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Draft Environmental Exposure Assessment for 1,2-Dichloroethane

Technical Support Document for the Draft Risk Evaluation

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KEY ABBREVIATIONS AND ACRONYMS

AERMOD	AMS/EPA Regulatory Model
AUF	Area use factor
BAF	Bioaccumulation factor
BCF	Bioconcentration factor
COC	Concentration of concern(
COU	Condition of use
E-FAST	Exposure and Fate Assessment Screening Tool
EPA	Environmental Protection Agency (U.S.)
FIR	Feed intake rate
NEI	National Emissions Inventory
OES	Occupational exposure scenario
RQ	Risk quotient
SIR	Soil or sediment intake rate
SSL	Soil screening levels
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act
TSD	Technical support document
U.S.	United States
VVWM-PSC	Variable Volume Water Mode – Point Source Calculator
WIR	Water intake rate
ww	Wet weight
7Q10	The lowest 7-day average flow that occurs (on average) once every 10 years

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Docket

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Disclaimer

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SUMMARY

This draft technical support document (TSD) accompanies the Toxic Substances Control Act (TSCA) *Draft Risk Evaluation for 1,2-Dichloroethane* (also called the "draft risk evaluation") (U.S. EPA, 2025e) and describes the environmental exposures through surface water, sediment, soil, air, and diet (via trophic transfer). Based on the fate and transport and ecological exposure analyses presented in (U.S. EPA, 2025a, d), the main environmental exposure pathways for 1,2-dichloroethane are surface water and air. Although inhalation is not expected to be a significant pathway for ecological exposure, air deposition to soil, followed by uptake of 1,1-dichloroethane through incidental ingestion and uptake by plants, are expected to be significant pathways. Whereas 1,2-dichloroethane exposure also occurs via land application of biosolids, because the quantities are lower than the amount of 1,2-dichloroethane occurring from air deposition to soil, the former pathway was not assessed quantitatively.

Due to the low availability of relevant, real-world biomonitoring data for exposure media or biota, exposures to aquatic and terrestrial species were assessed using modeled data and known maximum facility releases of 1,2-dichloroethane for each condition of use (COU)/occupational exposure scenario (OES). Dietary exposure was assessed via trophic transfer, which is the process by which chemical contaminants can be taken up by organisms through dietary and media exposures and transfer from one trophic level to another. Chemicals can be transferred from contaminated media and diet to biological tissue and accumulate throughout an organisms' lifespan (bioaccumulation) if the chemicals are not readily excreted or metabolized. Through dietary consumption of prey, a chemical can subsequently be transferred from one trophic level to another. If biomagnification occurs, higher trophic level predators will contain greater body burdens of a contaminant compared to lower trophic level organisms.

1,2-Dichloroethane (1) is not expected to be bioaccumulative (bioaccumulation factor [BAF] = 3.78 L/kg; bioconcentration factor [BCF] = 2 to 4.4 L/kg); (2) volatilizes from water (Henry's Law constant [HLC] = 1.54×10^{-3} atm-m^3/mol); (3) is not expected to persist in aquatic sediments unless release rates cause sediment concentrations to exceed biodegradation rates; and (4) might not persist in soil based on its HLC and vapor pressure (78.9 mm Hg). However, 1,2-dichloroethane is expected to have low degradation rates under most environmental conditions, may be continuously released to the environment, and measured concentrations have been reported in aquatic organism tissues. Based on these considerations, dietary exposure is a relevant route of exposure for wildlife.

Assessed aquatic trophic transfer included the ingestion of fish and crayfish by mink (representative aquatic-dependent mammal) and belted kingfishers (representative aquatic-dependent bird). Terrestrial trophic transfer included the ingestion of plants by meadow voles and northern bobwhites (representative herbivores), ingestion of earthworms by short-tailed shrews and American woodcocks (representative insectivores), and ingestion of the representative herbivores and representative insectivores by kestrels (representative avian predator).

The Disposal COU as well as the Manufacturing – domestic manufacture COUs resulted in the highest media concentrations for the surface water pathway and the air deposition to soil pathway, respectively. Estimated surface water concentrations are 4,740 µg/L for a 250-day release scenario and 62,900 µg/L for a 21-day release scenario. Estimated soil and soil porewater concentrations for 95th percentile daily deposition at the 30 m distance from source are 1,982 µg/kg and 910 µg/L, respectively.

1 APPROACH AND METHODOLOGY

There are two major environmental compartments for 1,2-dichloroethane exposures to ecological receptors—soil (from releases to air and subsequent air deposition) and surface water (from releases to water) (see *Draft Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025d)). EPA assessed 1,2-dichloroethane exposures via surface water, sediment, soil, and air, which were used to determine risks to aquatic and terrestrial species (see *Draft Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2025e). The contribution of air releases to exposure was assessed via deposition to soil.

EPA used two models—Variable Volume Water Model – Point Source Calculator (VVWM-PSC) and AMS/EPA Regulatory Model (AERMOD)—to assess the environmental concentrations resulting from the industrial and commercial release estimates. Information on these methods and models is available in the *Draft Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025d). EPA modeled 1,2-dichloroethane surface water, benthic pore water, and sediment concentrations using VVWM-PSC as described in Appendix A.1. Modeled surface water, sediment, and benthic pore water concentrations were used to assess 1,2-dichloroethane exposures to aquatic species. EPA also modeled 1,2-dichloroethane concentrations in soil via air deposition, using AERMOD, near facility (30 m from the source), as described in the *Draft Environmental Release Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025b). The distance of 30 m from source was selected as the most conservative scenario because the highest concentrations occurred at this distance.

EPA used calculated soil concentrations to assess risk to terrestrial species via trophic transfer (see Section 1). Specifically, the Agency based trophic transfer of 1,2-dichloroethane and potential risk to terrestrial animals on modeled air deposition to soil. Potential risk to aquatic-dependent wildlife used surface water and benthic pore water concentrations modeled via VVWM-PSC for each COU in combination with 1,2-dichloroethane fish and crayfish concentrations, using the estimated BCF of 4.4 (*Draft Chemistry and Fate and Transport Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025a)). Exposure factors for terrestrial organisms used within the trophic transfer analyses are presented in Section 4.1. Application of exposure factors and hazard values for organisms at different trophic levels is detailed within Section 4.2 and used equations described in the EPA's *Guidance for Developing Ecological Soil Screening Levels* (U.S. EPA, 2005a).

2 EXPOSURES TO AQUATIC SPECIES

2.1 Measured Concentrations in Aquatic Species

There are limited data available on 1,2-dichloroethane concentrations in fish and other invertebrates. A study in coastal Japan found a concentration of 0.28 µg/g 1,2-dichloroethane in mussels (*Mytilus edulis*), and a similar concentration (0.28 µg/g) of another chlorinated solvent, 1,1,2,2-tetrachloroethane (Yasuhara and Morita, 1987). A study in Lake Pontchartrain in Louisiana found 1,2-dichloroethane concentrations of 0.095 µg/g ww (wet weight) in oysters (*Crassostrea virginica*) and 0.001 to 0.0015 µg/g ww in clams (*Rangia cuneata*) (Ferrario et al., 1985). Other similar chlorinated solvents, including 1,1,1-trichloroethane, 1,1-dichloroethane, and trichloroethylene, reported concentrations of 0.0006 to 0.31 µg/g ww in oysters (*C. virginica* and *C. gigas*) and 0.0008 to 0.16 µg/g ww in clams (*R. cuneata* and *Tapes japonica*), in the same Lake Pontchartrain study as well as in a study in Japan (Gotoh et al., 1992; Ferrario et al., 1985). No reasonably available data on 1,2-dichloroethane concentrations in fish tissue were identified; however, data in fish muscle and liver tissue for other chlorinated solvents ranged from 0.00051 to 0.0049 µg/g for 1,1,1-trichloroethane and 0.00036 to 0.0293 µg/g for trichloroethylene (Roose and Brinkman, 1998).

Because these studies do not include non-detects or detection limits, and do not have many samples per study, the data are insufficient for use in calculating exposure to 1,2-dichloroethane. Additionally, these studies are not associated with known discharges but rather represent distant or ambient exposure. Due to the low amount of animal tissue data as well as the lack of surface water data associated with the concentrations reported above, 1,2-dichloroethane concentrations in fish and crayfish were modeled as described below to estimate exposure.

2.2 Modeled Concentrations in Aquatic Species

2.2.1 Modeled Concentrations Under Normal Conditions

Within the aquatic environment, a tiered approach was employed. Surface water releases were first assessed using methodologies based on EPA's Exposure and Fate Assessment Screening Tool (E-FAST) by comparing surface water concentrations resulting from a 21-day release scenario to the most sensitive concentration of concern (COC), the chronic water-column COC of 480 µg/L. Facilities and associated COUs/OESs with risk quotients (RQs) exceeding from the first tier estimated concentrations then proceeded to second tier modeling in the Variable Volume Water Model – Point Source Calculator (VVWM-PSC; Table 2-1). EPA used VVWM-PSC to estimate maximum daily average 1,2-dichloroethane surface water, benthic pore water and particulate sediment concentrations as described in the *Draft Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025d). The days of exceedance modeled in VVWM-PSC are not necessarily consecutive and could occur throughout a year at different times. Days of exceedance is calculated as the probability of exceedance multiplied by 365 days as described in Appendix A.1. The maximum surface water, benthic pore water, and sediment concentrations obtained by modeling over the operating days for each COU that proceeded to Tier II are presented in Table 2-2.

Table 2-1. Occurrence of Releases to Surface Water per COU/OES and Associated Risk Estimation Decisions

COU (Life Cycle Stage/ Category/ Subcategory)	OES	Releases to Surface Water	Tier I RQ >1	Tier II Conducted?
Manufacturing/ Domestic manufacture/ Domestic manufacture	Manufacturing	Yes	Yes	Yes
Manufacturing/ Import/ Import	Repackaging	Yes	No	No
Processing/ Repackaging/ Repackaging				
Processing/ Processing – as a reactant/ intermediate in: petrochemical manufacturing; plastic material and resin manufacturing; all other basic organic chemical manufacturing; all other basic inorganic chemical manufacturing	Processing as a reactant	Yes	Yes	Yes
Processing/ Recycling/ Recycling				
Industrial Use/ Process regulator *e.g.*, catalyst moderator; oxidation inhibitor				
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Fuels and fuel additives: all other petroleum and coal products manufacturing	Processing into formulation, mixture, or reaction product	Yes	Yes	Yes
Processing/ Processing – incorporated into formulation, mixture, or reaction product/processing aids: specific to petroleum production; plastics material and resin manufacturing				
Processing/ Processing – incorporated into formulation, mixture, or reaction product/adhesives and sealants; lubricants and greases; process regulators; degreasing and cleaning solvents; pesticide, fertilizer, and other agricultural chemical manufacturing				
Industrial Use/ Other use/ Process solvent				
Distribution in Commerce/ Distribution in commerce/ Distribution in commerce	Distribution in commerce	No	N/A	N/A
Industrial Use/ Adhesives and sealants/ Adhesives and sealants	Industrial application of adhesives and sealants	No	N/A	N/A
Industrial Use/ Functional fluids (closed systems)/ Heat transferring agent	Heat transferring agent	No	N/A	N/A
Industrial Use/ Lubricants and greases/ Solid film lubricants and greases	Industrial application of lubricants and greases	No	N/A	N/A
Industrial Use/ Solvents (for cleaning and degreasing)/ Degreasing and cleaning solvents	Commercial aerosol products	No	N/A	N/A
	Non-aerosol cleaning and degreasing	Yes	No	No

