

6. POTENTIAL FOR HUMAN EXPOSURE

6.1 OVERVIEW

1,1-Dichloroethane has been identified in at least 673 of the 1,699 hazardous waste sites that have been proposed for inclusion on the EPA National Priorities List (NPL) (HazDat 2007). However, the number of sites evaluated for 1,1-dichloroethane is not known. The frequency of these sites can be seen in Figure 6-1.

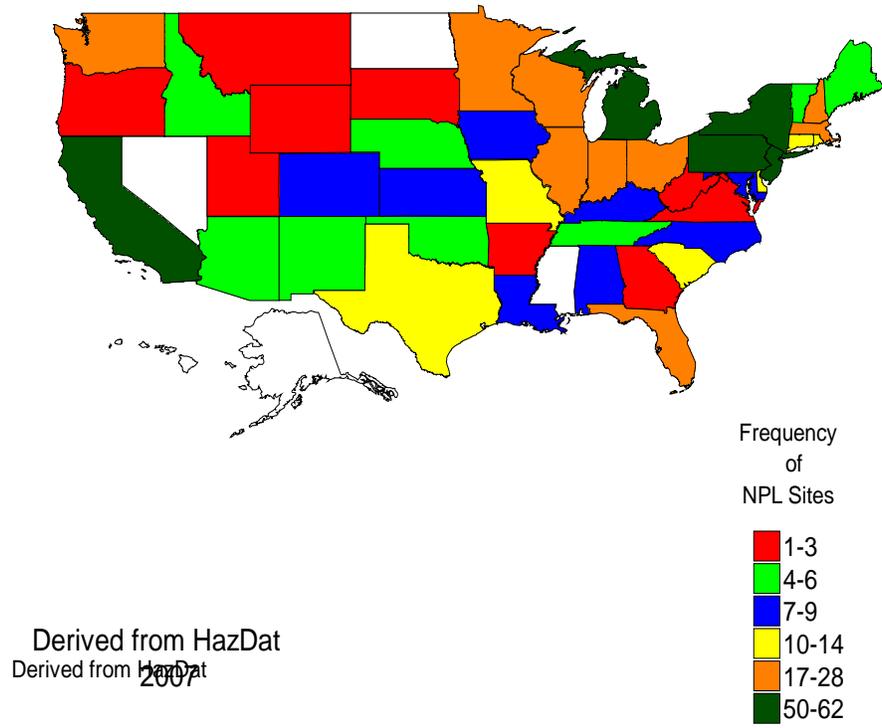
1,1-Dichloroethane has been identified in at least 400 of the 1,760 proposed (51), final (1,323), and deleted (386) hazardous waste sites listed on the EPA Superfund NPL under the synonym 1,1-dichloroethene (CASRN: 75-34-3) and at least 26 of the 1,760 EPA Superfund NPL sites under the synonym ethylidene dichloride (CASRN: 75-34-3) (EPA 2015c; NLM 2015). However, the number of sites evaluated for 1,1-dichloroethane is not known.

1,1-Dichloroethane in the environment is mainly related to the production, storage, consumption, transport, and disposal of 1,1-dichloroethane used as a chemical intermediate, solvent, finish remover, and degreaser. 1,1-Dichloroethane may occur in the environment as a biodegradation product of 1,1,1-trichloroethane. In addition, 1,1-dichloroethane was reported as a constituent in the gaseous emissions of cigarette smoke. Releases from industrial processes are almost exclusively to the atmosphere. Releases of the compound to surface waters and soils are expected to partition rapidly to the atmosphere through volatilization. Hydrolysis, photolysis, and biodegradation do not appear to be important processes in determining the environmental fate of 1,1-dichloroethane. It has been detected at generally low levels in ambient air, surface water, groundwater, drinking water, and human breath. Concentrations in environmental media are greatest near source areas (e.g., industrial point sources, hazardous waste sites).

The main route of human exposure to 1,1-dichloroethane is through inhalation of 1,1-dichloroethane in ambient or workplace air. Estimates of populations potentially exposed to 1,1-dichloroethane in workplace environments in the 1980s ranged from 715 to 1,957 workers (EPA 2001c). Ingestion of contaminated drinking water may also be an important route of exposure for populations living near industrial facilities and hazardous waste sites. Boman and Maibach (1996) concluded that exposure to skin results in very little absorption due to the compound's volatility; in addition, the concentration levels greatly diminish in properly ventilated areas.

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Figure 6-1. Frequency of NPL Sites with 1,1-Dichloroethane Contamination



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6.2 RELEASES TO THE ENVIRONMENT

The Toxics Release Inventory (TRI) data should be used with caution because only certain types of facilities are required to report (EPA 2005). This is not an exhaustive list. Manufacturing and processing facilities are required to report information to the TRI only if they employ 10 or more full-time employees; if their facility is included in Standard Industrial Classification (SIC) Codes 10 (except 1011, 1081, and 1094), 12 (except 1241), 20–39, 4911 (limited to facilities that combust coal and/or oil for the purpose of generating electricity for distribution in commerce), 4931 (limited to facilities that combust coal and/or oil for the purpose of generating electricity for distribution in commerce), 4939 (limited to facilities that combust coal and/or oil for the purpose of generating electricity for distribution in commerce), 4953 (limited to facilities regulated under RCRA Subtitle C, 42 U.S.C. section 6921 et seq.), 5169, 5171, and 7389 (limited S.C. section 6921 et seq.), 5169, 5171, and 7389 (limited to facilities primarily engaged in solvents recovery services on a contract or fee basis); and if their facility produces, imports, or processes $\geq 25,000$ pounds of any TRI chemical or otherwise uses $>10,000$ pounds of a TRI chemical in a calendar year (EPA 2005).

Of the 21,526 TRI facilities reporting nationwide, 1,1-dichloroethane (CASRN: 75-34-3), has been reported in 0 onsite TRI releases for the reporting year 2013. Of these TRI facilities reporting nationwide, 1,1-dichloroethane, under the synonym ethylidene dichloride (CASRN: 75-34-3), has been reported in 18 onsite TRI releases for the reporting year 2013 (NLM 2015).

Section 112 of the Clean Air Act (CAA) lists 1,1-dichloroethane as one of 188 hazardous air pollutants (HAPs) known to cause or suspected of causing cancer or other serious human health effects or ecosystem damage (EPA 2000). EPA's National Emission Inventory (NEI) database contains data regarding sources that emit criteria air pollutants and their precursors, and HAPs for the 50 United States, Washington DC, Puerto Rico, and the U.S. Virgin Islands (prior to 1999, criteria pollutant emission estimates were maintained in the National Emission Trends [NET] database and HAP emission estimates were maintained in the National Toxics Inventory [NTI] database). The NEI database derives emission data from multiple sources including: state and local environmental agencies; the TRI database; computer models for on-road and off-road emissions; databases related to EPA's Maximum Achievable Control Technology (MACT) programs to reduce emissions of hazardous air pollutants. Using composite data from the NTI database from 1990 to 1993, it was estimated that the annual emissions of 1,1-dichloroethane in the United States was approximately 274 tons per year during that time frame (EPA 2000).

