TABLE 3-7
VAPOR INTRUSION MODEL: SITE-SPECIFIC CALCULATIONS BASED ON DATA ENTERED
RESIDENTIAL SCENARIO

Former Lewis Chemical Corporation
0 & 12-24 Fairmount Court
Hyde Park, MA

Building Information **MORE ↓**

Source-building separation, L_T (cm)	Floor-wall seam perimeter, X_{crack} (cm)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Area of crack, A_{crack} (cm^2)
1	3,844	5.63E+04	1.63E+06	2.36E-04	183	1.75E-04	1	183	0.10	6.57E+01	3.84E+02

Capillary Zone **MORE ↓**

Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)
17.05	0.43	0.177	0.253

Soil Strata

Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)
0.370	0.019	9.92E-08	0.987	9.79E-08

Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)
0.370

Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)
0.370

END

TABLE 3-8
VAPOR INTRUSION MODEL: CALCULATION OF THE INFINITE SOURCE INDOOR ATTENUATION COEFFICIENT
RESIDENTIAL SCENARIO

Former Lewis Chemical Corporation
0 & 12-24 Fairmount Court
Hyde Park, MA

Chemical of Potential Concern	CAS Number	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Capill. Zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total effective diffusion coefficient, D^{eff}_T (cm^2/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Exponent of equivalent foundation Peclet # exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)
DICHLOROETHANE, 1,1-	75-34-3	7,450	2.89E-03	1.24E-01	1.46E-02	1.26E-03	8.01E-05	1.46E-02	1.19E+76	7.76E-04
DICHLOROETHANE, 1,2-	107-06-2	8,522	5.51E-04	2.37E-02	2.05E-02	1.78E-03	1.13E-04	2.05E-02	1.89E+54	8.60E-04
DICHLOROETHYLENE, 1,1-	75-35-4	6,392	1.47E-02	6.34E-01	1.78E-02	1.52E-03	9.68E-05	1.78E-02	5.24E+62	8.23E-04
DICHLOROETHYLENE, CIS-1,2-	156-59-2	7,734	2.04E-03	8.79E-02	1.45E-02	1.25E-03	7.96E-05	1.45E-02	4.95E+76	7.74E-04
DICHLOROETHYLENE, TRANS-1,2-	156-60-5	7,136	4.96E-03	2.13E-01	1.40E-02	1.19E-03	7.62E-05	1.40E-02	6.92E+79	7.63E-04
DICHLOROMETHANE	75-09-2	7,034	1.73E-03	7.46E-02	1.99E-02	1.71E-03	1.09E-04	1.99E-02	7.73E+55	8.52E-04
ETHYLBENZENE	100-41-4	10,155	3.18E-03	1.37E-01	1.48E-02	1.27E-03	8.09E-05	1.48E-02	1.83E+75	7.78E-04
TETRACHLOROETHYLENE	127-18-4	9,553	7.53E-03	3.24E-01	1.42E-02	1.21E-03	7.75E-05	1.42E-02	2.50E+78	7.67E-04
TOLUENE	108-88-3	9,154	2.93E-03	1.26E-01	1.72E-02	1.47E-03	9.38E-05	1.72E-02	7.61E+64	8.15E-04
TRICHLOROBENZENE, 1,2,4-	120-82-1	9,572	6.03E-04	2.60E-02	1.54E-02	1.33E-03	8.52E-05	1.54E-02	2.33E+72	7.91E-04
TRICHLOROETHANE, 1,1,1-	71-55-6	7,885	8.50E-03	3.66E-01	1.54E-02	1.32E-03	8.40E-05	1.54E-02	2.33E+72	7.88E-04
TRICHLOROETHYLENE	79-01-6	8,557	4.58E-03	1.97E-01	1.56E-02	1.33E-03	8.51E-05	1.56E-02	2.83E+71	7.91E-04
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	76-13-1	6,972	2.82E-01	1.21E+01	5.68E-03	4.85E-04	3.10E-05	5.68E-03	9.93E+195	5.06E-04
VINYL CHLORIDE	75-01-4	5,000	1.78E-02	7.65E-01	2.09E-02	1.79E-03	1.14E-04	2.09E-02	1.79E+53	8.61E-04
XYLENES (Mixed Isomers)	1330-20-7	10,248	2.65E-03	1.14E-01	1.52E-02	1.30E-03	8.30E-05	1.52E-02	2.53E+73	7.85E-04

TABLE 3-9
PREDICTED INDOOR AIR CONCENTRATION FOR RESIDENTIAL SCENARIO

Former Lewis Chemical Corporation
0 & 12-24 Fairmount Court
Hyde Park, MA

Chemical of Potential Concern	CAS Number	Soil Gas Concentration (mg/m^3)	Attenuation Factor (a)	Estimated Indoor Air Concentration (mg/m^3)	MADEP Background Indoor Air Concentration[3]
Volatile Organic Compounds					
1,1,1-Trichloroethane	71-55-6	1.1E+03	7.9E-04	8.9E-01	
1,1-Dichloroethane	75-34-3	1.6E+01	7.8E-04	1.2E-02	
1,1-Dichloroethene	75-35-4	1.9E+01	8.2E-04	1.6E-02	
1,2,4-Trimethylbenzene	95-63-6	3.8E+00	7.8E-04	3.0E-03	
1,2-Dichloroethane	107-06-2	6.0E+00	8.6E-04	5.1E-03	
cis-1,2-Dichloroethene	156-59-2	4.4E+02	7.7E-04	3.4E-01	
Ethylbenzene	100-41-4	7.3E+00	7.8E-04	5.7E-03	
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	76-13-1	3.0E+02	5.1E-04	1.5E-01	
Methylene chloride	75-09-2	1.4E+01	8.5E-04	1.2E-02	
Tetrachloroethene	127-18-4	1.3E+03	7.7E-04	1.0E+00	
Toluene	108-88-3	2.3E+01	8.2E-04	1.9E-02	
trans-1,2-Dichloroethene	156-60-5	6.1E+00	7.6E-04	4.7E-03	
Trichloroethene	79-01-6	9.0E+02	7.9E-04	7.1E-01	
Vinyl chloride	75-01-4	7.0E+00	8.6E-04	6.0E-03	
Total Xylenes	1330-20-7	3.2E+01	7.8E-04	2.5E-02	

Notes:

1. $[OHM]_{air} = [OHM]vapor * alpha$

   Where:

   $[OHM]_{air}$ = Estimated indoor air concentration, in units of mg/m^3.

   $[OHM]_{vapor}$ = Concentration of chemical in soil gas, based on the average concentration detected among soil gas samples SG-1 through SG-6, April 2006.

   alpha = A calculated attenuation factor that relates the indoor air concentration to the concentration in the soil vapor. Dimensionless.

ATTACHMENT 4: ESTIMATION OF AMBIENT AIR CONCENTRATIONS: TRENCH MODEL

ATTACHMENT 4

ESTIMATION OF EXPOSURE POINT CONCENTRATIONS IN AMBIENT AIR IN A TRENCH

1.0 INTRODUCTION

While undertaking excavation activities, construction or utility workers may encounter groundwater. In addition to being dermally exposed to chemicals of potential concern (COPCs) present in groundwater, construction/utility workers may also inhale volatile COPCs that emanate from standing water and saturated soils in the excavation area. A combination of two exposure models was used to estimate exposure point concentrations of volatile organic constituents (VOCs) in groundwater that may accumulate and volatilize into an excavation trench for the Disposal site (the "Site") at the Former Lewis Chemical Corporation, 0 & 12-24 Fairmount Court, Hyde Park, Massachusetts.

A conservative screening-level model (RTI Model; USEPA, 1990) describing simple mass transfer of volatile constituents from liquid surfaces to air was used in this analysis. The RTI model predicts mass emission rates (mass/time) based on an individual constituent's overall mass transfer coefficient, the area of the liquid surface, and the concentration of the constituent in the liquid phase. The overall mass transfer coefficient was based on an estimation technique presented in Lyman (1982).

The compound-specific flux rate was then entered into a simple one-box mass balance model which integrates the effects of air movement through the trench. This model estimates the concentration of contaminant in air (in milligrams of compound per cubic meter (mg/m^3) of air) which was used as the exposure point concentration in ambient air of a trench for construction workers who may conduct subsurface work at the Site. Descriptions of both of these models and associated assumptions are provided below.

As discussed in the risk characterization, two VOC hot spots were identified in Site groundwater; these hot spots are co-located with the two soil hot spots. Hot Spot #1 is located by the southeastern corner of the building, and is represented by monitoring wells ESM-5, ESM-6, ESM-15, PZ-02, ESM-9, B1/0W-1; Hot Spot #2 is located near the northeastern corner of the building, and is represented by monitoring wells ESM-3, PZ-01, PZ-03. Each hot spot was designated as a distinct exposure point, and the remainder of the site was designated as a "sitewide" exposure point. Tables 4-1, 4-2 and 4-3 present the trench model calculations for the construction worker exposure scenario for the sitewide exposure point as well as Hot Spot #1 and Hot Spot #2, respectively.

2.0 MODEL FOR VOLATILE CONSTITUENT MASS EMISSION RATE

The RTI model was originally developed for assessing volatile emissions from aerated and non-aerated lagoons. The model is also applicable to quiescent and turbulent conditions. The model was selected for this analysis due to the similarities between a quiescent lagoon and standing water in the bottom of a trench. This model, which predicts a mass emission rate, is based on the contaminant concentration in the liquid phase (i.e., groundwater seeping into a trench), the area of the trench, and the overall mass transfer coefficient of each volatile constituent.

The RTI Model is summarized as follows:

$$E = K \times SA \times C$$

where,

E	=	Mass emission rate of contaminant in air phase (g/sec)
K	=	Overall mass transfer coefficient (m/sec)
SA	=	Liquid surface area (m^2)
C	=	Concentration of contaminant in liquid phase (g/m^3 or equivalently, mg/L)

For the calculation of E, K is converted from units of m/hr to m/sec with a conversion factor of 1 hour per 3,600 seconds.

The liquid-phase concentration (C) was based on groundwater representative of each exposure point. Construction workers may potentially be exposed to COPCs in shallow (i.e., <15 feet below grade) groundwater while conducting excavation activities during Site redevelopment. We assumed that construction workers may potentially encounter groundwater within any portion of the Site area where groundwater depth was less than 15 feet below ground surface (bgs). Therefore, for the sitewide exposure point, wells evaluated included DUP, DUP 2, ESM-01 ,ESM-02 ,ESM-04 ,ESM-04, DUP, ESM-07, ESM-08, ESM-10, ESM-11, ESM-12, ESM-13, ESM-14, and ESM-16. The average of the temporal average wellhead concentration for each COPC (data collected between 2002-2006) from the above-identified monitoring wells was used as the concentration of contaminant in liquid phase. For Hot Spot #1, the liquid-phase concentration for each COPC was based on the average of the temporal average wellhead concentration from monitoring wells ESM-5, ESM-6, ESM-15, PZ-02, ESM-9 and B1/OW-1. For Hot Spot #2, the liquid-phase concentration for each COPC was based on the average of the temporal average wellhead concentration from monitoring wells ESM-3, PZ-01, and PZ-03.

The overall mass transfer coefficient, K (m/hr), is related to the liquid-phase exchange coefficient, k_L (m/hr), and the gas-phase exchange coefficient, k_g (m/hr), as follows:

$$\frac{1}{K} = \frac{1}{k_L} + \frac{RT}{Hk_g}$$

where,

R	=	Universal gas constant, 8.206×10^{-5} (m^3-atm/mol-°K)
T	=	Temperature (298°K)
H	=	Henry's Law Constant (m^3-atm/mol)

The overall mass transfer coefficient can be determined from experiment or from knowledge of the liquid- and gas-phase exchange coefficients. Model calculations may also be performed relating these coefficients to physical properties such as the molecular weight and scaling based upon mass transfer coefficients for other compounds. One set of such relationships, presented in Lyman (1981), is given by:

$$k_L = (20\sqrt{44/M}) \times CF \text{ (m / hr)}$$

where,

k_L	=	Liquid-phase exchange coefficient (m/hr)
20	=	Liquid-phase exchange coefficient (cm/hr)

44	=	Molecular weight of CO_2 (g/mole)
M	=	Molecular weight of chemical of interest (g/mole)
CF	=	Units conversion factor (1 m per 100 cm)

and:

$$k_g = (3000\sqrt{18/M}) \text{ x CF (m / hr)}$$

where,

k_g	=	Gas-phase exchange coefficient (m/hr)
3000	=	Gas-phase exchange coefficient for H_2O (cm/hr)
18	=	Molecular weight of H_20 (g/mole)
M	=	Molecular weight of chemical of interest (g/mole)
CF	=	Units conversion factor (1 m per 100 cm)

The overall mass transfer coefficients and mass emission rates are presented in Tables 4-1, 4-2 and 4-3.

3.0 MODEL FOR ESTIMATING AIR CONCENTRATIONS

To estimate the concentration of groundwater constituents in the ambient air of an excavation trench, we used a simple one-box mass balance model. This model assumes that emissions from pooled groundwater in the trench are diluted into air passing through the excavation. The parameters used to calculate the volume of air flowing through the trench and thus the volume into which the emissions are diluted include the following:

- the windspeed, which was assumed to be 12.4 miles/hour (5.5 meters per second), which is the average wind speed for Boston, Massachusetts, based on 57 years of data (NRCC, 2005);
- the width of the excavation, which was assumed to be 1 meter (or 3 feet); and
- the depth of the excavation, which is the approximate average depth to water among wells included in each exposure point, based on 2006 gauging data.

Since OSHA-required dewatering practices would be implemented, it is unlikely that subsurface construction will result in significant contact with groundwater. However, in keeping with the protective and comprehensive nature of this analysis, the exposure pathway was assumed to be complete. Concentrations of volatile constituents were estimated as follows:

$$[OHM]_{air} = \frac{E}{Q} \times \frac{1}{A} \times CF$$

where,

$[OMH]_{air}$	=	Concentration of contaminant in air (mg/m^3)
E	=	Mass emission rate of contaminants (g/s) (as estimated in Section 2.0)
Q	=	Windspeed of air moving through trench (m/s)
A	=	Cross-sectional area of trench (m^2)
CF	=	Units conversion factor (1000 mg per g)

The results of the mass emission rate modeling including derivation of mass transfer coefficients, chemical-specific volatilization rates, and estimated trench air concentrations are presented in Table 4-1 through 4-3.