COU (Life Cycle Stage/ Category/ Subcategory)	OES	Releases to Surface Water	Tier I RQ >1	Tier II Conducted?
Commercial Use/ Plastic and rubber products/ Products such as: plastic and rubber products	Plastic and rubber products	No	N/A	N/A
Commercial Use/ Fuels and related products/ Fuels and related products	Fuels and related products	No	N/A	N/A
Commercial Use/ Other use/ Laboratory chemical	Laboratory use	Yes	No	No
Consumer Use/ Plastic and rubber products/ Plastic and rubber products	N/A	N/A	N/A	N/A
Disposal/ Disposal/ Disposal	Waste handling, disposal, and treatment (WWT)	Yes	Yes	Yes
	Waste handling, disposal, and treatment (POTW)	Yes	Yes	Yes
	Waste handling, disposal, and treatment (Remediation)	Yes	No	No

COU = condition of use; OES = occupational exposure scenario; POTW = publicly owned treatment work; RQ = risk quotient; WWT = wastewater treatment

EPA calculated 1,2-dichloroethane concentrations in fish and crayfish for each COU/OES that proceeded to Tier II (Table_Apx A-3 and Table_Apx A-4). The highest calculated concentrations of 1,2-dichloroethane in fish and crayfish were 21 and 17.996 µg/g, respectively, for the Disposal COU/Waste handling, treatment, and disposal (WWT) OES. The lowest calculated concentrations were 0.092 and 0.084 µg/g for fish and crayfish, respectively, for the Processing into formulation, mixture, or reaction product OES. The lower calculated concentrations are similar to the 1,2-dichloroethane concentration reported in oysters (Ferrario et al., 1985) and the highest reported concentrations of other chlorinated solvents in fish tissues (Roose and Brinkman, 1998). Concentrations of 1,2-dichloroethane in fish were calculated by multiplying the maximum VVWM-PSC modeled surface water concentrations based on the number of operating days per year for each industrial and commercial release scenario (Table_Apx A-3) by the EPI Suite™-generated bioconcentration factor (BCF) of 4.4. Similarly, concentrations of 1,2-dichloroethane in crayfish were calculated by multiplying the maximum VVWM-PSC modeled benthic pore water concentrations based on the number of operating days per year for each industrial and commercial release scenario (Table_Apx A-4) by the estimated BCF of 4.4. These whole fish and crayfish 1,2-dichloroethane concentrations were used within the screening level assessment for trophic transfer described in Section 4.

Table 2-2. Estimated Maximum Concentrations of 1,2-Dichloroethane in Aquatic Media by COU/OES Using Facility Operating Days/Year as the Days of Release

COU (Life Cycle Stage/ Category/ Subcategory)	OES	Facility	Surface Water Concentration (µg/L)	Pore Water Concentration (µg/L)	Sediment Concentration (mg/kg)
Manufacture/ Domestic manufacturing/ Domestic manufacturing	Manufacturing	LAJ660151	3,380	3,260	8,890
Processing/ Processing – as a reactant/intermediate in: petrochemical manufacturing; plastic material and resin manufacturing; all other basic organic chemical manufacturing; all other basic inorganic chemical manufacturing	Processing as a reactant	GAIS00500	387	374	1,020
Processing/ Recycling/ Recycling					
Industrial Use/ Process regulator *e.g.*, catalyst moderator; oxidation inhibitor					
Processing/ Processing – incorporated into formulation, mixture, or reaction product/fuels and fuel additives: all other petroleum and coal products manufacturing	Processing into formulation, mixture, or reaction product	IN0002861	21	19	53
Processing/ Processing – incorporated into formulation, mixture, or reaction product/processing aids: specific to petroleum production; plastics material and resin manufacturing					
Processing/Processing – incorporated into formulation, mixture, or reaction product/adhesives and sealants; lubricants and greases; process regulators; degreasing and cleaning solvents; pesticide, fertilizer, and other agricultural chemical manufacturing					
Industrial Use/ Other use/ Process solvent					
Disposal/ Disposal/ Disposal	Waste handling, disposal, and treatment (WWT)	ARR001968	4,740	4,090	11,200
Disposal/ Disposal/ Disposal	Waste handling, treatment and disposal (POTW)	CA0085235	2,310	2,290	6,240
COU = condition of use; OES = occupational exposure scenario; POTW = publicly owned treatment work; WWT = wastewater treatment					

3 EXPOSURES TO TERRESTRIAL SPECIES

3.1 Measured Concentrations in Terrestrial Species

Only one environmental study was identified which tested for 1,2-dichloroethane or related solvents in terrestrial organisms. This study of urban rats in Oslo, Norway, tested for but did not detect 1,2-dichloroethane and trichloroethylene in the livers of rats (detection limit of 0.02 µg/g dry weight) (COWI AS, 2018).

3.2 Modeled Concentrations in Terrestrial Species

In general, for terrestrial mammals and birds, relative contribution to total exposure associated with inhalation is secondary in comparison to exposures by diet and indirect ingestion. EPA has evaluated the relative contribution of inhalation exposures for terrestrial mammals and birds per the *Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs)* (U.S. EPA, 2003a, b). That guidance shows inhalation is not as important to total exposure as ingestion. Other factors that guided EPA's decision to qualitatively assess 1,2-dichloroethane inhalation exposure to terrestrial receptors at a population level were limited facility releases and the lack of 1,2-dichloroethane inhalation hazard data in terrestrial mammals for ecologically relevant endpoints. Air deposition to soil modeling is described in the *Draft Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025d). EPA determined the primary exposure pathway for terrestrial organisms is through soil, via dietary uptake, and incidental ingestion. As described in the *Draft Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025d), the Integrated Indoor-Outdoor Air Calculator (IIOAC) Model and subsequently AERMOD were used to assess the estimated release of 1,2-dichloroethane to soil via air deposition 30 m from the facility from emissions reported to TRI and NEI. Annual application of biosolids was considered as a potential source of 1,2-dichloroethane in soil as described in the *Draft Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025d). However, the quantities of 1,2-dichloroethane through biosolid application are expected to be negligible (see Section 3.8 of the *Draft Chemistry and Fate and Transport Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025a). Thus, only air deposition was assessed quantitatively. Resulting soil pore water concentrations from daily air deposition were calculated as described in the *Draft Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025d). The maximum soil and soil pore water concentrations resulting from air deposition per OES are reported in Table 3-1.

Terrestrial plants were assessed for exposure to 1,2-dichloroethane soil pore water concentrations, and 1,2-dichloroethane soil and soil pore water concentrations were used for estimating dietary exposure through trophic transfer, as described in the *Draft Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2025e). For trophic transfer, EPA assumed 1,2-dichloroethane concentrations in dietary species *Trifolium* sp. as equal to the 1,2-dichloroethane maximum soil pore water concentrations for daily air deposition to soil (see Table_Apx A-9) and in earthworm (*Eisenia fetida*) as equal to the aggregate of maximum soil and soil pore water concentrations from daily air deposition of 1,2-dichloroethane (see Table_Apx A-9). These are both conservative assumptions because they presume that all 1,2-dichloroethane in the soil is taken up into the organism. The highest concentrations of 1,2-dichloroethane resulting from air deposition to soil in *Trifolium* sp. and earthworms were 1.26 mg/kg and 3.26 mg/kg, respectively, for the Manufacture – domestic manufacturing COU/Manufacturing OES.

Table 3-1. Estimated Maximum Concentrations of 1,2-Dichloroethane from Air Deposition to Soil and Soil Pore Water by COU/OES

COU (Life Cycle Stage /Category/ Subcategory)	OES	Soil (µg/kg)	Soil Pore Water Concentration (µg/L)
Manufacture/ Domestic manufacturing/ Domestic manufacturing	Manufacturing	1,982	910
Manufacturing/ Import/ Import	Repackaging	16	7.2
Processing/ Repackaging/ Repackaging			
Processing/Processing – as a reactant/intermediate in: petrochemical manufacturing; plastic material and resin manufacturing; all other basic organic chemical manufacturing; all other basic inorganic chemical manufacturing	Processing as a reactant	12	5.3
Processing/ Recycling/ Recycling			
Industrial Use/ Process regulator *e.g.*, catalyst moderator; oxidation inhibitor			
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Fuels and fuel additives: all other petroleum and coal products manufacturing	Processing into formulation, mixture, or reaction product	148	68
Processing/ Processing – incorporated into formulation, mixture, or reaction product/processing aids: specific to petroleum production; plastics material and resin manufacturing			
Processing/ Processing – incorporated into formulation, mixture, or reaction product/adhesives and sealants; lubricants and greases; process regulators; degreasing and cleaning solvents; pesticide, fertilizer, and other agricultural chemical manufacturing			
Industrial Use/ Other use/ Process solvent			
Disposal/ Disposal/ Disposal	Waste handling, disposal, and treatment	15	6.8
COU = condition of use; OES = occupational exposure scenario			

4 TROPHIC TRANSFER EXPOSURE

4.1 Trophic Transfer (Wildlife)

Trophic Transfer is the process by which chemical contaminants can be taken up by organisms through dietary and media exposures and be transferred from one trophic level to another. EPA has assessed the available studies collected in accordance with 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 called "Draft Systematic Review Protocol") (U.S. EPA, 2021) and *Draft Risk Evaluation for 1,2-Dichloroethane – Systematic Review Protocol* (U.S. EPA, 2025f) relating to the biomonitoring of 1,2-dichloroethane.

1,2-Dichloroethane is released to the environment by multiple exposure pathways (see *Draft Chemistry and Fate and Transport Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025a). The primary exposure pathway for terrestrial mammals and birds is through diet. On land, deposition of 1,2-dichloroethane from air to soil is the primary exposure pathway for dietary exposure to terrestrial mammals and birds, whereas the primary exposure pathway for aquatic organisms is surface water releases from facilities. Benthic pore water 1,2-dichloroethane concentrations determined by VVMW-PSC modeling based on the COU/OES-specific number of operating days per year (see *Draft Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2025e) are approximately equal to surface water concentrations across all COUs (see *Draft Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025d)—indicating that the exposure to 1,2-dichloroethane through the aquatic dietary exposure pathway for higher trophic levels will occur from consumption of organisms in the water column or in the sediment.

Representative mammal and bird species were chosen to connect the 1,2-dichloroethane transport exposure pathway via terrestrial trophic transfer. Uptake of contaminated soil pore water is connected by the representative plant *Trifolium* sp., through the representative herbivorous mammal meadow vole (*Microtus pennsylvanicus*) and the representative herbivorous bird the northern bobwhite (*Colinus virginianus*), to the American kestrel (*Falco sparverius*). The meadow vole and northern bobwhite were selected to represent herbivores as the majority of their diet consists of plant matter and they are native North American species. *Trifolium* sp. was selected as the representative plant because plants of this genus comprise a significant portion of the meadow vole diet (Lindroth and Batzli, 1984). Uptake of aggregated contaminated soil and soil pore water is connected by the representative soil invertebrate earthworm (*Eisenia fetida*) to the representative insectivorous mammal, short-tailed shrew (*Blarina brevicauda*), and the representative insectivorous bird, the American woodcock (*Scolopax minor*), through to the American kestrel. The short-tailed shrew and American woodcock were selected to represent insectivores as they are highly insectivorous and are native North American species. The earthworm was selected as the representative soil invertebrate because earthworms and other annelids comprise a significant portion of the short-tailed shrew diet (U.S. EPA, 1993). American kestrel was selected as the representative predator because it is a native North American species with a varied diet that includes invertebrates and vertebrates.

