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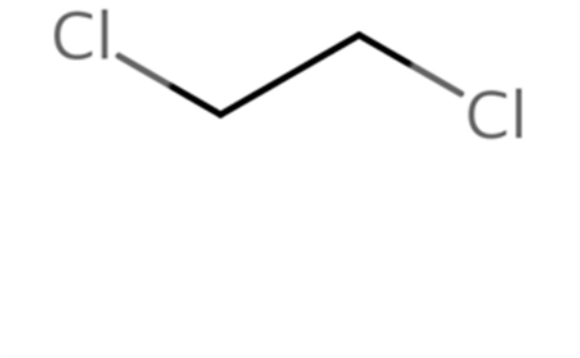
Draft Chemistry and Fate and Transport Assessment for 1,2-Dichloroethane

Technical Support Document for the Draft Risk Evaluation

CASRN 107-06-2



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KEY ABBREVIATIONS AND ACRONYMS

BCF	Bioconcentration factor
BAF	Bioaccumulation factor
CASRN	Chemical Abstracts Service Registry Number
CTD	Characteristic Travel Distance
DRAS	Hazardous Waste Delisting Risk Assessment Software
DRE	Destruction and Removal Efficiency
EPA	Environmental Protection Agency (U.S.)
GAC	Granular activated carbon
HLC	Henry's Law constant
K_{OA}	Octanol-air partition coefficient
K_{OW}	Octanol-water partition coefficient
LRTP	Long-range transport potential (and LRTP Model)
NLM	National Library of Medicine
NIST	National Institute of Standards and Technology
OCSPP	Office of Chemical Safety and Pollution Prevention (EPA)
OECD	Organisation for Economic Co-operation and Development
OPPT	Office of Pollution Prevention and Toxics (EPA)
PCA	1,1,2,2-Tetrachloroethane
POTW	Publicly owned treat works
PSC	Point Source Calculator
RCRA	Resource Conservation and Recovery Act

115	TE	Transfer Efficiency
116	TRI	Toxics Release Inventory
117	TSCA	Toxic Substance Control Act
118	TSD	Technical support document
119	U.S.	United States
120	VOC	Volatile organic compound
121	VP	Vapor pressure

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Docket
Supporting information can be found in the public docket, Docket ID EPA-HQ-OPPT-2018-0427.

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SUMMARY

This draft technical support document (TSD) accompanies the *Draft Risk Evaluation for 1,2-Dichloroethane* (also called the "draft risk evaluation") (U.S. EPA, 2025i). EPA evaluated the reasonably available information identified by the Agency through its systematic review process under the Toxic Substances Control Act (TSCA) (U.S. EPA, 2021) to characterize the physical and chemical properties as well as the environmental fate and transport information for 1,2-dichloroethane. The following key points summarize EPA's draft assessment.

Physical and Chemical Properties

1,2-Dichloroethane is a colorless oily liquid with a chloroform-like odor. It is soluble in water (8,600 mg/L) and is miscible in most organic solvents. With a Henry's Law constant (HLC) of 1.54×10^{-3} atm m^3/mol at 25 °C, 1,2-dichloroethane is moderately volatile from water.

Fate and Transport in Air

Gaseous 1,2-dichloroethane released to air is expected to primarily remain in air due to its high vapor pressure (78.9 mmHg at 25 °C) and low potential to sorb to particulates in the air (log octanol-air partition coefficient [K_{OA}] = 2.7). In air it will react with hydroxyl radicals (·OH) with a half-life of 42 to 51 days and can be subject to long-range transport. Given the relatively large quantities released to air under the TSCA conditions of use (COUs), in conjunction with its high potential for persistence in the atmosphere, air is expected to be an important medium for exposure to 1,2-dichloroethane.

Fate and Transport in Soil

Releases of 1,2-dichloroethane to soil can be subject to volatilization to air, biodegradation, and runoff to surface waters. Due to its low affinity for soil organic matter (Log K_{OC} 1.3–1.77), migration through soil to groundwater can occur. Biodegradation of 1,2-dichlororethane fractions remaining in soil can occur with half-lives ranging from days to months.

Fate and Transport in Surface Water and Sediment

In surface water, 1,2-dichloroethane will be subject to volatilization to air due to its greater propensity to partition into air than into water (HLC of 1.54×10^{-3} atm m^3/mol at 25 °C). 1,2-Dichloroethane is not likely to undergo biodegradation in surface water. Due to its water solubility (8,600 mg/L), continuous releases of 1,2-dichloroethane to water will result in a portion of the release remaining in water. 1,2-Dichloroethane can migrate to sediments through advection/diffusion into pore water, but it will not be significantly sorbed to organic matter in sediments. Biodegradation can occur in sediments with half-lives ranging from days to months.

Fate and Transport in Groundwater

Biodegradation in groundwater will generally occur slowly; however, half-lives can vary widely from days to years depending on environmental conditions.

Persistence and Bioaccumulation

1,2-Dichloroethane meets criteria for persistence in all media but does not meet criteria to be classified as bioaccumulative based on estimated bioconcentration/bioaccumulation factor (BCF/BAF) values of less than 1,000.

Conclusions

Due to the high release amounts of 1,2-dichloroethane into the air and its low photodegradation rates, air is expected to be a major exposure pathway. Its high-water solubility and low sorption potential suggest that water and land pathways could also be significant if released directly to water or onto soil.

1 INTRODUCTION

1,2-Dichloroethane is used primarily in the synthesis of vinyl chloride used in the manufacture of plastic products (U.S. EPA, 2025i). The following sections discuss the selection of the physical and chemical properties to be used in subsequent analysis of 1,2-dichloroethane. Fate in each specific compartment of environmental media (soil, sediment, surface water, groundwater, atmospheric and indoor air) are discussed, as well as the processes and endpoints (*e.g.*, biodegradation, transformation, hydrolysis, photolysis, sorption) that contribute to the fate and transport of 1,2-dichloroethane within and through various environmental media.

1.1 Approach and Methodology

EPA gathered and evaluated physical and chemical property data and environmental fate and transport information according to the process described in the *Draft Systematic Review Protocol Supporting TSCA Risk Evaluations for Chemical Substances Version 1.0: A Generic TSCA Systematic Review Protocol with Chemical-Specific Methodologies* (also referred to as the "Draft Systematic Review Protocol") (U.S. EPA, 2021). During the evaluation of 1,2-dichloroethane, EPA considered both measured and estimated physical and chemical property data. Reasonably available environmental fate data—including biodegradation rates, removal during wastewater treatment, and partitioning coefficients—are among selected parameters for use in the current draft risk evaluation. In assessing the environmental fate and transport of 1,2-dichloroethane, EPA considered the full range of results from sources that were rated high confidence. Information on the fully extracted dataset is available in the supplemental file *Data Quality Evaluation and Data Extraction information for Environmental Fate and Transport Studies for 1,2-Dichloroethane* (U.S. EPA, 2025c) and *Data Quality Evaluation and Data Extraction information for Physical and Chemical Properties for 1,2-Dichloroethane* (U.S. EPA, 2025d).

During the evaluation of 1,2-dichloroethane, EPA considered both measured and estimated data as applicable. Some fate estimates were based on modeling results from EPI Suite™ (U.S. EPA, 2012b), a predictive tool for physical/chemical and environmental fate properties. Information regarding model inputs is provided in Section 3.3.1. EPI Suite™ was reviewed by the EPA Science Advisory Board (SAB, 2007), and the individual models that comprise EPI Suite™ have been peer reviewed through publication in technical journals. Citations for the supporting manuscripts are available in the EPI Suite™ Help files.

The Organisation for Economic Co-operation and Development's (OECD) Overall Environmental Persistence (P_{OV}) and Long-Range Transport Potential (LRTP) Screening Tool, Version 2.2 (Wegmann et al., 2009) was used to estimate overall persistence for 1,2-dichloroethane and its potential for long-range transport. That tool used the following inputs: a molecular mass of 98.96 g/mol, a log K_{AW} of −1.201, a log K_{OW} of 1.48, an atmospheric half-life of 51 days, a water half-life of 365 days, and a soil half-life of 365 days (see also Table 2-1 and Table 3-1).

EPA conducted a Tier I assessment that involves evaluating partitioning values for the substance to identify the environmental compartments (*i.e.*, water, sediment, biosolids, soil, groundwater, and air) of major and minor relevance to the fate and transport of 1,2-dichloroethane. The Agency next conducted a Tier II assessment to identify the fate pathways and media most likely to cause exposure to environmental releases. Media-specific fate analyses were performed as described in Section 3.5.

2 PHYSICAL AND CHEMICAL PROPERTIES OF 1,2-DICHLOROETHANE

2.1 Evidence Integration for Physical and Chemical Properties

Due to the relatively high availability of data, only studies with an overall data quality determination of high were selected for use in determining the representative physical and chemical properties of 1,2-dichloroethane for use in the draft risk evaluation. The systematic review process identified multiple data with the same quality rating for many physical and chemical properties discussed in this TSD. Some of these data were duplicates that were initially extracted more than once (*e.g.*, when multiple databases cite the same study), but were later removed during data curation before subsequent analysis. Much of the remaining data were collected under standard environmental conditions (*i.e.*, 20–25 °C and 760 mmHg). These data are presented in the box and whisker plots provided below in Figure 2-1), which also includes descriptive statistics such as the mean and median.