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TABLE 4-1
ESTIMATION OF AMBIENT AIR CONCENTRATIONS IN A TRENCH
CONSTRUCTION WORKER : SITE
Former Lewis Chemical Corporation
0 & 12-24 Fairmount Court
Hyde Park, Massachusetts

Chemical of Potential Concern	CAS Number	C Groundwater Concentration (mg/l)	SA Liquid Surface Area (m^2)	Trench Dimensions (L) Length (m)	(W) Width (m)	(D) Depth (m)	H Henry's Law Constant (m^3-atm/mol-K)	M Molecular Weight (g/mole)	kg Phase Exchange Coefficient - Gas (m/hr)	kl Phase Exchange Coefficient - Liquid (m/hr)	K Overall Mass Transfer Coefficient (m/sec)	E Emission Rate (g/s)	Q Wind Speed (m/s)	A Cross-sectional Area of Trench (m^2)	Estimated Trench Air Concentration (mg/m^3)
Volatile Organic Compounds (VOCs)															
1,1,1-Trichloroethane	71-55-6	2.977	3.1	12.2	1.0	2.7	1.72E-02	133	1.10E+01	1.15E-01	3.14E-05	2.85E-04	5.543296	12.2	4.22E-03
1,1-Dichloroethane	75-34-3	0.469	3.1	12.2	1.0	2.7	5.62E-03	99	1.28E+01	1.33E-01	3.54E-05	5.07E-05	5.543296	12.2	7.50E-04
1,1-Dichloroethene	75-35-4	0.057	3.1	12.2	1.0	2.7	2.61E-02	97	1.29E+01	1.35E-01	3.71E-05	6.48E-06	5.543296	12.2	9.58E-05
1,2,4-Trichlorobenzene	120-82-1	0.005	3.1	12.2	1.0	2.7	1.42E-03	181	9.45E+00	9.85E-02	2.32E-05	3.55E-07	5.543296	12.2	5.25E-06
1,2,4-Trimethylbenzene	95-63-6	0.018	3.1	12.2	1.0	2.7	6.95E-03	120	1.16E+01	1.21E-01	3.24E-05	1.82E-06	5.543296	12.2	2.69E-05
1,2-Dichlorobenzene	95-50-1	0.031	3.1	12.2	1.0	2.7	1.92E-03	147	1.05E+01	1.09E-01	2.68E-05	2.50E-06	5.543296	12.2	3.70E-05
1,2-Dichloroethane	107-06-2	0.048	3.1	12.2	1.0	2.7	1.18E-03	99	1.28E+01	1.33E-01	3.05E-05	4.44E-06	5.543296	12.2	6.56E-05
1,3,5-Trimethylbenzene	108-67-8	0.004	3.1	12.2	1.0	2.7	8.77E-03	120	1.16E+01	1.21E-01	3.27E-05	3.94E-07	5.543296	12.2	5.83E-06
1,4-Dichlorobenzene	106-46-7	0.002	3.1	12.2	1.0	2.7	2.41E-03	147	1.05E+01	1.09E-01	2.75E-05	1.72E-07	5.543296	12.2	2.55E-06
4-Isopropyltoluene	99-87-6	0.060	3.1	12.2	1.0	2.7	1.10E-02	134	1.10E+01	1.15E-01	3.11E-05	5.73E-06	5.543296	12.2	8.47E-05
Chlorobenzene	108-90-7	0.023	3.1	12.2	1.0	2.7	3.11E-03	113	1.20E+01	1.25E-01	3.21E-05	2.21E-06	5.543296	12.2	3.27E-05
Chloroethane	75-00-3	0.018	3.1	12.2	1.0	2.7	1.11E-02	65	1.58E+01	1.65E-01	4.48E-05	2.51E-06	5.543296	12.2	3.71E-05
cis-1,2-Dichloroethene	156-59-2	2.997	3.1	12.2	1.0	2.7	4.08E-03	97	1.29E+01	1.35E-01	3.52E-05	3.22E-04	5.543296	12.2	4.76E-03
Ethylbenzene	100-41-4	0.681	3.1	12.2	1.0	2.7	7.88E-03	106	1.24E+01	1.29E-01	3.46E-05	7.19E-05	5.543296	12.2	1.06E-03
Isopropylbenzene	98-82-8	0.001	3.1	12.2	1.0	2.7	1.15E-02	120	1.16E+01	1.21E-01	3.29E-05	1.32E-07	5.543296	12.2	1.95E-06
Methylene Chloride	75-09-2	0.141	3.1	12.2	1.0	2.7	3.25E-03	85	1.38E+01	1.44E-01	3.71E-05	1.59E-05	5.543296	12.2	2.35E-04
n-Propylbenzene	103-65-1	0.001	3.1	12.2	1.0	2.7	1.05E-02	120	1.16E+01	1.21E-01	3.28E-05	1.31E-07	5.543296	12.2	1.94E-06
sec-Butylbenzene	135-98-8	0.005	3.1	12.2	1.0	2.7	1.76E-02	134	1.10E+01	1.15E-01	3.14E-05	4.65E-07	5.543296	12.2	6.88E-06
Tetrachloroethene	127-18-4	0.073	3.1	12.2	1.0	2.7	1.77E-02	166	9.88E+00	1.03E-01	2.82E-05	6.27E-06	5.543296	12.2	9.28E-05
Toluene	108-88-3	0.584	3.1	12.2	1.0	2.7	6.64E-03	92	1.33E+01	1.38E-01	3.70E-05	6.58E-05	5.543296	12.2	9.73E-04
trans-1,2-Dichloroethene	156-60-5	0.040	3.1	12.2	1.0	2.7	9.38E-03	97	1.29E+01	1.35E-01	3.64E-05	4.41E-06	5.543296	12.2	6.52E-05
Trichloroethene	79-01-6	0.171	3.1	12.2	1.0	2.7	9.85E-03	131	1.11E+01	1.16E-01	3.13E-05	1.63E-05	5.543296	12.2	2.41E-04
Vinyl Chloride	75-01-4	0.193	3.1	12.2	1.0	2.7	2.78E-02	63	1.61E+01	1.68E-01	4.62E-05	2.72E-05	5.543296	12.2	4.02E-04
Xylenes (Total)	1330-20-7	1.098	3.1	12.2	1.0	2.7	6.63E-03	106	1.24E+01	1.29E-01	3.44E-05	1.15E-04	5.543296	12.2	1.71E-03
Petroleum Hydrocarbons															
C19-C36 Aliphatic Hydrocarbons	NA c19-36	1.155	3.1	12.2	1.0	2.7	--	--	NC	NC	NC	NC	5.543296	12.2	NC
C9-C10 Aromatic Hydrocarbons	NA c9-10	0.563	3.1	12.2	1.0	2.7	7.92E-03	120	1.16E+01	1.21E-01	3.26E-05	5.59E-05	5.543296	12.2	8.27E-04

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 average temporal concentration among all monitoring wells within each exposure point.
3. Liquid surface area was calculated as the length of the trench times the width of the trench. Although we assume that no more than 10 percent of the trench will contain some standing water, we have assumed 25 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 0.25 was applied to the liquid surface area.
4. We assumed a trench length of 40 feet or 12.2 meters. The depth of the trench was assumed to be 3.1 meters, which is the average depth to groundwater at this exposure point. To calculate the liquid surface area, the width of the trench was assumed to be 3 feet or 1 meter.
5. Henry's Law constants were obtained from MADEP, Bureau of Waste Site Cleanup and Office of Research and Standards (ORS), Workbook: MCP GW2 alpha.xls, Sheet chemprops, January 2006.
6. Windspeed of air moving through the trench was based on 41 years of data by Northeast Regional Climate Center, Cornell University, Ithaca, NY. The mean wind speed for Boston, MA of 12.41 miles/h was used to represent the windspeed of air moving through the trench.
7. The cross-sectional area of the trench is based on the trench dimensions above. Therefore, the cross-sectional area was simply calculated as (L x W) or 12.2 meter x 1.0 meters = 12.2 square meters.
8. NC = Not Calculated.

TABLE 4-2
ESTIMATION OF AMBIENT AIR CONCENTRATIONS IN A TRENCH
CONSTRUCTION WORKER AT HOT SPOT #1

Former Lewis Chemical Corporation
0 & 12-24 Fairmount Court
Hyde Park, MA

Chemical of Potential Concern	CAS Number	C	SA	Trench Dimensions			H	M	kg	kl	K	E	Q	A	Estimated
		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)	Trench Air Concentration (mg/m^3)
Volatile Organic Compounds (VOCs)															
1,1,1-Trichloroethane	71-55-6	65.450	3.1	12.2	1.0	1.9	1.72E-02	133	1.10E+01	1.15E-01	3.14E-05	6.28E-03	5.543296	12.2	9.28E-02
1,1,2-Trichloroethane	79-00-5	0.070	3.1	12.2	1.0	1.9	8.24E-04	133	1.10E+01	1.15E-01	2.44E-05	5.20E-06	5.543296	12.2	7.69E-05
1,1-Dichloroethane	75-34-3	2.320	3.1	12.2	1.0	1.9	5.62E-03	99	1.28E+01	1.33E-01	3.54E-05	2.51E-04	5.543296	12.2	3.71E-03
1,1-Dichloroethene	75-35-4	2.581	3.1	12.2	1.0	1.9	2.61E-02	97	1.29E+01	1.35E-01	3.71E-05	2.92E-04	5.543296	12.2	4.31E-03
1,2,4-Trimethylbenzene	95-63-6	0.056	3.1	12.2	1.0	1.9	6.95E-03	120	1.16E+01	1.21E-01	3.24E-05	5.51E-06	5.543296	12.2	8.15E-05
1,2-Dichlorobenzene	95-50-1	0.189	3.1	12.2	1.0	1.9	1.92E-03	147	1.05E+01	1.09E-01	2.68E-05	1.55E-05	5.543296	12.2	2.29E-04
1,2-Dichloroethane	107-06-2	1.698	3.1	12.2	1.0	1.9	1.18E-03	99	1.28E+01	1.33E-01	3.05E-05	1.58E-04	5.543296	12.2	2.33E-03
Benzene	71-43-2	0.092	3.1	12.2	1.0	1.9	5.55E-03	78	1.44E+01	1.50E-01	3.99E-05	1.12E-05	5.543296	12.2	1.66E-04
Chlorobenzene	108-90-7	0.366	3.1	12.2	1.0	1.9	3.11E-03	113	1.20E+01	1.25E-01	3.21E-05	3.58E-05	5.543296	12.2	5.30E-04
Chloroethane	75-00-3	0.062	3.1	12.2	1.0	1.9	1.11E-02	65	1.58E+01	1.65E-01	4.48E-05	8.44E-06	5.543296	12.2	1.25E-04
cis-1,2-Dichloroethene	156-59-2	29.109	3.1	12.2	1.0	1.9	4.08E-03	97	1.29E+01	1.35E-01	3.52E-05	3.13E-03	5.543296	12.2	4.62E-02
Ethylbenzene	100-41-4	0.786	3.1	12.2	1.0	1.9	7.88E-03	106	1.24E+01	1.29E-01	3.46E-05	8.31E-05	5.543296	12.2	1.23E-03
Methylene Chloride	75-09-2	1.890	3.1	12.2	1.0	1.9	3.25E-03	85	1.38E+01	1.44E-01	3.71E-05	2.14E-04	5.543296	12.2	3.16E-03
Tetrachloroethene	127-18-4	5.749	3.1	12.2	1.0	1.9	1.77E-02	166	9.88E+00	1.03E-01	2.82E-05	4.95E-04	5.543296	12.2	7.31E-03
Toluene	108-88-3	11.915	3.1	12.2	1.0	1.9	6.64E-03	92	1.33E+01	1.38E-01	3.70E-05	1.34E-03	5.543296	12.2	1.99E-02
trans-1,2-Dichloroethene	156-60-5	0.166	3.1	12.2	1.0	1.9	9.38E-03	97	1.29E+01	1.35E-01	3.64E-05	1.84E-05	5.543296	12.2	2.72E-04
Trichloroethene	79-01-6	72.012	3.1	12.2	1.0	1.9	9.85E-03	131	1.11E+01	1.16E-01	3.13E-05	6.88E-03	5.543296	12.2	1.02E-01
Vinyl Chloride	75-01-4	1.096	3.1	12.2	1.0	1.9	2.78E-02	63	1.61E+01	1.68E-01	4.62E-05	1.54E-04	5.543296	12.2	2.28E-03
Xylenes (Total)	1330-20-7	1.115	3.1	12.2	1.0	1.9	6.63E-03	106	1.24E+01	1.29E-01	3.44E-05	1.17E-04	5.543296	12.2	1.73E-03

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 average temporal concentration among all monitoring wells within each exposure point.
3. Liquid surface area was calculated as the length of the trench times the width of the trench. Although we assume that no more than 10 percent of the trench will contain some standing water, we have assumed 25 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 0.25 was applied to the liquid surface area.
4. We assumed a trench length of 40 feet or 12.2 meters. The depth of the trench was assumed to be 3.1 meters, which is the average depth to groundwater at this exposure point. To calculate the liquid surface area, the width of the trench was assumed to be 3 feet or 1 meter.
5. Henry's Law constants were obtained from MADEP, Bureau of Waste Site Cleanup and Office of Research and Standards (ORS), Workbook: MCP GW2 alpha.xls, Sheet chemprops, January 2006.
6. Windspeed of air moving through the trench was based on 41 years of data by Northeast Regional Climate Center, Cornell University, Ithaca, NY. The mean wind speed for Boston, MA of 12.41 miles/h was used to represent the windspeed of air moving through the trench.
7. The cross-sectional area of the trench is based on the trench dimensions above. Therefore, the cross-sectional area was simply calculated as (L x W) or 12.2 meter x 1.0 meters = 12.2 square meters.
8. NC = Not Calculated.

TABLE 4-3
ESTIMATION OF AMBIENT AIR CONCENTRATIONS IN A TRENCH
CONSTRUCTION WORKER AT HOT SPOT #2

Former Lewis Chemical Corporation
0 & 12-24 Fairmount Court
Hyde Park, MA

Chemical of Potential Concern	CAS Number	C	SA	Trench Dimensions			H	M	kg	kl	K	E	Q	A	Estimated
		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)	Trench Air Concentration (mg/m^3)
Volatile Organic Compounds (VOCs)															
1,1,1-Trichloroethane	71-55-6	7.414	3.1	12.2	1.0	1.4	1.72E-02	133	1.10E+01	1.15E-01	3.14E-05	7.11E-04	5.543296	12.2	1.05E-02
1,1-Dichloroethane	75-34-3	2.027	3.1	12.2	1.0	1.4	5.62E-03	99	1.28E+01	1.33E-01	3.54E-05	2.19E-04	5.543296	12.2	3.24E-03
1,1-Dichloroethene	75-35-4	0.335	3.1	12.2	1.0	1.4	2.61E-02	97	1.29E+01	1.35E-01	3.71E-05	3.79E-05	5.543296	12.2	5.60E-04
1,2,4-Trimethylbenzene	95-63-6	0.020	3.1	12.2	1.0	1.4	6.95E-03	120	1.16E+01	1.21E-01	3.24E-05	2.00E-06	5.543296	12.2	2.96E-05
1,2-Dichlorobenzene	95-50-1	0.329	3.1	12.2	1.0	1.4	1.92E-03	147	1.05E+01	1.09E-01	2.68E-05	2.69E-05	5.543296	12.2	3.98E-04
1,2-Dichloroethane	107-06-2	0.265	3.1	12.2	1.0	1.4	1.18E-03	99	1.28E+01	1.33E-01	3.05E-05	2.46E-05	5.543296	12.2	3.64E-04
Benzene	71-43-2	0.026	3.1	12.2	1.0	1.4	5.55E-03	78	1.44E+01	1.50E-01	3.99E-05	3.21E-06	5.543296	12.2	4.75E-05
cis-1,2-Dichloroethene	156-59-2	19.896	3.1	12.2	1.0	1.4	4.08E-03	97	1.29E+01	1.35E-01	3.52E-05	2.14E-03	5.543296	12.2	3.16E-02
Ethylbenzene	100-41-4	0.417	3.1	12.2	1.0	1.4	7.88E-03	106	1.24E+01	1.29E-01	3.46E-05	4.41E-05	5.543296	12.2	6.52E-04
Tetrachloroethene	127-18-4	1.416	3.1	12.2	1.0	1.4	1.77E-02	166	9.88E+00	1.03E-01	2.82E-05	1.22E-04	5.543296	12.2	1.80E-03
Toluene	108-88-3	14.487	3.1	12.2	1.0	1.4	6.64E-03	92	1.33E+01	1.38E-01	3.70E-05	1.63E-03	5.543296	12.2	2.42E-02
trans-1,2-Dichloroethene	156-60-5	0.109	3.1	12.2	1.0	1.4	9.38E-03	97	1.29E+01	1.35E-01	3.64E-05	1.21E-05	5.543296	12.2	1.79E-04
Trichloroethene	79-01-6	4.305	3.1	12.2	1.0	1.4	9.85E-03	131	1.11E+01	1.16E-01	3.13E-05	4.12E-04	5.543296	12.2	6.08E-03
Vinyl Chloride	75-01-4	2.563	3.1	12.2	1.0	1.4	2.78E-02	63	1.61E+01	1.68E-01	4.62E-05	3.61E-04	5.543296	12.2	5.34E-03
Xylenes (Total)	1330-20-7	1.659	3.1	12.2	1.0	1.4	6.63E-03	106	1.24E+01	1.29E-01	3.44E-05	1.74E-04	5.543296	12.2	2.58E-03

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 average temporal concentration among all monitoring wells within each exposure point.
3. Liquid surface area was calculated as the length of the trench times the width of the trench. Although we assume that no more than 10 percent of the trench will contain some standing water, we have assumed 25 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 0.25 was applied to the liquid surface area.
4. We assumed a trench length of 40 feet or 12.2 meters. The depth of the trench was assumed to be 3.1 meters, which is the average depth to groundwater at this exposure point. To calculate the liquid surface area, the width of the trench was assumed to be 3 feet or 1 meter.
5. Henry's Law constants were obtained from MADEP, Bureau of Waste Site Cleanup and Office of Research and Standards (ORS), Workbook: MCP GW2 alpha.xls, Sheet chemprops, January 2006.
6. Windspeed of air moving through the trench was based on 41 years of data by Northeast Regional Climate Center, Cornell University, Ithaca, NY. The mean wind speed for Boston, MA of 12.41 miles/h was used to represent the windspeed of air moving through the trench.
7. The cross-sectional area of the trench is based on the trench dimensions above. Therefore, the cross-sectional area was simply calculated as (L x W) or 12.2 meter x 1.0 meters = 12.2 square meters.
8. NC = Not Calculated.