Meadow vole primarily feed on plant shoots with a preference for dicot shoots in the summer and fall. When green vegetation is not available, meadow vole will feed on other foods such as seeds and roots. Depending on the location and season, dicot shoots may comprise 12 to 66 percent of the meadow vole's diet (U.S. EPA, 1993). Northern bobwhite primarily consume seeds as well as a smaller portion of fruits and green vegetation, with total plant foods comprising 78.7 to 96.8 percent (crop and gizzard volume) of their diet. Short-tailed shrew primarily feed on invertebrates with earthworms comprising approximately 31 percent (stomach volume) to 42 percent (frequency of occurrence) of their diet.

American woodcock primarily feed on invertebrates with a preference for earthworms. When earthworms are not available, other soil invertebrates and a small proportion of vegetation may be consumed. Depending on the location and season, earthworms may comprise 58 to 99 percent of the American woodcock diet. American kestrel have a varied diet that includes invertebrates, mammals, birds, and reptiles. The proportion of prey type will vary by habitat and prey availability. For trophic transfer analysis, the American kestrel diet comprised equal proportions of the three representative prey species, which approximates the dietary composition of the American kestrel winter diet reported by Meyer (1987).

The calculations for assessing 1,2-dichloroethane exposure from soil uptake by plant and earthworm and the transfer of 1,2-dichloroethane through diet to higher trophic levels are presented in Section 4.2; biota concentrations are provided in Table_Apx A-10 and Table_Apx A-11. Because surface water sources for wildlife water ingestion are typically ephemeral, the trophic transfer analysis for terrestrial organisms assumed 1,2-dichloroethane exposure concentration for wildlife water intake are equal to soil concentrations for each corresponding exposure scenario. Because these concentrations also come from a distance relatively close to the release source, this is a conservative assumption.

The representative, semi-aquatic terrestrial mammal species is the American mink (*Mustela vison*), which has a highly variable diet depending on their habitat. In a riparian habitat, American mink derive 74 to 92 percent of their diet from aquatic organisms, which includes fish, crustaceans, birds, mammals, and vegetation (Alexander, 1977). The representative aquatic-dependent avian species is the belted kingfisher (*Megaceryle alcyon*), which is a year-round resident across most of the United States that can typically be found near water. The belted kingfisher primarily consumes fish but also consumes crayfish (U.S. EPA, 1993).

Similar to soil concentrations used for terrestrial organisms, the highest modeled surface water and benthic pore water 1,2-dichloroethane concentration across exposure scenarios were used as surrogates for the 1,2-dichloroethane concentration found in the American mink's and American kestrel's diets in the form of both water intake and a diet of either fish (bioconcentration from surface water) or crayfish (bioconcentration from benthic pore water). For trophic transfer, fish and crayfish concentrations shown in Table_Apx A-3 and Table_Apx A-4, respectively, are used in conjunction with trophic transfer calculations provided below in Section 4.2.

4.2 Trophic Transfer (Dietary Exposure)

EPA conducted screening level approaches for aquatic and terrestrial risk estimation based on exposure via trophic transfer using conservative assumptions for factors such as area use factor (AUF) as well as 1,2-dichloroethane absorption from diet, soil, sediment, and water. This chlorinated solvent has releases to aquatic and terrestrial environments as shown in the *Draft Chemistry and Fate and Transport Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025a). Due to lack of reasonably available measured data, a BCF of 4.4 for 1,2-dichloroethane was estimated using EPI Suite™ (U.S. EPA, 2012). Table_Apx A-3 and Table_Apx A-4 report estimated concentrations of 1,2-dichloroethane within representative fish and crayfish tissue based on the estimated BCF. A screening level analysis was conducted for trophic transfer, which employs a combination of conservative assumptions (*i.e.*, conditions for several exposure factors included within Equation 4-1) and use of the maximum values obtained from modeled and/or monitoring data from relevant environmental compartments.

Following the basic equations as reported in Chapter 4 of the *U.S. EPA Guidance for Developing Ecological Soil Screening Levels* (U.S. EPA, 2005a), wildlife receptors may be exposed to contaminants in soil by two main pathways: incidental ingestion of soil while feeding as well as ingestion of food items that have become contaminated due to uptake from soil. The general equation used to estimate dietary exposure via these two pathways is provided below (Equation 4-1). It was adapted to include consumption of water contaminated with 1,2-dichloroethane, and for semi-aquatic mammals—incidental ingestion of sediment instead of soil (see also Table 4-1).

Exposure factors for food intake rate (FIR) and water intake rate (WIR) were sourced from the EPA's *Wildlife Exposure Factors Handbook* (U.S. EPA, 1993). The proportion of total food intake that is soil (Ps) is represented at the 90th percentile for representative taxa (short-tailed shrew, meadow vole, northern bobwhite, American woodcock, and American kestrel) and was sourced from calculations and modeling in EPA's *Guidance for Developing Ecological Soil Screening Levels* (U.S. EPA, 2005a). The proportion of total food intake that is sediment (Ps) for representative taxa (American mink) was calculated by dividing the sediment ingestion rate (SIR) by food consumption which was derived by multiplying the FIR by the body weight of the mink (sourced from *Wildlife Exposure Factors Handbook* (U.S. EPA, 1993). The SIR for American mink was sourced from calculations in EPA's *Second Five Year Review Report Hudson River PCBs Superfund Site Appendix 11 Human Health and Ecological Risks* (U.S. EPA, 2017). Incidental sediment ingestion is expected to be negligible for belted kingfishers (Tetra Tech, 2018).

Equation 4-1.

$$DE_j = \left(\left[S_j * P_s * \mathrm{FIR} * \mathrm{AF}_{sj}\right] + \left[W_j * AF_{wj} * \mathrm{WIR}\right] + \left[\sum_{i=1}^{N} B_{ij} * P_i * \mathrm{FIR} * \mathrm{AF}_{ij}\right]\right) * AUF$$

Where:

DE_j	=	Dietary exposure for contaminant (*j*) (mg/kg-body weight [bw]/day)
S_j	=	Concentration of contaminant (*j*) in soil or sediment (mg/kg dry weight)
P_s	=	Proportion of total food intake that is soil or sediment (kg soil/kg food; SIR/[(FIR)(bw)])
SIR	=	Sediment intake rate (kg of sediment [dry weight] per day)
FIR	=	Food intake rate (kg of food [dry weight] per kg body weight per day)
AF_{sj}	=	Absorbed fraction of contaminant (*j*) from soil or sediment (*s*) (for screening purposes set = 1)
W_j	=	Concentration of contaminant (*j*) in water (mg/L); assumed to equal soil pore water concentrations for the purposes of terrestrial trophic transfer
AF_{wj}	=	Absorbed fraction of contaminant (*j*) from water (*w*) (for screening purposes set = 1)
WIR	=	Water intake rate (kg of water per kg body weight per day)
N	=	Number of different biota type (*i*) in diet
B_{ij}	=	Concentration of contaminant (*j*) in biota type (*i*) (mg/kg dry weight)
P_i	=	Proportion of biota type (*i*) in diet
AF_{ij}	=	Absorbed fraction of contaminant (*j*) from biota type (*i*) (for screening purposes set = 1)
AUF	=	Area use factor (for screening purposes set = 1)

Table 4-1. Terms and Values Used to Assess Potential Trophic Transfer of 1,2-Dichloroethane for Terrestrial and Aquatic-Dependent Receptors

Term	Earthworm (*Eisenia fetida*)	Short-Tailed Shrew (*Blarina brevicauda*)	American Woodcock (*Scolopax minor*)	*Trifolium* sp.	Meadow Vole (*Microtus pennsylvanicus*)	Northern Bobwhite (*Colinus virginianus*)	American Kestrel (*Falco sparverius*)	American Mink (*Mustela vison*)	Belted Kingfisher (*Megaceryle alcyon*)
P_s	1	0.03 [a]	0.164 [a]	1	0.032 [a]	0.139 [a]	0.057 [a]	5.4E−04 [b]	0 [c]
SIR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.2E−04 [e]	0
FIR	1	0.555 [d]	0.77 [d]	1	0.325 [d]	0.07775 [d]	0.3 [d]	0.22 [d]	0.5 [d]
AF_{sj}	1	1	1	1	1	1	1	1	1
AF_{wj}	1	1	1	1	1	1	1	1	1
WIR	1	0.223 [d]	0.1 [d]	1	0.21 [d]	0.115 [d]	0.115 [d]	0.105[d]	0.11 [d]
N	1	1	1	1	1	1	2 to 3 [g]	1	1
P_i	1	1	1	1	1	1	1	1	1
AF_{ij}	1	1	1	1	1	1	1	1	1
bw	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.0195 kg [f]	N/A
AUF	1	1	1	1	1	1	1	1	1
Highest values based on daily air deposition									
S_j [h]	3.259 mg/kg [i] 1,2-Dichloroethane	3.259 mg/kg [i] 1,2-Dichloroethane	3.259 mg/kg[i] 1,2-Dichloroethane	1.259 mg/kg [j] 1,2-Dichloroethane	3.259 mg/kg [i] 1,2-Dichloroethane	3.259 mg/kg [i] 1,2-Dichloroethane	3.259 mg/kg [i] 1,2-Dichloroethane	N/A	N/A
W_j	1.26 mg/kg [i] 1,2-Dichloroethane	1.26 mg/kg [i] 1,2-Dichloroethane	1.26 mg/kg [i] 1,2-Dichloroethane	1.26 mg/kg [i] 1,2-Dichloroethane	1.26 mg/kg [i] 1,2-Dichloroethane	1.26 mg/kg [i] 1,2-Dichloroethane	1.26 mg/kg [i] 1,2-Dichloroethane	N/A	N/A
B_{ij}	3.3 mg/kg[i] 1,2-Dichloroethane (soil and soil pore water)	3.3 mg/kg 1,2-Dichloroethane (worm)	3.3 mg/kg 1,2-Dichloroethane (worm)	1.3 mg/kg[j] 1,2-Dichloroethane (soil pore water)	1.3 mg/kg 1,2-Dichloroethane (plant)	1.3 mg/kg 1,2-Dichloroethane (plant)	3.3 mg/kg 1,2-Dichloroethane (worm) 1.863 mg/kg 1,2-Dichloroethane (shrew) 2.921 mg/kg 1,2-Dichloroethane (woodcock) 0.443 mg/kg 1,2-Dichloroethane (vole) 0.133 mg/kg 1,2-Dichloroethane (bobwhite)	N/A	N/A
Highest values based on release to surface water									
S_j [h]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11.2 mg/kg [k]	N/A