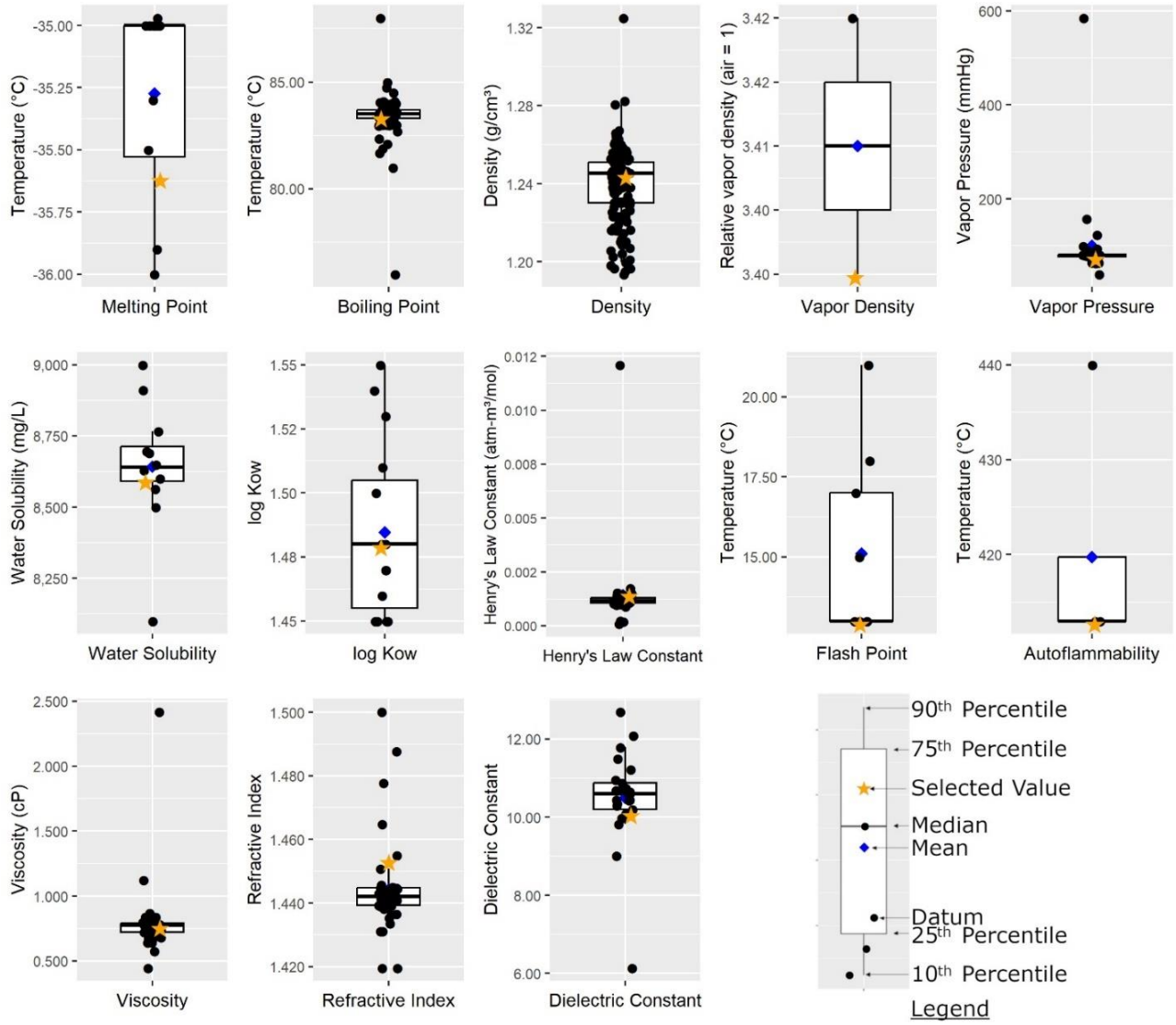

Figure 2-1. Physical and Chemical Property Data for 1,2-Dichloroethane Under Standard Conditions

For temperature-dependent parameters, only data collected at 25 °C and 760 mmHg are presented.

2.2 Selected Physical and Chemical Property Values for 1,2-Dichloroethane

Table 2-1. Summary of Physical and Chemical Property Values for 1,2-Dichloroethane

Property	Selected Value(s)	Reference(s)	Data Quality Rating
Molecular formula	$C_2H_4Cl_2$	N/A	N/A
Molecular weight	98.95 g/mol	N/A	N/A
Physical form	Colorless oily liquid with a chloroform-like odor	HSDB (2018), NCBI (2020a)	High
Melting point	−35.61 °C	Rumble (2018a)	High
Boiling point	83.43 °C	Rumble (2018a)	High
Density	1.24529 at 25 °C	Rumble (2018a)	High
Vapor pressure	78.9 mmHg at 25 °C	HSDB (2018)	High
Vapor density	3.4 (air = 1 g/cm^3)	NCBI (2020b)	High
Water solubility	8,600 mg/L at 25 °C	Rumble (2018b)	High
Octanol/water partition coefficient (log K_{OW})	1.48 at 25 °C	Elsevier (2019b)	High
Henry's Law constant	0.00154 atm m^3/mol at 25 °C	NIST (2022)	High
Flash point	13 °C	O'Neil (2013)	High
Autoflammability	413 °C	Rumble (2018c)	High
Viscosity	0.779 centipoise (cP) at 25 °C	Rumble (2018d)	High
Refractive index	1.4539 at 25 °C	Elsevier (2019a)	High
Dielectric constant	10.13 at 25 °C	Elsevier (2019a)	High

2.3 Physical and Chemical Property Endpoint Assessments

2.3.1 Melting Point

Systematic review identified 12 melting point data that ranged from −40 to −34.97 °C, with an average melting point of −35.7 ± 1.3 °C. The value −35.6 °C from a high-quality study (Rumble, 2018a) was selected as the melting point of 1,2-dichloroethane for use in this draft risk evaluation because it is in close agreement with the average of the identified data. The selected value aligns with the value reported in the *Final Scope of the Risk Evaluation for 1,2-Dichloroethane; CASRN 107-06-2* (also called "final scope") (U.S. EPA, 2020a). The standard deviation of the collected data is relatively low, indicating that the value of this parameter is well-defined.

2.3.2 Boiling Point

Systematic review identified 92 boiling point data that ranged from 61.55 to 88 °C. Excluding one statistical outlier, the range narrows, spanning 72.5 to 88 °C. The average boiling point of the 91 data points is 83.2 ± 1.6 °C. The value 83.4 °C from a high-quality study (Rumble, 2018a) was selected as the boiling point of 1,2-dichloroethane for this draft TSD and in the draft risk evaluation because it is in close agreement with the average of the identified data. The selected value aligns with the value reported in the final scope. The standard deviation of the collected data is relatively low, indicating that the value

of this parameter is well-defined.

2.3.3 Density

Systematic review identified a total of 156 density data points, including 20 collected at 20 °C and 41 at 25 °C. The data collected under standard conditions (*i.e.*, 20–25 °C) ranged from 1.23 to 1.325 g/cm^3 (specific gravity with reference to water and density were assumed to be the same metric). The average density of the 41 data points collected at 25 °C is 1.2479 ± 0.0123 g/cm^3. The value 1.24529 at 25 °C from a high-quality study (Rumble, 2018a) was selected as the density of 1,2-dichloroethane for the draft risk evaluation because it has a high level of precision and is closer to the average value than the value reported in the final scope. The standard deviation of the collected data is relatively low, indicating that the value of this parameter is well-defined.

2.3.4 Vapor Pressure

Systematic review identified 27 vapor pressure data points, including 3 collected at 20 °C and 17 at 25 °C. The data collected under standard conditions (*i.e.*, 20–25 °C) ranged 63.455 to 90 mmHg. The average vapor pressure of the 17 data collected at 25 °C is 76.46 ± 6.19 mmHg. The value 78.9 mmHg at 25 °C (HSDB, 2018) was selected as the vapor pressure of 1,2-dichloroethane for the draft risk evaluation because it is in close agreement with the average of the identified data. The selected value differs minimally from the value reported in the final scope. The standard deviation of the collected data is relatively low, indicating that the value of this parameter is well-defined.

2.3.5 Vapor Density

Systematic review identified two vapor density data points ranging from 3.40 to 3.42 (relative to air = 1 g/cm^3). The average vapor density of the data is 3.41. The value 3.40 (NCBI, 2020b) was selected as the vapor density of 1,2-dichloroethane for the draft risk evaluation; however, there is potential uncertainty for this selected value because systematic review did not identify a significant amount of data for this physical-chemical property. There was no value reported for vapor density in the final scope.

2.3.6 Water Solubility

Systematic review identified 30 water solubility data points, including 5 collected at 20 °C and 6 data collected at 25 °C. The data collected under standard conditions (*i.e.*, 20–25 °C) ranged from 8,333 to 8,696 mg/L. The average water solubility of the 6 data points collected at 25 °C is 8,584 ± 36 mg/L. The value 8,600 mg/L at 25 °C, a high-quality data point (Rumble, 2018b) was selected as the water solubility of 1,2-dichloroethane for the draft risk evaluation because it closely agrees with the mean of data identified, has a high level of precision, and was independently reported in multiple high-quality studies. It aligns with the value reported in the final scope. The standard deviation of the collected data at 25 °C is relatively low, indicating this parameter is well-defined.

2.3.7 Octanol/Water Partition Coefficient (log K_{OW})

Systematic review identified a total of 15 log K_{OW} data points that cover the range of 1.45 to 1.55. The average log K_{ow} of the data are 1.48 ± 0.03. The value 1.48 at 25 °C from a high-quality study (U.S. EPA, 2019) was selected as the log K_{ow} of 1,2-dichloroethane for the draft risk evaluation because it is in close agreement with the data identified and was independently reported in multiple high-quality studies. It aligns with the value reported in the final scope. The standard deviation of the collected data is relatively low, indicating this parameter is well-defined.