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Data downloaded from the 2005 NEI indicated that the total emission of 1,1-dichloroethane was approximately 387 tons, with the biggest source arising from point source waste disposal (EPA 2012c).

There are no known natural sources of 1,1-dichloroethane. It has been reported that 1,1,1-trichloroethane is rapidly biodegraded in anaerobic methanogenic environments, such as those found in landfills, to form 1,1-dichloroethane as the major product, with slow, yet complete anaerobic degradation of 1,1-dichloroethane to carbon dioxide also indicated (deBest et al. 1997; van Eekert et al. 1999; Vogel and McCarty 1987). 1,1,1-Trichloroethane occurs in the environment as a result of accidental spills, industrial manufacturing, and use processes. Laboratory studies designed to elucidate the degradation reactions of chloroethenes and chloroethanes have been described by Hallen et al. (1986) and Vogel and McCarty (1987). Hallen et al. (1986) observed that dechlorination reactions appear to be reversible, and chlorinated ethanes can be converted to chlorinated ethenes. Releases of 1,1-dichloroethane to the environment are a result of industrial manufacturing use processes and from the degradation of 1,1,1-trichloroethane. Additional sources of environmental release are fugitive emissions from storage, distribution, and disposal; use as an extraction solvent and fumigant or insecticide spray and in paints, varnish, and paint removers; as a constituent of medicines and stone, clay, and glass products; and in ore floatation (EPA 2001c; Infante and Tsongas 1982).

6.2.1 Air

Estimated releases of 20,972 pounds (~9.51 metric tons) of 1,1-dichloroethane to the atmosphere from 19 domestic manufacturing and processing facilities in 2013, accounted for about 90.1% of the estimated total environmental releases from facilities required to report to the TRI (TRI13 2014). These releases are summarized in Table 6-1.

Emissions to the atmosphere comprise >98% of all releases of 1,1-dichloroethane to the environment (TRI10 2012). 1,1-Dichloroethane released in the production of 1,1,1-trichloroethane accounts for about 52% of the atmospheric releases, with the production of 1,2-dichloroethane accounting for about 35%. Pellizzari (1982) reported the presence of low levels of 1,1-dichloroethane in ambient air of the Baton Rouge industrial area and at the Kin-Buc waste disposal site outside Edison, New Jersey. Eitzer (1995) observed low levels of 1,1-dichloroethane ($\leq 1 \mu\text{g}/\text{m}^3$) in at least one of eight municipal solid waste sites sampled in the United States.

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Table 6-1. Releases to the Environment from Facilities that Produce, Process, or Use 1,1-Dichloroethane^a

State ^c	RF ^d	Air ^e	Water ^f	UI ^g	Land ^h	Other ⁱ	Reported amounts released in pounds per year ^b		
							Total release		
							On-site ^j	Off-site ^k	On- and off-site
KY	1	56	0	0	0	0	56	0	56
LA	9	20,612	80	0	11	0	20,692	11	20,703
NY	1	2	0	0	0	0	2	0	2
OH	1	4	0	0	10	0	4	10	14
SC	1	1	0	0	0	0	1	0	1
TX	6	297	2	2,200	0	0	2,498	0	2,498
Total	19	20,972	82	2,200	21	0	23,254	21	23,275

^aThe TRI data should be used with caution since only certain types of facilities are required to report. This is not an exhaustive list. Data are rounded to nearest whole number.

^bData in TRI are maximum amounts released by each facility.

^cPost office state abbreviations are used.

^dNumber of reporting facilities.

^eThe sum of fugitive and point source releases are included in releases to air by a given facility.

^fSurface water discharges, waste water treatment-(metals only), and publicly owned treatment works (POTWs) (metal and metal compounds).

^gClass I wells, Class II-V wells, and underground injection.

^hResource Conservation and Recovery Act (RCRA) subtitle C landfills; other onsite landfills, land treatment, surface impoundments, other land disposal, other landfills.

ⁱStorage only, solidification/stabilization (metals only), other off-site management, transfers to waste broker for disposal, unknown

^jThe sum of all releases of the chemical to air, land, water, and underground injection wells.

^kTotal amount of chemical transferred off-site, including to POTWs.

RF = reporting facilities; UI = underground injection

Source: TRI13 2014 (Data are from 2013)

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Approximately 52,000 kg of 1,1-dichloroethane are released to the atmosphere by privately owned treatment work facilities (POTWs) each year (EPA 1980).

In 2002, air emissions from point, area, and mobile sources in the Great Lakes region were calculated. Data from Illinois, Indiana, Michigan, Minnesota, New York, Ontario, Pennsylvania, and Wisconsin were evaluated. Total emissions of 1,1-dichloroethane in the Great Lakes region were calculated to be 27,110 pounds from point sources and 1,360 pounds from area sources. All states reported only point source emissions for the compound with the exception of Minnesota, which reported 341 pounds from point sources and 1,360 pounds from area sources. Ontario and Illinois accounted for the majority of the emissions (41 and 33%, respectively). The other states each accounted for 1–9% of the emissions (Great Lakes Commission 2006).

1,1-Dichloroethane was detected with the VOCs emanating from a low-level radioactive waste disposal facility at the U.S. Geological Survey (USGS) Amargosa Desert Research Site in Nevada (Baker et al. 2012). The study quantified VOCs being emitted over an 11-year period and estimated the yearly vertical diffusive flux of the detected VOCs to the atmosphere. Concentrations decreased as the distance from the site increased. Samples taken at the site contained 29.9, 33.6, and 66 mg dichloroethane/m² per year, while samples taken 100 m from the site along the north south transect contained 2.8, 3.6, and 9.7 mg dichloroethane/m² per year in 2001, 2003, and 2005 respectively. At distances of 200 and 300 m, concentrations were reported as 0.0 mg dichloroethane/m² for 2001, 2003, and 2005. Table 6-2 summarizes the estimates obtained from locations along the north-south transect at distances of 0–400 m from the facility.

Emissions from six commercial cigarette brands were examined in a chamber study; five cigarettes per brand were smoked for approximately 6 minutes (Wang et al. 2012). The amount of 1,1-dichloroethane emitted during smoking ranged between 51 and 110 µg/cigarette. The average concentration of 1,1-dichloroethane during smoking ranged from 12 to 26 µg/m³ and the average concentration during the post-smoking period ranged from 7.9 to 17 µg/m³.

In 2011, 1,1-dichloroethane was detected in the gaseous emissions of a commercial poultry farm in Poland (Witkowska 2013). The farm consisted of five buildings that had mechanical ventilation systems. Measurements were taken over the turkey's rearing period, from week 4 to 19. The average concentrations detected in the turkey houses at week 4, 7, 10, and 13 were 1.15±0.55, 1.08±0.82,

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Table 6-2. Estimated Yearly Emissions of 1,1-Dichloroethane (mg/m² per Year)

Distance from landfill (m)	2001	2003	2005
0	29.9	33.6	66
25	22.6	31.8	51.5
50	18.4	17.9	Not reported
75	Not reported	16.4	Not reported
100	2.8	3.6	9.7
150	Not reported	0.1	Not reported
200	0.0	0.0	0.0
300	0.0	0.0	0.0
400	0.0	Not reported	Not reported

Source: Baker et al. 2012

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1.57±0.45, and 1.33±0.55 ppm, respectively. Reported concentrations for week 16 and 19 were 0.00 ppm.