Term	Earthworm (*Eisenia fetida*)	Short-Tailed Shrew (*Blarina brevicauda*)	American Woodcock (*Scolopax minor*)	*Trifolium* sp.	Meadow Vole (*Microtus pennsylvanicus*)	Northern Bobwhite (*Colinus virginianus*)	American Kestrel (*Falco sparverius*)	American Mink (*Mustela vison*)	Belted Kingfisher (*Megaceryle alcyon*)
								1,2-Dichloroethane	
W_j	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.74 mg/L [l] 1,2-Dichloroethane	4.74 mg/L [l] 1,2-Dichloroethane
B_{ij}	N/A	N/A	N/A	N/A	N/A	N/A	N/A	21 mg/kg [m] 1,2-Dichloroethane (fish)	21 mg/kg [m] 1,2-Dichloroethane (fish)
								18 mg/kg [n] 1,2-Dichloroethane (crayfish)	18 mg/kg [n] 1,2-Dichloroethane (crayfish)

AEROMOD = AMS/EPA Regulatory Model; FIR = food intake rate; SIR – soil/sediment intake rate; VVWM-PSC = Variable Volume Water Mode – Point Source Calculator (Model); WIR = water intake rate

[a] Soil ingestion as proportion of diet represented at the 90th percentile sourced from EPA's *Guidance for Developing Ecological Soil Screening Levels* (U.S. EPA, 2005a)

[b] Sediment ingestion as proportion of diet, calculated by dividing the SIR by kg food, where kg food = FIR multiplied by body weight (*bw*) of the mink

[c] Negligible sediment ingestion sourced from *Screening Level Ecological Risk Assessment San Juan River and Lake Powell Gold King Mine Incident Utah* (Tetra Tech, 2018)

[d] Exposure factors (FIR and WIR) sourced from EPA's *Wildlife Exposure Factors Handbook* (U.S. EPA, 1993)

[e] Exposure factor (SIR) sourced from EPA's *Second Five Year Review Report Hudson River PCBs Superfund Site Appendix 11 Human Health and Ecological Risks* (U.S. EPA, 2017)

[f] Mink body weight used to calculate Ps sourced from EPA's *Wildlife Exposure Factors Handbook* (U.S. EPA, 1993)

[g] For the trophic transfer pathway starting with earthworm, the American kestrel consumes earthworm, short-tailed shrew, and American woodcock. For the trophic transfer pathway starting with *Trifolium sp.*, the American kestrel consumes meadow vole and northern bobwhite

[h] 1,2-Dichloroethane concentration in aggregated soil and soil pore water for earthworm, short-tailed shrew, and meadow vole; 1,2-dichloroethane concentration in soil pore water for *Trifolium sp.*; 1,2-dichloroethane concentration in sediment for mink

[i] Highest modeled aggregated soil and soil pore water concentration of 1,2-dichloroethane calculated based on AERMOD modeling (daily deposition) for air 1,2-dichloroethane releases reported to Toxics Release Inventory (TRI) and National Emissions Inventory (NEI) for the COU/OES Manufacturing of 1,2-dichloroethane. Concentration of contaminant in water assumed to be equal to this concentration

[j] Highest modeled soil pore water concentration of 1,2-dichloroethane calculated based on AERMOD modeling (daily deposition) for air 1,2-dichloroethane releases reported to TRI and NEI for the COU/OES Manufacturing of 1,2-dichloroethane. Concentration of contaminant in water assumed to be equal to this concentration

[k] Highest sediment concentration of 1,2-dichloroethane obtained using VVWM-PSC modeling

[l] Highest surface water concentration of 1,2-dichloroethane obtained using VVWM-PSC modeling

[m] Highest fish concentration (mg/kg) calculated from highest surface water concentration of 1,2-dichloroethane (VVWM-PSC) and estimated BCF of 4.4 (U.S. EPA, 2012)

[n] Highest crayfish concentration (mg/kg) calculated from highest benthic pore water concentration of 1,2-dichloroethane (VVWM-PSC) and estimated BCF of 4.4 (U.S. EPA, 2012)

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As illustrated in Figure 4-1, representative mammal and bird species were chosen to connect (1) the 1,2-dichloroethane transport exposure pathway via trophic transfer of 1,2-dichloroethane uptake from contaminated soil and soil pore water to earthworm followed by consumption by an insectivorous mammal (short-tailed shrew) or insectivorous bird (American woodcock) and then their consumption by an avian predator (American kestrel); and (2) 1,2-dichloroethane uptake from contaminated soil pore water to plant (*Trifolium* sp.) followed by consumption by an herbivorous mammal (meadow vole) or herbivorous bird (northern bobwhite) and then their consumption by an avian predator (American kestrel). For aquatic-dependent terrestrial species, a representative mammal (American mink) and representative bird (belted kingfisher) were chosen to connect the 1,2-dichloroethane transport exposure pathway via trophic transfer from fish or crayfish uptake from contaminated surface water and benthic pore water.

At the screening level, one conservative assumption is that the invertebrate diet for the short-tailed shrew and American woodcock comprises 100 percent earthworms from contaminated soil. Similarly, the dietary assumption for the meadow vole and the northern bobwhite is 100 percent *Trifolium* sp. from contaminated soil. For the American mink and belted kingfisher, in one scenario 100 percent of their diet is predicted to come from fish, and in the second scenario 100 percent of their diet is predicted to come from crayfish. Additionally, the screening level analysis uses the highest modeled 1,2-dichloroethane soil, soil pore water, surface water, or benthic pore water contaminate levels based on daily air deposition (soil and soil pore water) as well as the COU/OES-specific number of operating days per year for surface water releases (surface water, benthic pore water, and sediment) to determine whether a more detailed assessment is required.

The highest soil and soil porewater concentrations calculated based on AERMOD daily air deposition for the COU/OES described in Table 3-1 were used to represent 1,2-dichloroethane concentrations in media for terrestrial trophic transfer. Similarly, the highest VVWM-PSC-modeled surface water and sediment concentrations over the operating days per year for the COU/OES described in Table 2-2 were used to represent 1,2-dichloroethane concentrations in media for trophic transfer to a semi-aquatic mammal (mink) and aquatic-dependent bird (kingfisher). Additional assumptions for this analysis have been considered to represent conservative screening values (U.S. EPA, 2005a). Within this model, incidental oral soil or sediment exposure is added to the dietary exposure (including water consumption) resulting in total oral exposure to 1,2-dichloroethane. In addition, EPA assumes that 100 percent of the contaminant is absorbed from both the soil (AFsj), water (AFwj) and biota representing prey (AFij). The proportional representation of time an animal spends occupying an exposed environment is known as the AUF and has been set at one for all biota within this equation (Table 4-1).

Values for calculated dietary exposure by COU are shown in Table_Apx A-10 and Table_Apx A-11 for trophic transfer to American kestrel from air deposition of 1,2-dichloroethane to soil; Table_Apx A-5 and Table_Apx A-6 for trophic transfer to mink consuming fish and crayfish; and Table_Apx A-7 and Table_Apx A-8 for trophic transfer to kingfisher consuming fish and crayfish. In each trophic transfer scenario for concentrations resulting from air deposition to soil, the manufacturing OES results in the highest biota concentrations and dietary exposure (Appendix A.2). In each trophic transfer scenario for concentrations resulting from releases to surface water, the waste handling, treatment, and disposal OES results in the highest biota concentrations and dietary exposure (Appendix A.2). The highest dietary exposure across all scenarios results from the waste handling, treatment, and disposal OES surface water releases and consumption of fish or crayfish by belted kingfisher and is 10.95 mg/kg/day for fish consumption (Table_Apx A-7).

Earthworm and *Trifolium* sp. concentrations (mg/kg) were conservatively assumed equal to aggregated soil and soil pore water concentrations (earthworm) or soil pore water concentrations only (*Trifolium* sp.). Fish and crayfish concentrations (mg/kg) were calculated using surface water and benthic pore water concentrations of 1,2-dichloroethane, respectively, from VVWM-PSC and an estimated BCF of 4.4 (U.S. EPA, 2012). A comparison of fish consumption in mink and kingfisher is also provided using actual measured concentrations of 1,2-dichloroethane in Lake Pontchartrain oysters (Ferrario et al., 1985) and the maximum measured surface water concentration of 1,2-dichloroethane as reported in the *Draft Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025d) instead of the modeled values. The estimated exposure for mink and kingfisher consuming fish based on these reported values are compared to the highest and lowest modeled values in Table 4-2.

Table 4-2. Comparison of Modeled and Measured Trophic Transfer Values in Consumption of Fish by Mink and Kingfisher

Predator	Highest Modeled Concentration (mg/kg/day) [a]	Lowest Modeled Concentration (mg/kg/day) [b]	Lake Pontchartrain Oyster Consumption Concentration (mg/kg/day) [c]
Mink	5.08	0.02	0.52
Kingfisher	10.95	3.03E−03	0.57

[a] Waste handling, treatment, and disposal (WWT) occupational exposure scenario (OES)
[b] Processing into formulation, mixture, or reaction product OES
[c] (Ferrario et al., 1985)

The trophic transfer of 1,2-dichloroethane from media to biota is illustrated in Figure 4-1 with its movement through the food web, as indicated by black arrows. Within the aquatic environment, the benthic zone is bounded by dashed black lines from the bottom of the water column to sediment surface and subsurface layers. The depth that the benthic environment extends into subsurface sediment is site-specific. Figure 4-1 illustrates the 1,2-dichloroethane BCF for aquatic organisms and FIRs for the representative terrestrial organisms.