ATTACHMENT 5: TOXICITY PROFILES

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

1,1,1-Trichloroethane

CAS # 71-55-6

Division of Toxicology ToxFAQs™ **September 2004**

This fact sheet answers the most frequently asked health questions (FAQs) about 1,1,1-trichloroethane. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to 1,1,1-trichloroethane usually occurs by breathing contaminated air. It is found in building materials, cleaning products, paints, and metal degreasing agents. You are not likely to be exposed to large enough amounts to cause adverse health effects. Inhaling high levels of 1,1,1-trichloroethane can cause you to become dizzy and lightheaded. Exposure to much higher levels can cause unconsciousness and other effects. This substance has been found in at least 809 of the 1,647 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is 1,1,1-trichloroethane?

1,1,1-Trichloroethane is a synthetic chemical that does not occur naturally in the environment. It also is known as methylchloroform, methyltrichloromethane, trichloromethylmethane, and α-trichloromethane. Its registered trade names are chloroethene NU® and Aerothene TT®.

No 1,1,1-trichloroethane is supposed to be manufactured for domestic use in the United States after January 1, 2002 because it affects the ozone layer. 1,1,1-Trichloroethane had many industrial and household uses, including use as a solvent to dissolve other substances, such as glues and paints; to remove oil or grease from manufactured metal parts; and as an ingredient of household products such as spot cleaners, glues, and aerosol sprays.

What happens to 1,1,1-trichloroethane when it enters the environment?

- Most of the 1,1,1-trichloroethane released into the environment enters the air, where it lasts for about 6 years.
- Once in the air, it can travel to the ozone layer, there sunlight can break it down into chemicals that may reduce the ozone layer
- Contaminated water from landfills and hazardous waste sites can contaminate surrounding soil and nearby surface water or groundwater.
- From lakes and rivers, most of the 1,1,1-trichloroethane evaporates quickly into the air.
- Water can carry 1,1,1-trichloroethane through the soil and into the groundwater where it can evaporate and pass through the soil as a gas, then be released to the air.
- Organisms living in soil or water may also break down 1,1,1-trichloroethane.
- It will not build up in plants or animals.

How might I be exposed to 1,1,1-trichloroethane?

- Breathing 1,1,1-trichloroethane in contaminated outdoor and indoor air. Because 1,1,1-trichloroethane was used so frequently in home and office products, you are likely to be exposed to higher levels indoors than outdoors or near hazardous waste sites. However, since 2002, 1,1,1-trichloroethane is not expected to be commonly used, and therefore, the likelihood of being exposed to it is remote.
- In the workplace, you could have been exposed to 1,1,1-trichloroethane while using some metal degreasing agents, paints, glues, and cleaning products.
- Ingesting contaminated drinking water and food.

How can 1,1,1-trichloroethane affect my health?

If you breathe air containing high levels of 1,1,1-trichloroethane for a short time, you may become dizzy and lightheaded and possibly lose your coordination. These effects rapidly disappear after you stop breathing contaminated air. If you breathe in much higher levels, you may become unconscious, your blood pressure may decrease, and your heart may stop beating. Whether breathing low levels of 1,1,1-trichloroethane for a long time

causes harmful effects is not known. Studies in animals show that breathing air that contains very high levels of 1,1,1-trichloroethane damages the breathing passages and causes mild effects in the liver, in addition to affecting the nervous system.

There are no studies in humans that determine whether eating food or drinking water contaminated with 1,1,1-trichloroethane could harm health. Placing large amounts of 1,1,1-trichloroethane in the stomachs of animals has caused effects on the nervous system, mild liver damage, unconsciousness, and even death.

If your skin contacts 1,1,1-trichloroethane, you might feel some irritation. Studies in animals suggest that repeated exposure of the skin might affect the liver and that very large amounts may cause death. These effects occurred only when evaporation was prevented.

How likely is 1,1,1-trichloroethane to cause cancer?

Available information does not indicate that 1,1,1-trichloroethane causes cancer. The International Agency for Research on Cancer (IARC) and the EPA have determined that 1,1,1-trichloroethane is not classifiable as to its carcinogenicity in humans.

How can 1,1,1-trichloroethane affect children?

Children exposed to large amounts of 1,1,1-trichloroethane probably would be affected in the same manner as adults. In animals, it has been shown that 1,1,1-trichloroethane can pass from the mother's blood into a fetus. When pregnant mice were exposed to high levels of 1,1,1-trichloroethane in air, their babies developed more slowly than normal and had some behavioral problems. However, whether similar effects occur in humans has not been demonstrated.

How can families reduce the risk of exposure to 1,1,1-trichloroethane?

Children can be exposed to 1,1,1-trichloroethane in household products, such as adhesives and cleaners. Parents should store household chemicals out of reach of young children to prevent accidental poisonings or skin irritation. Always store household chemicals in their original labeled containers. Never store household chemicals in containers that children would find attractive to eat or drink from, such as old soda bottles. Keep your Poison Control Center's number near the phone.

Sometimes older children sniff household chemicals in an attempt to get high. Your children may be exposed to 1,1,1-trichloroethane by inhaling products containing it. Talk with your children about the dangers of sniffing chemicals.

Is there a medical test to show whether I've been exposed to 1,1,1-trichloroethane?

Samples of your breath, blood, and urine can be tested to determine if you have recently been exposed to 1,1,1-trichloroethane. In some cases, these tests can estimate how much 1,1,1-trichloroethane has entered your body. To be of any value, samples of your breath or blood have to be taken within hours after exposure, and samples of urine have to be taken within 2 days after exposure. However, these tests will not tell you whether your health will be affected by exposure to 1,1,1-trichloroethane. The exposure tests are not routinely available in hospitals and clinics because they require special analytical equipment.

Has the federal government made recommendations to protect human health?

EPA regulates the levels of 1,1,1-trichloroethane that are allowable in drinking water. The highest level of 1,1,1-trichloroethane allowed in drinking water is 0.2 parts 1,1,1,-trichloroethane per 1 million parts of water (0.2 ppm).

The Occupational Safety and Health Administration (OSHA) has set a limit of 350 parts 1,1,1-trichloroethane per 1 million parts of air (350 ppm) in the workplace.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2004. Toxicological Profile for 1,1,1-Trichloroethane (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

1,1,2-TRICHLOROETHANE

CAS # 79-00-5

Agency for Toxic Substances and Disease Registry ToxFAQs **July 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about 1,1,2-trichloroethane. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: 1,1,2-Trichloroethane is primarily used as a solvent and a chemical intermediate in industry. Breathing high levels of it caused effects on the liver, kidney, and nervous system in animals. This chemical has been found in at least 45 of the 1,177 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is 1,1,2-trichloroethane?

(Pronounced 1,1,2-trī-klôr′ō-ĕth′ān′)

1,1,2-Trichloroethane is a colorless, sweet-smelling liquid. It does not burn easily, can be dissolved in water, and evaporates easily. It is used as a solvent (a chemical that dissolves other substances) and as an intermediate in the production of the chemical, 1,1-dichloroethane. 1,1,2-Trichloroethane is sometimes present as an impurity in other chemicals, and it may be formed when another chemical breaks down in the environment under conditions where there is no air.

What happens to 1,1,2-trichloroethane when it enters the environment?

- Most 1,1,2-trichloroethane released into the environment will go into the air.
- 1,1,2-Trichloroethane breaks down slowly in air; it takes approximately 49 days for half of it to break down.
- 1,1,2-Trichloroethane may enter the groundwater by filtering through the soil.
- It appears to stay in water for a long time; it takes years for it to break down.

How might I be exposed to 1,1,2-trichloroethane?

- Breathing outdoor air that contains it from industrial releases.
- Drinking contaminated water.
- Breathing contaminated workplace air.
- Touching it when used as a solvent in the workplace.
- Breathing air near a hazardous waste site that contains 1,1,2-trichloroethane.

How can 1,1,2-trichloroethane affect my health?

No information is available on how breathing or swallowing 1,1,2-trichloroethane may affect your health. Applying 1,1,2-trichloroethane to the skin of a person resulted in stinging and burning of the skin.

When animals breathed high levels of 1,1,2-trichloroethane, it affected the liver and kidneys. Nervous system effects, such as excitation and sleepiness, were also seen. When animals swallowed food or water containing 1,1,2-trichloroethane, effects on the stomach, blood, liver, kidneys, and nervous system were seen.

We do not know whether 1,1,2-trichloroethane can affect reproduction in people. Animal studies have not shown the chemical to affect normal reproduction and development.

How likely is 1,1,2-trichloroethane to cause cancer?

No information is available on whether or not 1,1,2-trichloroethane will cause cancer in people. Only one study is available on the ability of 1,1,2-trichloroethane to cause cancer in animals. This study found an increase in liver cancer in mice, but not in rats, who were fed the chemical for their lifetime.

The International Agency for Research on Cancer (IARC) has determined that 1,1,2-trichloroethane is not classifiable as to its carcinogenicity to humans.

Is there a medical test to show whether I've been exposed to 1,1,2-trichloroethane?

Samples of your breath, blood, and urine can be tested to determine if you have been recently exposed to 1,1,2-trichloroethane. These tests must be done soon after the exposure occurred. These tests will not tell you whether your health will be affected by 1,1,2-trichloroethane and are not routinely available in hospitals and clinics because they require special equipment.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.005 milligrams of 1,1,2-trichloroethane per liter of drinking water (0.005 mg/L).

Discharges, spills, or accidental releases of 100 pounds or more of 1,1,2-trichloroethane must be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit of 45 milligrams 1,1,2-trichloroethane per cubic meter of air (45 mg/m^3) for an 8-hour workday in a 40-hour workweek.

The American Conference of Governmental and Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH) also recommend an occupational exposure limit of 45 mg/m^3 for 1,1,2-trichloroethane.

The federal recommendations have been updated as of July 1999.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Milligram (mg): One thousandth of a gram.

National Priorities List: A list of the nation's worst hazardous waste sites.

Solvent: A substance that dissolves another substance.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1989. Toxicological profile for 1,1,2-trichloroethane. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

1,1-DICHLOROETHANE
CAS # 75-34-3

Agency for Toxic Substances and Disease Registry ToxFAQs **July 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about 1,1-dichloroethane. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: 1,1-Dichloroethane is used to make other chemicals and to dissolve and remove grease. Breathing very high levels can affect your heart and animal studies have seen kidney disease from long-term exposure to high levels in air. 1,1-Dichloroethane has been found in at least 248 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is 1,1-dichloroethane?

(Pronounced 1,1-dī′ klôr′ ō ĕth′ ān′)

1,1-Dichloroethane is a colorless, oily liquid with a sweet odor. It evaporates easily at room temperature and burns easily. It does not occur naturally in the environment.

In the past, 1,1-dichloroethane was used as a surgical anesthetic, but it is no longer used this way. Today it is used primarily to make other chemicals, to dissolve substances such as paint, varnish, and finish removers, and to remove grease.

What happens to 1,1-dichloroethane when it enters the environment?

- 1,1-Dichloroethane is released from industrial processes primarily to the air.
- 1,1-Dichloroethane evaporates from water rapidly into the air.
- It can also be found in the air as a breakdown product of another chemical, 1,1,1-trichloroethane.
- 1,1-Dichloroethane does not dissolve easily in water.
- Small amounts of 1,1-dichloroethane released to soil can evaporate into the air or move into groundwater.
- It is not known how long it stays in soil.
- 1,1-Dichloroethane is not expected to build up in the body tissues of animals.

How might I be exposed to 1,1-dichloroethane?

- Breathing air containing it from industrial releases or hazardous waste sites.
- Drinking contaminated tap water.
- Touching soil containing it.
- Touching contaminated materials in the workplace.

How can 1,1-dichloroethane affect my health?

Very limited information is available on the effects of 1,1-dichloroethane on people's health. The chemical was discontinued as a surgical anesthetic when effects on the heart, such as irregular heart beats, were reported.

1,1-DICHLOROETHANE
CAS # 75-34-3

Studies in animals have shown that 1,1-dichloroethane can cause kidney disease after long-term exposure to high levels in air. Delayed growth was seen in the offspring of animals who breathed high concentrations of the chemical during pregnancy.

How likely is 1,1-dichloroethane to cause cancer?

The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the EPA have not classified 1,1-dichloroethane for carcinogenicity.

1,1-Dichloroethane caused cancer in one study in which rats and mice were fed large doses of the chemical for their lifetimes.

Is there a medical test to show whether I've been exposed to 1,1-dichloroethane?

Tests are available that measure 1,1-dichloroethane in urine, blood, breath, and body tissues. These tests aren't available at most doctors' offices, but can be done at a special laboratory that has special equipment.

The tests must be done soon after exposure occurs, because most of the 1,1-dichloroethane that is taken into the body leaves within 2 days. In addition, these tests cannot tell you when you were exposed, or whether health effects will occur.

Has the federal government made recommendations to protect human health?

The EPA requires that spills or accidental releases into the environment of 1,000 pounds or more of 1,1-dichloroethane be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 400 milligrams of 1,1-dichloroethane per cubic meter of air (400 mg/m^3) for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) recommend the same exposure limit in air.

NIOSH currently recommends that a level of 12,150 mg/m^3 be considered immediately dangerous to life and health. This is the exposure level of 1,1-dichloroethane that is likely to cause permanent health problems or death.

The federal recommendations have been uipdated as of July 1999.

Glossary

Anesthetic: A substance used to cause numbness.
Carcinogenicity: Ability to cause cancer.
CAS: Chemical Abstracts Service.
Evaporate: To change into a vapor or gas.
Milligram (mg): One thousandth of a gram.

References

Agency for Toxic Substances and Disease Registry. 1990. Toxicological profile for 1,1-dichloroethane. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

1,1-DICHLOROETHENE
CAS # 75-35-4

Agency for Toxic Substances and Disease Registry ToxFAQs September 1995

This fact sheet answers the most frequently asked health questions (FAQs) about 1,1-dichloroethene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to 1,1-dichloroethene occurs mainly in the workplace. Breathing high levels of 1,1-dichloroethene can affect the liver, kidney, and central nervous system. This chemical has been found in at least 515 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

What is 1,1-dichloroethene?
(Pronounced 1,1-dī′klôr′ō ĕth′ēn)

1,1-Dichloroethene is an industrial chemical that is not found naturally in the environment. It is a colorless liquid with a mild, sweet smell. It is also called vinylidene chloride.

1,1-Dichloroethene is used to make certain plastics, such as flexible films like food wrap, and in packaging materials. It is also used to make flame retardant coatings for fiber and carpet backings, and in piping, coating for steel pipes, and in adhesive applications.

What happens to 1,1-dichloroethene when it enters the environment?

- 1,1-Dichloroethene enters the environment from industries that make or use it.
- 1,1-Dichloroethene evaporates very quickly from water and soil to the air.
- In the air, it takes about 4 days for it to break down.
- 1,1-Dichloroethene breaks down very slowly in water.
- It does not accumulate very much in fish or birds.
- In soil, 1,1-dichloroethene is slowly transformed to other less harmful chemicals.

How might I be exposed to 1,1-dichloroethene?

- Workers may be exposed in industries that make or use 1,1-dichloroethene (these industries are mainly in Texas and Louisiana).
- Food that is wrapped in plastic wrap may contain very low levels of 1,1-dichloroethene. The government controls these levels to prevent harm to your health.
- A small percentage (3%) of the drinking water supplies may contain very low levels of 1,1-dichloroethene.
- Air near factories that make or use 1,1-dichloroethene and air near hazardous waste sites may contain low levels of it.

How can 1,1-dichloroethene affect my health?

The main effect from breathing high levels of 1,1-dichloroethene is on the central nervous system. Some people lost their breath and fainted after breathing high levels of the chemical.