6.2.2 Water

Estimated releases of 82 pounds (~0.037 metric tons) of 1,1-dichloroethane to surface water from 15 domestic manufacturing and processing facilities in 2013, accounted for <1% of the estimated total environmental releases from facilities required to report to the TRI (TRI13 2014). This estimation includes surface water discharges, waste water treatment (metal only), and POTWs (metal and metal compounds) (TRI13 2014). These releases are summarized in Table 6-1.

Industrial releases of 1,1-dichloroethane to surface waters are minor in comparison to releases to the atmosphere. Industrial processes involving the use of 1,1-dichloroethane as a chemical intermediate or cleaning solvent are believed to be the largest sources of surface water releases. Young et al. (1983) reported 1,1-dichloroethane in the primary, secondary, and final effluents from municipal wastewater treatment plants. Approximately 1,000 kg of 1,1-dichloroethane are discharged in effluent from POTWs each year (EPA 1980).

6.2.3 Soil

Estimated releases of 21 pounds (~0.009 metric tons) of 1,1-dichloroethane to soils from eight domestic manufacturing and processing facilities in 2013, accounted for <0.01% of the estimated total environmental releases from facilities required to report to the TRI (TRI13 2014). An additional 2,200 pounds (~1.0 metric tons), constituting about 9.46% of the total environmental emissions, were released via underground injection (TRI13 2014). These releases are summarized in Table 6-1.

Little information was found regarding releases of 1,1-dichloroethane to soils. Approximately 4,000 kg of 1,1-dichloroethane from POTWs are dispersed on land each year as sludge (EPA 1980).

6.3 ENVIRONMENTAL FATE

6.3.1 Transport and Partitioning

Releases of 1,1-dichloroethane to the environment as a result of industrial activity are expected to be primarily to the atmosphere (see Section 6.2). 1,1-Dichloroethane released to the atmosphere may be

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transported long distances before being washed out in precipitation. For example, Pearson and McConnell (1975) attributed the presence of chlorinated organic compounds, including 1,1-dichloroethane, in upland waters to long-range aerial transport and deposition in precipitation. EPA (1982b) discussed the atmospheric fate of 1,1-dichloroethane in the Gulf Coast area, where there is a high percentage of cloudy days. Increased atmospheric losses due to washout in frequent, heavy rains could occur, although much of the 1,1-dichloroethane could be revolatilized. Dichloroethanes released in this area could be transported north by the prevailing winds to populated areas before significant photochemical degradation could occur.

Cupitt (1980), however, considered the loss of 1,2-dichloroethane from the atmosphere by dissolution into rain drops or adsorption onto aerosols insignificant compared with loss from chemical degradation based on mathematical calculations. Since 1,1-dichloroethane has higher volatility and lower aqueous solubility than the 1,2-isomer, physical removal of 1,1-dichloroethane from the atmosphere would be even less likely to be important. Pellizzari et al. (1979) measured actual concentrations of airborne contaminants in the vicinity of known emission sources of 1,1-dichloroethane, making aerial transport the logical source of downwind concentrations.

The Henry's law constant value for 1,1-dichloroethane (5.51×10^{-3} atm-m³/mol) suggests that it should partition rapidly to the atmosphere. The evaporation half-life depends on a number of factors; wind speed and mixing conditions of the receiving waters are particularly important. Dilling et al. (1975) and Dilling (1977) estimated a volatilization half-life of 22 minutes for 1,1-dichloroethane present at 1 ppm concentration in an open water column held at 25 °C and stirred at 200 rpm. Under these conditions, 90% of the compound was removed within 109 minutes. Volatilization half-lives determined in the laboratory are related to actual environmental situations by a correction factor that takes into account the oxygen re-aeration rate ratio. The re-aeration rate ratio has been determined to be 0.55 for 1,1-dichloroethane (Cadena et al. 1984). Using the values of Mabey et al. (1982) for oxygen re-aeration rates in ponds and rivers (0.19 and 0.96 day⁻¹, respectively), the evaporation half-life of 1,1-dichloroethane is estimated to be approximately 5 times longer for ponds than for rivers (>1 day for river water and >6 days for pond water).

Little information was found regarding partitioning of 1,1-dichloroethane from the water column onto sediments. According to DeWulf et al. (1996), 1,1-dichloroethane does not really accumulate on marine sediment and it will therefore not be an important sink for this compound. Analogs of the compound (i.e., dichloromethane, trichloromethane, and 1,1,1-trichloroethane) have not been found to concentrate

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selectively onto sediments (Dilling et al. 1975; Pearson and McConnell 1975). The K_{oc} values for these compounds are similar to the K_{oc} for 1,1-dichloroethane; therefore, partitioning to sediment from the water column is not likely to be an important environmental fate process for 1,1-dichloroethane.

1,1-Dichloroethane released to land surfaces in spills would rapidly volatilize to the atmosphere, but 1,1-dichloroethane remaining on soil surfaces would be available for transport into groundwater, since the compound does not sorb to soil particulates unless the organic content of the soil is high. Experimentally derived K_{oc} values for a silt loam soil also indicate that little sorption of 1,1-dichloroethane to low organic content soil is expected. Goodin and Webber (1992) conducted studies of several volatile organic compounds (VOCs), including 1,1-dichloroethane, to determine their fate in soils. It was determined that the compounds were lost from the soils mainly by volatilization, with first-order disappearance half-lives ranging from 1 to 949 hours. Wilson et al. (1981) found that although 50% of the applied 1,1-dichloroethane volatilized to the atmosphere, the remainder percolated rapidly through a sandy soil, suggesting ready availability to groundwater transport processes.

Gossett et al. (1983) analyzed the tissues of several species of aquatic organisms for 1,1-dichloroethane near the discharge of the Los Angeles County waste water treatment plant. The concentration of 1,1-dichloroethane in the effluent was 3.5 ppb; however, none was found in the animal tissues (detection limit of 0.3–0.5 ppb). These results may be evidence that the potential for 1,1-dichloroethane to bioconcentrate is low in aquatic organisms. An estimated bioconcentration factor of 5 indicates that bioconcentration would be low (HSDB 2012).

6.3.2 Transformation and Degradation

6.3.2.1 Air

In the atmosphere, 1,1-dichloroethane is oxidized by reaction with hydroxyl radicals. The rate constant for the vapor-phase reaction is 2.74×10^{-13} cm³/molecule-second at 25 °C (HSDB 2012). The residence time of the compound in the atmosphere has been estimated to be 49 days (HSDB 2012).

6.3.2.2 Water

1,1-Dichloroethane in surface water is expected to be lost to the atmosphere through volatilization before undergoing any significant chemical or biological degradation. The hydrolytic half-life of 1,1-dichloroethane at pH 7 and 25 °C has been estimated to be 60 years (Jeffers et al. 1989).