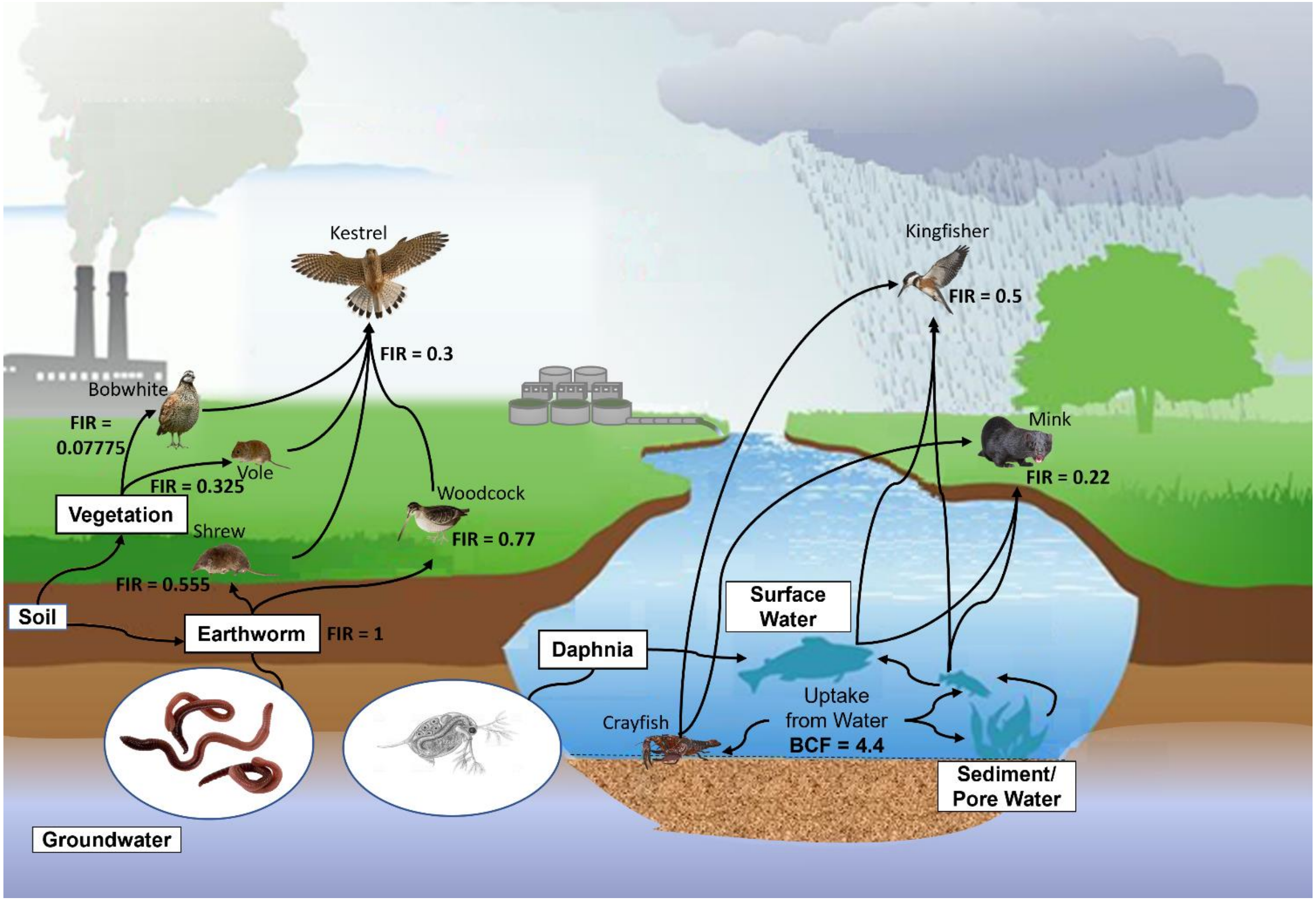

Figure 4-1. Trophic Transfer of 1,2-Dichloroethane in Aquatic and Terrestrial Ecosystems

5 WEIGHT OF SCIENTIFIC EVIDENCE CONCLUSIONS FOR ENVIRONMENTAL EXPOSURE ASSESSMENT

5.1 Strengths, Limitations, Assumptions, and Key Sources of Uncertainty for the Environmental Exposure Assessment

EPA used a combination of chemical-specific parameters and generic default parameters when estimating surface water, sediment, soil, and fish-tissue concentrations.

Concentrations of 1,2-dichloroethane in environmental media are expected to vary by exposure scenario. Release from industrial facilities, either by water or air, contribute to concentrations of 1,2-dichloroethane in the environment. Proximity to facilities and other sources may lead to elevated concentrations in soil or water via air deposition compared to locations that are more remote. The ability to locate releases by location reduces uncertainty in assumptions when selecting model input parameters that are typically informed by location (*e.g.*, meteorological data, land cover parameters for air modeling, flow data for water modeling).

The available measured ambient surface water monitoring data for 1,2-dichloroethane are poorly co-located with 1,2-dichloroethane facility release sites and the corresponding facility's permit effluent monitoring data. Therefore, EPA relied primarily on facility-specific releases to surface waters as reported to the Agency through National Pollutant Discharge Elimination System (NPDES) permit databases to estimate aqueous concentrations. The estimated 1,2-dichloroethane surface water concentrations are several orders of magnitude greater than concentrations reported in ambient surface water monitoring data. 1,2-Dichloroethane concentrations are estimated at the point of release based on facility's permit effluent monitoring data, whereas ambient surface water monitoring locations are neither spatially nor temporally aligned with known facility COU sites of release. For additional details, see Section 7.2 of the *Draft Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025d). Environmental exposures of aquatic invertebrates, vertebrates, and plants to 1,2-dichloroethane were assessed using estimated surface water, benthic pore water, and sediment concentrations resulting from reported releases to surface water (U.S. EPA, 2025d) using site-specific information such as flow data for the receiving water body at a release location. The confidence in the estimated surface water, benthic pore water, and sediment concentrations resulting from surface water releases is characterized as "robust." For additional details, see the *Draft Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025d).

There were no 1,2-dichloroethane soil monitoring data reflecting releases to air and deposition to soil found for comparison to modeled concentration estimates. Environmental exposures of soil invertebrates, terrestrial plants, and vertebrates to 1,2-dichloroethane were assessed using modeled air deposition of releases to soil (U.S. EPA, 2025d) and estimation of resulting bulk soil and soil porewater concentrations using conservative assumptions regarding persistence and mobility. The screening level models and methods used to estimate soil concentrations from air deposition are commonly used, peer-reviewed methods. Thus, the confidence in the estimated soil concentrations resulting from air deposition is characterized as robust.

5.2 Trophic Transfer Confidence

EPA uses several considerations when weighing the scientific evidence to determine confidence in the dietary exposure estimates. These considerations include the quality of the database, consistency, strength and precision, and relevance (Table_Apx A-12). This approach is in agreement with the Draft

Systematic Review Protocol (U.S. EPA, 2021) and *Draft Risk Evaluation for 1,2-Dichloroethane – Systematic Review Protocol* (U.S. EPA, 2025f). Table 5-1 summarizes how these considerations were determined for each dietary exposure threshold. For trophic transfer, EPA considers the evidence for insectivorous terrestrial mammals moderate; the evidence for insectivorous birds moderate, the evidence for herbivorous terrestrial mammals moderate; the evidence for herbivorous terrestrial birds moderate; the evidence for predatory birds moderate; the evidence for fish-consuming semi-aquatic mammals moderate; the evidence for crayfish-consuming semi-aquatic mammals slight; the evidence for fish-consuming aquatic-dependent birds moderate; and the evidence for crayfish-consuming aquatic-dependent birds slight (Table 5-1).

Quality of the Database; Consistency; and Strength (Effect Magnitude) and Precision

Few empirical biomonitoring data in ecological receptors were reasonably available for 1,2-dichloroethane or related chlorinated solvents. These data include two studies containing 1,2-dichloroethane measurements in bivalves (Yasuhara and Morita, 1987; Ferrario et al., 1985); one study containing fish tissue concentrations in other similar chlorinated solvents (1,1,1-trichloroethane and trichloroethylene) (Roose and Brinkman, 1998); and a third study with non-detect of 1,2-dichlorethane in fish, invertebrates, and urban rats (COWI AS, 2018). Thus, the quality of the database was rated slight. For COU/OES-based dietary exposure estimates, biota concentrations in representative species and their diet were calculated based on the methodology described in Section 1. The calculated aquatic biota concentrations were similar to or higher than the reported concentrations of 1,2-dichloroethane and related chlorinated solvents in aquatic biota, which resulted in a moderate confidence for consistency of the aquatic-based dietary exposure estimates for the trophic transfer analyses shown in Table 5-1 due to the need for conservative assumption when these numbers are used in risk assessment. This consideration was determined “N/A” for terrestrial-based dietary exposure estimates as no terrestrial biomonitoring data were available.

Because no empirical BCF or BAF data were reasonably available, concentrations in aquatic biota were calculated based on a predicted BCF derived from bioconcentration of a training set of chemicals from water to fish. Because the training set used to generate the 1,2-dichloroethane BCF value in EPI Suite contains other low-molecular weight chlorinated solvents (U.S. EPA, 2012), this results in a moderate confidence for strength and precision for the trophic transfer based on fish consumption. Applying this predicted BCF value based on fish to calculate whole crayfish concentrations adds uncertainty to dietary exposures estimates from consumption of sediment-dwelling invertebrates by mink and kingfishers, resulting in a slight confidence in the strength and precision of the dietary exposure estimates based on crayfish consumption. For terrestrial organism trophic transfer, due to lack of empirical BAF values, it was conservatively assumed that whole earthworm and whole plant concentrations were equal to soil and/or soil pore water concentrations. However, the use of species-specific exposure factors (*i.e.*, feed intake rate, water intake rate, and the proportion of soil or sediment within the diet) from reliable resources assisted in obtaining dietary exposure estimates within the RQ equation (U.S. EPA, 2017, 1993), thereby increasing the confidence for strength and precision and resulting in a moderate confidence for strength and precision of the dietary exposure estimates in terrestrial trophic transfer.

Relevance (Biological, Physical and Chemical, and Environmental)

The mammals and birds selected for the soil invertivore-, soil herbivore-, and aquatic-based trophic transfer analyses (U.S. EPA, 1993) were chosen based on their import in previous trophic transfer analyses conducted by the Agency (U.S. EPA, 2003a, b). Appropriate dietary species (earthworm, plant, fish, crayfish) were selected based on dietary information for provided in the Agency’s *Wildlife Exposure Factors Handbook* (U.S. EPA, 1993). The selection of the relevant highest trophic levels and their representative dietary species in the trophic transfer analyses increases confidence in the biological relevance of the dietary exposure estimates. Modeled concentrations for water and soil used to determine biota concentrations for trophic transfer were based on 1,2-dichloroethane data and not those of an analogue, therefore increasing confidence in physical and chemical relevance of the dietary exposures in the trophic transfer analyses. The current trophic transfer analysis investigated dietary exposure resulting from 1,2-dichloroethane in biota and environmentally relevant media such as soil, sediment, and water. The screening level analysis for trophic transfer used equation terms (*e.g.*, AUF and the proportion of 1,2-dichloroethane absorbed from diet as well as soil or sediment) all set to the most conservative values, as a screening level assessment of risk from 1,2-dichloroethane via trophic transfer.

Assumptions within the trophic transfer equation (Equation 4-1) for this analysis represent conservative screening values (U.S. EPA, 2005a) and those assumptions were applied similarly for each trophic level and representative species. Applications across representative species included assuming 100 percent 1,2-dichloroethane bioavailability from both the soil (AF_{sj}) and biota representing prey (AF_{ij}), and no biotransformation or other absorption, distribution, metabolism, or excretion. No additional dietary species other than the selected dietary species were included as part of the dietary exposure for the respective terrestrial mammal ($P_i = 1$). The AUF, defined as the home range size relative to the contaminated area (*i.e.*, site ÷ home range = AUF), within this screening level analysis was designated as one for all organisms that assumes that the organism lives its entire life within the exposure area. These conservative approaches, which likely overrepresent 1,2-dichloroethane's ability to transfer across trophic levels and decrease environmental relevance of the dietary exposures within the trophic transfer analyses, result in an overall moderate confidence for relevance of the dietary exposure estimates.

Trophic Transfer Confidence

With moderate confidence in both the strength and precision and relevance for the dietary exposure estimates to insectivorous and herbivorous terrestrial mammals and birds, the trophic transfer confidence is moderate in both cases. Due to moderate confidence in strength and precision and relevance in dietary exposure estimates to mink and belted kingfisher based on fish consumption, the trophic transfer confidence is moderate. Due to slight confidence in quality of the database and strength and precision considerations for dietary exposure estimates to mink and belted kingfisher based on crayfish consumption, the trophic transfer confidence is assigned as slight.