Breathing lower levels of 1,1-dichloroethene in air for a long time may damage your nervous system, liver, and lungs. Workers exposed to 1,1-dichloroethene have reported a loss in liver function, but other chemicals were present.

Animals that breathed high levels of 1,1-dichloroethene had damaged livers, kidneys, and lungs. The offspring of some of the animals had a higher number of birth defects. We do not know if birth defects occur when people are exposed to 1,1-dichloroethene.

Animals that ingested high levels of 1,1-dichloroethene had damaged livers, kidneys, and lungs. There were no birth defects in animals that ingested the chemical.

Spilling 1,1-dichloroethene on your skin or in your eyes can cause irritation.

How likely is 1,1-dichloroethene to cause cancer?

The Environmental Protection Agency (EPA) has determined that 1,1-dichloroethene is a possible human carcinogen.

Studies on workers who breathed 1,1-dichloroethene have not shown an increase in cancer. These studies, however, are not conclusive because of the small numbers of workers and the short time studied.

Animal studies have shown mixed results. Several studies reported an increase in tumors in rats and mice, and other studies reported no such effects.

Is there a medical test to show whether I've been exposed to 1,1-dichloroethene?

Tests are available to measure levels of 1,1-dichloroethene in breath, urine, and body tissues. These tests are not usually available in your doctor's office. However, a sample taken in your doctor's office can be sent to a special laboratory if necessary.

Because 1,1-dichloroethene leaves the body fairly quickly, these methods are useful only for finding exposures that have occurred within the last few days. These tests can't tell you if adverse health effects will occur from exposure to 1,1-dichloroethene.

Has the federal government made recommendations to protect human health?

The EPA has set a limit in drinking water of 0.007 parts of 1,1-dichloroethene per million parts of drinking water (0.007 ppm). EPA requires that discharges or spills into the environment of 5,000 pounds or more of 1,1-dichloroethene be reported.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 1 ppm of 1,1-dichloroethene in workplace air for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) currently recommends that workers breathe as little 1,1-dichloroethene as possible.

Glossary

Carcinogen: A substance that can cause cancer.
CAS: Chemical Abstracts Service.
Ingesting: Taking food or drink into your body.
ppm: Parts per million.
Tumor: An abnormal mass of tissue.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1994. Toxicological profile for 1,1-dichloroethene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Dichlorobenzenes

1,2-Dichlorobenzene CAS# 95-50-1
1,3-Dichlorobenzene CAS# 541-73-1
1,4-Dichlorobenzene CAS# 106-46-7

Division of Toxicology ToxFAQs™ **September 2004**

This fact sheet answers the most frequently asked health questions (FAQs) about dichlorobenzenes. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to dichlorobenzenes mostly occurs from breathing indoor air or workplace air. Exposure to high levels of 1,2- or 1,4-dichlorobenzene may be very irritating to your eyes and nose and cause difficult breathing, and an upset stomach. Extremely high exposures to 1,4-dichlorobenzene can result in dizziness, headaches, and liver problems. Liver effects have been observed in animals exposed to high levels of dichlorobenzenes. 1,2-, 1,3-, and 1,4-Dichlorobenzenes have been identified in at least 280, 176, and 331, respectively, of the 1,647 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are dichlorobenzenes?

There are three dichlorobenzene isomers—1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene. Dichlorobenzenes do not occur naturally. 1,2-Dichlorobenzene is a colorless to pale yellow liquid used to make herbicides. 1,3-Dichlorobenzene is a colorless liquid used to make herbicides, insecticides, medicine, and dyes. 1,4-Dichlorobenzene, the most important of the three chemicals, is a colorless to white solid with a strong, pungent odor. When exposed to air, it slowly changes from a solid to a vapor. Most people can smell 1,4-dichlorobenzene in the air at very low levels.

What happens to dichlorobenzenes when they enter the environment?

- 1,4-Dichlorobenzene enters the environment when it is used in mothballs and in toilet-deodorizer blocks. Very little enters the environment from hazardous waste sites.
- Some 1,2- and 1,3-dichlorobenzenes are released into the environment when used to make herbicides and when people use products that contain these chemicals.
- Dichlorobenzenes do not dissolve easily in water, the small amounts that enter water quickly evaporate into the air.
- Sometimes, dichlorobenzenes bind to soil and sediment. Dichlorobenzenes in soil usually are not easily broken down by soil organisms. Evidence suggests that plants and fish absorb dichlorobenzenes.

How might I be exposed to dichlorobenzenes?

- You may be exposed to 1,4-dichlorobenzene by breathing vapors from products used in the home or in buildings, such as air fresheners, mothballs and toilet-deodorizer blocks. 1,2- and 1,3-Dichlorobenzene are not found frequently in the air of homes and buildings because these chemicals are not used in household products.
- You may be exposed to very low levels of dichlorobenzenes in drinking water. You are not likely to be exposed to dichlorobenzenes in soil.
- You may also be exposed to low levels of dichlorobenzenes in beef, pork, chicken, eggs, baked goods, soft drinks, butter, peanut butter, fruits, vegetables, and fish.

How can dichlorobenzenes affect my health?

Very little is known about the health effects of 1,3-dichlorobenzene, especially in humans, but they are likely to be similar to those of 1,2- and 1,4-dichlorobenzene. Inhaling the vapor or dusts of 1,2-dichlorobenzene and 1,4-dichlorobenzene at very high concentrations could be very irritating to your eyes and nose and cause burning and tearing of the eyes, coughing, difficult breathing, and an upset stomach. Dizziness, headaches, and liver problems have also been observed in people exposed to very high levels of 1,4-dichlorobenzene.

People who have eaten 1,4-dichlorobenzene products regularly for long periods (months to years) developed skin

blotches and anemia. 1,4-Dichlorobenzene might cause a burning feeling in your skin if you hold mothballs or toilet-deodorizer blocks against your skin for a long time.
Breathing or eating any of the dichlorobenzenes caused harmful effects in the liver of laboratory animals. Animal studies also found that 1,2- and 1,4-dichlorobenzene caused effects in the kidneys and blood, and that 1,3-dichlorobenzene caused thyroid and pituitary effects.

How likely are dichlorobenzenes to cause cancer?

The Department of Health and Human Services (DHHS) has determined that 1,4-dichlorobenzene may reasonably be anticipated to be a carcinogen. There is no direct evidence that 1,4-dichlorobenzene can cause cancer in humans. However, animals given very high levels in water developed liver and kidney tumors.
1,2-Dichlorobenzene was not carcinogenic in laboratory animals and 1,3-dichlorobenzene has not been tested for its potential to cause cancer. Both the International Agency for Research on Cancer (IARC) and the EPA concluded that 1,2- and 1,3-dichlorobenzene are not classifiable as to human carcinogenicity.

How can dichlorobenzenes affect children?

Children who are exposed to dichlorobenzenes are likely to exhibit the same effects as adults, although this is not known for certain.
Children can also be exposed to dichlorobenzenes prenatally, because all three isomers have been detected in placenta samples, as well as through breast feeding. There is no reliable evidence suggesting that dichlorobenzenes cause birth defects, although animal data raise concern for effects of 1,4-dichlorobenzene on postnatal development of the nervous system.

How can families reduce the risk of exposure to dichlorobenzenes?

Exposure of children to 1,4-dichlorobenzene can be minimized by discouraging them from playing with, swallowing, or having skin contact with products containing 1,4-dichlorobenzene. These items should be stored out of reach of young children and kept in their original containers to prevent accidental poisonings. Keep your Poison Control Center's number by the phone.

Is there a medical test to show whether I've been exposed to dichlorobenzenes?

Several tests can be used to show if you have been exposed to dichlorobenzenes. The most commonly used tests measure their dichlorophenol breakdown products in urine and blood. The presence of the dichlorophenol breakdown products in the urine indicates a person has been exposed to dichlorobenzenes within the previous day or two. Another test measures the levels of dichlorobenzenes in your blood, but this is used less often. These tests require special equipment that is not routinely available in a doctor's office, but they can be performed in a special laboratory. Neither of these tests can be used to show how high the level of dichlorobenzene exposure was or to predict whether harmful health effects will follow.

Has the federal government made recommendations to protect human health?

EPA regulates the levels of dichlorobenzenes that are allowable in drinking water. The highest level of 1,4-dichlorobenzene allowed in drinking water is 0.075 parts 1,4-dichlorobenzene per 1 million parts of water (0.075 ppm). The Occupational Safety and Health Administration (OSHA) has set a limit for 1,4-dichlorobenzene of 75 parts 1,4-dichlorobenzene per 1 million parts of air (75 ppm) in the workplace.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2004. Toxicological Profile for Dichlorobenzenes (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

1,2-DICHLOROETHANE

CAS #107-06-2

Division of Toxicology ToxFAQs™ **September 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about 1,2-Dichloroethane. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to 1,2-dichloroethane usually occurs by breathing contaminated air in workplaces that use 1,2-dichloroethane. Breathing or ingesting high levels of 1,2-dichloroethane can cause damage to the nervous system, liver, kidneys, and lungs and may cause cancer. This substance has been found in at least 570 of the 1,585 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is 1,2-dichloroethane?

1,2-Dichloroethane, also called ethylene dichloride, is a manufactured chemical that is not found naturally in the environment. It is a clear liquid and has a pleasant smell and sweet taste.

The most common use of 1,2-dichloroethane is in the production of vinyl chloride which is used to make a variety of plastic and vinyl products including polyvinyl chloride (PVC) pipes, furniture and automobile upholstery, wall coverings, housewares, and automobile parts. It is also used to as a solvent and is added to leaded gasoline to remove lead.

What happens to 1,2-dichloroethane when it enters the environment?

❑ Most of the 1,2-dichloroethane released to the environment is released to the air. In the air, 1,2-dichloroethane breaks down by reacting with other compounds formed by sunlight. It can stay in the air for more than 5 months before it is broken down.
❑ 1,2-Dichloroethane can also be released into rivers and lakes. It breaks down very slowly in water and most of it will evaporate to the air.
❑ 1,2-Dichloroethane released in soil will either evaporate into the air or travel down through the soil and enter underground water.

How might I be exposed to 1,2-dichloroethane?

❑ The general population may be exposed to 1,2-dichloroethane by breathing air or drinking water that contains 1,2-dichloroethane.
❑ People who work or live near a factory where 1,2-dichloroethane is used, may be exposed to higher than usual levels.
❑ People living near uncontrolled hazardous waste sites may also be exposed to higher than usual levels of 1,2-dichloroethane.

How can 1,2-dichloroethane affect my health?

Nervous system disorders, liver and kidney diseases, and lung effects have been reported in humans ingesting or inhaling large amounts of 1,2-dichloroethane.

In laboratory animals, breathing or ingesting large amounts of 1,2-dichloroethane have also caused nervous system disorders and liver, kidney, and lung effects. Animal studies also suggest that 1,2-dichloroethane may damage the

immune system. Kidney disease has also been seen in animals ingesting low doses of 1,2-dichloroethane for a long time. Studies in animals indicate that 1,2-dichloroethane does not affect reproduction.

How likely is 1,2-dichloroethane to cause cancer?

Human studies examining whether 1,2-dichloroethane can cause cancer have been considered inadequate. In animals, increases in the occurrence of stomach, mammary gland, liver, lung, and endometrium cancers have been seen following inhalation, oral, and dermal exposure.

The Department of Health and Human Services (DHHS) has determined that 1,2-dichloroethane may reasonably be expected to cause cancer. The EPA has determined that 1,2-dichloroethane is a probable human carcinogen and the International Agency for Cancer Research (IARC) considers it to be a possible human carcinogen.

How can 1,2-dichloroethane affect children?

We do not know if exposure to 1,2-dichloroethane will result in birth defects or other developmental effects in people. Studies in animals suggest that 1,2-dichloroethane does not produce birth defects.

It is likely that health effects seen in children exposed to high levels of 1,2-dichloroethane will be similar to the effects seen in adults.

How can families reduce the risk of exposure to 1,2-dichloroethane?

The general population is not likely to be exposed to large amounts of 1,2-dichloroethane. In the past, it was used in small amounts in household products such as cleaning agents, pesticides, and wallpaper and carpet glue. Risk of exposure from this source could be eliminated if these older products were immediately discarded.

Children should avoid playing in soils near uncontrolled hazardous waste sites where 1,2-dichloroethane may have been discarded.

Is there a medical test to show whether I've been exposed to 1,2-dichloroethane?

Tests are available to measure 1,2-dichloroethane in breath, blood, breast milk, and urine of exposed people. Because 1,2-dichloroethane leaves the body fairly quickly, these tests need to be done within a couple of days of exposure. These tests cannot be used to predict the nature or severity of toxic effects. These tests are not usually done in the doctor's office.

Has the federal government made recommendations to protect human health?

The EPA allows 0.005 milligrams of 1,2-dichloroethane per liter of drinking water (0.005 mg/L).

The Occupational Safety and Health Administration has set a limit of 50 parts of 1,2-dichloroethane per million parts of air (50 ppm) in workplace air for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2001. Toxicological Profile for 1,2-Dichloroethane. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

2-BUTANONE
CAS # 78-93-3

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1995**

This fact sheet answers the most frequently asked health questions (FAQs) about 2-butanone. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to 2-butanone occurs in the workplace or from using consumer products containing it. Mild irritations of the eyes, nose, and throat were seen in people who breathed 2-butanone. This chemical has been found in at least 472 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

What is 2-butanone?

(Pronounced 2-byōō′tə-nōn)

2-Butanone is a manufactured chemical but it is also present in the environment from natural sources. It is a colorless liquid with a sharp, sweet odor. It is also known as methyl ethyl ketone (MEK).

2-Butanone is produced in large quantities. Nearly half of its use is in paints and other coatings because it will quickly evaporate into the air and it dissolves many substances. It is also used in glues and as a cleaning agent.

2-Butanone occurs as a natural product. It is made by some trees and found in some fruits and vegetables in small amounts. It is also released to the air from car and truck exhausts.

What happens to 2-butanone when it enters the environment?

- 2-Butanone enters the air during production, use and transport, and from hazardous waste sites.
- In air, one-half of it will break down from sunlight in 1 day or less.
- It dissolves in water and is broken down more slowly to a simpler chemical form in about 2 weeks.
- It does not stick to soil and will travel through the soil to the groundwater.
- Some of the 2-butanone in soil or water will evaporate into the air.
- It does not deposit in the bottom of rivers or lakes.
- It is not expected to concentrate in fish or increase in the tissues of animals further up the food chain.

How might I be exposed to 2-butanone?

- Breathing contaminated air from the production or use of paints, glues, coatings, or cleaning agents containing it.
- Breathing contaminated air near hazardous waste sites.
- Breathing cigarette smoke.
- Sniffing glues.
- Drinking contaminated water from wells near manufacturing or hazardous waste sites.
- Skin contact with the liquid during production or use.

How can 2-butanone affect my health?

The known health effects to people from exposure to 2-butanone are irritation of the nose, throat, skin, and eyes. No one has died from breathing 2-butanone alone. If 2-butanone is breathed along with other chemicals that damage health, it can increase the amount of damage that occurs.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

Serious health effects in animals have been seen only at very high levels. When breathed, these effects included birth defects, loss of consciousness, and death.

When swallowed, rats had nervous system effects including drooping eyelids and uncoordinated muscle movements. There was no damage to the ability to reproduce.

Mice who breathed low levels for a short time showed temporary behavioral effects. Mild kidney damage was seen in animals that drank water with lower levels of 2-butanone for a short time.

There are no long-term studies with animals either breathing or drinking 2-butanone.

How likely is 2-butanone to cause cancer?

The Department of Health and Human Services has not classified 2-butanone as to its human carcinogenicity.

The International Agency for Research on Cancer and the Environmental Protection Agency (EPA) have also not classified 2-butanone as to its human carcinogenicity.

Two studies of workers exposed to 2-butanone and other chemicals did not find an increase in cancer. No animal studies are available that examine the potential for 2-butanone to cause cancer.

Is there a medical test to show whether I've been exposed to 2-butanone?

Tests are available to measure 2-butanone or its breakdown products in blood, breath, and urine. These tests are useful only to measure recent exposures because 2-butanone and its breakdown products leave the body rapidly. These tests are not usually performed at your doctor's office, but your doctor can take blood or urine samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA requires that discharges or spills into the environment of 5,000 pounds of more of 2-butanone be reported.