2.3.8 Henry's Law Constant

Systematic review identified 40 Henry's Law constant (HLC) data points, including 29 collected at 20 to 25 °C. The data collected under standard conditions (*i.e.*, 20–25 °C) ranged from 0.0000943 to 0.00154

atm·m^3/mol. The mean HLC of the 26 data points collected at 25 °C is 0.00156 ± 0.00212 atm·m^3/mol. However, two of the included data points are modeled. When the two modeled data points are excluded, the mean of the data becomes 0.00118 ± 0.00016 atm·m^3/mol. The value 0.00154 atm·m^3/mol at 25 °C from a high-quality study (NIST, 2022) was selected as the HLC for 1,2-dichloroethane for the draft risk evaluation because it was independently reported in multiple high-quality studies. It varies slightly from the value reported in the final scope (0.00118 atm·m^3/mol). The standard deviation of the experimental data are relatively low, indicating that the value of this parameter is well-defined.

2.3.9 Flash Point

Systematic review identified nine flash point data that ranged from 13 to 21 °C. The flash point data collected include values measured using both closed cup and open cup techniques, with some sources reporting values for both techniques and others not indicating the technique used. Because closed and open cup measurement techniques generally result in a different value for flash point, it is important to note the measurement technique used. The average flash point of the nine data points is 15 ± 3 °C. The value 13 °C from a high-quality study (O'Neil, 2013) was selected as the flash point of 1,2-dichloroethane for the draft risk evaluation because it agrees with the mean of the data points identified and was independently reported in multiple high-quality studies. It also aligns with the value reported in the final scope.

2.3.10 Autoflammability

Systematic review identified four autoflammability data points that ranged from 413 to 440 °C. The average autoflammability of the data is 419 °C ± 12 °C. The value 413 °C from a high-quality study (Rumble, 2018c) was selected as the autoflammability of 1,2-dichloroethane for the draft risk evaluation because it is in general agreement with the mean of the data identified, was reported in multiple high-quality studies, and aligns with the value reported in the final scope.

2.3.11 Viscosity

Systematic review identified 45 viscosity data points, including 5 collected at 20 °C and 15 at 25 °C. The data collected under standard conditions (*i.e.*, 20–25 °C) ranged from 0.764 to 0.840 cP. The average viscosity of the 15 data collected at 25 °C is 0.779 ± 0.015 cP. The value 0.779 cP at 25 °C from a high-quality study (Rumble, 2018d) was selected as the viscosity of 1,2-dichloroethane for the draft risk evaluation because it is in close agreement with the mean of the identified data, was reported in multiple high-quality studies, and aligns with the value reported in the final scope. The standard deviation of the collected data is relatively low, indicating that this parameter is well-defined.

2.3.12 Refractive Index

Systematic review identified 50 refractive index data points, including 12 collected at 20 °C and 23 at 25 °C. The data collected standard environmental conditions (*i.e.*, 20–25 °C) ranged from 1.4196 to 1.5002. The average refractive index of the 23 data collected at 25 °C is 1.4503 ± 0.0164. The value 1.4503 at 25 °C from a high-quality study (Elsevier, 2019a) was selected as the refractive index of 1,2-dichloroethane for the draft risk evaluation because it is in close agreement with the mean of all identified data collected at 25 °C. Note that it varies slightly from the value reported in the final scope (1.4422). The standard deviation of the data collected at 25 °C is relatively low, indicating that the value of this parameter is well-defined.

2.3.13 Dielectric Constant

Systematic review identified 25 dielectric constant data points, including 6 collected at 20 °C and 10 at 25 °C. The data collected standard environmental conditions (*i.e.*, 20–25 °C) ranged from 6.14 to 12.70. The average dielectric constant of the 10 data collected at 25 °C was 10.07 ± 1.50. The value 10.07 at 25

°C (Elsevier, 2019a) was selected as the dielectric constant of 1,2-dichloroethane for the draft risk evaluation because it is in close agreement with the mean of all identified data collected at 25 °C. Note that it varies slightly from the value reported in the final scope (10.43). The standard deviation of the data collected at 25 °C is relatively low, indicating that the value of this parameter is well-defined.

2.4 Strengths, Limitations, Assumptions, and Key Sources of Uncertainty for the Physical and Chemical Property Assessment

The physical and chemical property data discussed in this document were the product of a systematic review of reasonably available information. Due to cross-referencing between many of the databases identified and assessed through the systematic review process, there is potential for data from one primary source to be collected multiple times resulting in duplication within the dataset. This duplication should be considered as a potential source of uncertainty in the standard deviation of the collected data; however, data-collection procedures and expert judgement were used to minimize this possibility whenever possible.

Overall, there is little uncertainty in the physical and chemical property data and analyses presented. The analyses above present the average and standard deviation of high-quality data, collected through the systematic review process for each physical and chemical parameter. The standard deviation is reported as uncertainty in the form of tolerance limits (± range) on the average value. Data extracted as a range of values were excluded from the calculations unless expert judgement could identify precise data points within the range. These statistical analyses may be indicative of the amount of uncertainty related to different instrumental techniques or other experimental differences between the studies used to generate the data. Additional sources of uncertainty in these reported physical and chemical values may be inherent to the measurement of the data point itself; for example, sources of uncertainty or measurement error related to the instrumental method, precision with which a data point is measured and reported in the data source. Finally, all data were assumed to be collected under standard environmental conditions (*i.e.*, 20–25 °C and 760 mmHg) unless otherwise specified.

3 ENVIRONMENTAL FATE AND TRANSPORT OF 1,2-DICHLOROETHANE

3.1 Evidence Integration for Fate and Transport Properties

Systematic review yielded relatively few available data for fate endpoints as compared to amount of data available for the physical and chemical property endpoints. Therefore, studies with an overall data quality determination of medium were considered alongside those rated high for use in determining the representative fate properties of 1,2-dichloroethane for the draft risk evaluation. The available studies are discussed in detail later in this section (see also Table 3-1).

3.2 Selected Fate and Transport Property Values for 1,2-Dichloroethane

Table 3-1. Environmental Fate Characteristics of 1,2-Dichloroethane

Property or Endpoint	Value[a]	Reference(s)	Data Quality Rating
Indirect photodegradation	k_{OH} = 2.09 to 2.54E−13 cm^3/mol-s, 42–51-day half-life (assuming 12-hour day, 1.5E06 ·OH/cm^3)	Taylor et al. (1991), Qiu et al. (1992)	High
Hydrolysis half-life	6.1–72 years half-life	Barbash Je (1989), Jeffers et al. (1989)	High
Biodegradation in groundwater Aerobic conditions	0.8–9 days half-life	Cox et al. (2000), Cox et al. (1998)	High Medium
Biodegradation in groundwater Nitrate reducing conditions	1–10 days half-life	Cox et al. (2000), Gerritse et al. (1999)	High
Biodegradation in groundwater Reducing conditions	33–843 days half-life	Huff et al. (2000); Henderson et al. (2007); Cox et al. (2000)	High
	58–11,242 days half-life	Lee et al. (1999); Ravi et al. (1998); Nobre and Nobre (2004); Bosma et al. (1998); Mayer (2006)	Medium
Biodegradation in river water or wetland sediments Aerobic conditions	No degradation detected in 4.5 days and 12 months	Mudder (1981), van der Zaan et al. (2009)	High
Biodegradation in river water or wetland sediments Reducing conditions	No degradation detected in 12 months	van der Zaan et al. (2009)	High
Biodegradation in river water or wetland microcosms Reducing conditions	6–51.5 days half-life	van der Zaan et al. (2009), Peijnenburg et al. (1998), Jafvert and Lee Wolfe (1987)	High

Property or Endpoint	Value[a]	Reference(s)	Data Quality Rating
Biodegradation in soil Aerobic conditions	6 to >28 days half-life	Watwood et al. (1991), Olaniran et al. (2011)	High
Biodegradation in soil Anaerobic conditions	>28 days half-life	Watwood et al. (1991)	High
Bioconcentration factor (BCF)	2–4.4[b] L/kg	Barrows et al. (1980), OECD (2002), U.S. EPA (2012a)	High
Bioaccumulation factor (BAF)	3.78 L/kg[b]	U.S. EPA (2012a)	High
Soil organic carbon:water partition coefficient (Log K_{OC})	1.3–1.77	Valsaraj et al. (1999), Wilson et al. (1981), Wefer-Roehl et al. (2001)	High
Octanol:air partition coefficient (Log K_{OA})	2.7± 0.2@ 25 °C	Lei et al. (2019)	High
Air:water partition coefficient (Log K_{AW})	−1.201[b]	U.S. EPA (2012a)	High
Removal in wastewater treatment	33–100% removal efficiency	O'Brien (1992), Kincannon et al. (1983), Roy F. Weston Inc (1980), U.S. EPA (1982)	High

[a] Measured unless otherwise noted
[b] Information was estimated using EPI Suite™ (U.S. EPA, 2012a)

3.3 Partitioning

The partition coefficients identified for 1,2-dichlorethane during systematic review indicate 1,2-dichloroethane is expected to have a low tendency to sorb to organic carbon in soil and sediment (log K_{OC} = 1.3–1.77) as well as a low tendency to partition to organic phases over water (log K_{OW} = 1.48). An HLC of 1.54×10^{-3} atm·m^3/mol at 25 °C indicates moderate volatilization from surface water and wet soil surfaces. A vapor pressure of 78.9 mmHg at 25 °C suggests releases to air will remain in air and volatilization is expected from dry soil surfaces as well.

