CHAPTER 6. 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 1,2-dichloroethene 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 adverse health effects (and techniques for developing methods to determine such health effects) of 1,2-dichloroethene.

Data needs are defined as substance-specific informational needs that, if met, would reduce the uncertainties of human health risk 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.

6.1 Information on Health Effects

Studies evaluating the health effects of inhalation, oral, and dermal exposure of humans and animals to 1,2-dichloroethene that are discussed in Chapter 2 are summarized in Figures 6-1, 6-2, and 6-3. The purpose of these figures is to illustrate the information concerning the health effects of 1,2-dichloroethene. The number of human and animal studies examining each endpoint is indicated regardless of whether an effect was found and the quality of the study or studies. Note that some studies evaluated multiple endpoints.

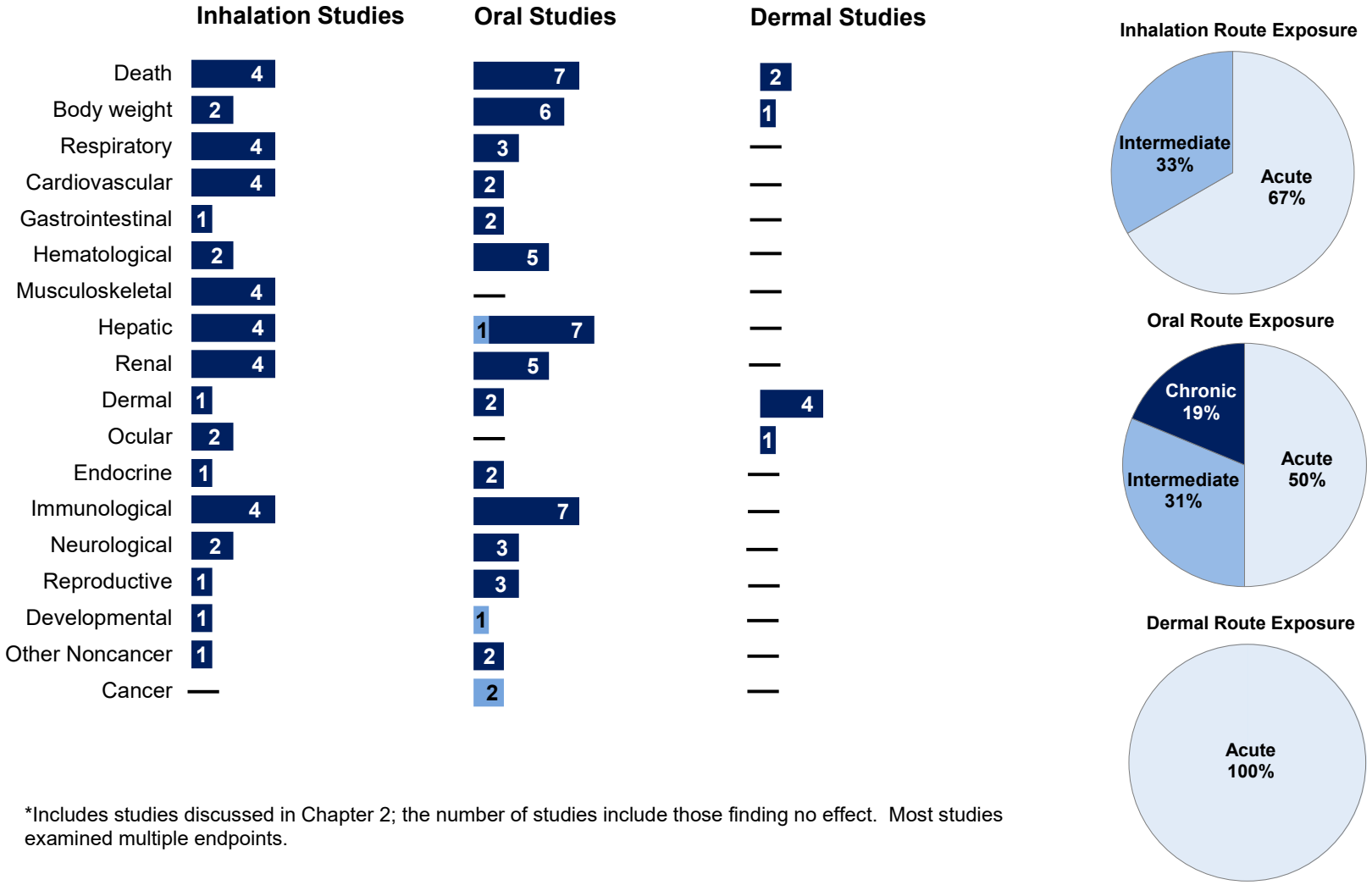
6.2 Identification of Data Needs

Missing information in Figures 6-1, 6-2, and 6-3 should not be interpreted as a "data need." A data need, as defined in ATSDR's *Decision Guide for Identifying Substance-Specific Data Needs Related to Toxicological Profiles* (ATSDR 1989), is substance-specific information necessary to conduct comprehensive public health assessments. Generally, ATSDR defines a data gap more broadly as any substance-specific information missing from the scientific literature.

Figure 6-1. Summary of Existing Health Effects Studies on trans-1,2-Dichloroethene by Route and Endpoint*

Lethality and potential hepatic and immune effects were the most studied endpoints for trans-1,2-dichoroethene

The majority of the studies examined oral exposure in **animals** (versus **humans**)

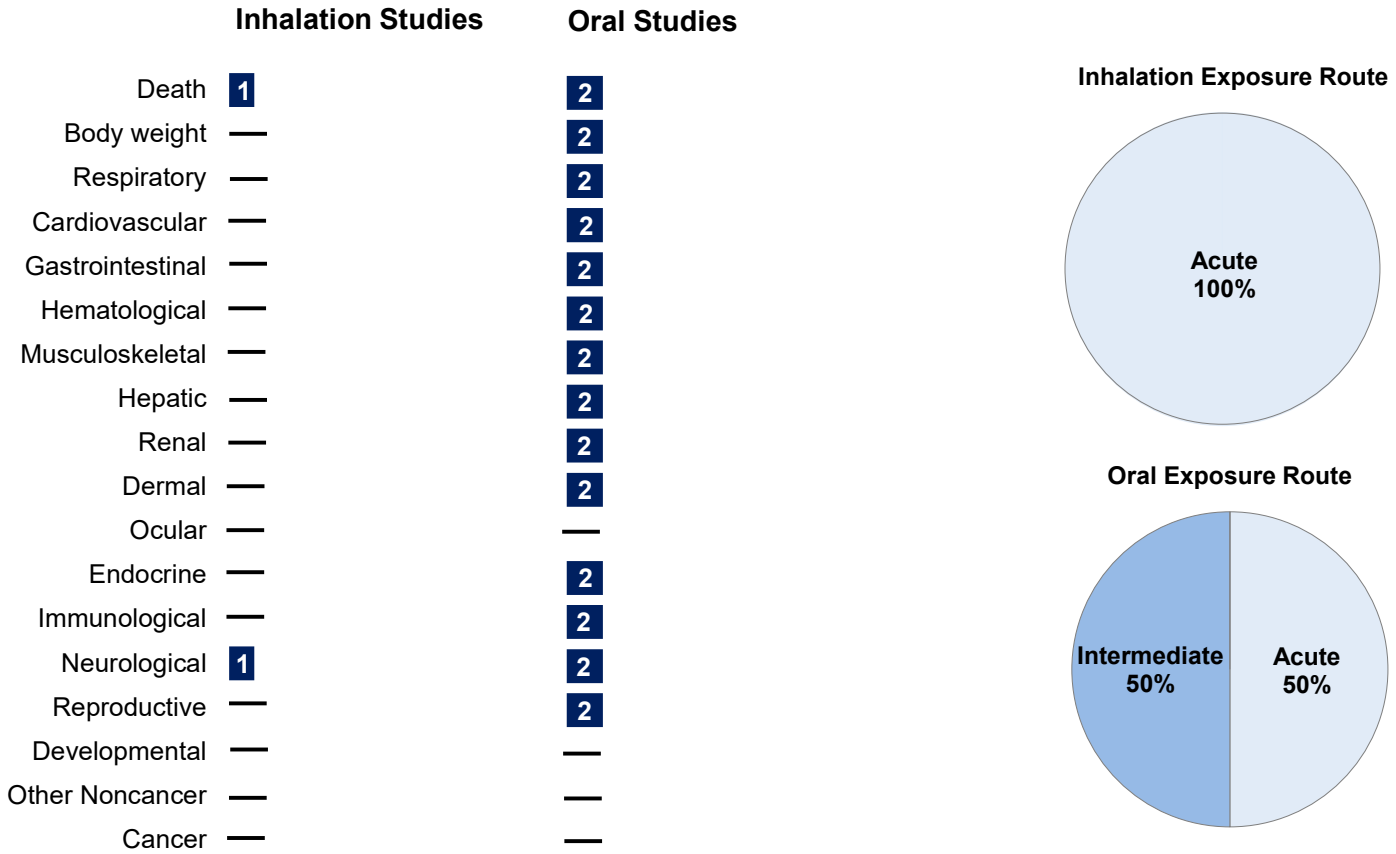


*Includes studies discussed in Chapter 2; the number of studies include those finding no effect. Most studies examined multiple endpoints.