The Occupational Safety and Health Administration (OSHA) set an occupational exposure limit of 200 parts of 2-butanone per million parts of workplace air (200 ppm) for an 8-hour workday, 40-hour workweek.

The American Conference of Governmental Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH) have established the same guidelines as OSHA for the workplace.

Glossary

Carcinogenicity: Ability to cause cancer.

Evaporate: To change into a vapor or a gas.

ppm: Parts per million.

Long-term: Lasting one year or longer.

Short time: Lasting 14 days or less.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Toxicological profile for 2-butanone. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ACETONE
CAS # 67-64-1

This fact sheet answers the most frequently asked health questions (FAQs) about acetone. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to acetone results mostly from breathing air, drinking water, or coming in contact with products or soil that contain acetone. Exposure to moderate-to-high amounts of acetone can irritate your eyes and respiratory system, and make you dizzy. Very high exposure may cause you to lose consciousness. This chemical has been found in at least 572 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

What is acetone?

(Pronounced ăs′ĭ-tōn′)

Acetone is a manufactured chemical that is also found naturally in the environment. It is a colorless liquid with a distinct smell and taste. It evaporates easily, is flammable, and dissolves in water. It is also called dimethyl ketone, 2-propanone, and beta-ketopropane.

Acetone is used to make plastic, fibers, drugs, and other chemicals. It is also used to dissolve other substances.

It occurs naturally in plants, trees, volcanic gases, forest fires, and as a product of the breakdown of body fat. It is present in vehicle exhaust, tobacco smoke, and landfill sites. Industrial processes contribute more acetone to the environment than natural processes.

What happens to acetone when it enters the environment?

- A large percentage (97%) of the acetone released during its manufacture or use goes into the air.
- In air, about one-half of the total amount breaks down from sunlight or other chemicals every 22 days.
- It moves from the atmosphere into the water and soil by rain and snow. It also moves quickly from soil and water back to air.
- Acetone doesn't bind to soil or build up in animals.
- It's broken down by microorganisms in soil and water.
- It can move into groundwater from spills or landfills.
- Acetone is broken down in water and soil, but the time required for this to happen varies.

How might I be exposed to acetone?

- Breathing low background levels in the environment.
- Breathing higher levels of contaminated air in the workplace or from using products that contain acetone (for example, household chemicals, nail polish, and paint).
- Drinking water or eating food containing acetone.
- Touching products containing acetone.
- For children, eating soil at landfills or hazardous waste sites that contain acetone.
- Smoking or breathing secondhand smoke.

How can acetone affect my health?

If you are exposed to acetone, it goes into your blood which then carries it to all the organs in your body. If it is a small amount, the liver breaks it down to chemicals that are not harmful and uses these chemicals to make energy for normal body functions. Breathing moderate- to-high levels

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

of acetone for short periods of time, however, can cause nose, throat, lung, and eye irritation; headaches; light-headedness; confusion; increased pulse rate; effects on blood; nausea; vomiting; unconsciousness and possibly coma; and shortening of the menstrual cycle in women.

Swallowing very high levels of acetone can result in unconsciousness and damage to the skin in your mouth. Skin contact can result in irritation and damage to your skin.

The smell and respiratory irritation or burning eyes that occur from moderate levels are excellent warning signs that can help you avoid breathing damaging levels of acetone.

Health effects from long-term exposures are known mostly from animal studies. Kidney, liver, and nerve damage, increased birth defects, and lowered ability to reproduce (males only) occurred in animals exposed long-term. It is not known if people would have these same effects.

How likely is acetone to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified acetone for carcinogenicity.

Acetone does not cause skin cancer in animals when applied to the skin. We don't know if breathing or swallowing acetone for long periods will cause cancer. Studies of workers exposed to it found no significant risk of death from cancer.

Is there a medical test to show whether I've been exposed to acetone?

Methods are available to measure the amount of acetone in your breath, blood, and urine. The test can tell you how much acetone you were exposed to, although the amount that people have naturally in their bodies varies with each person. The tests can't tell you if you will experience any health effects from the exposure.

The test must be performed within 2-3 days after exposure because acetone leaves your body within a few days. These tests are not routinely performed at your doctor's office, but your doctor can take blood or urine samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA requires that spills of 5,000 pounds or more of acetone be reported.

The Occupational Safety and Health Administration (OSHA) has set a maximum concentration limit in workplace air of 1,000 parts of acetone per million parts of air (1,000 ppm) for an 8-hour workday over a 40-hour week to protect workers. The National Institute for Occupational Safety and Health (NIOSH) recommends an exposure limit of 250 ppm in workplace air for up to a 10-hour workday over a 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.
Evaporate: To change into a vapor or a gas.
Ingesting: Taking food or drink into your body.
Long-term: Lasting one year or longer.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1994. Toxicological profile for acetone. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

BENZENE
CAS # 71-43-2

Division of Toxicology and Environmental Medicine ToxFAQs™ **September 2005**

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 1,001 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is benzene?

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

- ❑ Industrial processes are the main source of benzene in the environment.
- ❑ Benzene can pass into the air from water and soil.
- ❑ It reacts with other chemicals in the air and breaks down within a few days.
- ❑ Benzene in the air can attach to rain or snow and be carried back down to the ground.
- ❑ It breaks down more slowly in water and soil, and can pass through the soil into underground water.
- ❑ Benzene does not build up in plants or animals.

How might I be exposed to benzene?

- ❑ Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- ❑ Vapors (or gases) from products that contain benzene, such as glues, paints, furniture wax, and detergents, can also be a source of exposure.
- ❑ Air around hazardous waste sites or gas stations will contain higher levels of benzene.
- ❑ Working in industries that make or use benzene.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

The major effect of benzene from long-term exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection.

Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene will affect fertility in men.

How likely is benzene to cause cancer?

Long-term exposure to high levels of benzene in the air can cause leukemia, particularly acute myelogenous leukemia, often referred to as AML. This is a cancer of the blood-forming organs. The Department of Health and Human Services (DHHS) has determined that benzene is a known carcinogen. The International Agency for Research on Cancer (IARC) and the EPA have determined that benzene is carcinogenic to humans.

How can benzene affect children?

Children can be affected by benzene exposure in the same ways as adults. It is not known if children are more susceptible to benzene poisoning than adults.

Benzene can pass from the mother's blood to a fetus. Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How can families reduce the risks of exposure to benzene?

Benzene exposure can be reduced by limiting contact with gasoline and cigarette smoke. Families are encouraged not to smoke in their house, in enclosed environments, or near their children.

Is there a medical test to determine whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is a test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood; however, since benzene disappears rapidly from the blood, this test is only useful for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. The metabolite S-phenylmercapturic acid in urine is a sensitive indicator of benzene exposure. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 5 parts benzene per billion parts of water (5 ppb).

The Occupational Safety and Health Administration (OSHA) has set limits of 1 part benzene per million parts of workplace air (1 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Benzene (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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BROMOFORM AND DIBROMOCHLOROMETHANE
CAS # 75-25-2 and 124-48-1

This fact sheet answers the most frequently asked health questions (FAQs) about bromoform and dibromochloromethane. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Bromoform and dibromochloromethane are formed as by-products when chlorine is added to water supply systems. High levels of bromoform or dibromochloromethane can damage the liver and kidneys and affect the brain. Bromoform has been found in at least 140 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA). Dibromochloromethane has been found in at least 174 NPL sites.

What are bromoform and dibromochloromethane?

Bromoform and dibromochloromethane are colorless to yellow, heavy, nonflammable, liquids with a sweet odor. Small amounts are formed naturally by plants in the ocean. They are somewhat soluble in water and readily evaporate into the air. Most of the bromoform and dibromochloromethane that enters the environment is formed as byproducts when chlorine is added to drinking water to kill bacteria.

Only small quantities of bromoform and dibromochloromethane currently are produced in the United States. These chemicals were used in the past as solvents and flame retardants, or to make other chemicals, but now they are used mainly as laboratory reagents.

What happens to bromoform and dibromochloromethane when they enter the environment?

- When released to air, bromoform and dibromochloromethane are slowly broken down by reactions with other chemicals and sunlight or can be removed by rain.
- In water, these chemicals will evaporate to the air and/or be broken down slowly by bacteria.
- When released to soil, most will evaporate to the air, some will be broken down by bacteria, and some may filter into the groundwater.
- Bromoform and dibromomethane do not build up in the food chain.

How might I be exposed to bromoform and dibromochloromethane?

- The most likely way people are exposed to bromoform and dibromochloromethane is by drinking chlorinated water.
- You may breathe vapors released from chlorinated water in a swimming pool or during showering and bathing.
- Very small amounts of bromoform and dibromochloromethane may enter your body directly through your skin while bathing or swimming.
- People that live near a waste site containing bromoform or dibromochloromethane could be exposed by drinking contaminated groundwater or breathing vapors released to the air.
- Exposure could occur by breathing bromoform and dibromochloromethane in the air in or near a laboratory or factory that makes or uses these chemicals; however, this is unlikely for most people.

How can bromoform and dibromochloromethane affect my health?

Eating or breathing a large amount of bromoform slows down the normal brain activities and causes sleepiness; this tends to go away within a day. Exposure to very high amounts may cause unconsciousness and even death. No studies are available about health effects in people exposed to dibromochloromethane.

Animals exposed to high amounts of bromoform or dibromochloromethane developed liver and kidney injuries. Exposure to low levels of bromoform or

dibromochloromethane do not appear to seriously affect the brain, liver, or kidneys. We do not know if bromoform or dibromochloromethane affect fertility in humans, but studies in animals suggest that the risk of doing so is low.

How likely are bromoform and dibromochloromethane to cause cancer?

There is no conclusive evidence that bromoform or dibromochloromethane cause cancer in humans because no cancer studies of humans exposed exclusively to these chemicals are available. Studies in animals indicate that long-term intake of either bromoform or dibromochloromethane can cause liver and kidney cancer.

The International Agency for Research on Cancer (IARC) concluded that bromoform and dibromochloromethane are not classifiable as to human carcinogenicity. The EPA classified bromoform as a probable human carcinogen and dibromochloromethane as a possible human carcinogen.

How can bromoform and dibromochloromethane affect children?

The only information regarding effects of bromoform on the health of children is that from the early 1900s when this chemical was used as a sedative to treat children with whooping cough. In some cases of overdosing with extremely high doses, children appeared drowsy, then lifeless, just before dying. We do not know whether children are more susceptible to the effects of bromoform and dibromochloromethane than adults.

How can families reduce the risks of exposure to bromoform and dibromochloromethane?

❑ Families can reduce their exposure to bromoform and dibromochloromethane from tap water by installing commercially available filter systems at home.

❑ While bromoform is no longer used as a medicine, keeping children away from, or supervising children with, chemicals brought into the home, will reduce the potential for accidental exposures.

❑ Families can reduce their exposure by taking shorter baths or showers in water in which these chemicals are present and opening bathroom windows or using ceiling ventilation fans whenever possible.

Is there a medical test to determine whether I've been exposed to bromoform and dibromochloromethane?

Tests are available to measure levels of these chemicals and their breakdown products in samples of your blood, breath, or fat. These tests are not routinely available in a doctor's office because they require special equipment. Because bromoform and dibromochloromethane are eliminated from the body fairly quickly, these tests are only effective in detecting recent exposures (within 1 or 2 days at the most).

Has the federal government made recommendations to protect human health?

The EPA recommends that drinking water contain no more than 0.7 parts per million (0.7 ppm) of bromoform and 0.7 ppm of dibromochloromethane.

The Occupational Safety and Health Administration (OSHA) set a limit of 0.5 ppm for the level of bromoform in workplace air during an 8-hour workday, 40-hour work week. Because dibromochloromethane has such a limited use, OSHA has not set limits of exposure for workplace air.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Bromoform and Dibromochloromethane (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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CARBON DISULFIDE
CAS # 75-15-0

This fact sheet answers the most frequently asked health questions (FAQs) about carbon disulfide. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to carbon disulfide can occur by breathing it in the air and by drinking water or eating foods that contain it. Breathing very high levels can be life threatening because of its effects on the nervous system. Breathing low levels for long periods may result in headaches, tiredness, trouble sleeping, and slight changes in the nerves. Carbon disulfide has been found in at least 210 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is carbon disulfide?

(Pronounced kär′bən dī-sŭl′fīd′)

Pure carbon disulfide is a colorless liquid with a pleasant odor that is like the smell of chloroform. The impure carbon disulfide that is usually used in most industrial processes is a yellowish liquid with an unpleasant odor, like that of rotting radishes.

Carbon disulfide evaporates at room temperature, and the vapor is more than twice as heavy as air. It easily explodes in air and also catches fire very easily.

In nature, small amounts of carbon disulfide are found in gases released to the earth's surface as, for example, in volcanic eruptions or over marshes. Commercial carbon disulfide is made by combining carbon and sulfur at very high temperatures.

What happens to carbon disulfide when it enters the environment?

- Carbon disulfide evaporates rapidly when released to the environment.
- Most carbon disulfide in the air and surface water is from manufacturing and processing activities.
- It is found naturally in coastal and ocean waters.
- Carbon disulfide does not stay dissolved in water very long, and it also moves through soils fairly quickly.
- Carbon disulfide does not appear to be taken up in significant amounts by the organisms living in water.

How might I be exposed to carbon disulfide?

- The people most often exposed to carbon disulfide are workers in plants that use carbon disulfide in their manufacturing processes.
- People may be exposed by breathing air, drinking water, or eating foods that contain it.
- People may also be exposed through skin contact with soil, water, or other substances that contain carbon disulfide.

How can carbon disulfide affect my health?

At very high levels, carbon disulfide may be life-threatening because of its effects on the nervous system. People who

breathed carbon disulfide near an accident involving a railroad car showed changes in breathing and some chest pains.

Some workers who breathed high levels during working hours for at least 6 months had headaches, tiredness, and trouble sleeping. However, these workers may have been exposed to other chemicals besides carbon disulfide. Among workers who breathed lower levels, some developed very slight changes in their nerves.

Studies in animals indicate that carbon disulfide can affect the normal functions of the brain, liver, and heart. After pregnant rats breathed carbon disulfide in the air, some of the newborn rats died or had birth defects.

High concentrations of carbon disulfide have caused skin burns when the chemical accidentally touched people's skin.

How likely is carbon disulfide to cause cancer?

The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the EPA have not classified carbon disulfide for carcinogenicity.

There are no definitive data in humans or animals that indicate a carcinogenic potential for carbon disulfide.

Is there a medical test to show whether I've been exposed to carbon disulfide?

One chemical test using urine can be done to tell whether the levels of breakdown substances from carbon disulfide are higher than normal. However, the test is not specific for carbon disulfide exposure.

A second test based on a specific breakdown substance is more sensitive and specific. It also requires special equipment and cannot tell you exactly how much carbon disulfide you were exposed to or predict whether harmful effects will occur.

These tests aren't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA requires that spills or accidental releases into the environment of 100 pounds or more of carbon disulfide be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set a limit of 20 parts of carbon disulfide per million parts of air (20 ppm) for an 8-hour workday for a 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that workroom air levels of carbon disulfide not exceed 1 ppm for a 10-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: Ability of a substance to cause cancer.

CAS: Chemical Abstracts Service.

Dissolve: To disappear gradually.

Evaporate: To change into vapor or a gas.

References

This ToxFAQs information is taken from the 1996 Toxicological Profile for Carbon Disulfide produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

CHLOROBENZENE CAS # 108-90-7

Agency for Toxic Substances and Disease Registry ToxFAQs **July 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about chlorobenzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Chlorobenzene is used as a solvent for some pesticide formulations, as a degreaser, and to make other chemicals. High levels of chlorobenzene can damage the liver and kidneys and affect the brain. It has been found at 97 of the 1,177 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is chlorobenzene?

(Pronounced klôr′ō-bĕn′zēn)

Chlorobenzene is a colorless, flammable liquid with an aromatic, almond-like odor. Some of it will dissolve in water, but it readily evaporates into air. It does not occur naturally in the environment.

Chlorobenzene production in the United States has declined by more than 60% from its peak in 1960. It was used in the past to make other chemicals, such as phenol and DDT. Now chlorobenzene is used as a solvent for some pesticide formulations, to degrease automobile parts, and as a chemical intermediate to make several other chemicals.

What happens to chlorobenzene when it enters the environment?