3.3.1 Fugacity Modeling

To inform how environmental releases of 1,2-dichloroethane partition between environmental compartments (air, water, sediment, and soil) the approach described by Mackay et al. 1996 (Mackay et al.) using the Level III Fugacity Model in EPI Suite™ was employed. The model predicts the partitioning of a substance released to an evaluative environment between air, water, soil, and sediment and identifies important intermedia transfer processes. The Level III Fugacity Model is described as a steady-state, non-equilibrium model, which includes the processes of degradation, advection (flow out of the evaluative environment) and intermedia transfer. The model requires fate assessor input for 1,2-dichloroethane physical and chemical properties, releases to each compartment of the evaluative environment, and half-lives in each compartment.

Physical and chemical property inputs were taken from Table 2-1, including boiling point, melting point, HLC, water solubility, vapor pressure, and log K_{OW}. A log K_{OC} of 1.77, which is the high-end of the available range, was selected to model for the highest amount of 1,2-dichloroethane retained in soil. The K_{OC} and K_{OW} values control the partitioning in the water compartment, which comprises water,

suspended sediment, and aquatic biota. Due to the wide range of variability seen with biodegradation data in water, soil, and sediment, a half-life of 365 days was selected for those compartments to model low biodegradation rates. Similarly, a half-life of 51 days was selected for air, which is the high-end of the available range to model conservatively for the slowest rate of removal of 1,2-dichloroethane from the atmosphere.

Release rates were calculated using data reported to Toxic Release Inventory (TRI) in 2018, as presented in the final scope. The release rates used for the fugacity modeling for 1,2-dichloroethane are 90,900 kg/h for air, 700 kg/h for water, and 8,400 kg/h for soil. The model was run for different release scenarios and steady state partitioning percentages are provided in Table 3-2 below. The data for 100 percent release to air, water, and soil show that volatilization is expected to be greater from soil when compared to water, and that fugacity (tendency to escape from a compartment) is lowest for the air compartment. It is important to note that fugacity modeling assumes constant release to environmental compartments so the percent(s) in the medium/media with releases are inflated by the fraction of substance that was just released and has not yet transformed or partitioned into other media. For example, in the TRI release scenario, the percentage of 1,2-dichloroethane remaining in water is expected to be less than 4.91 percent—even if the conditions perfectly match the evaluative environment conditions. Based on release patterns and fugacity calculations, air is expected to be the major environmental compartment of concern for 1,2-dichloroethane. Soil/groundwater, surface water, and sediments are also expected to be compartments of concern for 1,2-dichloroethane.

Table 3-2. EPI Suite™ Level III Fugacity Modeling for 1,2-Dichloroethane Showing Partitioning for Different Media Release Scenarios[a] Assuming Constant Release

Release Scenario	Air (%)	Water (%)	Soil (%)	Sediment (%)
100% Air	97.4	2.06	0.48	0.01
100% Water	16.8	82.8	0.08	0.38
100% Soil	25.2	3.66	71.1	0.02
33% Air, 33% Water, 33% Soil	29.9	38.9	31	0.18
91% Air, 1% Water, 8% Soil (TRI)	77.8	4.91	17.3	0.02

TRI = Toxic Release Inventory
[a] Modeling used half-life values of 51 hours in air, 365 days in water, 365 days in soil, and 365 days in sediment (see Table 3-1).

3.4 Transformation Processes

1,2-Dichloroethane can undergo various transformation processes in environmental media that affect persistence and retention within the environment. Transformation processes include photodegradation, hydrolysis, and biodegradation.

3.4.1 Photodegradation

1,2-Dichloroethane is not expected to undergo significant direct photolysis because it does not absorb radiation in the environmentally available region (>290 nm) of the electromagnetic spectrum that has the potential to result in molecular degradation. 1,2-Dichloroethane will be degraded by reactions with photochemically-produced hydroxyl radicals, the major oxidizing species in the lower atmosphere with a global average concentration of 1.5×10^{6} mol/cm^3 (U.S. EPA, 2012a). Two high-quality experimental studies found the degradation rate constant for the reaction of 1,2-dichloroethane with hydroxyl radical to be 2.54×10^{-13} cm^3/mol-sec (Taylor et al., 1991) and 2.09×10^{-13} cm^3/mol-sec (Qiu et al., 1992), while

the AOPWIN™ model in EPI Suite™ estimated it to be 2.55×10^{-13} cm^3/molecules-second. This is equivalent to a half-life of 42 to 51 days, based on 12 hours of daylight per day. 1,2-Dichloroethane will undergo photo-oxidation in the atmosphere to form formyl chloride, chloroacetyl chloride, hydrochloric acid, carbon monoxide, and carbon dioxide (EC, 1994). 1,2-Dichloroethane is not expected to undergo significant photodegradation in environmental waters (Rathbun, 1998). The uncertainty associated with photodegradation half-lives for 1,2-dichloroethane is low.

3.4.2 Hydrolysis

1,2-Dichloroethane is expected to undergo hydrolysis at a very slow rate in environmental waters with a half-life of 72 years (Jeffers et al., 1989). It can undergo hydrolysis at faster half-lives of 6.1 to 37 years in the presence of phosphate and sodium sulphate (Barbash Je, 1989). Vinyl chloride can form under anaerobic conditions through alkaline hydrolysis (dehydrochlorination) of 1,2-dichloroethane, which at a pH of 7 and temperature of 25 °C, occurs at a rate of 1.04×10^{-11} min^{-1}, equivalent to a half-life of over 120,000 years (Hunkeler et al., 2002; Jeffers et al., 1989). The uncertainty associated with long hydrolysis half-lives for 1,2-dichloroethane is low.

3.4.3 Biodegradation

1,2-Dichloroethane can be degraded to chloroethane and subsequently ethane by reductive dechlorination (Hunkeler et al., 2002; Lee et al., 1999). It can also be degraded directly to ethene through reductive dihaloelimination in anaerobic environments (Cox et al., 2000). Laboratory microcosm studies confirmed that 1,2-dichloroethane can be oxidized to CO_2 under both anaerobic nitrate-reducing and aerobic conditions at 1,2-dichloroethane concentrations exceeding 10 percent of 1,2-dichloroethane solubility (Cox et al., 2000). Transformation products in aerobic environments include ethanol, chloroethanol, chloroacetate, glycolate, and carbon dioxide (Cox et al., 2000). Transformation products in anaerobic environments include vinyl chloride, ethene, ethane, and chloroethane (Hunkeler et al., 2002). Biodegradation references are discussed in more detail below.

Three rivers in Europe were sampled and biodegradation of 1,2-dichloroethane was not detected in the water phase of any of the samples over a 12-month incubation period (van der Zaan et al., 2009). A shake flask test and a modified river-die away test both recorded 0 percent degradation of 1,2-dichloroethane in water over a 4.5- to 24-day period, including a 21-day acclimation period (NCBI, 2020b; OECD, 2002). An Organisation for Economic Co-operation and Development (OECD) method, 301C Ready Biodegradability test (OECD, 1992) for 1,2-dichloroethane, was found in the J-check database maintained by the Japanese National Institute of Technology and Evaluation. 1,2-Dichloroethane was shown to reach 0 percent of its theoretical BOD (biochemical oxygen demand) in 2 weeks using an activated sludge inoculum at 30 mg/L (NCBI, 2020b). Although one study saw biodegradation occur in water, up to 18 percent in 10 days (Price et al., 1974), that study was noted to have some methodological deficiencies (OECD, 2002). Overall, the evidence suggests that aerobic biodegradation will not be a significant removal process of 1,2-dichloroethane from surface water bodies.

1,2-Dichloroethane was observed to biodegrade anaerobically through reductive dechlorination in sediment slurries from a stream in the Netherlands with half-life of 51.5 days (Peijnenburg et al., 1998). A second study found 1,2-dichloroethane was biodegraded in a sediment/water microcosm from a pond near Athens, Georgia, under anoxic conditions with a half-life exceeding 35 days (Jafvert and Lee Wolfe, 1987). A third study measured the biodegradation of 1,2-dichloroethane under different redox conditions (aerobic, nitrate reducing, iron-reducing, sulfate reducing, and methanogenic) in microcosms containing sediment and water sourced from three European rivers (van der Zaan et al., 2009).

The microcosms were incubated for 12 months. 1,2-Dichloroethane was observed to undergo reductive dechlorination in two of the three sediments under methanogenic conditions with a half-life of 38 to 46 days (van der Zaan et al., 2009). Some of the microorganisms responsible for reductive dechlorination in the microcosms include *Dehalococcoides*, *Dehalobacter*, *Desulfitobacterium*, and *Sulfurospirillum* genera and species; however, transformation did not always occur in their presence. One of the samples did not contain any of the tested microorganisms and neither was transformation observed in it at any of the tested redox conditions. In one of two sediments tested, 1,2-dichloroethane underwent biodegradation under iron reducing conditions with a half-life of 15 days. Another one of two sediments tested underwent biodegradation under denitrifying conditions with a half-life of 12 days. No biodegradation was observed in any of the tested sediments under aerobic or sulfate-reducing conditions. This suggests that biodegradation potential of 1,2-dichloroethane in sediment might also be dependent on geochemical properties of the sediment and might not always occur, even in the presence of relevant microorganisms. That study also concluded that the biodegradation capacity was present in the sediment and not in the water phase of the river because transformation was observed in microcosms containing water and sediment but not in microcosms containing only water.