Figure 6-2. Summary of Existing Health Effects Studies on cis-1,2-Dichloroethene by Route and Endpoint*

Lethality and neurological effects were the most studied endpoints for cis-1,2-dichloroethene

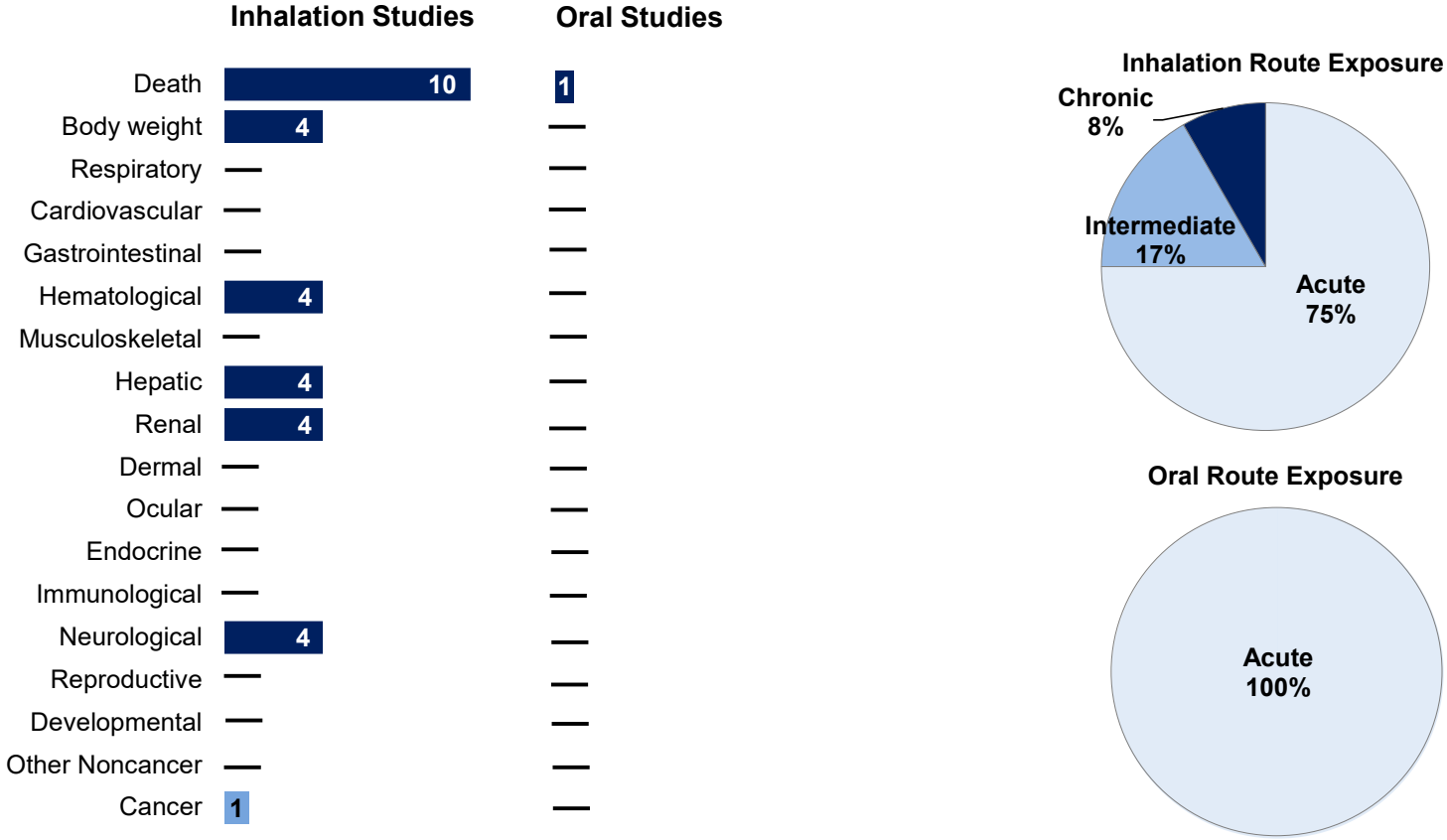
Studies examined oral exposure in **animals** (counts represent studies examining endpoint); no data were identified for **humans** (counts represent studies examining endpoint)



*Includes studies discussed in Chapter 2; the number of studies include those finding no effect. Most studies examined multiple endpoints. No dermal studies in humans or animals were located.