- Chlorobenzene released to air is slowly broken down by reactions with other chemicals and sunlight or can be removed by rain.
- In water, chlorobenzene will rapidly evaporate to the air and/or be broken down by bacteria.
- When released to soil, it is broken down rapidly by bacteria, but some will evaporate to the air and some may filter into the groundwater.
- Chlorobenzene does not build up in the food chain.

How might I be exposed to chlorobenzene?

- If you work where chlorobenzene is made or used you could be exposed by breathing air with chlorobenzene vapors or by spilling or splashing chlorobenzene on your skin.
- People that live near a waste site containing chlorobenzene could be exposed by drinking contaminated groundwater, breathing vapors released to the air, or getting contaminated soil on their skin.
- You could be exposed by eating food contaminated with chlorobenzene but there is not enough information to determine how often this occurs.

How can chlorobenzene affect my health?

Workers exposed to high levels of chlorobenzene in the air complained of headaches, nausea, sleepiness, numbness, and vomiting. We cannot be certain that all of these effects were due to chlorobenzene exposure because the workers may have been exposed to other chemicals.

Animal studies indicate that the liver, kidney, and central nervous system are affected by exposure to chlorobenzene.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

Effects on the central nervous system from breathing chlorobenzene include unconsciousness, tremors, restlessness, and death. Longer exposure has caused liver and kidney damage. The limited data available indicate that chlorobenzene does not cause birth defects or infertility.

How likely is chlorobenzene to cause cancer?

It is not known whether chlorobenzene causes cancer in people. Although chlorobenzene did not produce cancer in animal studies with rats and mice, liver nodules which can lead to cancer were produced in male rats. The EPA has determined that chlorobenzene is not classifiable as to human carcinogenicity based on inadequate evidence in both humans and animals.

Is there a medical test to show whether I've been exposed to chlorobenzene?

Exposure to chlorobenzene can be determined by measuring it or its metabolites in urine, exhaled air, blood, and body fat, but these tests cannot be used to predict whether harmful health effects will occur. These tests are not usually done in the doctors' office because special equipment is needed.

Has the federal government made recommendations to protect human health?

The EPA has set a Maximum Contaminant Level (MCL) of 0.1 parts per million (0.1 ppm) for chlorobenzene in drinking water. Concentrations in drinking water for short-term exposures (up to 10 days) should not exceed 2 ppm. The EPA recommends that levels of chlorinated benzenes (a group of chemicals that includes chlorobenzene) in lakes and streams should be limited to 0.488 ppm to prevent possible health effects from drinking water or eating fish contaminated with this group of chemicals. Any release to the environment greater than 100 pounds of chlorobenzene must be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set a workplace air concentration limit of 75 ppm over an 8-hour workday, 40-hour workweek.

The federal recomendations have been updated as of July 1999.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or a gas.

National Priorities List: A list of the nation's worst hazardous waste sites.

Pesticide: A substance that kills pests.

ppm: Parts per million.

Solvent: A substance that dissolves another substance.

Tremor: Trembling or shaking caused by disease or stress.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1990. Toxicological profile for chlorobenzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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CHLOROETHANE
CAS # 75-00-3

This fact sheet answers the most frequently asked health questions (FAQs) about chloroethane. For more information, call the ATSDR Information Center at 1-888-422-08737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to chloroethane can occur from breathing air or drinking water containing it. Exposure to high levels of chloroethane can affect your nervous system, causing lack of muscle control and unconsciousness. This substance has been found in at least 282 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is chloroethane?

(Pronounced klôr′ ō ĕth′ ān′)

Chloroethane is a colorless gas at room temperature and pressure. It has a characteristically sharp smell. It is a liquid when stored in pressurized containers; however, the liquid evaporates quickly when exposed to room air. Chloroethane catches fire easily.

It was used in leaded gasoline, but strict new government regulations have reduced that use dramatically. It is used in the production of cellulose, dyes, medicinal drugs, and other commercial products, and as a solvent and refrigerant.

It is also used to numb the skin before medical procedures such as ear piercing and skin biopsies and as a treatment in sports injuries.

What happens to chloroethane when it enters the environment?

- Most chloroethane exists as a gas in the atmosphere.
- It breaks down fairly rapidly (about half disappears within 40 days) by reacting with other substances in the air.
- Small amounts can enter groundwater by filtering through the soil.
- In groundwater, chloroethane is slowly changed into a simpler form by reaction with water.
- Some types of bacteria in water may break it down to smaller compounds.

How might I be exposed to chloroethane?

- Chloroethane can be released to air from factories that manufacture or use it.
- It can evaporate from landfills.
- It can be released during its use as a solvent, refrigerant, and anesthetic.
- Chloroethane may be present in drinking water as a result of chlorination.
- People may be exposed through skin contact if it is used in a medical procedure.
- Workers who may be exposed include doctors, nurses, mechanics, plumbers, and painters.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

How can chloroethane affect my health?

Brief exposure to high levels can produce temporary feelings of drunkenness. At higher levels, it can cause lack of muscle coordination and unconsciousness. It can also cause stomach cramps, nausea, vomiting, and eye irritation. Chloroethane is sometimes applied to the skin as a numbing agent before surgery. If it is applied for too long, frostbite can result. Some people had allergic reactions to it, and others experienced mild pain after being sprayed for 10 seconds.

How likely is chloroethane to cause cancer?

Laboratory tests in animals have shown that long-term exposure can cause cancer in mice. It is not known whether it causes cancer in humans. The International Agency for Research on Cancer (IARC) has concluded that chloroethane is not classifiable as to its carcinogenicity in humans.

How can chloromethane affect children?

We don't know whether chloroethane exposure can affect development in people. In animal studies, the babies of mice exposed to chloroethane during pregnancy had delayed development. It is not known whether children differ from adults in their susceptibility to chloroethane.

How can families reduce the risk of exposure to chloroethane?

- ❑ Avoid using products that contain chloroethane if you are pregnant.
- ❑ Limit the use of consumer products that contain it.
- ❑ Open windows and doors when such products are used in the home.
- ❑ Make sure containers are tightly covered.
- ❑ Make your children aware of the harmful effects of sniffing glue, paints, and other solvents.
- ❑ Store products containing it safely and follow directions carefully.

Is there a medical test to show whether I've been exposed to chloroethane?

There are complex analytical tests that chemists use to measure chloroethane in blood, milk, or urine. However, no commonly used medical tests are available to determine whether or not a person has been exposed to chloroethane.

Has the federal government made recommendations to protect human health?

EPA requires industries to report accidental discharges or spills of 100 pounds or more of chloroethane to EPA.

The Occupational Safety and Health Administration (OSHA) regulates the amount of chloroethane in workplace air. The limit for an 8-hour workday, over a 40-hour workweek, is 1,000 parts per million (1,000 ppm).

The American Conference of Governmental Industrial Hygienists (ACGIH) recommends a limit of 100 ppm chloroethane in workplace air.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1998. Toxicological profile for chloroethane. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

1,2-DICHLOROETHENE
CAS # 540-59-0, 156-59-2, and 156-60-5

This fact sheet answers the most frequently asked health questions (FAQs) about 1,2-dichloroethene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to 1,2-dichloroethene occurs mainly in workplaces where it is made or used. Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired. *cis*-1,2-Dichloroethene has been found in at least 146 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA). *trans*-1,2-Dichloroethene was found in at least 563 NPL sites. 1,2-Dichloroethene was found at 336 sites, but the isomer (*cis*- or *trans*-) was not specified.

What is 1,2-dichloroethene?

(Pronounced 1,2-dī-klôr′ ō-ĕth′ēn)

1,2-Dichloroethene, also called 1,2-dichloroethylene, is a highly flammable, colorless liquid with a sharp, harsh odor. It is used to produce solvents and in chemical mixtures. You can smell very small amounts of 1,2-dichloroethene in air (about 17 parts of 1,2-dichloroethene per million parts of air [17 ppm]).

There are two forms of 1,2-dichloroethene; one is called *cis*-1,2-dichloroethene and the other is called *trans*-1,2-dichloroethene. Sometimes both forms are present as a mixture.

What happens to 1,2-dichloroethene when it enters the environment?

- 1,2-Dichloroethene evaporates rapidly into air.
- In the air, it takes about 5-12 days for half of it to break down.
- Most 1,2-dichloroethene in the soil surface or bodies of water will evaporate into air.
- 1,2-Dichloroethene can travel through soil or dissolve in water in the soil. It is possible that it can contaminate groundwater.
- In groundwater, it takes about 13-48 weeks to break down.
- There is a slight chance that 1,2-dichloroethene will break down into vinyl chloride, a different chemical which is believed to be more toxic than 1,2-dichloroethene.

How might I be exposed to 1,2-dichloroethene?

- Breathing 1,2-dichloroethene that has leaked from hazardous waste sites and landfills.
- Drinking contaminated tap water or breathing vapors from contaminated water while cooking, bathing, or washing dishes.
- Breathing 1,2-dichloroethene, touching it, or touching contaminated materials in the workplace.

How can 1,2-dichloroethene affect my health?

Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired; breathing very high levels can kill you.

When animals breathed high levels of *trans*-1,2-dichloroethene for short or longer periods of time, their livers and lungs were damaged and the effects were more severe with longer exposure times. Animals that breathed very high

levels of *trans*-1,2-dichloroethene had damaged hearts.

Animals that ingested extremely high doses of *cis*- or *trans*-1,2-dichloroethene died.

Lower doses of *cis*-1,2-dichloroethene caused effects on the blood, such as decreased numbers of red blood cells, and also effects on the liver.

The long-term (365 days or longer) human health effects after exposure to low concentrations of 1,2-dichloroethene aren't known. One animal study suggested that an exposed fetus may not grow as quickly as one that hasn't been exposed.

Exposure to 1,2-dichloroethene hasn't been shown to affect fertility in people or animals.

How likely is 1,2-dichloroethene to cause cancer?

The EPA has determined that *cis*-1,2-dichloroethene is not classifiable as to its human carcinogenicity.

No EPA cancer classification is available for *trans*-1,2-dichloroethene.

Is there a medical test to show whether I've been exposed to 1,2-dichloroethene?

Tests are available to measure concentrations of the breakdown products of 1,2-dichloroethene in blood, urine, and tissues. However, these tests aren't used routinely to determine whether a person has been exposed to this compound. This is because after you are exposed to 1,2-dichloroethene, the breakdown products in your body that are detected with these tests may be the same as those that come from exposure to other chemicals. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum allowable level of *cis*-1,2-dichloroethene in drinking water at 0.07 milligrams per liter of water (0.07 mg/L) and *trans*-1,2-dichloroethene at 0.1 mg/L.

The EPA requires that any spills or accidental release of 1,000 pounds or more of 1,2-dichloroethene must be reported to the EPA.

The Occupational Health Safety and Health Administration (OSHA) has set the maximum allowable amount of 1,2-dichloroethene in workroom air during an 8-hour workday in a 40-hour workweek at 200 parts of 1,2-dichloroethene per million parts of air (200 ppm).

Glossary

Carcinogenicity: Ability of a substance to cause cancer.

CAS: Chemical Abstracts Service.

Fertility: Ability to reproduce.

Ingest: To eat or drink something.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Solvent: A chemical that can dissolve other substances.

References

This ToxFAQs information is taken from the 1996 Toxicological Profile for 1,2-Dichloroethene produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ETHYLBENZENE
CAS # 100-41-4

This fact sheet answers the most frequently asked health questions (FAQs) about ethylbenzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Breathing very high levels can cause dizziness and throat and eye irritation. Ethylbenzene has been found in at least 731 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?

(Pronounced ĕth′ əl bĕn′ zēn′)

Ethylbenzene is a colorless, flammable liquid that smells like gasoline. It is found in natural products such as coal tar and petroleum and is also found in manufactured products such as inks, insecticides, and paints.

Ethylbenzene is used primarily to make another chemical, styrene. Other uses include as a solvent, in fuels, and to make other chemicals.

What happens to ethylbenzene when it enters the environment?

- Ethylbenzene moves easily into the air from water and soil.
- It takes about 3 days for ethylbenzene to be broken down in air into other chemicals.
- Ethylbenzene may be released to water from industrial discharges or leaking underground storage tanks.
- In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.
- In soil, it is broken down by soil bacteria.

How might I be exposed to ethylbenzene?

- Breathing air containing ethylbenzene, particularly in areas near factories or highways.
- Drinking contaminated tap water.
- Working in an industry where ethylbenzene is used or made.
- Using products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Limited information is available on the effects of ethylbenzene on people's health. The available information shows dizziness, throat and eye irritation, tightening of the chest, and a burning sensation in the eyes of people exposed to high levels of ethylbenzene in air.

Animals studies have shown effects on the nervous system, liver, kidneys, and eyes from breathing ethylbenzene in air.

How likely is ethylbenzene to cause cancer?

The EPA has determined that ethylbenzene is not classifiable as to human carcinogenicity.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

No studies in people have shown that ethylbenzene exposure can result in cancer. Two available animal studies suggest that ethylbenzene may cause tumors.

How can ethylbenzene affect children?

Children may be exposed to ethylbenzene through inhalation of consumer products, including gasoline, paints, inks, pesticides, and carpet glue. We do not know whether children are more sensitive to the effects of ethylbenzene than adults.

It is not known whether ethylbenzene can affect the development of the human fetus. Animal studies have shown that when pregnant animals were exposed to ethylbenzene in air, their babies had an increased number of birth defects.

How can families reduce the risk of exposure to ethylbenzene?

Exposure to ethylbenzene vapors from household products and newly installed carpeting can be minimized by using adequate ventilation.

Household chemicals should be stored out of reach of children to prevent accidental poisoning. Always store household chemicals in their original containers; never store them in containers children would find attractive to eat or drink from, such as old soda bottles. Gasoline should be stored in a gasoline can with a locked cap.

Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.

Is there a medical test to show whether I've been exposed to ethylbenzene?

Ethylbenzene is found in the blood, urine, breath, and some body tissues of exposed people. The most common way to test for ethylbenzene is in the urine. This test measures substances formed by the breakdown of ethylbenzene. This test needs to be done within a few hours after exposure occurs, because the substances leave the body very quickly.

These tests can show you were exposed to ethylbenzene, but cannot predict the kind of health effects that might occur.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level of 0.7 milligrams of ethylbenzene per liter of drinking water (0.7 mg/L).

The EPA requires that spills or accidental releases into the environment of 1,000 pounds or more of ethylbenzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 100 parts of ethylbenzene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for ethylbenzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

METHYL *TERT*-BUTYL ETHER (MTBE) CAS # 1634-04-4

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1997**

This fact sheet answers the most frequently asked health questions (FAQs) about methyl *tert*-butyl ether (MTBE). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Methyl *tert*-butyl ether (MTBE) is a flammable liquid which is used as an additive in unleaded gasoline. Drinking or breathing MTBE may cause nausea, nose and throat irritation, and nervous system effects. MTBE has been found in at least 11 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is methyl *tert*-butyl ether?

(Pronounced měth′əl tûr′shē-ĕr′ē byo͞ot′l ē′thər)

Methyl *tert*-butyl ether (MTBE) is a flammable liquid with a distinctive, disagreeable odor. It is made from blending chemicals such as isobutylene and methanol, and has been used since the 1980s as an additive for unleaded gasolines to achieve more efficient burning.

MTBE is also used to dissolve gallstones. Patients treated in this way have MTBE delivered directly to their gall bladders through special tubes that are surgically inserted.

What happens to MTBE when it enters the environment?

- MTBE quickly evaporates from open containers and surface water, so it is commonly found as a vapor in the air.
- Small amounts of MTBE may dissolve in water and get into underground water.
- It remains in underground water for a long time.
- MTBE may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- MTBE may be broken down quickly in the air by sunlight.
- MTBE does not build up significantly in plants and animals.

How might I be exposed to MTBE?

- Touching the skin or breathing contaminated air while pumping gasoline.
- Breathing exhaust fumes while driving a car.
- Breathing air near highways or in cities.
- Drinking, swimming, or showering in water that has been contaminated with MTBE.
- Receiving MTBE treatment for gallstones.

How can MTBE affect my health?

Breathing small amounts of MTBE for short periods may cause nose and throat irritation. Some people exposed to MTBE while pumping gasoline, driving their cars, or working

in gas stations have reported having headaches, nausea, dizziness, and mental confusion. However, the actual levels of exposure in these cases are unknown. In addition, these symptoms may have been caused by exposure to other chemicals.

