5.52E-05	1.1E-06		
<i>Noncarcinogens</i>										
Trichloroethene	8.48E-02	48	4	30	30	3.10E-03			4.00E+01	7.7E-05
Napthalene	8.55E-03	48	4	30	30	3.12E-04			0.003	1.0E-01
TOTAL RISK								1.2E-06		1.0E-01

1. TWA air concentration is a time weighted average concentration based on an individual spending 3.75 hrs in the field house and 0.25 hr in the elevator for each 4 hr event. Weighted average = $[(3.75 \times \text{Air Conc field house}) + (0.25 \times \text{Air conc elevator})] / 4$

DRAFT Table O.4(b). Field House Child Resident Risk

This spread sheet is the final calculation of risk from indoor air exposure in the field house.

Air concentrations are a time weighted average - see last sheet for calculation.

In accordance with MADEP guidance, the average daily exposure is scaled from the indoor air concentration based on the site specific exposure parameters. Exposure period is set to 18 yrs assuming exposure could occur from age 1 yr through 18.

Compound	Indoor Air conc (ug/m3) (1)	Exposure Frequency (events/yr)	Exposure Duration (hrs/event)	Exposure Period (yrs)	Averaging Period (yrs)	Average Daily Exposure (ug/m3)	Unit Risk (ug/m3)-1	ECLR	RfC (mg/m3)	Hazard Index
<i>Carcinogens</i>										
Trichlorothene	8.48E-02	48	4	18	70	4.46E-04	1.10E-04	4.9E-08		
Teterachloroethene	2.37E+00	48	4	18	70	1.25E-02	5.52E-05	6.9E-07		
<i>Noncarcinogens</i>										
Trichlorothene	8.48E-02	48	4	18	18	1.86E-03			4.00E+01	4.6E-05
Napthalene	8.55E-03	48	4	18	18	1.87E-04			0.003	6.2E-02
TOTAL RISK								7.4E-07		6.3E-02

1. TWA air concentration is a time weighted average concentration based on an individual spending 3.75 hrs in the field house and 0.25 hr in the elevator for each 4 hr event. Weighted average = $[(3.75 \times \text{Air Conc field house}) + (0.25 \times \text{Air conc elevator})] / 4$

DRAFT Table O.4(c). Field House Worker Risk

This spread sheet is the final calculation of risk from indoor air exposure in the field house.

Air concentrations are a time weighted average - see last sheet for calculation.

In accordance with MADEP guidance, the average daily exposure is scaled from the indoor air concentration based on the site specific exposure parameters. Exposure period is set to 30yrs for worker, 8hrs/day, 5days/wk, 50 wks/yr

Compound	Indoor Air conc (ug/m3) (1)	Exposure Frequency (events/yr)	Exposure Duration (hrs/event)	Exposure Period (yrs)	Averaging Period (yrs)	Average Daily Exposure (ug/m3)	Unit Risk (ug/m3)-1	ECLR	RfC (mg/m3)	Hazard Index
<i>Carcinogens</i>										
Trichlorothene	8.48E-02	250	8	15	70	3.87E-03	1.10E-04	4.3E-07		
Teterachloroethene	2.37E+00	250	8	15	70	1.08E-01	5.52E-05	6.0E-06		
<i>Noncarcinogens</i>										
Trichlorothene	8.48E-02	250	8	15	15	1.61E-02			4.00E+01	4.0E-04
Napthalene	8.55E-03	250	8	15	15	1.63E-03			0.003	5.4E-01
TOTAL RISK								6.4E-06		5.4E-01

1. TWA air concentration is a time weighted average concentration based on an individual spending 7.5 hrs in the field house and 0.5 hr in the elevator for each 8hr event. Weighted average = $[7.5 \times \text{Air Conc field house}] + (0.5 \times \text{Air conc elevator}) / 8$