

## 5. POTENTIAL FOR HUMAN EXPOSURE

### 5.1 OVERVIEW

The primary disposition of 1,1-dichloroethane in the environment is related to the production, storage, consumption, transport, and disposal of 1,1-dichloroethane used as a chemical intermediate, solvent, finish remover, and degreaser. 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).

Inhalation of 1,1-dichloroethane in ambient or workplace air is generally the main route of human exposure to the compound. Estimates of populations potentially exposed to 1,1-dichloroethane in workplace environments range from 715 to 1,957 workers (NIOSH 1976, 1984). Inhalation of ambient air and ingestion of contaminated drinking water may also be important routes of exposure for populations living near industrial facilities and hazardous waste sites.

### 5.2 RELEASES TO THE ENVIRONMENT

There are no known natural sources of 1,1-dichloroethane, but McCarty et al. (1986) reported that 1,1,1-trichloroethane is biodegraded in anaerobic methanogenic environments, such as those found in landfills, to form 1,1-dichloroethane. 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 the compound to the environment result from industrial manufacturing and use processes. Additional sources of environmental release are fugitive emissions from storage, distribution, and disposal; use as an extraction solvent and fumigant; and as a constituent of medicines and stone, clay, and glass products (Infante and Tsongas 1982).

EPA has identified 1,177 NPL sites. We do not know how many of the 1,177 NPL sites have been evaluated for 1,1-dichloroethane. 1,1-Dichloroethane has been found at 248 of the total number of sites evaluated for that compound. As more sites are evaluated by EPA, this number may change (VIEW 1989). The frequency of these sites within the United States can be seen in Figure 5-1.