There are no data on the effects in people of drinking MTBE. Studies with rats and mice suggest that drinking MTBE may cause gastrointestinal irritation, liver and kidney damage, and nervous system effects.

How likely is MTBE to cause cancer?

There is no evidence that MTBE causes cancer in humans. One study with rats found that breathing high levels of MTBE for long periods may cause kidney cancer. Another study with mice found that breathing high levels of MTBE for long periods may cause liver cancer.

The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the EPA have not classified MTBE as to its carcinogenicity.

Is there a medical test to show whether I've been exposed to MTBE?

MTBE and its breakdown product, butyl alcohol, can be detected in your breath, blood, or urine for up to 1 or 2 days after exposure. These tests aren't available at most doctors' offices, but can be done at special laboratories that have the right equipment. There is no other test specific to determining MTBE exposure.

Has the federal government made recommendations to protect human health?

The EPA has issued guidelines recommending that, to protect children, drinking water levels of MTBE not exceed 4 milligrams per liter of water (4 mg/L) for an exposure of 1-10 days, and 3 mg/L for longer-term exposures.

The American Conference of Governmental Industrial Hygienists (ACGIH) has recommended an exposure limit of 40 parts of MTBE per million parts of air (40 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or gas.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.

References

This ToxFAQs information is taken from the 1996 Toxicological Profile for Methyl *tert*-Butyl Ether produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

METHYLENE CHLORIDE
CAS # 75-09-2

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about methylene chloride. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to methylene chloride occurs mostly from breathing contaminated air, but may also occur through skin contact or by drinking contaminated water. Breathing in large amounts of methylene chloride can damage the central nervous system. Contact of eyes or skin with methylene chloride can result in burns. Methylene chloride has been found in at least 882 of 1,569 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is methylene chloride?

Methylene chloride is a colorless liquid with a mild, sweet odor. Another name for it is dichloromethane. Methylene chloride does not occur naturally in the environment.

Methylene chloride is used as an industrial solvent and as a paint stripper. It may also be found in some aerosol and pesticide products and is used in the manufacture of photographic film.

What happens to methylene chloride when it enters the environment?

❑ Methylene chloride is mainly released to the environment in air. About half of the methylene chloride in air disappears in 53 to 127 days.

❑ Methylene chloride does not easily dissolve in water, but small amounts may be found in drinking water.

❑ We do not expect methylene chloride to build up in plants or animals.

How might I be exposed to methylene chloride?

❑ The most likely way to be exposed to methylene chloride is by breathing contaminated air.

❑ Breathing the vapors given off by products containing methylene chloride. Exposure to high levels of methylene chloride is likely if methylene chloride or a product containing it is used in a room with inadequate ventilation.

How can methylene chloride affect my health?

If you breathe in large amounts of methylene chloride you may feel unsteady, dizzy, and have nausea and a tingling or numbness of your finger and toes. A person breathing smaller amounts of methylene chloride may become less attentive and less accurate in tasks requiring hand-eye coordination. Skin contact with methylene chloride causes burning and redness of the skin.

How likely is methylene chloride to cause cancer?

We do not know if methylene chloride can cause cancer in humans. An increased cancer risk was seen in mice

breathing large amounts of methylene chloride for a long time.

The World Health Organization (WHO) has determined that methylene chloride may cause cancer in humans.

The Department of Health and Human Services (DHHS) has determined that methylene chloride can be reasonably anticipated to be a cancer-causing chemical.

The EPA has determined that methylene chloride is a probable cancer-causing agent in humans.

How can methylene chloride affect children?

It is likely that health effects seen in children exposed to high amounts of methylene chloride will be similar to the effects seen in adults. We do not know if methylene chloride can affect the ability of people to have children or if it causes birth defects. Some birth defects have been seen in animals inhaling very high levels of methylene chloride.

How can families reduce the risk of exposure to methylene chloride?

❑ Families may be exposed to methylene chloride while using products such as paint removers. Such products should always be used in well-ventilated areas and skin contact should be avoided.
❑ Children should not be allowed to remain near indoor paint removal activities.

Is there a medical test to show whether I've been exposed to methylene chloride?

❑ Several tests can measure exposure to methylene chloride. These tests are not routinely available in your doctor's office.
❑ Methylene chloride can be detected in the air you breathe out and in your blood. These tests are only useful for detecting exposures that have occurred within a few days.
❑ It is also possible to measure carboxyhemoglobin (a chemical formed in the blood as methylene chloride breaks down in the body) in the blood or formic acid (a breakdown product of methylene chloride) in the urine. These tests are not specific for methylene chloride.

Has the federal government made recommendations to protect human health?

❑ The EPA requires that releases of methylene chloride of 1,000 pounds or more be reported to the federal government.
❑ The EPA recommends that exposure of children to methylene chloride be limited to less than 10 milligrams per liter of drinking water (10 mg/L) for 1 day or 2 mg/L for 10 days.
❑ The Food and Drug Administration (FDA) has established limits on the amounts of methylene chloride that can remain after processing of spices, hops extract, and decaffeinated coffee.
❑ The Occupational Safety and Health Administration (OSHA) has set limits of 25 parts methylene chloride per million parts of workplace air (25 ppm) for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for methylene chloride. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

NAPHTHALENE
CAS # 91-20-3

1-METHYLNAPHTHALENE
CAS # 90-12-0

2-METHYLNAPHTHALENE
CAS # 91-57-6

Division of Toxicology ToxFAQs™ August 2005

This fact sheet answers the most frequently asked health questions (FAQs) about naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene happens mostly from breathing air contaminated from the burning of wood, tobacco, or fossil fuels, industrial discharges, or moth repellents. Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. Naphthalene has caused cancer in animals. Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene have been found in at least 687, 36, and 412, respectively, of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What are naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Naphthalene is a white solid that evaporates easily. Fuels such as petroleum and coal contain naphthalene. It is also called white tar, and tar camphor, and has been used in mothballs and moth flakes. Burning tobacco or wood produces naphthalene. It has a strong, but not unpleasant smell. The major commercial use of naphthalene is in the manufacture of polyvinyl chloride (PVC) plastics. Its major consumer use is in moth repellents and toilet deodorant blocks.

1-Methylnaphthalene and 2-methylnaphthalene are naphthalene-related compounds. 1-Methylnaphthalene is a clear liquid and 2-methylnaphthalene is a solid; both can be smelled in air and in water at very low concentrations.

1-Methylnaphthalene and 2-methylnaphthalene are used to make other chemicals such as dyes and resins. 2-Methylnaphthalene is also used to make vitamin K.

What happens to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene when they enter the environment?

- Naphthalene enters the environment from industrial and domestic sources, and from accidental spills.
- Naphthalene can dissolve in water to a limited degree and may be present in drinking water from wells close to hazardous waste sites and landfills.
- Naphthalene can become weakly attached to soil or pass through soil into underground water.
- In air, moisture and sunlight break it down within 1 day. In water, bacteria break it down or it evaporates into the air.
- Naphthalene does not accumulate in the flesh of animals or fish that you might eat.
- 1-Methylnaphthalene and 2-methylnaphthalene are expected to act like naphthalene in air, water, or soil because they have similar chemical and physical properties.

How might I be exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

- Breathing low levels in outdoor air.
- Breathing air contaminated from industrial discharges or smoke from burning wood, tobacco, or fossil fuels.
- Using or making moth repellents, coal tar products, dyes or inks could expose you to these chemicals in the air.
- Drinking water from contaminated wells.
- Touching fabrics that are treated with moth repellents containing naphthalene.
- Exposure to naphthalene, 1-methylnaphthalene and 2-methylnaphthalene from eating foods or drinking beverages is unlikely.

How can naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene affect my health?

Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. This could cause you to have too few red blood cells until your body replaces the destroyed cells. This condition is called hemolytic anemia. Some symptoms of hemolytic anemia are fatigue, lack of appetite, restlessness, and pale skin. Exposure to large amounts of naphthalene may also cause nausea, vomiting, diarrhea, blood in the urine, and a yellow color to the skin. Animals sometimes develop cloudiness in their eyes after swallowing high amounts of naphthalene. It is not clear whether this also develops in people. Rats and mice that breathed naphthalene vapors daily for a lifetime developed irritation and inflammation of their nose and lungs. It is unclear if naphthalene

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causes reproductive effects in animals; most evidence says it does not.

There are no studies of humans exposed to 1-methylnaphthalene or 2-methylnaphthalene.

Mice fed food containing 1-methylnaphthalene and 2-methylnaphthalene for most of their lives had part of their lungs filled with an abnormal material.

How likely are naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene to cause cancer?

There is no direct evidence in humans that naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene cause cancer. However, cancer from naphthalene exposure has been seen in animal studies. Some female mice that breathed naphthalene vapors daily for a lifetime developed lung tumors. Some male and female rats exposed to naphthalene in a similar manner also developed nose tumors.

Based on the results from animal studies, the Department of Health and Humans Services (DHHS) concluded that naphthalene is reasonably anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) concluded that naphthalene is possibly carcinogenic to humans. The EPA determined that naphthalene is a possible human carcinogen (Group C) and that the data are inadequate to assess the human carcinogenic potential of 2-methylnaphthalene.

How can naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene affect children?

Hospitals have reported many cases of hemolytic anemia in children, including newborns and infants, who either ate naphthalene mothballs or deodorants cakes or who were in close contact with clothing or blankets stored in naphthalene mothballs. Naphthalene can move from a pregnant woman's blood to the unborn baby's blood. Naphthalene has been detected in some samples of breast milk from the general U.S. population, but not at levels that are expected to be of concern.

There is no information on whether naphthalene has affected development in humans. No developmental abnormalities were observed in the offspring from rats, mice, and rabbits fed naphthalene during pregnancy.

We do not have any information on possible health effects of 1-methylnaphthalene or 2-methylnaphthalene on children.

How can families reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

❑ Families can reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene by avoiding smoking tobacco, generating smoke during cooking, or using fireplaces or heating appliances in the their homes.

❑ If families use naphthalene-containing moth repellents, the material should be enclosed in containers that prevent vapors from escaping, and kept out of the reach from children.

❑ Blankets and clothing stored with naphthalene moth repellents should be aired outdoors to remove naphthalene odors and washed before they are used.

❑ Families should inform themselves of the contents of air deodorizers that are used in their homes and refrain from using deodorizers with naphthalene.

Is there a medical test to determine whether I've been exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Tests are available that measure levels of these chemicals and their breakdown products in samples of urine, feces, blood, maternal milk, or body fat. These tests are not routinely available in a doctor's office because they require special equipment, but samples can be sent to special testing laboratories. These tests cannot determine exactly how much naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene you were exposed to or predict whether harmful effects will occur. If the samples are collected within a day or two of exposure, then the tests can show if you were exposed to a large or small amount of naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene.

Has the federal government made recommendations to protect human health?

The EPA recommends that children not drink water with over 0.5 parts per million (0.5 ppm) naphthalene for more than 10 days or over 0.4 ppm for any longer than 7 years. Adults should not drink water with more than 1 ppm for more than 7 years. For water consumed over a lifetime (70 years), the EPA suggests that it contain no more than 0.1 ppm naphthalene.

The Occupational Safety and Health Administration (OSHA) set a limit of 10 ppm for the level of naphthalene in workplace air during an 8-hour workday, 40-hour workweek. The National Institute for Occupational Safety and Health (NIOSH) considers more than 500 ppm of naphthalene in air to be immediately dangerous to life or health. This is the exposure level of a chemical that is likely to impair a worker's ability to leave a contaminate area and therefore, results in permanent health problems or death.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Naphthalene, 1-Methylnaphthalene, and 2-Methylnaphthalene (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TETRACHLOROETHYLENE
CAS # 127-18-4

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1997**

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing. Exposure to very high concentrations of tetrachloroethylene can cause dizziness, headaches, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Tetrachloroethylene has been found in at least 771 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is tetrachloroethylene?

(Pronounced tĕt′rə-klôr′ ō-ĕth′ə-lēn′)

Tetrachloroethylene is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products.

Other names for tetrachloroethylene include perchloroethylene, PCE, and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part tetrachloroethylene per million parts of air (1 ppm) or more, although some can smell it at even lower levels.

What happens to tetrachloroethylene when it enters the environment?

- Much of the tetrachloroethylene that gets into water or soil evaporates into the air.
- Microorganisms can break down some of the tetrachloroethylene in soil or underground water.
- In the air, it is broken down by sunlight into other chemicals or brought back to the soil and water by rain.
- It does not appear to collect in fish or other animals that live in water.

How might I be exposed to tetrachloroethylene?

- When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.
- When you drink water containing tetrachloroethylene, you are exposed to it.

How can tetrachloroethylene affect my health?

High concentrations of tetrachloroethylene (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death.

Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used tetrachloroethylene to get a "high."

In industry, most workers are exposed to levels lower than those causing obvious nervous system effects. The health effects of breathing in air or drinking water with low levels of tetrachloroethylene are not known.

Results from some studies suggest that women who work in dry cleaning industries where exposures to tetrachloroethyl-

ene can be quite high may have more menstrual problems and spontaneous abortions than women who are not exposed. However, it is not known if tetrachloroethylene was responsible for these problems because other possible causes were not considered.

Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that tetrachloroethylene can cause liver and kidney damage. Exposure to very high levels of tetrachloroethylene can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

How likely is tetrachloroethylene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that tetrachloroethylene may reasonably be anticipated to be a carcinogen. Tetrachloroethylene has been shown to cause liver tumors in mice and kidney tumors in male rats.

Is there a medical test to show whether I've been exposed to tetrachloroethylene?

One way of testing for tetrachloroethylene exposure is to measure the amount of the chemical in the breath, much the same way breath-alcohol measurements are used to determine the amount of alcohol in the blood.

Because it is stored in the body's fat and slowly released into the bloodstream, tetrachloroethylene can be detected in the breath for weeks following a heavy exposure.

Tetrachloroethylene and trichloroacetic acid (TCA), a breakdown product of tetrachloroethylene, can be detected in the blood. These tests are relatively simple to perform. These tests aren't available at most doctors' offices, but can be performed at special laboratories that have the right equipment.

Because exposure to other chemicals can produce the same breakdown products in the urine and blood, the tests for breakdown products cannot determine if you have been exposed to tetrachloroethylene or the other chemicals.

Has the federal government made recommendations to protect human health?

The EPA maximum contaminant level for the amount of tetrachloroethylene that can be in drinking water is 0.005 milligrams tetrachloroethylene per liter of water (0.005 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 100 ppm for an 8-hour workday over a 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that tetrachloroethylene be handled as a potential carcinogen and recommends that levels in workplace air should be as low as possible.

Glossary

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Milligram (mg): One thousandth of a gram.

Nonflammable: Will not burn.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Tetrachloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TOLUENE
CAS # 108-88-3

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about toluene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to toluene occurs from breathing contaminated workplace air, in automobile exhaust, some consumer products paints, paint thinners, fingernail polish, lacquers, and adhesives. Toluene affects the nervous system. Toluene has been found at 959 of the 1,591 National Priority List sites identified by the Environmental Protection Agency

What is toluene?

Toluene is a clear, colorless liquid with a distinctive smell. Toluene occurs naturally in crude oil and in the tolu tree. It is also produced in the process of making gasoline and other fuels from crude oil and making coke from coal.

Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes.

What happens to toluene when it enters the environment?

❑ Toluene enters the environment when you use materials that contain it. It can also enter surface water and groundwater from spills of solvents and petrolieum products as well as from leasking underground storage tanks at gasoline stations and other facilities.

❑ When toluene-containing products are placed in landfills or waste disposal sites, the toluene can enter the soil or water near the waste site.

❑ Toluene does not usually stay in the environment long.

❑ Toluene does not concentrate or buildup to high levels in animals.

How might I be exposed to toluene?

❑ Breathing contaminated workplace air or automobile exhaust.

❑ Working with gasoline, kerosene, heating oil, paints, and lacquers.

❑ Drinking contaminated well-water.

❑ Living near uncontrolled hazardous waste sites containing toluene products.

How can toluene affect my health?

Toluene may affect the nervous system. Low to moderate levles can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, and

hearing and color vision loss. These symptoms usually disappear when exposure is stopped.

Inhaling High levels of toluene in a short time can make you feel light-headed, dizzy, or sleepy. It can also cause unconsciousness, and even death.