One study evaluated biodegradation in two partially saturated soil samples spiked with 100 ng/g of 1,2-dichloroethane over a period of 4 weeks (Watwood et al., 1991). Under aerobic conditions, 15.1 to 23.9 percent biodegradation was measured after 4 weeks, while only 3.3 to 3.4 percent biodegradation was measured under anaerobic conditions. Higher magnitude of biodegradation was measured in the sandy soil compared to the clay rich soil under both aerobic and anaerobic conditions. A second study measured aerobic biodegradation half-lives for 1,2-dichloroethane of 6 and 9 days in soil/groundwater microcosms containing loam and clay soils, respectively (Olaniran et al., 2011). However, these microcosms were more representative of saturated soils given the volume of water utilized; the slower rates seen in (Watwood et al., 1991) are likely more representative of biodegradation rates in the vadose zone.

Seven field-scale studies identified by systematic review measured biodegradation of 1,2-dichloroethane in groundwater under iron-reducing, sulphate-reducing, or methanogenic conditions, yielding half-lives ranging from 73 to 11,242 days (Henderson et al., 2007; Mayer, 2006; Nobre and Nobre, 2004; Huff et al., 2000; Lee et al., 1999; Bosma et al., 1998; Ravi et al., 1998). Even given the wide ranges of measured half-lives, the rate of biodegradation can be considered slow in all cases. Five sediment/groundwater microcosm studies measured biodegradation rates under iron-reducing, sulphate-reducing, or methanogenic conditions (Henderson et al., 2007; Cox et al., 2000; Gerritse et al., 1999; Lee et al., 1999; Klečka et al., 1998). The measured half-lives ranged from 33 to 843 days. These results are similar to the field-scale measurements, supporting the conclusion that biodegradation of 1,2-dichloroethane in anaerobic groundwater environments will be slow.

Three studies measured the biodegradation of 1,2-dichloroethane in aerobic or nitrate-reducing, sediment-groundwater microcosms. The measured half-lives were much shorter than those measured under anoxic/strongly reducing environments. One study measured a half-life of 10 days under nitrate-reducing conditions in sediment affected by 1,2-dichloroethane from a manufacturing facility (Gerritse et al., 1999). A second study found a half-life of 1 to 6 days under nitrate-reducing conditions in sediment impacted by an industrial landfill (Cox et al., 2000). That same study found a half-life of 2 to 5 days in the same sediment under aerobic conditions. A third study found half-lives of 0.8 to 9 days under aerobic conditions in sediment impacted by a drum storage site containing 1,2-dichloroethane (Cox et al., 1998). Collectively, these studies show that biodegradation can be expected to occur much faster under aerobic or nitrate-reducing conditions where indigenous microbes have been pre-exposed to 1,2-dichloroethane and have, therefore, likely adapted to using 1,2-dichloroethane as a substrate. This

conclusion is supported by an anaerobic enrichment culture study that reported a biodegradation half-life of 1,2-dichloroethane reduction from about 25 days to 1 day in the presence of oxygen or nitrogen electron acceptors (Munro et al., 2017). Under environmental conditions, 1,2-dichloroethane might not degrade rapidly where the indigenous microbes have not had time to adapt to utilizing 1,2-dichloroethane as a substrate. An exception to these findings was presented by a fourth study—an aerobic enzyme assay—that measured relatively long half-lives of 106 to 294 days for 1,2-dichloroethane aerobic biodegradation in groundwater sampled from a leaded gasoline spill at two sites in New Mexico (Reiss and Guerra, 2003). This could highlight the fact that biodegradation of 1,2-dichloroethane in the water phase alone might be expected to occur much slower than when water and aquifer sediment is combined (van der Zaan et al., 2009).

Overall, the extrapolation of degradation rates measured in the laboratory to field rates, differences in environmental conditions such as presence or absence of pre-adapted microorganisms, redox conditions, and geochemical properties, are factors that contribute to the uncertainty associated with expected biodegradation rates of 1,2-dichloroethane in the environment.

3.5 Media Assessments

3.5.1 Air and Atmosphere

1,2-Dichloroethane may be released to the atmosphere by fugitive and stack industrial facility emissions. No high-quality measured data were available for overall environmental persistence and long-range transport potential of 1,2-dichloroethane in air. High-quality measured rates of photodegradation of 1,2-dichloroethane through its reaction with hydroxyl radicals were found in the literature search conducted as part of systematic review for 1,2-dichloroethane (U.S. EPA, 2025j). The data indicate slow photodegradation rates for 1,2-dichloroethane, which suggests persistence in the atmosphere (Section 3.4.1).

The OECD-P_{OV} and LRTP Screening Tool (Version 2.2) (Wegmann et al., 2009) estimated a P_{OV} for 1,2-dichloroethane of 81 days, a Characteristic Travel Distance (CTD) of 24,255 km, and a Transfer Efficiency (TE) of 10.4 percent when reported releases are made solely to air. A P_{OV} of 81 days suggests that 1,2-dichloroethane will be persistent in the environment. The CTD is the distance from the point of release of the chemical to the point at which the concentration of the chemical has dropped to about 37 percent of its initial value. A CTD of 24,453 km suggests that 1,2-dichloroethane has the potential to undergo long-range transport in the air. Evidence exists of long-range transport in air as 1,2-dichloroethane has been detected far from release sites in the troposphere over the northern Atlantic and Pacific Oceans (EC, 1994; Class and Ballschmiter, 1986). Monitoring information for 1,2-dichloroethane in air is discussed in more detail in the *Draft Environmental Media Concentrations for 1,2-Dichloroethane* (U.S. EPA, 2025f). The TE estimates the percentage of emitted chemical that is deposited to surface media after transport away from the region of release. A TE of 10.4 percent suggests that only about 10 percent of 1,2-dichloroethane emitted to air will be deposited to surface media after transport away from the region of release; thus, wet or dry deposition will not be a major source of concern for 1,2-dichloroethane in the atmosphere. Relative to the overall environmental persistence and LRTP of 10 generic polychlorinated biphenyl (PCB) homologues in the tool's database, 1,2-dichloroethane has lower overall environmental persistence with similar TE and CTD.

3.5.2 Aquatic Environments

EPA relied on high-quality physical and chemical property data in Table 2-1 and Table 3-1 of the draft risk evaluation (*e.g.,* HLC, VP, WS, K_{OW}, K_{OC}) and EPI Suite™ and the Point Source Calculator (PSC) Models (discussed further in the *Draft Environmental Exposure Assessment for 1,2-Dichloroethane* TSD

(U.S. EPA, 2025e)) to inform 1,2-dichloroethane partitioning to sediment and volatilization from water. Conclusions on the biodegradation rates of 1,2-dichloroethane in aquatic environments (aerobic surface water and anaerobic sediment) were informed by the results of OECD Ready Biodegradability tests such as the modified shake test as well as non-guideline aerobic and anaerobic biodegradation studies conducted in sediment and surface water microcosms (Section 3.4.3).

3.5.2.1 Surface Water

1,2-Dichloroethane is expected to undergo hydrolysis at a very slow rate in environmental waters with a half-life of 6.1 to 72 years (Section 3.4.2). Aquatic photodegradation is also not expected to be significant (see Section 3.4.1). A water solubility of 8,600 mg/L at 25 °C suggests that some of the 1,2-dichloroethane released to water will remain in water. An HLC of 1.54×10^{-3} atm-m^3/mol at 25 °C suggests that volatilization will be a significant removal process for 1,2-dichloroethane from surface water. Based on available biodegradation information (Section 3.4.3), 1,2-dichloroethane is not expected to biodegrade in aerobic surface water. Thus, 1,2-dichloroethane could persist in surface water when rate of removal (volatilization) is less than rate of release to water.

3.5.2.2 Sediments

Based on a measured soil organic carbon:water partition coefficient (K_{OC}) of 20.0 to 58.9 (Wefer-Roehl et al., 2001; Valsaraj et al., 1999; Wilson et al., 1981), 1,2-dichloroethane is not expected to bind strongly to suspended and benthic sediment. Rather, it will remain in solution and be mobile in water and sediment porewater. Based on available biodegradation information (Section 3.4.3), 1,2-dichloroethane might degrade slowly in anaerobic sediments. Based on the preceding expectation, 1,2-dichloroethane is not expected to persist in aquatic sediments unless release rates to surface water cause sediment concentrations to exceed biodegradation rates.

3.5.3 Terrestrial Environments

Limited data directly applicable to the fate of 1,2-dichloroethane in soil was found in the literature search conducted as part of systematic review. High-quality studies on the sorption of 1,2-dichloroethane to soil and sediment were used in combination with high-quality physical and chemical properties data described in Section 2.2 and 3.1 of this document (*e.g.*, HLC, VP, WS, K_{OW}), EPI Suite™, and the Hazardous Waste Delisting Risk Assessment Software (DRAS) to inform the fate assessment of 1,2-dichloroethane in soil and groundwater. DRAS is discussed further in the *Draft Environmental Exposure Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025e).

Two studies on the biodegradation of 1,2-dichloroethane conducted in laboratory groundwater and soil systems were used to inform the potential rates of biodegradation in soils. One demonstrated aerobic biodegradation half-lives on the order of days while the other study measured half-lives exceeding 4 weeks in both aerobic and anaerobic soil. The soil biodegradation studies are discussed further in Section 3.4.3 of this draft TSD.