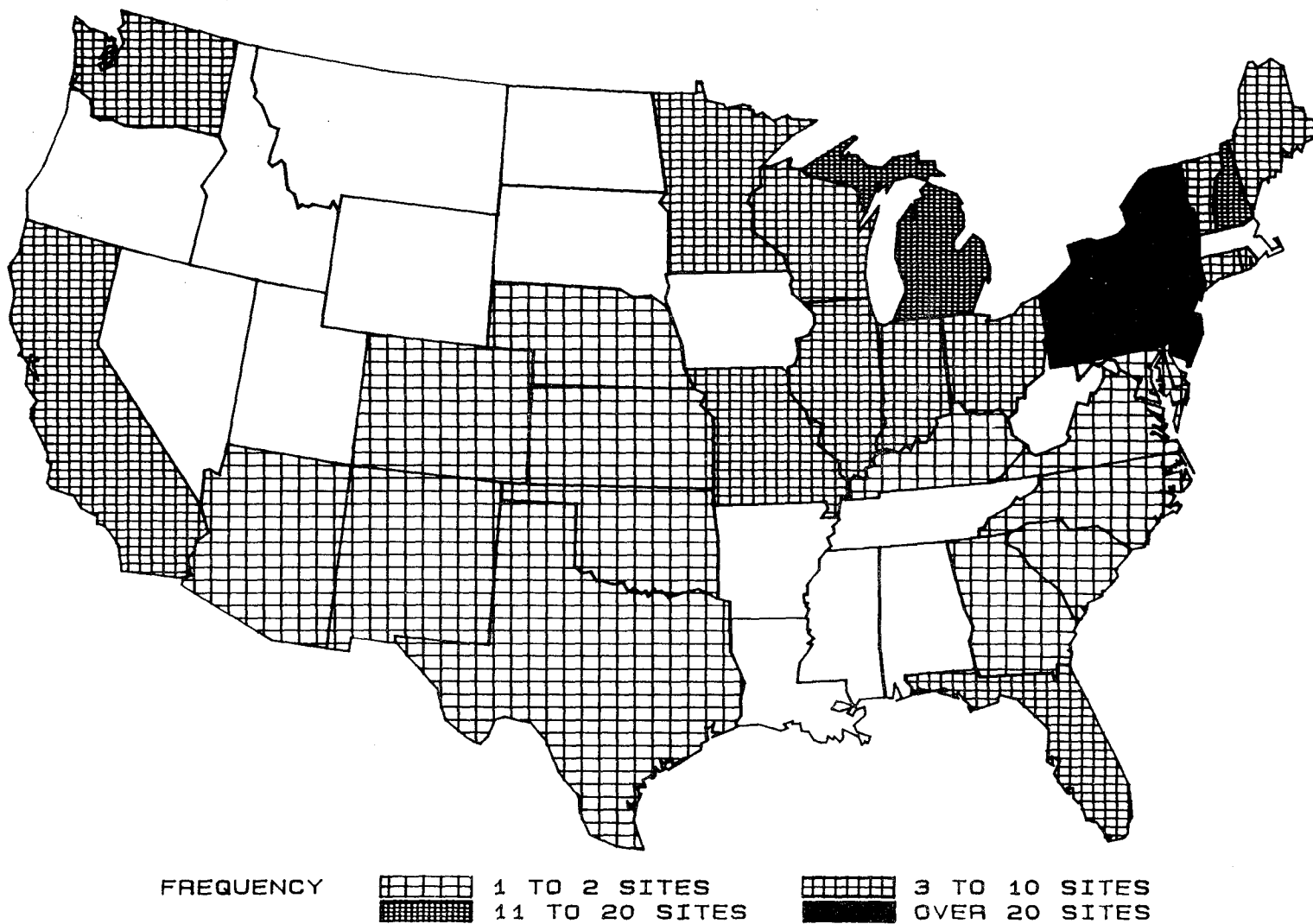


FIGURE 5-1. FREQUENCY OF SITES WITH 1, 1-DICHLOROETHANE CONTAMINATION

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### 5.2.1 Air

Emissions to the atmosphere comprise more than 99% of all releases of 1,1-dichloroethane to the environment (Perwak et al. 1982). 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. Approximately 52,000 kg of 1,1-dichloroethane are released to the atmosphere by privately owned treatment work facilities (POTWs) each year (EPA 1980).

### 5.2.2 Water

Industrial releases of 1,1-dichloroethane, to surface waters are minor in comparison to releases to the atmosphere. Releases from solvent use and POTWs account for only 2,000 kg annually (Perwak et al. 1982). 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).

1,1-Dichloroethane has been detected in groundwater samples taken at an estimated 9% of the NPL hazardous water sites participating in the Contract Laboratories Program (CLP) at a geometric mean concentration of 23.1 ppb for the positive samples (CLP 1989). The compound was also detected in surface water samples taken at an estimated 2% of the NPL hazardous waste sites participating in the CLP at a geometric mean concentration of 24 ppb for the positive samples. Note that these data from the CLP Statistical Database represent frequency of occurrence and concentration information of NPL sites only.

### 5.2.3 Soil

Little information was found regarding releases of 1,1-dichloroethane to soils. Solvent use and POTWs are the only identified sources of 1,1-dichloroethane releases to the land, with 6,000 kg released in 1978 (Perwak et al. 1982). Approximately 4,000 kg of 1,1-dichloroethane from POTWs are dispersed on land each year as sludge (EPA 1980).

1,1-Dichloroethane has been detected in soil samples taken at an estimated 0.7% of the NPL hazardous waste sites participating in the Contract Laboratory Program (CLP) at a geometric mean concentration of 40.8 ppb for the positive samples (CLPSD 1989). Note that these data from the CLP Statistical

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Database represent frequency of occurrence and concentration information for NPL sites only.

### 5.3 ENVIRONMENTAL FATE

#### 5.3.1 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 5.2). 1,1-Dichloroethane released to the atmosphere may be 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 longrange aerial transport and deposition in precipitation. Perwak et al. (1982) 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 (EPA 1985). 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.