High levels of toluene may affect your kidneys.

How likely is toluene to cause cancer?

Studies in humans and animals generally indicate that toluene does not cause cancer.

The EPA has determined that the carcinogenicity of toluene can not be classified.

How can toluene affect children?

It is likely that health effects seen in children exposed to toluene will be similar to the effects seen in adults. Some studies in animals suggest that babies may be more sensitive than adults.

Breathing very high levels of toluene during pregnancy can result in children with birth defects and retard mental abilities, and growth. We do not know if toluene harms the unborn child if the mother is exposed to low levels of toluene during pregnancy.

How can families reduce the risk of exposure to toluene?

❑ Use toluene-containing products in well-ventilated areas.

❑ When not in use, toluene-containing products should be tightly covered to prevent evaporation into the air.

Is there a medical test to show whether I've been exposed to toluene?

There are tests to measure the level of toluene or its breakdown products in exhaled air, urine, and blood. To determine if you have been exposed to toluene, your urine or blood must be checked within 12 hours of exposure. Several other chemicals are also changed into the same breakdown products as toluene, so some of these tests are not specific for toluene.

Has the federal government made recommendations to protect human health?

EPA has set a limit of 1 milligram per liter of drinking water (1 mg/L).

Discharges, releases, or spills of more than 1,000 pounds of toluene must be reported to the National Response Center.

The Occupational Safety and Health Administration has set a limit of 200 parts toluene per million of workplace air (200 ppm).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Toluene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TRICHLOROETHYLENE

CAS # 79-01-6

Division of Toxicology ToxFAQs™ **July 2003**

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Trichloroethylene is a colorless liquid which is used as a solvent for cleaning metal parts. Drinking or breathing high levels of trichloroethylene may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Trichloroethylene has been found in at least 852 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

Trichloroethylene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

Trichloroethylene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

What happens to trichloroethylene when it enters the environment?

- Trichloroethylene dissolves a little in water, but it can remain in ground water for a long time.
- Trichloroethylene quickly evaporates from surface water, so it is commonly found as a vapor in the air.
- Trichloroethylene evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.
- Trichloroethylene may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- Trichloroethylene does not build up significantly in plants and animals.

How might I be exposed to trichloroethylene?

- Breathing air in and around the home which has been contaminated with trichloroethylene vapors from shower water or household products such as spot removers and typewriter correction fluid.
- Drinking, swimming, or showering in water that has been contaminated with trichloroethylene.
- Contact with soil contaminated with trichloroethylene, such as near a hazardous waste site.
- Contact with the skin or breathing contaminated air while manufacturing trichloroethylene or using it at work to wash paint or grease from skin or equipment.

How can trichloroethylene affect my health?

Breathing small amounts may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating.

Breathing large amounts of trichloroethylene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage.

Drinking large amounts of trichloroethylene may cause nausea, liver damage, unconsciousness, impaired heart function, or death.

Drinking small amounts of trichloroethylene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Skin contact with trichloroethylene for short periods may cause skin rashes.

How likely is trichloroethylene to cause cancer?

Some studies with mice and rats have suggested that high levels of trichloroethylene may cause liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. Although, there are some concerns about the studies of people who were exposed to trichloroethylene, some of the effects found in people were similar to effects in animals.

In its 9th Report on Carcinogens, the National Toxicology Program (NTP) determined that trichloroethylene is "reasonably anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) has determined that trichloroethylene is "probably carcinogenic to humans."

Is there a medical test to show whether I've been exposed to trichloroethylene?

If you have recently been exposed to trichloroethylene, it can be detected in your breath, blood, or urine. The breath test, if it is performed soon after exposure, can tell if you have been exposed to even a small amount of trichloroethylene.

Exposure to larger amounts is assessed by blood and urine tests, which can detect trichloroethylene and many of its breakdown products for up to a week after exposure. However, exposure to other similar chemicals can produce the same breakdown products, so their detection is not absolute proof of exposure to trichloroethylene. This test isn't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level for trichloroethylene in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5 parts of TCE per billion parts water.

The EPA has also developed regulations for the handling and disposal of trichloroethylene.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 100 parts of trichloroethylene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: The ability of a substance to cause cancer.
CAS: Chemical Abstracts Service.
Evaporate: To change into a vapor or gas.
Milligram (mg): One thousandth of a gram.
Nonflammable: Will not burn.
ppm: Parts per million.
Sediment: Mud and debris that have settled to the bottom of a body of water.
Solvent: A chemical that dissolves other substances.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Trichloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Vinyl Chloride
CAS# 75-01-4

Division of Toxicology ToxFAQs™ **September 2004**

This fact sheet answers the most frequently asked health questions (FAQs) about vinyl chloride. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to vinyl chloride occurs mainly in the workplace. Breathing high levels of vinyl chloride for short periods of time can cause dizziness, sleepiness, unconsciousness, and at extremely high levels can cause death. Breathing vinyl chloride for long periods of time can result in permanent liver damage, immune reactions, nerve damage, and liver cancer. This substance has been found in at least 616 of the 1,647 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is vinyl chloride?

Vinyl chloride is a colorless gas. It burns easily and it is not stable at high temperatures. It has a mild, sweet odor. It is a manufactured substance that does not occur naturally. It can be formed when other substances such as trichloroethane, trichloroethylene, and tetrachloroethylene are broken down. Vinyl chloride is used to make polyvinyl chloride (PVC). PVC is used to make a variety of plastic products, including pipes, wire and cable coatings, and packaging materials.

Vinyl chloride is also known as chloroethene, chloroethylene, and ethylene monochloride.

What happens to vinyl chloride when it enters the environment?

- ❑ Liquid vinyl chloride evaporates easily. Vinyl chloride in water or soil evaporates rapidly if it is near the surface.
- ❑ Vinyl chloride in the air breaks down in a few days to other substances, some of which can be harmful.
- ❑ Small amounts of vinyl chloride can dissolve in water.
- ❑ Vinyl chloride is unlikely to build up in plants or animals that you might eat.

How might I be exposed to vinyl chloride?

- ❑ Breathing vinyl chloride that has been released from plastics industries, hazardous waste sites, and landfills.
- ❑ Breathing vinyl chloride in air or during contact with your skin or eyes in the workplace.
- ❑ Drinking water from contaminated wells.

How can vinyl chloride affect my health?

Breathing high levels of vinyl chloride can cause you to feel dizzy or sleepy. Breathing very high levels can cause you to pass out, and breathing extremely high levels can cause death.

Some people who have breathed vinyl chloride for several years have changes in the structure of their livers. People are more likely to develop these changes if they breathe high levels of vinyl chloride. Some people who work with vinyl chloride have nerve damage and develop immune reactions. The lowest levels that produce liver changes, nerve damage, and immune reaction in people are not known. Some workers exposed to very high levels of vinyl chloride have problems with the blood flow in their hands. Their fingers turn white and hurt when they go into the cold.

The effects of drinking high levels of vinyl chloride are unknown. If you spill vinyl chloride on your skin, it will cause numbness, redness, and blisters.

Animal studies have shown that long-term exposure to vinyl chloride can damage the sperm and testes.

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

How likely is vinyl chloride to cause cancer?

The U.S. Department of Health and Human Services has determined that vinyl chloride is a known carcinogen. Studies in workers who have breathed vinyl chloride over many years showed an increased risk of liver cancer; brain cancer, lung cancer, and some cancer of the blood have also been observed in workers.

How can vinyl chloride affect children?

It has not been proven that vinyl chloride causes birth defects in humans, but studies in animals suggest that vinyl chloride might affect growth and development. Animal studies also suggest that infants and young children might be more susceptible than adults to vinyl chloride-induced cancer.

How can families reduce the risk of exposure to vinyl chloride?

Tobacco smoke contains low levels of vinyl chloride, so limiting your family's exposure to cigarette or cigar smoke may help reduce their exposure to vinyl chloride.

Is there a medical test to show whether I've been exposed to vinyl chloride?

The results of several tests can sometimes show if you have been exposed to vinyl chloride. Vinyl chloride can be measured in your breath, but the test must be done shortly after exposure. This is not helpful for measuring very low levels of vinyl chloride. The amount of the major breakdown product of vinyl chloride, thiodiglycolic acid, in the urine may give some information about exposure. However, this test must be done shortly after exposure and does not reliably indicate the level of exposure.

Vinyl chloride can bind to genetic material in your body. The amount of this binding can be measured by sampling your blood and other tissues. This measurement will give information about whether you have been exposed to vinyl chloride, but it is not sensitive enough to determine the effects on the genetic material resulting from exposure. These tests are not available at most doctors' offices, but can be done at special laboratories.

Has the federal government made recommendations to protect human health?

Vinyl chloride is regulated in drinking water, food, and air. The EPA requires that the amount of vinyl chloride in drinking water not exceed 0.002 milligrams per liter (mg/L) of water.

The Occupational Safety and Health Administration (OSHA) has set a limit of 1 part vinyl chloride per 1 million parts of air (1 ppm) in the workplace.

The Food and Drug Administration (FDA) regulates the vinyl chloride content of various plastics. These include plastics that carry liquids and plastics that contact food. The limits for vinyl chloride content vary depending on the nature of the plastic and its use.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2004. Toxicological Profile for Vinyl Chloride (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

XYLENE

CAS # 1330-20-7

Division of Toxicology and Environmental Medicine ToxFAQs™ September 2005

This fact sheet answers the most frequently asked health questions (FAQs) about xylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to xylene occurs in the workplace and when you use paint, gasoline, paint thinners and other products that contain it. People who breathe high levels may have dizziness, confusion, and a change in their sense of balance. Xylene has been found in at least 844 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

There are three forms of xylene in which the methyl groups vary on the benzene ring: *meta*-xylene, *ortho*-xylene, and *para*-xylene (*m*-, *o*-, and *p*-xylene). These different forms are referred to as isomers.

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar. Chemical industries produce xylene from petroleum. It is one of the top 30 chemicals produced in the United States in terms of volume.

Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

What happens to xylene when it enters the environment?

- ❑ Xylene evaporates quickly from the soil and surface water into the air.
- ❑ In the air, it is broken down by sunlight into other less harmful chemicals.
- ❑ It is broken down by microorganisms in soil and water.
- ❑ Only a small amount of it builds up in fish, shellfish, plants, and other animals living in xylene-contaminated water.

How might I be exposed to xylene?

- ❑ Using a variety of consumer products including gasoline, pain, varnish, shellac, rust preventives, and cigarette smoke. Xylene can be absorbed through the respiratory tract and through the skin.
- ❑ Ingesting xylene-contaminated food or water, although these levels are likely to be very low.
- ❑ Working in a job that involves the use of xylene such as painters, paint industry workers, biomedical laboratory workers, automobile garage workers, metal workers, and furniture refinishers.

How can xylene affect my health?

No health effects have been noted at the background levels that people are exposed to on a daily basis.

High levels of exposure for short or long periods can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

How likely is xylene to cause cancer?

Both the International Agency for Research on Cancer (IARC) and the EPA have found that there is insufficient information to determine whether or not xylene is carcinogenic.

How can xylene affect children?

The effects of xylene have not been studied in children, but it is likely that they would be similar to those seen in exposed adults. Although there is no direct evidence, children may be more sensitive to acute inhalation exposure than adults because their narrower airways would be more sensitive to swelling effects.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy.

How can families reduce the risks of exposure to xylene?

- ❑ Exposure to xylene as solvents (in paints or gasoline) can be reduced if the products are used with adequate ventilation and if they are stored in tightly closed containers out of the reach of small children.
- ❑ Sometimes older children sniff household chemicals in attempt to get high. Talk with your children about the dangers of sniffing xylene.
- ❑ If products containing xylene are spilled on the skin, then the excess should be wiped off and the area cleaned with soap and water.

Is there a medical test to determine whether I've been exposed to xylene?

Laboratory tests can detect xylene or its breakdown products in exhaled air, blood, or urine. There is a high degree of agreement between the levels of exposure to xylene and the levels of xylene breakdown products in the urine. However, a urine sample must be provided very soon after exposure ends because xylene quickly leaves the body. These tests are not routinely available at your doctor's office.

Has the federal government made recommendations to protect human health?

The EPA set a limit of 10 parts xylene per million parts drinking water (10 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 100 parts xylene per million parts of workplace air (100 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Xylene (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

DI-*n*-OCTYLPHTHALATE (DNOP)
CAS # 117-84-0

This fact sheet answers the most frequently asked health questions (FAQs) about di-*n*-octylphthalate (DNOP). For more information, call the ATSDR Information Center at 1-800-447-1544. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to di-*n*-octylphthalate occurs mainly from eating food or drinking water that is stored in plastic containers. The health effects of breathing, ingesting, or touching di-*n*-octylphthalate are not known. This substance has been found in at least 300 of the 1,416 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is di-*n*-octylphthalate?

(Pronounced dī′-n-ŏk′tĭl thăl′ āt)

Di-*n*-octylphthalate is a colorless, odorless, oily liquid that doesn't evaporate easily. It is a man-made substance used to keep plastics soft or more flexible. This type of plastic can be used for medical tubing and blood storage bags, wire and cables, carpetback coating, floor tile, and adhesives. It is also used in cosmetics and pesticides.

What happens to di-*n*-octylphthalate when it enters the environment?

- Di-*n*-octylphthalate can be released to water or air during its manufacture, by leaking from plastics in landfills, or from the burning of plastic products.
- If di-*n*-octylphthalate is released into the air, it may be deposited on the ground or to surface water in rain or dust particles.
- Di-*n*-octylphthalate sticks tightly to soil, sediment, and dust particles.
- Di-*n*-octylphthalate is mainly broken down into other substances by microorganisms.
- It can also be broken down in reactions with sunlight, other chemicals in the atmosphere, or water.
- Small amounts of di-*n*-octylphthalate can build up in animals that live in water, such as fish and oysters.

How might I be exposed to di-*n*-octylphthalate?

- Eating foods stored in containers made with di-*n*-octylphthalate that has leaked into the food.
- Receiving blood transfusions, dialysis, or other medical treatments in which the equipment is made of plastics containing di-*n*-octylphthalate.
- Breathing contaminated air, drinking contaminated water, or touching contaminated soil near hazardous waste sites or an industrial manufacturing facility that uses or makes di-*n*-octylphthalate.

How can di-*n*-octylphthalate affect my health?

Little information is known about the health effects that might be caused by di-*n*-octylphthalate. It is not known what happens when you breathe or ingest the chemical.

DI-*n*-OCTYLPHTHALATE (DNOP)
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Some rats and mice that were given very high doses of di-*n*-octylphthalate by mouth died. Mildly harmful effects have been seen in the livers of some rats and mice given very high doses of di-*n*-octylphthalate by mouth for short (14 days or less) or intermediate periods (15 to 365 days) of time, but lower doses given for short periods of time generally caused no harmful effects.

No information is available on the health effects of having di-*n*-octylphthalate in contact with human skin. It can be mildly irritating when applied to the skin of animals.

It is not known whether or not di-*n*-octylphthalate could affect the ability to have children, or if it could cause birth defects.

How likely is di-*n*-octylphthalate to cause cancer?

Di-*n*-octylphthalate is not known to cause cancer in humans or animals.

Di-*n*-octylphthalate has not been classified as to its carcinogenicity by the Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), or the EPA.

Is there a medical test to show whether I've been exposed to di-*n*-octylphthalate?

Di-*n*-octylphthalate and its principal breakdown products can be measured in urine, blood, and tissues. However, it is not known if they are specific for di-*n*-octylphthalate or for how long after exposure occurs the test is useful. These facts cannot be used to determine how much di-*n*-octylphthalate you were exposed to or predict whether harmful effects will occur.

This test is not part of a routine medical examination, but it can be done by the doctor's request at special laboratories.

Has the federal government made recommendations to protect human health?

The EPA has recently determined that there is not enough evidence to say that di-*n*-octylphthalate causes harmful effects in humans or the environment.

The EPA requires that spills or accidental releases into the environment of 5,000 pounds or more of di-*n*-octylphthalate be reported to the EPA.

Glossary

CAS: Chemical Abstracts Service.

Carcinogenicity: Ability to cause cancer.

Evaporate: To change into a vapor or a gas.

Ingest: To eat or drink something.

Sediment: Mud and debris that have settled to the bottom of a body of water.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Di-*n*-octylphthalate produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.