Figure 6-3. Summary of Existing Health Effects Studies for Mixtures of trans- and cis-1,2-Dichloroethene by Route and Endpoint*

Lethality was the most studied endpoint for mixtures of cis- and trans-1,2-dichloroethene
Fewer studies evaluated health effects in humans than animals (counts represent studies examining endpoint)



*Includes studies discussed in Chapter 2; the number of studies include those finding no effect. Most studies examined multiple endpoints. No dermal studies in humans or animals were located.

MRLs.

trans-1,2-Dichloroethene Inhalation MRLs. An acute-duration inhalation MRL was derived for trans-1,2-dichloroethene. Additional studies may provide data to further define the NOAEL-LOAEL boundary. The intermediate-duration inhalation database is inadequate to derive an MRL. Few studies have evaluated potential health effects of intermediate-duration inhalation exposure, and the only reliable study did not identify adverse effects at the highest exposure concentration tested (4,000 ppm). Studies assessing higher exposure levels may identify adverse effects of intermediate-duration inhalation exposure. No chronic-duration inhalation studies on trans-1,2-dichloroethene were identified; therefore, a chronic-duration inhalation MRL was not derived. Chronic-duration inhalation studies may provide data to develop a chronic-duration MRL for inhaled trans-1,2-dichloroethene.

trans-1,2-Dichloroethene Oral MRLs. An intermediate-duration oral MRL was derived for trans-1,2-dichloroethene; however, additional studies could provide corroborating data for immune effects. For other effects observed in intermediate-duration oral studies for which the biological significance is uncertain (e.g., altered serum glucose and hematological parameters), studies could provide information to determine if effects are toxicologically relevant to human health. An acute-duration oral MRL was not derived, as most studies were designed to assess acute lethality. Studies assessing sublethal effects of acute-duration oral exposure may provide data to develop an acute-duration oral MRL for trans-1,2-dichloroethene. A chronic-duration oral MRL was not derived because no chronic-duration oral exposure studies were identified. Studies assessing effects of chronic-duration oral exposure may provide data for derivation of a chronic-duration oral MRL.

cis-1,2-Dichloroethene Inhalation MRLs. No inhalation MRLs were derived for any exposure duration for cis-1,2-dichloroethene due to inadequate data. Therefore, studies examining comprehensive toxicological endpoints for acute-, intermediate-, and chronic-duration inhalation exposure to cis-1,2-dichloroethene may provide data to develop MRLs.

cis-1,2-Dichloroethene Oral MRLs. No acute-, intermediate-, and chronic-duration oral MRLs were derived for cis-1,2-dichloroethene due to inadequate data. Therefore, studies examining comprehensive toxicological endpoints for all exposure durations may provide data to develop MRLs for cis-1,2-dichloroethene.

Health Effects.

Hematological. A few studies in laboratory animals showed that some hematological parameters may be affected by exposure to trans-1,2-dichloroethene (NTP 2002) or cis-1,2-dichloroethene (EPA/AMRL 1990, McCauley et al. 1995). However, effects are either very small in magnitude or are not clinically consistent (e.g., decreased hematocrit in the absence of decrease erythrocyte count). Therefore, additional studies to assess effects of exposure to cis- and trans-1,2-dichloroethene may be helpful to determine the relationship between exposure to cis- or trans-1,2-dichloroethene and the hematological system.

Reproductive. No studies were located regarding reproductive toxicity of 1,2-dichloroethene in humans by inhalation, oral, or dermal exposure. In animals, histopathological examination of reproductive tissues did not identify effects of trans-1,2-dichloroethene (DuPont 1998; Hayes et al. 1987; NTP 2002) or cis-1,2-dichloroethene (EPA/AMRL 1990; McCauley et al. 1995). However, additional studies assessing reproductive function would be useful to determine the potential for cis- and trans-1,2-dichloroethene to produce adverse effects on the reproductive system.