Table 5-1. 1,2-Dichloroethane Evidence Table Summarizing Overall Confidence Derived for Trophic Transfer (Dietary)

Types of Evidence	Quality of the Database	Consistency	Strength and Precision	Relevance [a]	Trophic Transfer Confidence
Chronic avian assessment (insectivorous)	N/A	N/A	++	++	Moderate
Chronic avian assessment (herbivorous)	N/A	N/A	++	++	Moderate
Chronic avian assessment (predatory)	N/A	N/A	++	++	Moderate
Chronic avian assessment (fish consumption)	N/A	++	++	++	Moderate
Chronic avian assessment (crayfish consumption)	N/A	++	+	++	Slight
Chronic mammalian assessment (insectivorous)	+	N/A	++	++	Moderate
Chronic mammalian	+	N/A	++	++	Moderate

Types of Evidence	Quality of the Database	Consistency	Strength and Precision	Relevance [a]	Trophic Transfer Confidence
assessment (herbivorous)					
Chronic mammalian assessment (fish consumption)	+	++	++	++	Moderate
Chronic mammalian assessment (crayfish consumption)	+	++	+	++	Slight

[a] Relevance includes biological, physical/chemical, and environmental relevance.
+ + + Robust confidence suggests thorough understanding of the scientific evidence and uncertainties. The supporting weight of scientific evidence outweighs the uncertainties to the point where it is unlikely that the uncertainties could have a significant effect on the dietary exposure estimate.
+ + Moderate confidence suggests some understanding of the scientific evidence and uncertainties. The supporting scientific evidence weighed against the uncertainties is reasonably adequate to characterize dietary exposure estimates.
+ Slight confidence is assigned when the weight of scientific evidence may not be adequate to characterize the scenario, and when the assessor is making the best scientific assessment possible in the absence of complete information. There are additional uncertainties that may need to be considered.
N/A = Indeterminate confidence corresponds to entries in evidence tables where information is not available within a specific evidence consideration.

6 ENVIRONMENTAL EXPOSURE ASSESSMENT CONCLUSIONS

EPA assessed the reasonably available information for environmental exposures of 1,2-dichloroethane to aquatic and terrestrial species. The key points of the environmental exposure assessment are summarized in the bullets below:

- EPA expects the main environmental exposure pathways for 1,2-dichloroethane to be surface water and air. The air pathway was assessed for its contribution via deposition to soil.
- 1,2-Dichloroethane exposure to aquatic species through surface water and sediment were modeled to estimate concentrations near industrial and commercial uses.
    - Modeled data based on number of operating days per year estimate surface water concentrations ranged from 21 to 4,740 µg/L, benthic pore water concentrations ranged from 19 to 4,090 µg/L, and sediment concentrations range from 53 to 11,200 µg/kg from facility releases to surface waters. The highest releases were from the Disposal COU/Waste handling, treatment, and disposal (WWT) OES.
    - EPA also estimated fish tissue and crayfish tissue concentrations by COU using the modeled water releases from industrial uses.
- 1,2-Dichloroethane exposure to terrestrial species through soil, surface water, and soil pore water was also assessed using modeled data.
    - Modeled data based on air deposition to soil estimated soil concentrations ranged from 11.76 to 2,000 mg/kg and estimated soil pore water concentrations ranged from 7.4 to 1,259 mg/L.
- Exposure through diet was assessed through a trophic transfer analysis, which estimated the transfer of 1,2-dichloroethane from soil through the terrestrial food web and from surface water and sediment through the aquatic food web using representative species.
    - 1,2-Dichloroethane exposure to terrestrial organisms occurs primarily through diet via the surface water pathway for semi-aquatic terrestrial mammals and aquatic-dependent birds, with release of 1,2-dichloroethane to surface water as a source and via the soil pathway for terrestrial mammals. Deposition from air to soil is another source of 1,2-dichloroethane.
    - Maximum concentrations of 1,2-dichloroethane in diet were 5.08 mg/kg/day in Mink (consuming fish), 10.95 mg/kg/day in Belted Kingfisher (consuming fish), and 2.57 mg/kg/day for American Kestrel (consuming insectivorous animals).
    - For terrestrial mammals and birds, relative contribution to total exposure associated with inhalation is generally secondary in comparison to exposures by diet and indirect ingestion. Therefore, direct inhalation exposure of 1,2-dichloroethane to terrestrial receptors via air was not assessed quantitatively.

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APPENDICES

Appendix A ENVIRONMENTAL EXPOSURE ESTIMATES

Surface water concentrations at the facility release site estimated in U.S. EPA (2025d) for a 21-day release scenario and an operating days per year release scenario were compared to the chronic COC. Details on how the COCs for aquatic ecological species were determined can be found in U.S. EPA (2025c). Concentrations that exceeded those chronic CoCs were kept for a second modeling step using the Point Source Calculator (PSC) (U.S. EPA, 2019).

A.1 The Point Source Calculator

A.1.1 Description of the Point Source Calculator

The PSC is a tool designed to estimate acute and chronic concentrations of chemicals directly released to surface water bodies. It is a proposed potential refinement to E-FAST for estimating exposures from wastewater discharges to surface waters. In addition to calculating aqueous concentrations (in the water column) based on the chemical loading release rate and receiving water body streamflow as E-FAST does, the PSC accounts for several key physicochemical processes that can affect levels of a released chemical during transport. More specifically, the PSC allows for chemical removal through sorption to sorption to sediment, volatilization, and transformation processes (*i.e.*, aerobic and anaerobic metabolism, hydrolysis, and photolysis), thus providing a higher tiered model that produces a potentially less conservative estimates of concentration and exposure compared to E-FAST. In addition, the PSC provides estimates of the chemical concentration in the benthic pore water and bulk sediment of a receiving water body. Because of these additional processes, PSC requires a number of chemical-specific input parameters, including chemical partitioning (sediment, air, water) and degradation rates. PSC also requires specific release site parameters, such as water body dimensions, baseflow, and meteorological data as well as a group of water column and benthic porewater/sediment biogeochemical parameters. A description of the PSC input parameters can be found in Section 4 of the *Point Source Calculator: A Model for Estimating Chemical Concentration in Water Bodies* file (U.S. EPA, 2019).

The PSC is particularly useful for estimating sediment pore water concentrations for assessing benthic organism exposures, but was designed for use on a site-specific basis; thus, requiring a number of assumptions about release site parameters before applying to national-scale exposure assessments. Because the PSC has more input parameters and requires default assumptions for national-scale assessments, EPA's Office of Pesticides Program (OPP) performed a thorough sensitivity analysis to identify a standard set of assumptions for PSC runs that can be applied nationally. This sensitivity analysis informed OPPT's use of the PSC Model and choice of input parameters, which are detailed below. Of the additional parameters considered to effect chemical concentration in the water column, benthic porewater, and benthic bulk sediment, the most are the user's selection of the meteorological file, water body dimensions, and water body baseflow. Although the baseflow should be included for each individual site, without sufficient information on the meteorology or receiving water body dimensions, it is recommended to use the following standard input parameters: the 90th percentile meteorological file (*i.e.*, w24027) and water body dimensions of 5 m × 1 m × 40 m (width × depth × length).

A.1.2 Point Source Calculator Input Parameters

The following tables include the standard set of input parameters used with the PSC, excluding the mass release and constant flow rate parameters, which changed for each site and scenario (acute or chronic). A new list of facility release sites were created from those releases that resulted in an estimated aqueous concentration of 1,2-dichlorethane exceeding aquatic and benthic COCs found in the *Draft Environmental Hazard Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025c). For either scenario, the constant flow rate remained the same. Here the estimated 7Q10 flow value created in the *Draft Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2025d) was used. The default Water Column and Benthic compartment PSC input parameters were used as well as the default Mass Transfer Coefficient. The respective water column and benthic chronic CoCs were used for each of the water column and benthic pore water toxicity options.

Table_Apx A-1. 1,2-Dichloroethane Chemical-Specific PSC Input Parameters

Parameter	Value
K_{OC}	58.88 mL/g
Water column half-life	51.5 days at 25 °C
Photolysis half-life	51 days at 30N
Hydrolysis half-life	26,280 days at 25 °C
Benthic half-life	10,000 days at 25 °C
Molecular weight	98.95 g/mol
Vapor pressure	78.9 torr at 25 °C
Solubility	8600 mg/L at 25 °C
Henry's Law constant	0.00154 atm·m^3/mol at 25 °C
Heat of Henry	29,423 J/mol
Reference temperature	25 °C

Table_Apx A-2. Meteorologic and Hydrologic PSC Input Parameters

Meteorologic and Hydrologic Input Parameters	
Meteorologic data file	w24027
Water body dimensions (width × depth × length)	5 m × 1 m × 40 m
Constant flow rate (m^3/day)	Site 7Q10 flow

A.1.3 Water Column, Pore Water, and Benthic Sediment Results

The PSC estimates daily concentrations of the chemical in the water column, benthic pore water, and bulk benthic sediment for a given year, and repeats the simulation for 30 consecutive years. The main Results tab of the PSC software includes a time series graph of these daily simulations repeated for 30 years. The Results tab also provides concentration estimates on a daily sliding average (*i.e.*, "1-Day Avg", "7-Day Avg", "28-Day Avg"). These averages reflect the maximum of the entire times series for the period of days indicated, meaning a "21-Day Avg" is the maximum average of 21 consecutive daily estimated concentrations. However, these average metrics do not necessarily correspond to the first group that might be indicated by the metric. For example, the "21-Day Avg" may not include the first 21 days of each year's simulation. Concentration results for the water column (µg/L), pore water (µg/L), and total benthic sediment (µg/kg) were retrieved for the "21-Day Avg" and a user-defined "350-Day Avg" to coincide with two release duration scenarios. One scenario assumes the number of release days is equivalent to the shortest hazard duration from which the chronic COCs were derived (21 days). A second scenario assumes that the release is averaged out over the total number of operating days.

The PSC also estimates the number of days that the chemical concentration exceeds a user-defined concentration of concern for each of the water column, pore water, and benthic bulk sediment compartments. The days of exceedance was estimated by multiplying the "1-Day Avg" "Days > CoC" fraction by 365 days. This metric aligns with the daily concentration output file. Note, through this approach the user's mass release schedule bounds the days of exceedance metric in the water column primarily because of washout (*i.e.*, replacement of "clean water" from downstream water transport) that occurs immediately following the last day of chemical mass release in the model. The days of exceedance metric should be interpreted with caution for this reason.