Conclusions on the biodegradation rates of 1,2-dichloroethane in anaerobic groundwater were informed by three studies identified during systematic review and another six identified after systematic review. Conclusions on its biodegradation rates in aerobic groundwater were informed by one study identified during systematic review and two post-systematic review studies. These studies demonstrate slow biodegradation of 1,2-dichloroethane in methanogenic, sulphate-, or iron-reducing environments and rapid biodegradation in aerobic or nitrate-reducing environments. The groundwater biodegradation studies are discussed further in Section 3.4.3.

Limited data directly applicable to the fate of 1,2-dichloroethane in landfills and landfill leachate plumes

were found in the literature search conducted as part of systematic review. High-quality studies on the sorption of 1,2-dichloroethane to soil and sediment were used in combination with high-quality physical and chemical properties data described in Section 2 of this document (*e.g.*, HLC, VP, WS, K_{OW}, K_{OC}), and DRAS to inform the fate assessment of 1,2-dichloroethane in landfills, landfill leachate plumes, and groundwater. Because data on the biodegradation of 1,2-dichloroethane in landfills and landfill leachate plumes were not found, studies on the biodegradation of 1,2-dichloroethane conducted in laboratory groundwater systems were used to inform the potential rates of biodegradation. The studies are discussed further in Section 3.4.3. Those studies demonstrated slow biodegradation of 1,2-dichloroethane in anaerobic groundwater; therefore, it is assumed that the biodegradation rates of 1,2-dichloroethane in landfills and landfill leachate plumes will be similar.

3.5.3.1 Soil

Measured soil organic carbon partition coefficients of 20.0 to 58.9 (Wefer-Roehl et al., 2001; Valsaraj et al., 1999; Wilson et al., 1981) for 1,2-dichloroethane indicates it will have a low affinity for organic matter in soil; therefore, 1,2-dichloroethane will likely be subject to migration in water through surface soil and unlined landfills to groundwater. 1,2-Dichloroethane releases to soil surfaces might also be subject to volatilization from wet and dry soils based on its HLC (0.00154 atm-m^3/mol) and vapor pressure (78.9 mmHg), respectively. 1,2-Dichloroethane is expected to be bioavailable in soil porewater due to its water solubility of 8,600 mg/L.

3.5.3.2 Groundwater and Aquifer Sediment

Releases of 1,2-dichloroethane to land (*e.g.*, via landfills without adequate leachate controls) might migrate through soil and reach groundwater. Measured soil organic carbon partition coefficients of 20 to 58.9 for 1,2-dichloroethane indicate it will have a low affinity for organic matter in groundwater and will remain mostly in solution. 1,2-Dichloroethane has a hydrolysis half-life of approximately 6.1 to 72 years (Barbash Je, 1989; Jeffers et al., 1989), which means that loss of 1,2-dichloroethane from groundwater through hydrolysis is not expected. Losses of 1,2-dichloroethane from groundwater will be mainly due to biodegradation, which are expected to be slow except for biodegradation in aerobic or nitrate-reducing condition (see Section 3.4.3).

1,2-Dichloroethane has been detected in groundwater near facilities releasing 1,2-dichloroethane (Gerritse et al., 1999; Cox et al., 1998; Klečka et al., 1998), areas impacted by leaded gasoline spills (Henderson et al., 2007; Mayer, 2006; Reiss and Guerra, 2003), as well as groundwater impacted by landfill leachate (Cox et al., 2000; Klečka et al., 1998). More details of 1,2-dichloroethane in groundwater can be found in the *Draft General Population Exposure Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025g).

1,2-Dichloroethane can be formed from anaerobic biodegradation (hydrogenolysis) of PCA, forming 1,1,2-trichloroethane (1,1,2-TCA) and subsequently 1,2-dichloroethane (Lorah et al., 1997). Thus, there is uncertainty as to whether the presence of 1,2-dichloroethane in terrestrial environments result from the release and anaerobic biodegradation of parent compounds (PCA or 1,1,2-TCA) or from the direct release of 1,2-dichloroethane itself.

Some factors that have been shown to influence biodegradation rates in groundwater include the presence of indigenous microorganisms capable of utilizing 1,2-dichloroethane as a carbon source for growth, groundwater redox conditions, and exposure histories (Munro et al., 2017; Klečka et al., 1998). Groundwater concentrations resulting from releases of 1,2-dichloroethane to land under the TSCA COUs are discussed in detail in the *Draft General Population Exposure Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025g).

3.5.3.3 Landfills

Landfill leachate is generated by excess rainwater percolating through the waste layers of a landfill. Pollutants such as 1,2-dichloroethane can be transferred from the landfilled waste material to the percolating leachate through combined physical, chemical, and microbial processes (Christensen et al., 2001). Compounds in leachate entering an aquifer will be subject to dilution as the leachate mixes with the groundwater. 1,2-Dichloroethane does not appreciably bind to aquifer suspended solids and biodegradation can be slow; thus, dilution might be the only attenuating factor. Due in part to slow groundwater flow rates and complex (tortuous) flow paths, contaminants such as 1,2-dichloroethane can form plumes. Concentrations in a plume might vary but are generally highest in the center of the plume and closest to the source and decrease with distance from the source.

No studies that measured the concentration of 1,2-dichloroethane in landfill leachate in the United States were found through systematic review. One study found after systematic review reported zero to trace amounts of 1,2-dichloroethane in five samples of landfill leachate; however, 1,2-dichloroethane was not found in any groundwater samples (Schrab et al., 1993) with a detection limit of 2 to 5 µg/L.

According to TRI reporting, over 16,000 lb/year of 1,2-dichloroethane was disposed to a single Resource Conservation and Recovery Act (RCRA) Subtitle C landfill (hazardous waste landfill) between 2015 and 2020. For other classes of landfills, over 9,000 lb of 1,2-dichloroethane were released to a single landfill. The required design and operating procedures of Subtitle C landfills minimize the movement of leachate from the landfill; however, releases of 1,2-dichloroethane to landfills with faulty or inadequate leachate controls might migrate through soil and reach groundwater.

To evaluate the significance of landfills as an exposure pathway, leachate-impacted groundwater concentrations of 1,2-dichloroethane were estimated using DRAS (U.S. EPA, 2020b). That software performs a multi-pathway and multi-chemical risk assessment to evaluate the acceptability of a waste to be disposed of in a Subtitle D landfill or surface impoundment instead of under RCRA Subtitle C requirements. For landfills, DRAS models a mismanagement scenario at an unlined Subtitle D landfill where releases to groundwater are not controlled and 30 days of waste is always left uncovered at the surface, subject to air emission and runoff. EPA used the estimated 1,2-dichloroethane groundwater concentrations resulting from leachate contamination to make an initial determination of the importance of the landfill leachate groundwater exposure pathway. Modeling using DRAS represents a high-end exposure scenario and was done to help characterize the land pathways and does not necessarily represent likely scenarios. Further discussion and details of the landfill modeling are provided in the *Draft General Population Exposure Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025g).

As noted in Section 3.5.3.2 above, 1,2-dichloroethane can form as a degradation product of some higher chlorinated solvents such as 1,1,2-trichloroethane (Huff et al., 2000), which can introduce uncertainty in assessing the source of 1,2-dichloroethane in landfill leachate or leachate impacted groundwater.

3.6 Persistence Potential of 1,2-Dichloroethane

Based on the studies described in Section 3.5, 1,2-dichloroethane is expected to be persistent in air based on its atmospheric oxidation half-life of 42 to 51 days and groundwater where biodegradation half-lives of months or greater are expected depending on environmental conditions. There is uncertainty associated with persistence of 1,2-dichloroethane in surface water, depending on actual release rates and volatilization rates. There is also uncertainty associated with persistence in soil based on limited data availability.

3.6.1 Destruction and Removal Efficiency

Incineration of waste 1,2-dichloroethane from industrial activities is expected to occur at hazardous waste incinerators at a Destruction and Removal Efficiency (DRE) of 99.99 percent. Regulations at 40 CFR part 63, Subpart EEE – National Emission Standards for Hazardous Air Pollutants from Hazardous Waste Combustors, require all hazardous waste combustors (incinerators, cement kilns, lightweight aggregate kilns, solid fuel boilers, liquid fuel boilers, and hydrochloric acid production furnaces) to achieve a DRE of 99.99 percent for each principal organic hazardous constituent (POHC), including 1,2-dichloroethane.

3.6.2 Removal in Wastewater Treatment

Based on an HLC of 0.00154 atm·m^3/mol, the removal of 1,2-dichloroethane during activated sludge wastewater treatment is expected to be mainly by volatilization. It is not readily biodegradable in water (Section 3.4.3) so significant biodegradation is not expected to occur during wastewater treatment. Because 1,2-dichloroethane has moderate water solubility (8,600 mg/L), although volatilization from wastewater will occur, a portion of 1,2-dichloroethane may remain in the wastewater and be discharged with the effluent.

Three studies found through the systematic review process recorded measured waste treatment removal efficiencies for 1,2-dichloroethane exceeding 90 percent (O'Brien, 1992; Kincannon et al., 1983; Roy F. Weston Inc, 1980). An activated sludge wastewater treatment plant in Iran measured 99 percent removal rate of 1,2-dichloroethane (Shokrollahzadeh et al., 2008). A completely mixed continuous flow activated sludge reactor achieved 98.6 percent removal of 1,2-dichloroethane in wastewater, mainly by stripping (99%). Adsorption was shown to remove 1 percent and biodegradation, 0 percent (Kincannon et al., 1983), respectively.

The removal efficiency of 1,2-dichloroethane from wastewater was measured in 6 of 50 wastewater treatment plants using activated sludge treatment in the EPA 40 POTW [publicly owned treatment works] Study (U.S. EPA, 1982). The minimum observed removal was 33 percent and the maximum 100 percent with a mean of 75.5 percent and a median of 89.5 percent for the six plants. The removal rate was above 90 percent in three of the six plants.