Developmental. One epidemiological study examining developmental effects of *in utero* and possible early life exposure to trans-1,2-dichloroethene did not find associations between exposure and neural tube defects or oral cleft defects (Ruckart et al. 2013). Only one study evaluating developmental effects of trans-1,2-dichhloroethene was identified, and no studies evaluating developmental effects of cis-1,2-dichloroethene were located. The developmental study on trans-1,2-dichloroethene identified resorptions and decreased fetal weight as effects. However, there is uncertainty regarding resorptions because the number of resorptions per litter in the control was below the recent historical control range and were within the historical range in the treatment groups. Additional studies may provide data to determine the effects of cis- and trans-1,2-dichloroethene on developmental effects.

Immunotoxicity. One study on trans-1,2-dichloroethene evaluating immunological function was identified, and no studies evaluating immunological effects of cis-1,2-dichloroethene were located. Additional studies could provide supportive data on the immunotoxicity of trans-1,2-dichloroethene and determine if cis-1,2-dichloroethene also affects immune system function.

Epidemiology and Human Dosimetry Studies. A few epidemiological studies have examined general population exposure to trans-1,2-dichloroethene (Ji et al. 2016; Ruckart et al. 2013, 2015). However, studies of occupational populations were not identified. Additional epidemiological studies on general populations and studies on worker populations could provide important information on the potential effects of 1,2-dichloroethene in humans. Studies could also provide important information on potential dose-response relationships.

Biomarkers of Exposure and Effect. 1,2-Dichlorethene has been detected in blood and expired air. For exposure, it is important to identify methods that can correlate levels of 1,2-dichloroethene in blood or biological tissues and exposure levels. Studies focusing on correlation of blood or urine levels of 1,2-dichloroethene or its metabolites with exposure levels would be useful to facilitate future medical surveillance that can lead to early detection.

No known biomarkers are currently used to characterize effects specifically caused by 1,2-dichloroethene. No unique effects of 1,2-dichloroethene have been identified.

Absorption, Distribution, Metabolism, and Excretion. The absorption, distribution, metabolism, and excretion of 1,2-dichloroethene isomers have not been well-studied. Studies evaluating all toxicokinetic processes could provide data to develop a comprehensive understanding of the toxicokinetics of 1,2-dichloroethene and determine if there are differences between the cis- and trans-isomers.

Comparative Toxicokinetics. Given that few studies have evaluated the toxicokinetics of 1,2-dichloroethene, little information is available to compare potential differences in toxicokinetics between different animal species or between animals and humans. Investigation of 1,2-dichloroethene toxicokinetics in different animal species and comparison of detected metabolites with those detected in occupationally exposed individuals would be useful for determining an appropriate animal model for studying 1,2-dichloroethene.

Children's Susceptibility. Very little information on children's susceptibility to 1,2-dichloroethene is available in humans or animals. General population studies of children exposed *in utero* did not identify associations between exposure and neural tube defects, oral cleft defects, or childhood hematopoietic cancers (Ruckart et al. 2013). The only study in animals on susceptibility is a developmental study showing decreased fetal weight. Furthermore, no studies have evaluated how immature drug

metabolizing systems could affect children's susceptibility to 1,2-dichloroethene. Additional developmental studies in animals and studies exposing immature animals to 1,2-dichloroethene may provide additional information to further understand children's susceptibility.

Physical and Chemical Properties. The physical and chemical properties of both cis- and trans-1,2-dichloroethene are well characterized (see Table 4-2) and allow prediction of the transport and transformation of the chemicals in the environment. Therefore, no data needs have been identified at this time.

Production, Import/Export, Use, Release, and Disposal. Current production and import/export volumes and usage data are presently unavailable in the literature. Much of the information regarding 1,2-dichloroethene may be difficult to obtain because many manufacturing companies maintain confidentiality. Production volume submissions for 2020 submitted to the EPA CDR system indicated that 1,2-dichloroethene had a production volume of 1,000,000–<20,000,000 pounds; however, more detailed facts were omitted since they were considered CBI (EPA 2022a). Furthermore, determining the percentage of 1,2-dichloroethene that is used as a captive intermediate (i.e., the 1,2-dichloroethene consumed in closed processes in which the compound is not isolated), as opposed to its use as a solvent, is critical to estimating the amount released to the environment. Differences in toxicity and environmental fate also suggest that isomer-specific information on use and consumption is important. Determination of the levels of 1,2-dichloroethene in consumer products is essential for estimating the exposure of the general population. With up-to-date and accurate production, import/export, and use data, the extent of release into the environment and the potential for human exposure could be more realistically determined. Disposal methods have been described and appear to be satisfactory.