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As summarized in Klecka et al. (1990), 1,1-dichloroethane is produced by biodegradation of 1,1,1-trichloroethane in groundwater. Further degradation could also occur. In the absence of oxygen and in the presence of anaerobic, methane-producing bacteria, halocarbons are transformed by reductive dehydrohalogenation in a step-wise manner: 1,1,1-trichloroethane → 1,1-dichloroethane → chloroethane. van Eeker et al. (1999) reported 31.1% anaerobic degradation of 1,1-dichloroethane to mainly chloroethane (14.5%) in living sludge after 25 days. Under aerobic conditions, Tabak et al. (1981) reported about 50% degradation of 1,1-dichloroethane by unadapted microorganisms isolated from municipal waste water inoculum after 7 days, which was increased to 78% degradation by adapted organisms in the same time period. 1,1-Dichloroethane has been reported to be resistant to biological degradation by bacteria isolated from shallow aquifer aerobic groundwater after 8–16 weeks incubation (Wilson et al. 1983).

Data from landfill sites with a documented contamination history were examined by Cline and Viste (1985). They observed that 1,1-dichloroethane was detected in groundwater at sites where the compound had not been handled or disposed of and concluded that 1,1-dichloroethane had been produced by anaerobic degradation of other compounds present, particularly 1,1,1-trichloroethane. Washington and Cameron (2001) used well monitoring data, from a landfill with a contamination history, to calculate a degradation rate constant for 1,1-dichloroethane. Under sulfate-reducing conditions at 10 °C, the rate constant was found to be 6.0×10^{-3} L/day with a half-life of 115 days.

6.3.2.3 Sediment and Soil

1,1-Dichloroethane in soils is expected to volatilize to the atmosphere or be transported to groundwater before undergoing significant abiotic transformation; the compound is not expected to sorb to soils of low organic content. As in surface waters, direct photolysis of 1,1-dichloroethane on soil surfaces is not expected. The rate of biodegradation of 1,1-dichloroethane in soils is unknown. In subsurface soil, the loss of 1,1-dichloroethane through biodegradation is expected to be insignificant (Wilson et al. 1983). The biodegradation half-life of 1,1,1-trichloroethane under anaerobic conditions has been reported to be about 16 days, whereas the half-life of 1,1-dichloroethane has been reported to be >30–60 days (Wood et al. 1985).

Hamonts et al. (2012) monitored chlorinated aliphatic hydrocarbons, such as 1,1-dichloroethane, in groundwater that discharges into the Zenne River over a 21-month period. The Zenne River had been

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previously continuously contaminated with municipal sewage containing chlorinated aliphatic hydrocarbons. The study also evaluated microbial reductive dechlorination occurring under anaerobic conditions in the river sediments. Microbial degradation of 1,1-dichloroethane was evident in the riverbed locations in which *Dehalobactor* spp. was detected; however, in the absence of this microorganism, 1,1-dichloroethane did not appear to degrade.

6.4 LEVELS MONITORED OR ESTIMATED IN THE ENVIRONMENT

Reliable evaluation of the potential for human exposure to 1,1-dichloroethane depends in part on the reliability of supporting analytical data from environmental samples and biological specimens. Concentrations of 1,1-dichloroethane in unpolluted atmospheres and in pristine surface waters are often so low as to be near the detection limits of analytical methods. In reviewing data on 1,1-dichloroethane levels monitored or estimated in the environment, it should also be noted that the amount of chemical identified analytically is not necessarily equivalent to the amount that is bioavailable. The analytical methods available for monitoring 1,1-dichloroethane in a variety of environmental media are detailed in Chapter 7.

1,1-Dichloroethane has been detected in ambient urban and rural air, in waste gas generated from garbage dumps, and in surface water, groundwater, and drinking water. Quantitative concentration information is presented in the following sections by environmental medium.

6.4.1 Air

The Air Quality System (AQS) database is EPA's repository of criteria air pollutants and hazardous air pollutants (HAPs) containing monitoring data from over 2,600 monitoring sites across the United States. Detailed AQS ambient air monitoring data from 2013 for 1,1-dichloroethane are summarized in Table 6-3 (http://www.epa.gov/ttnamti1/toxdat.html#data*). Data for other years are available as zipped Microsoft Access database files that may be accessed directly from the EPA website. In general, the average concentration of the samples for 1,1-dichloroethane in outdoor air was approximately 0.02 $\mu\text{g}/\text{m}^3$. The highest reported concentration (4.4 $\mu\text{g}/\text{m}^3$) occurred in one sample from Kentucky. The second highest reported concentration (0.83 $\mu\text{g}/\text{m}^3$) also occurred in one sample from Kentucky. The third highest reported concentration (0.81 $\mu\text{g}/\text{m}^3$) was detected in 173 samples from Ohio. Rhode Island had the largest number of samples with detectable concentrations, 836 samples, that ranged in concentration from 0.004 to 0.12 $\mu\text{g}/\text{m}^3$. The 24-hour average concentration of 1,1-dichloroethane in outdoor air ranged from

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Table 6-3. 2013 Air Monitoring Data from Air Toxics Data Ambient Monitoring Archive for 1,1-Dichloroethane

State ^a	Number of samples	Concentration range ($\mu\text{g}/\text{m}^3$)
AK	61	0
AZ	104	0
CO	61	0
FL	32	0.0081–0.18
FL	376	0
GA	237	0
IA	87	0
IL	180	0
IN	28	0.04
IN	442	0
KY	33	0.044–4.4
KY	467	0
MA	141	0.004–0.0081
MA	25	0
ME	36	0.016–0.4
ME	244	0
MI	2	0.34–0.35
MI	329	0
MN	1	0.004
MN	1,008	0
MO	61	0
MS	121	0
NC	437	0
NJ	1	0.045
NJ	239	0
NY	238	0.004–0.47
NY	483	0
OH	173	0.81
OH	243	0
OK	303	0
PA	27	0.04–0.12
PA	274	0
RI	836	0.004–0.012
RI	42	0
SC	118	0
TX	6	0.04–0.2
TX	2,355	0
UT	52	0
VA	89	0

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Table 6-3. 2013 Air Monitoring Data from Air Toxics Data Ambient Monitoring Archive for 1,1-Dichloroethane

State ^a	Number of samples	Concentration range ($\mu\text{g}/\text{m}^3$)
VT	140	0
WA	57	0
WI	95	0

^aPost office state abbreviations used.

Source: EPA 2015b

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approximately 0.008 to 3.5.4 $\mu\text{g}/\text{m}^3$ (0.001–1.09 ppb). The analytical methods had detection limits that ranged between 0.0081 and 3.4 $\mu\text{g}/\text{m}^3$ (EPA, 2015b).