For comparison, the Sewage Treatment Plant (STP) Model in EPI Suite™ (U.S. EPA, 2012a) was run using the physical and chemical properties reported in Table 2-1. The biodegradation half-life was set to 10,000 hours to simulate a scenario with no biodegradation of the chemical during treatment. The model predicted 39.6 percent overall removal with 38.3 percent attributable to volatilization and 1.3 percent by sorption to activated sludge.

The uncertainty in wastewater treatment removal efficiencies for 1,2-dichloroethane is high, given the measured data range of 33 to 100 percent and the value of 39.6 percent estimated using EPI Suite™. In this section EPA presented a range of removal values to characterize the range of observed and predicted removal rates; however, these removal rates are not used in the exposure assessments because EPA is relying on reported DMR data, which accounts for wastewater treatment removal efficiency, with the exception of the byproducts assessment, which uses a conservative screening analysis for exposures via surface water (see the *Draft Byproducts Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025a)). The estimated value of 39.6 percent was used as a conservative factor in the screening analysis for the byproducts assessment (U.S. EPA, 2025a).

3.6.3 Removal in Drinking Water Treatment

Drinking water in the United States is typically sourced from surface water bodies (*i.e.*, lakes, rivers, and

reservoirs) as well as groundwater. The source water flows or is pumped to a treatment plant where it undergoes a series of filtration and treatment steps before being distributed to homes and communities. In the United States, public water systems often use conventional treatment processes that include coagulation, flocculation, sedimentation, filtration, and disinfection, as required by law and regulations.

Traditional water treatment methods, such as coagulation, sedimentation, filtration, and chlorination, typically have minimal impact on lowering volatile organic compounds (VOCs) concentrations in drinking water. Studies have indicated that conventional treatment processes can reduce 1,2-dichloroethane levels by 0 to 29 percent. However, part of this reduction might result from unintentional volatilization during the treatment process (U.S. EPA, 1994, 1989; Love et al., 1982). The EPA Drinking Water Treatability Database (TDB) (U.S. EPA, 2025k) lists aeration and air stripping as well as granular activated carbon (GAC) as processes able to remove *cis*-1,2-dichloroethylene at an efficiency exceeding 80 percent to concentrations below 10 µg/L. Due to its similar HLC, 1,2-dichloroethane is also expected to be efficiently removed by air stripping technologies. GAC can also remove 1,2-dichloroethane in drinking water (Speth, 1988). Based on the forgoing references, the uncertainty associated with drinking water treatment removal efficiencies of 1,2-dichloroethane is high because removal efficiencies can range from low to high depending on treatment method used.

3.7 Bioaccumulation Potential of 1,2-Dichloroethane

One reference was found on the bioconcentration potential of 1,2-dichloroethane. It measured a BCF of 2 L/Kg in whole fish in a flowthrough system for 14 days (Barrows et al., 1980). In comparison, the EPI Suite™ BCF/BAF model (Version 4.1) (U.S. EPA, 2012a) estimated BCF and upper-trophic BAF values of 4.4 and 3.78, respectively. A full discussion of the performance of the BCF/BAF estimation methods used in EPI Suite™ is available in the help files. The data suggest 1,2-dichloroethane does not meet criteria to be considered bioaccumulative (BCF/BAF > 1,000) (Federal Register, 1999).

An alternative to estimating BCF and BAF values with EPI Suite™ is the use of EPA's Office of Water methodology for deriving bioaccumulation factors intended to develop BAFs for setting national water quality criteria (U.S. EPA, 2003). Procedure #3 for chemicals classified in that methodology as nonionic organic chemicals with low hydrophobicity (log K_{OW} < 4) and low susceptibility to metabolic transformation was used to calculate BAF values for upper trophic level fish of 2.6 L/kg tissue. This value is in general agreement with the EPI Suite™ predicted BAF value of 3.78 and suggests low likelihood for bioaccumulation of 1,2-dichloroethane. The uncertainty associated with the bioconcentration/bioaccumulation potential of 1,2-dichloroethane is low, as both measured and estimated values show similar bioaccumulation potential.

3.8 Overall Fate and Transport of 1,2-Dichloroethane

Based on the pattern of releases reported to TRI between 2015 to 2020, most of the releases of 1,2-dichloroethane to the environment were made to air. A relatively high vapor pressure (78.9 mmHg) and HLC (0.00154 atm m^3/mol) suggest that 1,2-dichloroethane will remain in air and will volatilize from both moist and dry soil, as well as from water surfaces. Photodegradation in air is not expected to be rapid ($t_{1/2}$ = 42–51 days). Thus, air is expected to be the major pathway of concern for 1,2-dichloroethane. Based on an estimated octanol-air partition coefficient (K_{OA}) of 501.2 (U.S. EPA, 2012a), because 1,2-dichloroethane is not expected to associate with airborne particulates, dry deposition from air is not expected. Due to its slow photodegradation rate, it has the potential to undergo long-range transport in air. Evidence of long-range transport in air exists as 1,2-dichloroethane was detected in the troposphere over remote areas of the northern Atlantic and Pacific Oceans (Class and Ballschmiter, 1986). Concentrations of up to 80 ng/m^3 have been measured in ambient air within the United States between 2006 to 2015 (see *Draft Environmental Media Concentrations for 1,2-*

Dichloroethane (U.S. EPA, 2025f)).

Hydrolysis in environmental waters is not expected to be a significant transformation process for 1,2-dichloroethane based on a measured half-life of 6.1 to 72 years (Barbash Je, 1989; Jeffers et al., 1989). Three standardized tests all show that 1,2-dichloroethane fails the ready-biodegradability test including a modified shake flask test with a 21-day acclimation period followed by a 5 to 9 day incubation period, a modified shake flask test with a 24-day incubation period, a modified river die-away test with a 21-day acclimation period and a 5 day incubation period, and a 28-day Japanese MITI (Ministry of International Trade and Industry) test (NCBI, 2020b; OECD, 2002; Dow Chemical, 1990). The results of these studies suggest that biodegradation in surface water will not be significant. Given its high HLC, volatilization is expected to be a more important process than biodegradation in the fate of 1,2-dichloroethane in environmental waters. Based on a measured K_{OC} of 20.0 to 58.9 (Wefer-Roehl et al., 2001; Valsaraj et al., 1999; Wilson et al., 1981), 1,2-dichloroethane in aquatic environments is not expected to bind strongly to suspended and benthic sediment. 1,2-Dichloroethane is expected to be mobile in the environment and can leach into groundwater. It will undergo anaerobic biodegradation through reductive dechlorination to yield transformation products, including vinyl chloride, ethene, ethane, and chloroethane (Hunkeler et al., 2002); transformation products in aerobic aquatic environments include ethanol, chloroethanol, chloroacetate, glycolate, and carbon dioxide (Cox et al., 2000). 1,2-Dichloroethane concentrations of up to 0.5 µg/L have been measured in U.S. surface waters between 2015 to 2020 (*Draft Environmental Media Concentrations for 1,2-Dichloroethane* (U.S. EPA, 2025f)).

1,2-Dichloroethane is expected to volatilize from moist soil surfaces given its HLC of 0.00154 atm m^3/mol (NIST, 2022). It can easily be dissolved into soil pore water based on a water solubility of 8,600 mg/l (Rumble, 2018b) and reach groundwater due to its relatively low affinity for soil organic matter as indicated by an K_{OC} of 20.0 to 58.9 (Wefer-Roehl et al., 2001; Valsaraj et al., 1999; Wilson et al., 1981). Biodegradation in soil has been shown to occur with a half-life of weeks to months (Olaniran et al., 2011; Watwood et al., 1991); however, a half-life of months is more likely under unsaturated conditions. Instead, volatilization will likely be a more significant removal process of 1,2-dichloroethane from soil at shallow depths. Concentrations of up to 240 µg/L have been measured in groundwater within the United States between 1982 to 2011 with a detection frequency of 23 percent or less (*Draft Environmental Media Concentrations for 1,2-Dichloroethane* (U.S. EPA, 2025f)). No monitoring studies were found documenting concentrations of 1,2-dichloroethane in U.S. soils.

Given the relatively high HLC of 0.00154 atm-m^3/mol at 25 °C, volatilization is expected to be the major means of removal of 1,2-dichloroethane during wastewater treatment. Biodegradation in sludge is not expected to be a significant process (Kincannon et al., 1983). Sorption to sludge is also not expected to be a significant removal process given the low K_{OC} value of 20.0 to 58.9. No recent data were found on 1,2-dichloroethane concentrations in biosolids. 1,2-Dichloroethane was not included on the master list of chemicals found in biosolids compiled from Biennial Reviews and Sewage Sludge Surveys. As discussed in Section 3.6.2, only about 1 percent of 1,2-dichloroethane is expected to be removed by sorption in biological wastewater treatment based on its K_{OC} value. Thus, due to low sorption of 1,2-dichloroethane to solids and the high potential for volatilization, exposure to 1,2-dichloroethane through contact with land applied biosolids (treated wastewater sludge) is not expected to be a significant exposure pathway.

Overall, 1,2-dichloroethane meets the criteria for being described as persistent in the environment based on low degradation rates under most environmental conditions but does not meet the criteria for being categorized as bioaccumulative (Federal Register, 1999).

Figure 3-1 below is a pictorial description of the fate and transport of 1,2-dichlooethane in the environment.