Environmental Fate. 1,2-Dichloroethene released to the environment partitions mainly to the atmosphere (Eisenreich et al. 1981; Swann et al. 1983; Thomas 1982). Important sources of 1,2-dichloroethene include industrial releases and degradation products from other solvents such as trichloroethene, tetrachloroethene, and vinyl chloride (Parsons et al. 1984; Shen 1982b; Smith and Dragun 1984; Vogel et al. 1987). 1,2-Dichloroethene isomers have predicted atmospheric half-lives of 12 days (cis) and 5 days (trans) (Goodman et al. 1986). Both isomers react with hydroxyl radicals in the atmosphere, forming amyl chloride, but atmospheric ozone, nitrate radicals, and singlet oxygen have little environmental effect (Atkinson and Carter 1984). In surface waters, the isomers of 1,2-dichloroethene are rapidly volatilized; half-lives of 5–6.2 hours are estimated for water 1 m deep (Dilling 1977). The compound is not significantly bound to soils or sediments (Barber et al. 1988). Soil-groundwater

degradation processes are anaerobic and may involve multiple pathways. Additional information about the long-term atmospheric fate would be useful, because of the importance of this pathway and the uncertainty of atmospheric degradation processes.

Bioavailability from Environmental Media. No specific information is available regarding human inhalation, oral, or dermal absorption of 1,2-dichloroethene from air, water, food, or soil. Exposure via contaminated drinking water is particularly relevant to humans. Since 1,2-dichloroethene is a neutral lipophilic chemical with a low molecular weight, it probably is readily absorbed through the lungs and gastrointestinal tract. The few available toxicity studies of animals exposed to 1,2-dichloroethene support this hypothesis (Filser and Bolt 1979; Gargas et al. 1988, 1989). No information about human exposure to 1,2-dichloroethene in the environment and the resulting concentrations in human tissue was located. Studies of absorption of 1,2-dichloroethene from air, water, food, and soil in contaminated environments near hazardous waste sites would allow for determination of the rate and extent of absorption from each of these media and for comparison of the potential hazards posed by 1,2-dichloroethene within these media.

Food Chain Bioaccumulation. Few data are available describing the food chain bioaccumulation of 1,2-dichloroethene. Experimental data are unavailable; therefore, it is not known if the bioconcentration potential is consistent with estimated values obtained from regression equations. The estimated BCF of 6 for fathead minnows (Veith and Kosian 1983) suggests that the potential for 1,2-dichloroethene to bioconcentrate is low for aquatic organisms. Therefore, further studies on bioaccumulation are not recommended. However, biomagnification studies would enable scientists to assess the dangers of human exposure to 1,2-dichloroethene from fish and seafood.

Exposure Levels in Environmental Media. Data describing exposure levels in air, surface water, drinking water, groundwater, and soil are limited. 1,2-Dichloroethene has been detected in urban and rural air, air near hazardous waste sites, and indoor air (Grimsrud and Rasmussen 1975; Lipsky and Jacot 1985; Shah and Singh 1988; Vogt and Walsh 1985). 1,2-Dichloroethene is a contaminant monitored for and has current data in the AQS (EPA 2022b). It was one of the original contaminants tested in U.S. drinking water supplies during the first two rounds of the UCMR (EPA 2001). Limited monitoring data of 1,2-dichloroethene in foods are available (FDA 2024); however, additional monitoring data are needed to better understand potential exposures through ingestion of food sources. Additional indoor air monitoring and vapor intrusion studies have been identified as a data need.

Exposure Levels in Humans. 1,2-Dichloroethene is not a naturally occurring substance. Levels of 1,2-dichloroethene in human blood was below the detection limits for all age and demographic groups in the 2011–2012 NHANES monitoring program (CDC 2021). Information on biological media monitoring of the general population, particularly populations near waste sites, is necessary for assessing the need to conduct health studies on these populations.

Exposures of Children. Children are expected to be exposed to 1,2-dichloroethene by the same pathways that affect adults. Since 1,2-dichloroethene is denser than air, it is possible that concentrations may be higher at lower levels where crawling or playing children may come in contact with it indoors. However, exposure studies on children are identified as a data need since there are no current studies available.

6.3 Ongoing Studies

No ongoing studies were identified in the National Institute of Health (NIH) RePORTER (2024) database.