1,1-Dichloroethane was not seen at a detection limit of 5 ppt in ambient rural air samples taken in southeastern Washington state (Grimsrud and Rasmussen 1975). It has been found at higher concentrations in ambient air samples from urban areas of the United States. EPA (1983b) tabulated atmospheric levels at urban, rural, and industrial sites across the United States and reported a median concentration of 55 ppt. Pellizzari (1982) reported the detection of low levels (unspecified concentrations) of the compound in the vicinity of the Baton Rouge industrial area. EPA (1983a) reported that the average concentration of the compound in the air of seven urban locations in 1980–1981 ranged from 0.1 to 1.5 ppb. It has also been detected in samples of ambient air collected in the vicinity of hazardous waste disposal sites, such as the Kin-Buc site near Edison, New Jersey, at a level of 23 $\mu\text{g}/\text{m}^3$ (5.68 ppm) (Pellizzari 1982). EPA (1978) tabulated analytical results for 1,1-dichloroethane in the ambient air of various locations generally in close proximity to industrial plants, including Magna, Utah (0.082 ppb); Iberville, Louisiana (0.12 ppm); Deer Park, Texas (0.14 ppb); and Baton Rouge (0.058 ppb) and Geismar, Louisiana (0.14 ppb).

Barkley et al. (1980) found no 1,1-dichloroethane in the ambient air surrounding nine houses bordering the old Love Canal. Gupta et al. (1984) found 1,1-dichloroethane at higher levels indoors (mean concentration of 3.2 ppb) than outdoors (not detected) in residences in suburban Knoxville, Tennessee, and concluded that there must be a source of the compound inside the home. Possible sources were not identified except to suggest building materials or chlorinated water.

Air monitoring data from 22 tire fire incidents across the United States were evaluated. 1,1-Dichloroethane was detected at low levels in the vicinity of several of the fires. It was noted that the source may be from something other than the burning tires (EPA 1993).

Air was monitored over a 3-week period at the Fresh Kills Landfill of Staten Island, New York. The overall air emission rate for 1,1-dichloroethane was 0.216 g/second (EPA1996a).

In 1994, 1,1-dichloroethane was not detected in six spatial sites around the Columbus metro area. Detection limits of the analysis were 0.05 ppb (Spicer 1996).

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In 1996, Mohamed et al. (2002) monitored VOCs in air at 13 urban locations in the United States for 1 year. Monitoring sites were located in Louisiana, Texas, Vermont, and New Jersey. TRI reporting facilities near the monitoring sites ranged from 0 to 38 facilities. 1,1-Dichloroethane was detected at all 13 of the monitoring stations at levels <1 ppb by volume (ppbv). The detection limit of the analytical method was <0.5 ppbv.

1,1-Dichloroethane was detected in the headspace of five out of eight household bleach products at levels ranging from 0.7 to 176 $\mu\text{g}/\text{m}^3$. It was concluded that the compound was formed by the reaction of hypochlorite and the organic matter of the product's additives. In addition, 1,1-dichloroethane levels of indoor air increased during the use of bleach products, from 0.004–0.01 $\mu\text{g}/\text{m}^3$ before use, to 0.01–0.62 $\mu\text{g}/\text{m}^3$ during use, and then to 0.01–0.29 $\mu\text{g}/\text{m}^3$ after use (Odabasi 2008).

From February to December 2009, 1,1-dichloroethane was detected in ambient air samples from four sites in Seoul, Korea (Jong Ro, Yang Jae, Gwang Jin, and Gang Seo) at concentrations of 0.04–0.18, 0.03–0.08, 0.04–0.15, and 0.04–0.32 ppb, respectively (Kim et al. 2012).

6.4.2 Water

. The compound has been found in samples of urban runoff from Long Island, New York, and Eugene, Oregon, at concentrations of 1.5 and 3 ppb, respectively (Cole et al. 1984). Coniglio et al. (1980) summarized groundwater monitoring data obtained by numerous state agencies and reported that 1,1-dichloroethane was found in 18% of the wells tested, with a maximum concentration of 11,330 ppb. They cautioned that the state data may have been biased since the monitoring was generally conducted by the states in areas where contamination was suspected. However, 1,1-dichloroethane has been detected in groundwater sampled during random testing of water supplies (see further discussion).

Finished water supplies obtained from groundwater sources were tested by EPA for contaminants. It was reported that up to 10.8% of 158 nonrandom sample sites from across the United States contained detectable levels of 1,1-dichloroethane. The maximum concentration was 4.2 ppb (Westrick et al. 1984).

Drinking water samples from a number of urban and rural locations in the United States have been reported to be contaminated with 1,1-dichloroethane. Unspecified levels of the compound have been detected in drinking water samples taken from Philadelphia (Suffet et al. 1980). Private drinking water wells in Wisconsin were found to contain unspecified levels of 1,1-dichloroethane in 11 of 617 wells

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surveyed (Krill and Sonzogni 1986). Concentrations of 1–3 ppb were reported in four public well water supplies in Iowa (EPA 1985).

Groundwater samples taken from 178 hazardous waste disposal sites were found to contain 1,1-dichloroethane at 18% frequency (Plumb 1987), with an average concentration of 0.31 ppm and a maximum concentration of 56.1 ppm (Yang and Rauckman 1987). Using the STORET database, Staples et al. (1985) reported median concentrations of <0.1 ppb in 8,716 samples of ambient water (3% detectable values), <1.0 ppb in 1,375 effluent samples (5% detectable values), <5.0 ppb in 354 sediment samples (0.6% detectable values), and <0.05 ppb in 94 biota samples (no detectable values).

Nine shallow groundwater samples contained 1,1-dichloroethane with a maximum concentration of 2.2 µg/L, in 5.3% of 208 urban wells sampled in the United States (Kolpin et al. 1997).

1,1-Dichloroethane was detected above background levels in groundwater beneath Savannah River Site's Interim Sanitary Landfill. Several wells at the site were sampled twice each in 2005. The site was in operation from 1992 to 1998 (DOE2005).

The Aerojet-General Corporation reports that 1,1-dichloroethane is present as a groundwater contaminant just outside Sacramento, California, in varying concentrations in several separate domestic and industrial well water samples and test borings. Additionally, a 1996 study indicated the presence of the compound in groundwater from the Glassboro region of Southern New Jersey at a detection frequency of 5% and a concentration of >0.1 µg/L (HSDB 2012).

The Solid Waste Management Unit 12 in South Carolina was in use from the 1970s until 1981. In September 1999, water sampled from an excavation hole that contained a leaking underground storage tank (UST) contained 1,1-dichloroethane at a concentration of 84,300 µg/L. Monitoring efforts of wells surrounding the site from August 2000 to November 2007 detected 1,1-dichloroethane as a consistent contaminant in the groundwater. Groundwater samples from August 2001 indicated that the highest concentrations of contaminants in groundwater were near the UST, indicating that it was the source area. Maximum measured concentrations of 1,1-dichloroethane of 155,000 µg/L were found at that time. Natural and engineered remediation efforts have contributed to the irregular decline of contaminants. On the northern side of the facility, concentrations of 1,1-dichloroethane in groundwater at one of the wells declined from >100 µg/L in 2000 to approximately 20–30 µg/L in 2003, remained relatively unchanged in 2003–2005, and declined in 2006–2007 (USGS 2006b).