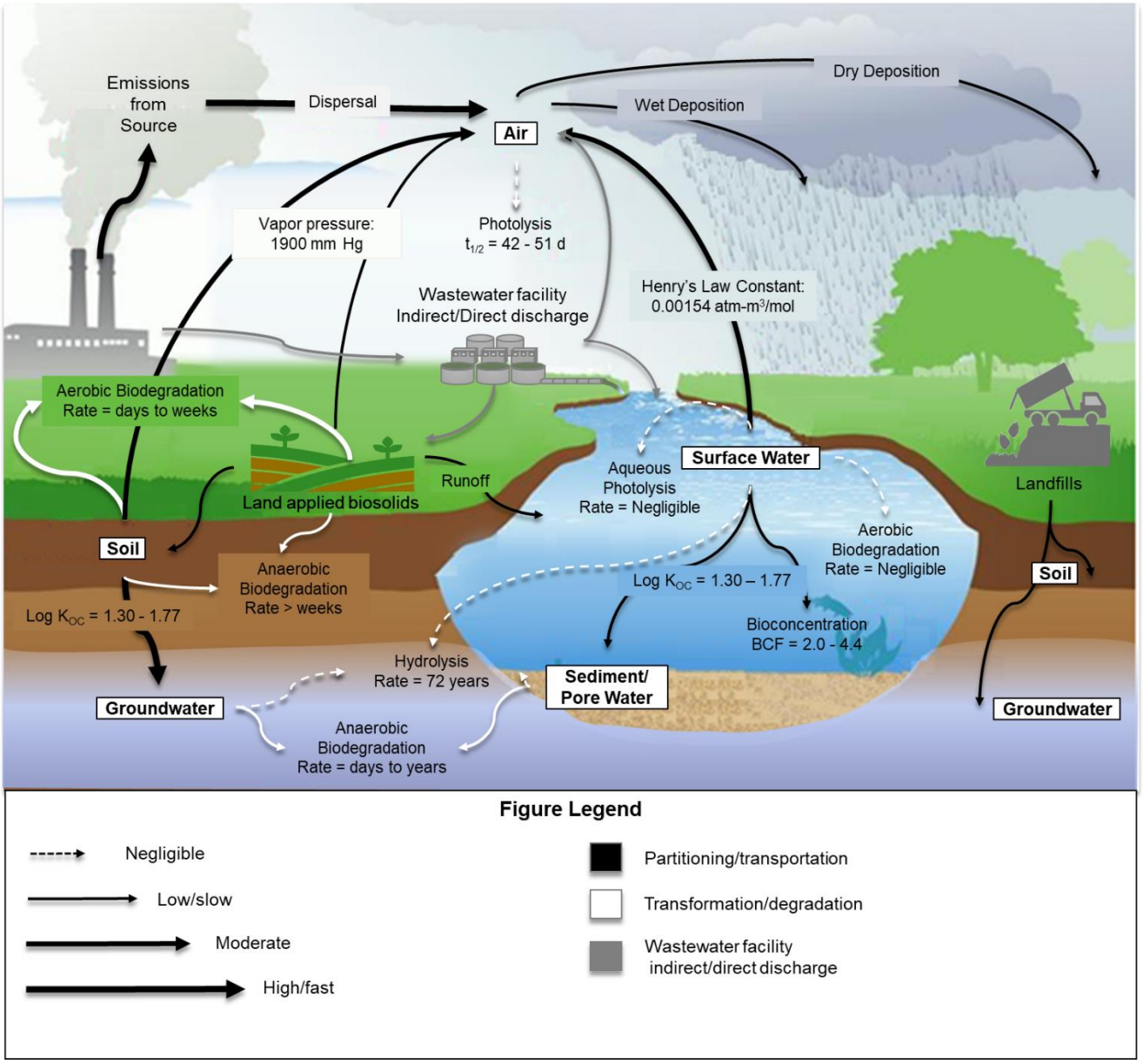

Figure 3-1. Transport, Partitioning, and Degradation of 1,2-Dichloroethane in the Environment
The diagram depicts the distribution (grey arrows), transport and partitioning (black arrows), as well as the transformation and degradation (white arrows) of 1,2-dichloroethane in the environment. The width of the arrow is a qualitative indication of the likelihood that the indicated partitioning will occur or the rate at which the indicated degradation will occur (*i.e.*, wider arrows indicate more likely partitioning or more rapid degradation).

4 WEIGHT OF SCIENTIFIC EVIDENCE CONCLUSIONS FOR 1,2-DICHLOROETHANE

4.1 Strengths, Limitations, Assumptions, and Key Sources of Uncertainty for Physical and Chemical Properties

Overall, there is little uncertainty in the physical and chemistry data and analyses presented. Additional sources of uncertainty in these reported physical and chemical property values may be inherent to the measurement of the data point itself; for example, sources of uncertainty or measurement error related to the instrumental method and precision with which a data point is measured and reported in the data source. Finally, all data was assumed to be collected under standard environmental conditions (*i.e.*, 20–25 °C and 760 mmHg) unless otherwise specified.

4.2 Weight of Scientific Evidence for Fate and Transport

Evaluation of the weight of scientific evidence conclusions for the fate and transport of 1,2-dichloroethane is shown below and is based on categorization described in the *Draft Systematic Review Protocol Supporting TSCA Risk Evaluations for Chemical Substances* (U.S. EPA, 2021).

Given the consistent results from numerous high-quality studies discussed in Section 3, there is robust evidence of the following:

- 1,2-Dichloroethane is not expected to undergo significant direct photolysis but will undergo indirect photodegradation by reacting slowly with hydroxyl radicals in the atmosphere with a half-life of 42 to 51 days.
- 1,2-Dichloroethane is expected to hydrolyze very slowly in water.
- 1,2-Dichloroethane is not expected to biodegrade in surface water or sediments under aerobic conditions.
- Under certain conditions, 1,2-dichloroethane can biodegrade rapidly. Those conditions include groundwater under aerobic or nitrate-reducing conditions and with previous exposure to 1,2-dichloroethane, appropriate microbes, and/or in the presence of nutrients and supplemental substrates such as acetate, toluene, or benzene.
- 1,2-Dichloroethane is not expected to sorb to soil/sediment particles and therefore has the potential to reach groundwater.
- 1,2-Dichloroethane is not expected to partition to organic matter in the air and therefore will not undergo dry or wet deposition.
- 1,2-Dichloroethane is expected to have low bioaccumulation potential in aquatic and terrestrial organisms.
- 1,2-Dichloroethane is expected to be removed during wastewater treatment processes mainly through a combination of volatilization and biodegradation; however, while the concentrations of 1,2-dichloroethane are likely to be low in biosolids due to volatilization during the treatment process, there is uncertainty regarding the concentrations in biosolids that could be land applied because of a lack of monitoring data.

As a result of limited studies identified, there is moderate evidence of the following:

- 1,2-Dichloroethane is expected to undergo long-range transport in air due to its slow photodegradation rate in air.
- 1,2-Dichloroethane is expected to biodegrade rapidly in soils.

- Except under specific circumstances, 1,2-dichloroethane is expected to generally biodegrade slowly under reducing conditions in groundwater.
- 1,2-Dichloroethane is expected to enter groundwater from unlined or improperly managed landfills.
- 1,2-Dichloroethane is expected to have low removal rates from conventional drinking water treatment systems but may be highly removed by other advanced treatment technologies (*e.g.*, low profile aeration).

4.2.1 Strengths, Limitations, Assumptions, and Key Sources of Uncertainty for the Fate and Transport Assessment

Partitioning of 1,2-dichloroethane in the environment was informed by the Level III Fugacity Model in EPI Suite™. The assumptions, applicability, domain, and accuracy of the EPI Suite™ model are discussed in the help files. Inputs to the Level III Fugacity Model include half-lives in various media, physical and chemical properties, and emissions to air, water, and soil. Model results are significantly impacted by uncertainties in half-lives. However, based on current release patterns with greater than 90 percent released to air, the uncertainty associated with the fugacity modeling results are low because the uncertainty associated with degradation of 1,2-dichloroethane in air is low.

Uncertainty in rates of biodegradation and volatilization are key sources of uncertainty in the fate assessment for aquatic and terrestrial environments. There is a wide range of biodegradation half-lives from available studies such that biodegradation within a given compartment can occur rapidly or slowly depending on environmental factors. Volatilization of 1,2-dichloroethane from surface water, soil, and landfills is a complex process. Although the importance of the process is qualitatively addressed in this draft assessment, because quantitative estimates were not made, volatilization may have been underestimated or overestimated. In addition, conclusions about persistence of 1,2-dichloroethane in water and soil were also based upon biodegradation and volatilization rates, thus introducing uncertainty into those conclusions. Finally, many of the reviewed studies consist of laboratory studies; as such, extrapolating rates of biodegradation observed in the laboratory study to field biodegradation rates introduces uncertainty.

5 CONCLUSIONS

Based on the high release amounts of 1,2-dichloroethane to air and low photodegradation rates, air is expected to be a major pathway of exposure. A high-water solubility and low sorption potential also means the water and land pathways could also be significant when directly released to those media.

Based on the preceding conclusions, the human health risk assessment focuses on inhalation risk from exposure to 1,2-dichloroethane in air as well as oral and dermal risk from exposure to water. See *Draft General Population Exposure Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025g), *Draft Occupational Exposure Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025h), and *Draft Consumer Exposure Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025b) for details.

The environmental risk assessment will assess risk to terrestrial and aquatic organisms from exposure to 1,2-dichloroethane in the water. The risk to terrestrial organisms from exposure to 1,2-dichloroethane in air via deposition to soil was also assessed. See *Draft Environmental Exposure Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025e) for details.

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