Henry's law constant value for 1,1-dichloroethane ( $4.2 \times 10^{-2}$  atm-m<sup>3</sup>/mol) suggests that it should partition rapidly to the atmosphere. 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 reaeration rate ratio. The reaeration rate ratio has been determined to be 0.55 for 1,1-dichloroethane (Cadena et al. 1984). Using the values of Mabey et al. (1981) for oxygen reaeration rates in ponds and rivers (0.19 and 0.96 day<sup>-1</sup>, respectively), the evaporation half-life of 1,1-dichloroethane is estimated to be approximately five times longer for ponds than for rivers (more than 1 day for river water and more than 6 days for pond water). Therefore, evaporation may be the most

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significant means of removal of 1,1-dichloroethane from aquatic media (EPA 1985).

No information was found regarding partitioning of 1,1-dichloroethane from the water column onto sediments. However, analogs of the compound (i.e., dichloromethane, trichloromethane, and 1,1,1-trichloroethane) have not been found to concentrate 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, adsorption onto sediments would not be considered significant for 1,1-dichloroethane (EPA 1985).

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. 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. Environmental surveys conducted by EPA have detected 1,1-dichloroethane in groundwater sources in the vicinity of contaminated sites (EPA 1985).

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 wastewater 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. EPA (1984) estimated the bioconcentration factor from the  $K_{OW}$  as 6.6, indicating that bioconcentration would not be expected.

### 5.3.2 Transformation and Degradation

#### 5.3.2.1 Air

In the atmosphere, 1,1-dichloroethane is oxidized by reaction with hydroxyl radicals. The residence time of the compound in the atmosphere has been estimated by several investigators to be 44 days (Singh et al. 1981; Howard and Evenson 1976).

#### 5.3.2.2 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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According to McCarty et al. (1986), 1,1-dichloroethane appears to be 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  $\rightarrow$  1,1-dichloroethane  $\rightarrow$  chloroethane  $\rightarrow$  ethanol  $\rightarrow$  carbon dioxide. 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 (1984). 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.

### 5.3.2.3 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 greater than 30-60 days (Wood et al. 1985).

## 5.4 LEVELS MONITORED OR ESTIMATED IN THE ENVIRONMENT

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.

### 5.4.1 Air

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. Brodzinsky and Singh (1983) tabulated atmospheric levels at urban, rural, and industrial sites across the

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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. Singh et al. (1983) 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). Hoefler et al. (1982) found a level of 1.1 mg/kg of the compound in waste gas generated at a garbage dump. Pellizzari (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 ppb); 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.

### 5.4.2 Water

Perwak et al. (1982) summarized data from EPA's STORET database, where reported concentrations of 1,1-dichloroethane range from undetected (<10 ppb) to 1,900 ppb, with the highest reading in the Upper Mississippi River basin at Alton, Illinois. However, they observed that monitoring results reported for 1,1-dichloroethane in surface waters are almost always below the detection limit (generally 10 ppb). The compound has also 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). 1,1-Dichloroethane was detected at a maximum concentration of 220 ppb in samples from 193 private wells in Rhode Island analyzed over a period of nine years (RIDH 1989). A maximum concentration of 40 ppb 1,1-dichloroethane

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was detected in 6 public drinking water systems in Rhode Island between April 1982, and April 1989 (RIDH 1989).

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 surveyed (Krill and Sonzogni 1986). Concentrations of 1-3 ppb were reported in four public well water supplies in Iowa (Kelley 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 of 56.1 ppm (Yang and Rauckman 1987). Using the STORET database, Staples et al. (1985) reported median concentrations of less than 0.1 ppb in 8,716 samples of ambient water (3% detectable values), less than 1.0 ppb in 1,375 effluent samples (5% detectable values), less than 5.0 ppb in 354 sediment samples (0.6% detectable values), and less than 0.05 ppb in 94 biota samples (no detectable values). Also using the STORET database, Perwak et al. (1982) reported that 1,1-dichloroethane was not found in the sediment of the lower Mississippi or the western Gulf of Mexico; however, a maximum concentration of 5 ppb was detected in sediment samples from the Pacific Northwest.