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The National Water Quality Assessment Program (NAWQA) evaluated 3,496 wells nationwide for the presence of VOCs from 1985 to 2001. 1,1-Dichloroethane had an overall detection frequency of 0.86% at an assessment level of 0.2 µg/L; a detection frequency of 0.17% at an assessment level of 1 µg/L; and a detection frequency of 0.029% at an assessment level of 5 µg/L. The compound was also detected as a mixture with 1,1,1-trichloroethane in 0.71% of the samples (USGS 2006a). According to the report, there were 30 detections of 1,1-dichloroethane in 3,496 aquifer samples. More specifically, 7 detections occurred in 2,400 domestic well samples, 22 detections occurred in 1,096 public well samples, 20 detections occurred in 847 urban area shallow groundwater samples, and 1 detection occurred in 723 agricultural area shallow groundwater samples. Reported concentrations ranged from approximately 0.007 to 9 µg/L, with the bulk of the samples falling in the range of 0.02–0.2 µg/L (USGS 2006a).

1,1-Dichloroethane was detected in 2.3% of 130 groundwater well samples at a maximum concentration of 0.6 µg/L (Bi et al. 2012). Samples were collected during 2008 and 2009 from five alluvial plains in East China considered to be susceptible to contamination from human activities.

From May 3, 1999 through October 23, 2000, random samples from 954 water sources across the United States were collected. The sources included 579 groundwater and 375 surface water samples.

1,1-Dichloroethane was detected in 11 groundwater samples at levels between 0.1 and 10 µg/L (USGS 2003a).

Shallow groundwaters underlying areas of residential and commercial use in Salt Lake Valley, Utah were analyzed for VOCs such as 1,1-dichloroethane using monitoring wells at 30 separate sites (USGS 2003b). 1,1-Dichloroethane was detected in one of the samples, at an estimated concentration of 0.03 µg/L (below the laboratory reporting level of 0.07µg/L).

1,1-Dichloroethane was one of the primary VOCs detected in several water quality studies from the Snake River Plain aquifer conducted between 1987 and 2005 (USGS 2010a). In April 2007, the USGS National Water Quality Laboratory analyzed perched groundwater samples from well USGS 92 at the Radioactive Waste Management Complex in the Snake River Plain aquifer and 1,1-dichloroethane was detected at a concentration of 0.8 µg/L (USGS 2010a).

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The CALEPA (2003) analysis of 13,347 California groundwater sources of drinking water found 1,1-dichloroethane in 68 samples, ranging from 0.51 to 30 ppb. 1,1-Dichloroethane was not found in any of the 754 surface water sources of drinking water sampled.

Samples from 2,948 wells across the United States were sampled between 1985 and 1995. The sources consisted of both drinking water and non-drinking water in 406 urban wells and 2,542 rural wells. The detection frequency of 1,1-dichloroethane was 6.4% in urban wells and 0.7% in rural wells. Reported concentrations were approximately 0.2–60 µg/L with a median of approximately 0.45 µg/L, and approximately 0.2–8 µg/L with a median of about 0.7 µg/L, respectively (Squillace et al. 1999).

VOCs were examined in 30 public water supply wells in the Columbia aquifer in Delaware (USGS 2010c). In 2000, 1,1-dichloroethane was detected 6 times at concentrations ranging from 0.015 to 0.149 µg/L and in 2008, the chemical was detected 4 times at concentrations of <0.04–0.135 µg/L. Active wells were resampled in a study by the Source Water Assessment and Protection Program from August through November 2008. Twenty-two of the original wells and 8 similar wells were sampled. The range of detected concentrations remained the same; however, the number of detections decreased by 1 for both years.

The USGS assessed the quality of source water from public supply wells in the United States from 1993 to 2007 (USGS 2010d). 1,1-Dichloroethane was detected in 7.7% of 832 samples, and 1.4% of the samples contained ≥ 0.2 µg/L (USGS 2010b). The maximum concentration of 1,1-dichloroethane detected was 4.878 µg/L.

6.4.3 Sediment and Soil

Very little information was found on the ambient concentrations of 1,1-dichloroethane in soil, or on the current disposal of waste products containing the compound in landfills. 1,1-Dichloroethane was detected, yet not quantified, in soil samples of Love Canal, New York. At a detection limit of 0.5 ppb, 1,1-dichloroethane was not detected in sediment of the submarine outfall region of the Los Angeles County (Joint Water Pollution Control Plant [JWPCP]) municipal waste water treatment plant (HSDB 2012). The compound has more commonly been detected in ambient air and groundwater samples taken at hazardous waste sites, and it is expected that the lack of available soil monitoring data is at least in part due to rapid partitioning of 1,1-dichloroethane released to soils to these other media.

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Soil gas was monitored for the U.S. Army from October 2010 until September 2011 in Fort Gordon, Georgia (USGS 2012). Soil-gas samplers were installed at three former fuel-dispensing stations in order to assess organic soil-gas contaminants for the Resource Conservation and Recovery Act Part B Hazardous Waste Permit process. There were 55 samplers at one site, 30 samplers at a second site, and 39 samplers at a third site. 1,1-Dichloroethane was reported as not detected in all samples and the method detection limit was 0.02 µg (USGS 2012).

6.4.4 Other Environmental Media

Little information was found on the levels of 1,1-dichloroethane in other media. Ferrario et al. (1985) measured 33 ppb wet weight of 1,1-dichloroethane in oysters from Lake Pontchartrain near New Orleans, Louisiana; however, 1,1-dichloroethane was not detected in two types of clams. Kallonen et al. (1985) detected 1,1-dichloroethane in the effluent gases of burning polyester fiber fill. Data on concentrations in human breath are presented in Section 6.5. 1,1-Dichloroethane was not found in any samples in a survey of 234 table-ready foods evaluated for the presence of VOCs (Heikes et al. 1995). Page and Lacroix (1995) found 1,1-dichloroethane in three peanut butter samples at levels of 1.1, 1.9, and 3.7 µg/kg; however, the compound was not found in several other foods that were analyzed.

6.5 GENERAL POPULATION AND OCCUPATIONAL EXPOSURE

The greatest source of exposure to 1,1-dichloroethane for most of the U.S. population is inhalation of the compound in contaminated air, especially near source areas. Another potential route of human exposure is ingestion of the compound in contaminated drinking water, and use of consumer products that may contain 1,1-dichloroethane. The general population may also be exposed through inhalation of cigarette smoke (Wang et al. 2012). Occupational exposure to 1,1-dichloroethane may occur via inhalation or dermal contact at workplaces where it is produced or used (HSDB 2012).

The Fourth National Report on Human Exposures to Environmental Chemicals, published and updated by the Centers for Disease Control and Prevention (CDC 2015), reported data for 1,1-dichlorethane from the National Health and Nutrition Examination Survey (NHANES) for the survey years 2003–2004 and 2005–2006. These data are summarized in Table 6-4. Blood concentrations of 1,1-dichloroethane for male and female participants of ages 12–>60 years and various ethnicities were reported. Concentrations of 1,1-dichloroethane in all categories for all NHANES survey years were below the detection limit of the method (0.01 µg/L) (CDC 2015).