A.2 Concentrations in Biota and Associated Dietary Exposure Estimates

Table_Apx A-3. 1,2-Dichloroethane Fish Concentrations Calculated from VVWM-PSC Modeled Industrial and Commercial 1,2-Dichloroethane Releases

COU (Life Cycle Stage/ Category/ Subcategory)	OES	Facility	SWC (µg/L) [a]	Fish Concentration (µg/g)
Manufacturing/ Domestic manufacture/ Domestic manufacture	Manufacturing	LAJ660151	3,380	14.872
Processing/ Processing – as a reactant/ Intermediate in: petrochemical manufacturing; plastic material and resin manufacturing; all other basic organic chemical manufacturing; all other basic inorganic chemical manufacturing	Processing as a reactant	GAIS00500	387	1.703
Processing/ Recycling/ Recycling				
Industrial Use/ Process regulator *e.g.*, catalyst moderator; oxidation inhibitor				
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Fuels and fuel additives: all other petroleum and coal products manufacturing	Processing into formulation, mixture, or reaction product	IN0002861	21	0.092
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Processing aids: specific to petroleum production; plastics material and resin manufacturing				
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Adhesives and sealants; lubricants and greases; process regulators; degreasing and cleaning solvents; pesticide, fertilizer, and other agricultural chemical manufacturing				
Industrial Use/ Other use/ Process solvent				
Disposal/ Disposal/ Disposal	Waste handling, disposal, and treatment (WWT)	ARR001968	4,740	20.856
Disposal/ Disposal/ Disposal	Waste handling, treatment and disposal (POTW)	CA0085235	2,310	10.164

COU = condition of use; OES = occupational exposure scenario; POTW = publicly owned treatment work; SWC = surface water concentration; WWT = wastewater treatment

Table_Apx A-4. 1,2-Dichloroethane Crayfish Concentrations Calculated from VVWM-PSC Modeled Industrial and Commercial 1,2-Dichloroethane Releases

COU (Life Cycle/ Category/ Subcategory)	Scenario Name	Facility	PWC (µg/L) [a]	Crayfish Concentration (µg/g)
Manufacturing/ Domestic manufacture/ Domestic manufacture	Manufacturing	LAJ660151	3,260	14.344
Processing/ Processing – as a reactant/ Intermediate in: petrochemical manufacturing; plastic material and resin manufacturing; all other basic organic chemical manufacturing; all other basic inorganic chemical manufacturing	Processing as a reactant	GAIS00500	374	1.646
Processing/ Recycling/ Recycling				
Industrial Use/ Process regulator *e.g.*, catalyst moderator; oxidation inhibitor				
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Fuels and fuel additives: all other petroleum and coal products manufacturing	Processing into formulation, mixture, or reaction product	IN0002861	19	0.084
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Processing aids: specific to petroleum production; plastics material and resin manufacturing				
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Adhesives and sealants; lubricants and greases; process regulators; degreasing and cleaning solvents; pesticide, fertilizer, and other agricultural chemical manufacturing				
Industrial Use/ Other use/ Process solvent				
Disposal/ Disposal/ Disposal	Waste handling, disposal, and treatment (WWT)	ARR001968	4,090	17.996
Disposal/Disposal/ Disposal	Waste handling, treatment and disposal (POTW)	CA0085235	2,290	10.076

COU = condition of use; POTW = publicly owned treatment work; PWC = benthic pore water concentration; WWT = wastewater treatment

Table_Apx A-5. Dietary Exposure Estimates Using EPA's Wildlife Risk Model for Eco-SSLs for Screening Level Trophic Transfer of 1,2-Dichloroethane to the American Mink (*Mustela vison*) from Consumption of Fish

COU (Life Cycle Stage/ Category/ Subcategory)	OES	Fish Concentration (mg/kg) [a]	1,2-Dichloroethane Dietary Exposure (mg/kg/day) [b]
Manufacturing/ Domestic manufacture/ Domestic manufacture	Manufacturing	14.87	3.63
Processing /Processing – as a reactant/ Intermediate in: petrochemical manufacturing; plastic material and resin manufacturing; all other basic organic chemical manufacturing; all other basic inorganic chemical manufacturing	Processing as a reactant	1.70	0.42
Processing / Recycling/ Recycling			
Industrial Use/ Process regulator *e.g.*, catalyst moderator; oxidation inhibitor			
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Fuels and fuel additives: all other petroleum and coal products manufacturing	Processing into formulation, mixture, or reaction product	0.09	2.48E−04
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Processing aids: specific to petroleum production; plastics material and resin manufacturing			
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Adhesives and sealants; lubricants and greases; process regulators; degreasing and cleaning solvents; pesticide, fertilizer, and other agricultural chemical manufacturing			
Industrial Use/ Other use/ Process solvent			
Disposal/ Disposal/ Disposal	Waste handling, disposal, and treatment (WWT)	20.86	5.08
Disposal/ Disposal/ Disposal	Waste handling, treatment and disposal (POTW)	10.16	2.48
Published data			
Lake Pontchartrain oysters (Ferrario et al., 1985)		9.5E−02	0.52

COU = condition of use; OES = occupational exposure scenario; POTW = publicly owned treatment work; SSL = soil screening levels; WWT = wastewater treatment
[a] Whole fish concentrations were calculated using the highest modeled max daily average surface water concentrations for 1,2-dichloroethane (via PSC modeling based on total number of operating days) and a BCF of 4.4.
[b] Dietary exposure to 1,2-dichloroethane includes consumption of biota (fish), incidental ingestion of sediment, and ingestion of water.

Table_Apx A-6. Dietary Exposure Estimates Using EPA's Wildlife Risk Model for Eco-SSLs for Screening Level Trophic Transfer of 1,2-Dichloroethane to the American Mink (*Mustela vison*) from Consumption of Crayfish

COU (Life Cycle Stage/ Category/ Subcategory)	OES	Crayfish Concentration (mg/kg) [a]	1,2-Dichloroethane Dietary Exposure (mg/kg/day) [b]
Manufacturing/ Domestic manufacture/ Domestic manufacture	Manufacturing	14.34	3.51
Processing/ Processing – as a reactant/ Intermediate in: petrochemical manufacturing; plastic material and resin manufacturing; all other basic organic chemical manufacturing; all other basic inorganic chemical manufacturing	Processing as a reactant	1.65	0.40
Processing/ Recycling/ Recycling			
Industrial Use/ Process regulator *e.g.*, catalyst moderator; oxidation inhibitor			
Processing/ Processing – incorporated into formulation, mixture, or reaction product/Fuels and fuel additives: all other petroleum and coal products manufacturing	Processing into formulation, mixture, or reaction product	0.08	2.26E−04
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Processing aids: specific to petroleum production; plastics material and resin manufacturing			
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Adhesives and sealants; lubricants and greases; process regulators; degreasing and cleaning solvents; pesticide, fertilizer, and other agricultural chemical manufacturing			
Industrial Use/ Other use/ Process solvent			
Disposal/ Disposal/ Disposal	Waste handling, disposal, and treatment (WWT)	18.00	4.46
Disposal/ Disposal/ Disposal	Waste handling, treatment and disposal (POTW)	10.08	2.46

COU = condition of use; OES = occupational exposure scenario; POTW = publicly owned treatment work; WWT = wastewater treatment

[a] Whole crayfish concentrations calculated using the highest modeled max daily average benthic pore water concentrations for 1,2-dichloroethane (via PSC modeling based on total number of operating days) and a BCF of 4.4.

[b] Dietary exposure to 1,2-dichloroethane includes consumption of biota (crayfish), incidental ingestion of sediment, and ingestion of water.

Table_Apx A-7. Dietary Exposure Estimates Using EPA's Wildlife Risk Model for Eco-SSLs for Screening Level Trophic Transfer of 1,2-Dichloroethane to the Belted Kingfisher (*Megaceryle alcyon*) from Consumption of Fish

COU (Life Cycle Stage/ Category/ Subcategory)	OES	Fish Concentration (mg/kg) [a]	1,2-Dichloroethane Dietary Exposure (mg/kg/day) [b]
Manufacturing/ Domestic manufacture/ Domestic manufacture	Manufacturing	14.87	7.81
Processing/ Processing – as a reactant/ Intermediate in: petrochemical manufacturing; plastic material and resin manufacturing; all other basic organic chemical manufacturing; all other basic inorganic chemical manufacturing	Processing as a reactant	1.70	0.89
Processing/ Recycling/ Recycling			
Industrial Use/ Process regulator *e.g.*, catalyst moderator; oxidation inhibitor			
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Fuels and fuel additives: all other petroleum and coal products manufacturing	Processing into formulation, mixture, or reaction product	0.09	3.03E−03
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Processing aids: specific to petroleum production; plastics material and resin manufacturing			
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Adhesives and sealants; lubricants and greases; process regulators; degreasing and cleaning solvents; pesticide, fertilizer, and other agricultural chemical manufacturing			
Industrial Use/ Other use/ Process solvent			
Disposal/ Disposal/ Disposal	Waste handling, disposal, and treatment (WWT)	20.86	10.95
Disposal/ Disposal/ Disposal	Waste handling, treatment and disposal (POTW)	10.16	5.34
Published data			
Lake Pontchartrain oysters (Ferrario et al., 1985)		9.5E−02	0.57

COU = condition of use; OES = occupational exposure scenario; POTW = publicly owned treatment work; WWT = wastewater treatment
[a] Whole fish concentrations calculated using the highest modeled max daily average surface water concentrations for 1,2-dichloroethane (via PSC modeling based on total number of operating days) and a BCF of 4.4.
[b] Dietary exposure to 1,2-dichloroethane includes consumption of biota (fish), incidental ingestion of sediment, and ingestion of water.

Table_Apx A-8. Dietary Exposure Estimates Using EPA's Wildlife Risk Model for Eco-SSLs for Screening Level Trophic Transfer of 1,2-Dichloroethane to the Belted Kingfisher (*Megaceryle alcyon*) from Consumption of Crayfish

COU (Life Cycle Stage/Category/Subcategory)	OES	Crayfish Concentration (mg/kg) [a]	1,2-Dichloroethane Dietary Exposure (mg/kg/day) [b]
Manufacturing/ Domestic manufacture/ Domestic manufacture	Manufacturing	14.34	7.54
Processing/Processing – as a reactant/ Intermediate in: petrochemical manufacturing; plastic material and resin manufacturing; all other basic organic chemical manufacturing; all other basic inorganic chemical manufacturing	Processing as a reactant	1.65	0.87
Processing/ Recycling/ Recycling			
Industrial Use/ Process regulator *e.g.*, catalyst moderator; oxidation inhibitor			
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Fuels and fuel additives: all other petroleum and coal products manufacturing	Processing into formulation, mixture, or reaction product	0.08	2.76E−03
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Processing aids: specific to petroleum production; plastics material and resin manufacturing			
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Adhesives and sealants; lubricants and greases; process regulators; degreasing and cleaning solvents; pesticide, fertilizer, and other agricultural chemical manufacturing			
Industrial Use/ Other use/ Process solvent			
Disposal/ Disposal/ Disposal	Waste handling, disposal, and treatment (WWT)	18.00	9.52
Disposal/ Disposal/ Disposal	Waste handling, treatment and disposal (POTW)	10.08	5.29

COU = condition of use; OES = occupational exposure scenario; POTW = publicly owned treatment work; SSL = soil screening levels; WWT = wastewater treatment

[a] Whole crayfish concentrations calculated using the highest modeled max daily average benthic pore water concentrations for 1,2-dichloroethane (via PSC modeling based on total number of operating days) and a BCF of 4.4.

[b] Dietary exposure to 1,2-dichloroethane includes consumption of biota (crayfish), incidental ingestion of sediment, and ingestion of water.