### 5.4.3 Soil

No 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. 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.

### 5.4.4 Other 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 2 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 5.5.



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### 5.5 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. Another potential route of human exposure is ingestion of the compound in contaminated drinking water. There have been no reports of adverse effects associated with occupational inhalation of 1,1-dichloroethane in humans, and amounts dermally absorbed are reported to be insufficient to cause systemic injury (ACGIH 1971). Industrial exposures can result from the use of 1,1-dichloroethane as a chemical intermediate, solvent, and a component of fumigant formulations (ACGIH 1971).

The National Occupational Hazard Survey (NOHS), conducted by NIOSH from 1972 to 1974, estimated that 715 workers in 143 plants were potentially exposed to 1,1-dichloroethane in the workplace in 1970 (NIOSH 1976). These estimates were derived from observations of the actual use of 1,1-dichloroethane (90% of total estimate) and the use of trade name products known to contain 1,1-dichloroethane (10%). The exposed workers were in the rubber and plastic, chemical and allied products, electrical equipment and supply, medical and other health services, miscellaneous business services, and oil and gas extraction industries. The occupational groups with exposed workers were assemblers, agricultural and biological technicians, chemists, electrical and electronic engineering technicians, therapists, geologists, and machine operators.

Preliminary data from a second workplace survey, the National Occupational Exposure Survey (NOES), conducted by NIOSH from 1980 to 1983, indicated that 1,957 workers, including 272 women, were potentially exposed to 1,1-dichloroethane in the workplace in 1980 (NIOSH 1984). 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 (100%).

Neither the NOHS nor the NOES databases contain information on the frequency, level, or duration of exposure of workers to any of the chemicals listed therein. They provide only estimates of workers potentially exposed to the chemicals.

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.

Zweidinger et al. (1982) 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)

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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 ppt reported by Brodzinsky and Singh (1983) and a theoretical average inhalation of 20 m<sup>3</sup> of air per day, the average inhalation exposure to 1,1-dichloroethane for an individual in the United States is estimated at 4 µg/day (EPA 1985).

### 5.6 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 1985) 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.

### 5.7 ADEQUACY OF THE DATABASE

Section 104(i) of CERCLA 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 data needs have been identified by a joint team of scientists from ATSDR, NTP, and EPA. They are defined as substancespecific informational needs that, if known, would reduce or eliminate the uncertainties of human health assessment. Each data need discussion highlights the availability, or absence, of the relevant exposure information. A statement that reflects the importance of identified data needs is also included. In the future, these data needs will be evaluated and prioritized, and a substance-specific research agenda will be proposed.

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### 5.7.1 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, Use, Release, and Disposal.** 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 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 not available. 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.

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**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 wastewater 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 less than 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 levels. Additional information on bioconcentration and biomagnification would be useful in determining if food chain bioaccumulation is an important source of human exposure.

**Exposure Levels in Environmental Media.** 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  $\mu\text{g}/\text{day}$ . 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.

**Exposure Registries.** No exposure registries for 1,1-dichloroethane were located. This compound is not currently one of the compounds for which a subregistry has been established in the National Exposure Registry. The compound will be considered in the future when chemical selection is made for subregistries 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 the exposure to this compound.

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### 5.7.2 On-going Studies

Long-term research studies on the environmental fate of 1,1-dichloroethane have not been identified. The data generated as a result of the remedial investigation/feasibility studies of the 189 sites on the National Priority List (NPL) known to be contaminated with 1,1-dichloroethane should add to the current knowledge regarding the environmental transport and fate of the compound.

As part of the Third National Health and Nutrition Evaluation Survey (NHANES III), the Environmental Health Laboratory Sciences Division of the Center for Environmental Health and Injury Control, Centers for Disease Control, will be analyzing human blood samples for 1,1-dichloroethane and other volatile organic compounds. These data will give an indication of the frequency of occurrence and background levels of these compounds in the general population.