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Table 6-4. Geometric Mean and Selected Percentiles of Blood Concentrations of 1,1-Dichloroethane (in ng/L) for the U.S. Population from the National Health and Nutrition Examination Survey (NHANES)

	Survey years	Geometric mean (95% CI) ^a	Selected percentiles (95% CI)				Sample size
			50 th	75 th	90 th	95 th	
Total	2003–2004	* ^a	<LOD ^b	<LOD	<LOD	<LOD	1,367
	2005–2006	*	<LOD	<LOD	<LOD	<LOD	3,193
Age group							
12–19 years	2005–2006	*	<LOD	<LOD	<LOD	<LOD	941
20–59 years	2003–2004	*	<LOD	<LOD	<LOD	<LOD	1,367
	2005–2006	*	<LOD	<LOD	<LOD	<LOD	1,569
≥60 years	2005–2006	*	<LOD	<LOD	<LOD	<LOD	683
Gender							
Males	2003–2004	*	<LOD	<LOD	<LOD	<LOD	670
	2005–2006	*	<LOD	<LOD	<LOD	<LOD	1,510
Females	2003–2004	*	<LOD	<LOD	<LOD	<LOD	697
	2005–2006	*	<LOD	<LOD	<LOD	<LOD	1,683
Race/ethnicity							
Mexican Americans	2003–2004	*	<LOD	<LOD	<LOD	<LOD	267
	2005–2006	*	<LOD	<LOD	<LOD	<LOD	778
Non-Hispanic blacks	2003–2004	*	<LOD	<LOD	<LOD	<LOD	300
	2005–2006	*	<LOD	<LOD	<LOD	<LOD	832
Non-Hispanic whites	2003–2004	*	<LOD	<LOD	<LOD	<LOD	695
	2005–2006	*	<LOD	<LOD	<LOD	<LOD	1,347

^aNot calculated; the proportion of results below limit of detection (LOD) was too high to provide a valid result. The ^b<LOD means less than the limit of detection, which may vary for some chemicals by year and by individual sample. LODs for survey years 2003–2004 and 2005–2006 were 0.01 and 0.01 µg/L, respectively.

CI = confidence interval

Source: CDC 2015

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The National Occupational Exposure Survey (NOES), conducted by NIOSH from 1981 to 1983, indicated that 1,957 workers, including 272 women, were potentially exposed to 1,1-dichloroethane in the workplace (NOES 1990). The exposed workers were employed in the chemical and allied products and business service industries, as chemical technicians; plumbers, pipefitters, and steamfitters; supervisors in production occupations; electricians; machinists; chemical engineers; and welders and cutters. The estimates were based on direct observation by the surveyor of the actual use of the compound.

NIOSH (1978) noted that there was a large potential for exposure to 1,1-dichloroethane in the workplace during its use as a dewaxer of mineral oils, extractant for heat-sensitive substances, or fumigant, and in the manufacture of vinyl chloride and high-vacuum rubber and silicon grease.

The EPA (1982a) and Wallace et al. (1982) conducted a study of the levels of 1,1-dichloroethane in the inhaled and exhaled air and drinking water of college students in Texas and North Carolina. Low levels (<0.49 ppb) of 1,1-dichloroethane were found in the personal air quality monitors of the Texas students, whose campus bounded a petrochemical manufacturing area, but none was detected in the exhaled breath samples. 1,1-Dichloroethane was not detected in the breathing zone air of the North Carolina students.

Barkley et al. (1980) found a trace of 1,1-dichloroethane in the expired breath of one resident whose home bordered the old Love Canal, but none was detected in ambient air. Wallace et al. (1984) found a trace of 1,1-dichloroethane in the expired breath and drinking water of one resident of New Jersey).

Assuming a median ambient air level of 55 pptv reported by EPA (1983b) and a theoretical average inhalation of 20 m³ air/day, the average inhalation exposure to 1,1-dichloroethane for an individual in the United States is estimated at 4 µg/day.

Buckley et al. (1997) reported the detection of 1,1-dichloroethane in 1 of 16 blood samples at a concentration of 0.01 µg/L. 1,1-Dichloroethane was detected in <10% of blood samples from 1,000 people between the years 1988 and 1994 (Needham et al. 1995). In October 2001, Edelman et al. (2003) analyzed blood and urine samples from World Trade Center firefighters for VOCs, including 1,1-dichloroethane; detection of the compound was insignificant. A National Health and Nutrition Survey of the U.S. population in 2003–2004 screened for 1,1-dichloroethane in blood samples at a limit of detection (LOD) concentration of 0.01 ng/mL (CDC 2015). The samples were taken from 1,367 participants in the age range of 20–59 years old, about half females (n=679) and half males (n=670). The survey included Mexican Americans (n=267), non-Hispanic blacks (n=300), and non-

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Hispanic whites (n=695). The portion of the data below the LOD for 1,1-dichloroethane was too high to provide valid results (CDC 2015).

6.6 EXPOSURES OF CHILDREN

This section focuses on exposures from conception to maturity at 18 years in humans. Differences from adults in susceptibility to hazardous substances are discussed in Section 3.7, Children's Susceptibility.

Children are not small adults. A child's exposure may differ from an adult's exposure in many ways. Children drink more fluids, eat more food, breathe more air per kilogram of body weight, and have a larger skin surface in proportion to their body volume. A child's diet often differs from that of adults. The developing human's source of nutrition changes with age: from placental nourishment to breast milk or formula to the diet of older children who eat more of certain types of foods than adults. A child's behavior and lifestyle also influence exposure. Children crawl on the floor, put things in their mouths, sometimes eat inappropriate things (such as dirt or paint chips), and spend more time outdoors. Children also are closer to the ground, and they do not use the judgment of adults to avoid hazards (NRC 1993).

There are no exposure studies or body burden measurements of 1,1-dichloroethane in children.

1,1-Dichloroethane has been detected in air, as discussed in Section 6.4.1, and inhalation of contaminated air likely represents the greatest route of potential exposure for children. 1,1-Dichloroethane has also been detected in drinking water, and therefore, ingestion of contaminated water is a possible source of exposure. Dichloroethane (isomer not specified) has been detected in human milk (Urusova 1953); however, these data are not current.

6.7 POPULATIONS WITH POTENTIALLY HIGH EXPOSURES

Human exposure to 1,1-dichloroethane is expected to be highest among certain occupational groups (e.g., chemical and allied products industry workers) and members of the general population living in the vicinity of industrial point emission sources (EPA 2001c) and hazardous waste sites. The compound has been detected in both ambient air and water in low concentrations, with substantially higher concentrations in localized areas around industrial and disposal sites. No information was found regarding the number of people potentially exposed around hazardous waste sites.

Smokers are exposed to higher concentrations of 1,1-dichloroethane than nonsmokers. Emissions from cigarette smoke can contain between 51 and 110 µg 1,1-dichloroethane/cigarette (Wang et al. 2012). The

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average concentration of 1,1-dichloroethane at the onset of smoking and 60 minutes after smoking ranges from 7.9 to 26 $\mu\text{g}/\text{m}^3$. In addition, nonsmokers who are in close proximity to cigarette smoke are susceptible to higher exposure concentrations.

6.8 ADEQUACY OF THE DATABASE

Section 104(i)(5) of CERCLA, as amended, directs the Administrator of ATSDR (in consultation with the Administrator of EPA and agencies and programs of the Public Health Service) to assess whether adequate information on the health effects of 1,1-dichloroethane is available. Where adequate information is not available, ATSDR, in conjunction with NTP, is required to assure the initiation of a program of research designed to determine the health effects (and techniques for developing methods to determine such health effects) of 1,1-dichloroethane.

The following categories of possible data needs have been identified by a joint team of scientists from ATSDR, NTP, and EPA. They are defined as substance-specific informational needs that if met would reduce the uncertainties of human health assessment. This definition should not be interpreted to mean that all data needs discussed in this section must be filled. In the future, the identified data needs will be evaluated and prioritized, and a substance-specific research agenda will be proposed.

6.8.1 Identification of Data Needs

Physical and Chemical Properties. The physical/chemical properties of 1,1-dichloroethane are sufficiently well characterized to enable assessment of the environmental fate of this compound.

Production, Import/Export, Use, Release, and Disposal. According to the Emergency Planning and Community Right-to-Know Act of 1986, 42 U.S.C. Section 11023, industries are required to submit substance release and off-site transfer information to the EPA. The TRI, which contains this information for 2013, became available in October of 2014. This database is updated yearly and should provide a list of industrial production facilities and emissions.

Based on its industrial use, 1,1-dichloroethane is primarily released to the atmosphere, and humans are potentially exposed to this chemical through the inhalation or ingestion of contaminated air or water. However, because the data available on production, import, export, use, and disposal are limited, it is difficult to estimate whether or not the potential for human exposure to 1,1-dichloroethane may be substantial. Data concerning the production and use of 1,1-dichloroethane both within the United States

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and worldwide are extremely limited. Information regarding possible disposal methods, criteria, and regulations are available; however, the present criteria may undergo revision in the near future. Information on current production levels, quantities imported and exported, proportions allocated to various uses, and proportions and efficiencies associated with differing modes of disposal is limited. This information would be useful in identifying potential sources and levels of exposure, thus enabling identification of exposed populations.

Environmental Fate. Releases from industrial processes are almost exclusively to the atmosphere, and releases of the compound to surface waters and soils are expected to partition rapidly to the atmosphere through volatilization. 1,1-Dichloroethane released to the atmosphere may be transported long distances before being washed out in precipitation. Although 1,1-dichloroethane released to land surfaces in spills would rapidly volatilize to the atmosphere, the 1,1-dichloroethane remaining on soil surfaces would be available for transport into groundwater. The atmospheric residence time of 1,1-dichloroethane is about 44 days. The dominant removal mechanism is reaction with hydroxyl free radicals. Hydrolysis and biodegradation do not appear to be important processes in the environmental fate of this compound. Data are lacking on the partitioning of 1,1-dichloroethane from the water column onto sediments. Additional information on the atmospheric transformation and on the rate of biodegradation of 1,1-dichloroethane in soils would be useful in the determination of its environmental fate.

Bioavailability from Environmental Media. Data are incomplete on the bioavailability of 1,1-dichloroethane from environmental media. Animal data on 1,1-dichloroethane exposure via inhalation and oral administration in drinking water suggest that the compound is bioavailable following inhalation of ambient air and ingestion of drinking water. Additional information on the bioavailability of 1,1-dichloroethane from air, water, soil, and sediment would be useful in determining actual risks associated with exposure to environmental levels of 1,1-dichloroethane.

Food Chain Bioaccumulation. The information located on the potential for bioconcentration of 1,1-dichloroethane in plants, aquatic organisms, or animals is limited. An analysis of animal tissues from several species of aquatic organisms near the discharge of a waste water treatment plant did not detect 1,1-dichloroethane in the animal tissues, although the compound was found in the effluent. However, 1,1-dichloroethane has been detected in oysters (33 ppb wet weight). An estimated bioconcentration potential of <1 from the K_{ow} suggests that bioconcentration would not be expected. Very little information was found regarding the biomagnification of 1,1-dichloroethane among food chain trophic

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levels. Additional information on bioconcentration and biomagnification would be useful in determining whether food chain bioaccumulation is an important source of human exposure.

Exposure Levels in Environmental Media. Reliable monitoring data for the levels of 1,1-dichloroethane in contaminated media at hazardous waste sites are needed so that the information obtained on levels of 1,1-dichloroethane in the environment can be used in combination with the known body burden of 1,1-dichloroethane to assess the potential risk of adverse health effects in populations living in the vicinity of hazardous waste sites.

Limited information is available regarding ambient concentrations of 1,1-dichloroethane in soils. Based on a median ambient air level reported in 1982, the average inhalation exposure to 1,1-dichloroethane for an individual in the United States has been estimated to be 4 µg/day. The information on foodstuffs is limited to the detection of 1,1-dichloroethane in oysters (33 ppb wet weight). Additional site-specific concentration data for ambient air, drinking water, soil, and biota would be helpful in estimating potential exposure of the general population as well as populations in the vicinity of hazardous waste sites.

Exposure Levels in Humans. Although relatively recent estimates of the size of the population occupationally exposed to 1,1-dichloroethane are available from NIOSH, monitoring data on workplace exposures are generally limited, with a few observations about 1,1-dichloroethane included in detailed studies of 1,2-dichloroethane. A study of the levels of 1,1-dichloroethane in the inhaled and exhaled air and drinking water of college students in Texas and North Carolina found low levels (<0.49 ppb) of 1,1-dichloroethane in the personal air quality monitors of the Texas students, whose campus bounded a petrochemical manufacturing area, but none in samples of their exhaled breath. Additional information on the availability of biomarkers that could be used to indicate human exposure to 1,1-dichloroethane would be helpful.

This information is necessary for assessing the need to conduct health studies on these populations.

Exposures of Children. A data need has been identified to conduct body burden studies of 1,1-dichloroethane in children. Measurements of 1,1-dichloroethane in blood samples for a population of adults was conducted in 2003–2004 as part of the National Health and Nutrition Examination Survey (CDC 2015). Most of the samples were below the detection limit of 0.01 ng/mL. Similar results among a group of children would demonstrate that exposure to 1,1-dichloroethane is low for both children and adults.

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Child health data needs relating to susceptibility are discussed in Section 3.12.2, Identification of Data Needs: Children's Susceptibility.

Exposure Registries. No exposure registries for 1,1-dichloroethane were located. This substance is not currently one of the compounds for which a sub-registry has been established in the National Exposure Registry. The substance will be considered in the future when chemical selection is made for sub-registries to be established. The information that is amassed in the National Exposure Registry facilitates the epidemiological research needed to assess adverse health outcomes that may be related to exposure to this substance.

6.8.2 Ongoing Studies

No ongoing studies regarding sponsored by NIH or EPA were identified for 1,1-dichloroethane.