Table_Apx A-9. 1,2-Dichlorethane Plant (*Trifolium* sp.) and Earthworm Concentrations Calculated from AERMOD-Modeled Industrial and Commercial Releases Reported to TRI

COU (Life Cycle Stage/ Category/ Subcategory)	OES	Soil (µg/kg) [a]	Soil Pore Water Conc. (µg/L) [a]	Plant Concentration (mg/kg)	Earthworm Concentration (mg/kg)
Manufacturing/ Domestic manufacture/ Domestic manufacture	Manufacturing	1,982	910	0.91	2.9
Manufacturing/ Import/ Import	Repackaging	16	7.2	7.2E−03	2.3E−02
Processing/ Repackaging/ Repackaging					
Processing/ Processing – as a reactant/ Intermediate in: petrochemical manufacturing; plastic material and resin manufacturing; all other basic organic chemical manufacturing; all other basic inorganic chemical manufacturing	Processing as a reactant	12	5.3	5.3E−03	1.7E−02
Processing/ Recycling/ Recycling					
Industrial Use/ Process regulator *e.g.*, catalyst moderator; oxidation inhibitor					
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Fuels and fuel additives: all other petroleum and coal products manufacturing	Processing into formulation, mixture, or reaction product	148	68	6.8E−02	0.22
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Processing aids: specific to petroleum production; plastics material and resin manufacturing					
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Adhesives and sealants; lubricants and greases; process regulators; degreasing and cleaning solvents; pesticide, fertilizer, and other agricultural chemical manufacturing					
Industrial Use/ Other use/ Process solvent					
Disposal/ Disposal/ Disposal	Waste handling, disposal, and treatment	15	6.8	6.8E−03	2.2E−02

AERMOD = AMS/EPA Regulatory Model; COU = condition of use; OES = occupational exposure scenario
[a] Soil catchment and soil catchment pore water concentrations estimated from 95th percentile maximum daily air deposition rates 30 m from facility for 1,2-dichloroethane air releases reported to Toxics Release Inventory (TRI) and National Emissions Inventory (NEI).

Table_Apx A-10. Dietary Exposure Estimates Using EPA's Wildlife Risk Model for Eco-SSLs for Screening Level Trophic Transfer of 1,2-Dichloroethane to the American Kestrel Consuming Insectivorous Animals from Air Deposition to Soil for 1,2-Dichloroethane Releases Reported to TRI

COU (Life Cycle Stage/ Category/ Subcategory)	OES	Earthworm Concentration (mg/kg) [a]	Short-Tailed Shrew Concentration (mg/kg/day) [b]	American Woodcock Concentration (mg/kg/day) [b]	1,2-Dichloroethane Dietary Exposure (mg/kg/day) [b]
Manufacturing/ Domestic manufacture/ Domestic manufacture	Manufacturing	2.9	1.7	2.6	2.3
Manufacturing/ Import/ Import	Repackaging	6.3E−03	7.9E−03	4.5E−03	7.1E−03
Processing/ Repackaging/ Repackaging					
Processing/ Processing – as a reactant/ Intermediate in: petrochemical manufacturing; plastic material and resin manufacturing; all other basic organic chemical manufacturing; all other basic inorganic chemical manufacturing	Processing as a reactant	1.7E−02	9.7E−03	1.5E−02	1.3E−02
Processing/ Recycling/ Recycling					
Industrial Use/ Process regulator e.g., catalyst moderator; oxidation inhibitor					
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Fuels and fuel additives: all other petroleum and coal products manufacturing	Processing into formulation, mixture, or reaction product	0.22	0.12	0.19	0.17
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Processing aids: specific to petroleum production; plastics material and resin manufacturing					
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Adhesives and sealants; lubricants and greases; process regulators; degreasing and cleaning solvents; pesticide, fertilizer, and other agricultural chemical manufacturing					
Industrial Use/ Other use/ Process solvent					
Disposal/ Disposal/ Disposal	Waste handling, disposal, and treatment	2.2E−02	1.2E−02	1.9E−02	1.7E−02

COU = condition of use; OES = occupational exposure scenario; SSL = soil screening levels; TRI = Toxics Release Inventory

[a] Estimated 1,2-dichloroethane concentration in representative soil invertebrate, earthworm, assumed equal to aggregated highest calculated soil and soil pore water concentration via air deposition of 1,2-dichloroethane in fugitive air releases reported to TRI to soil.

[b] Dietary exposure to 1,2-dichloroethane includes consumption of biota (earthworm), incidental ingestion of soil, and ingestion of water.

Table_Apx A-11. Dietary Exposure Estimates Using EPA's Wildlife Risk Model for Eco-SSLs for Screening Level Trophic Transfer of 1,2-Dichloroethane to the American Kestrel Consuming Herbivorous Animals from Air Deposition to Soil for 1,2-Dichloroethane Releases Reported to TRI

COU (Life Cycle Stage/ Category/ Subcategory)	OES	Plant Conc. (mg/kg) [a]	Meadow Vole Conc. (mg/kg/day) [b]	Northern Bobwhite Conc. (mg/kg/day) [b]	1,2-Dichloroethane Dietary Exposure (mg/kg/day) [b]
Manufacturing/ Domestic manufacture/ Domestic manufacture	Manufacturing	0.91	0.33	0.10	0.28
Manufacturing/ Import/Import	Repackaging	2.5E−03	8.9E−04	2.8E−04	7.7E−04
Processing/ Repackaging/ Repackaging					
Processing/ Processing – as a reactant/ Intermediate in: petrochemical manufacturing; plastic material and resin manufacturing; all other basic organic chemical manufacturing; all other basic inorganic chemical manufacturing	Processing as a reactant	5.3E−03	1.9E−03	6.0E−04	1.7E−03
Processing/ Recycling/ Recycling					
Industrial Use/ Process regulator e.g., catalyst moderator; oxidation inhibitor					
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Fuels and fuel additives: all other petroleum and coal products manufacturing	Processing into formulation, mixture, or reaction product	6.8E−02	2.4E−02	7.6E−03	2.1E−02
Processing/ Processing – incorporated into formulation, mixture, or reaction product/ Processing aids: specific to petroleum production; plastics material and resin manufacturing					
Processing/Processing – incorporated into formulation, mixture, or reaction product/ Adhesives and sealants; lubricants and greases; process regulators; degreasing and cleaning solvents; pesticide, fertilizer, and other agricultural chemical manufacturing					
Industrial Use/ Other use/ Process solvent					
Disposal/ Disposal/ Disposal	Waste handling, disposal, and treatment	6.7E−03	2.4E−03	7.6E−04	2.1E−03

COU = condition of use; OES = occupational exposure scenario; SSL = soil screening levels
[a] Estimated 1,2-dichloroethane concentration in representative soil invertebrate, earthworm, assumed equal to aggregated highest calculated soil and soil pore water concentration via air deposition of 1,2-dichloroethane in fugitive air releases reported to Toxics Release Inventory (TRI) to soil.
[b] Dietary exposure to 1,2-dichloroethane includes consumption of biota (*Trifolium* sp.), incidental ingestion of soil, and ingestion of water.

A.3 Rubric for Weight of Scientific Evidence

The weight of scientific evidence fundamentally means that the evidence is weighed (*i.e.*, ranked), and weighted (*i.e.*, a piece or set of evidence or uncertainty may have more importance or influence in the result than another). Based on the weight of scientific evidence and uncertainties, a confidence statement was developed that qualitatively ranks (*i.e.*, robust, moderate, slight, or indeterminate) the confidence in the environmental exposure estimates. The qualitative confidence levels are described below and illustrated in Table_Apx A-12.

The evidence considerations and criteria detailed within (U.S. EPA, 2021) will guide the application of strength-of-evidence judgments for environmental hazard effect within a given evidence stream and were adapted from Table 7-10 of the Draft Systematic Review Protocol (U.S. EPA, 2021).

EPA used the strength-of-evidence and uncertainties from (U.S. EPA, 2021) for the environmental exposure assessment to qualitatively rank the overall confidence using evidence for environmental exposure. Confidence levels of robust (+ + +), moderate (+ +), slight (+), or indeterminant are assigned for each evidence property that corresponds to the evidence considerations (U.S. EPA, 2021). The rank of the quality of the database consideration is based on the systematic review data quality rank (high, medium, or low) for studies that measure 1,2-dichloroethane in water or animal tissue, and whether there are data gaps in the environmental dataset. Another consideration in the quality of the database is the risk of bias (*i.e.*, how representative is the study to ecologically relevant endpoints). The high, medium, and low systematic review ranks correspond to the evidence table ranks of robust (+ + +), moderate (+ +), or slight (+), respectively. The evidence considerations are weighted based on professional judgement to obtain the overall confidence for each exposure estimate. In other words, the weights of each evidence property relative to the other properties are dependent on the specifics of the weight of scientific evidence and uncertainties that are described in the narrative and may or may not be equal. Therefore, the overall score is not necessarily a mean or defaulted to the lowest score. The confidence levels and uncertainty type examples are described below.

Confidence Levels

- Robust (+ + +) confidence suggests thorough understanding of the scientific evidence and uncertainties. The supporting weight of scientific evidence outweighs the uncertainties to the point where it is unlikely that the uncertainties could have a significant effect on the exposure or hazard estimate.
- Moderate (+ +) confidence suggests some understanding of the scientific evidence and uncertainties. The supporting scientific evidence weighed against the uncertainties is reasonably adequate to characterize exposure or hazard estimates.
- Slight (+) confidence is assigned when the weight of scientific evidence may not be adequate to characterize the scenario, and when the assessor is making the best scientific assessment possible in the absence of complete information. There are additional uncertainties that may need to be considered.
- Indeterminant (N/A) corresponds to entries in evidence tables where information is not available within a specific evidence consideration.

Types of Uncertainties

The following uncertainties may be relevant to one or more of the weight of scientific evidence considerations listed above and will be integrated into that property's rank in the evidence (Table_Apx A-12).

- Scenario uncertainty: Uncertainty regarding missing or incomplete information needed to fully

define the exposure and dose.
    - The sources of scenario uncertainty include descriptive errors, aggregation errors, errors in professional judgment, and incomplete analysis.
- Parameter uncertainty: Uncertainty regarding some parameter.
    - Sources of parameter uncertainty include measurement errors, sampling errors, variability, and use of generic or surrogate data.
- Model uncertainty: Uncertainty regarding gaps in scientific theory required to make predictions on the basis of causal inferences.
    - Modeling assumptions may be simplified representations of reality.

Table_Apx A-12 summarizes the weight of scientific evidence and uncertainties while increasing transparency on how EPA arrived at the overall confidence level for each exposure hazard threshold. In contrast, symbols are used to provide a visual overview of the confidence in the body of evidence while de-emphasizing an individual ranking that may give the impression that ranks are cumulative (*e.g.*, ranks of different categories may have different weights).

Table_Apx A-12. Considerations that Inform Evaluations of the Strength of the Evidence Within an Evidence Stream (*i.e.*, Apical Endpoints, Mechanistic, or Field Studies)

Consideration	Increased Evidence Strength (of the Apical Endpoints, Mechanistic, or Field Studies Evidence)	Decreased Evidence Strength (of the Apical Endpoints, Mechanistic, or Field Studies Evidence)
The evidence considerations and criteria presented here guide the application of strength-of-evidence judgments for an outcome or environmental hazard effect within a given evidence stream. Evidence integration or synthesis results that do not warrant an increase or decrease in evidence strength for a given consideration are considered "neutral" and are not described in this table (and, in general, are captured in the assessment-specific evidence profile tables).		
Quality of the database* (risk of bias)	• A large evidence base of high- or medium-quality studies increases strength. • Strength increases if relevant species are represented in a database.	• An evidence base of mostly low-quality studies decreases strength. • Strength also decreases if the database has data gaps for relevant species (*i.e.*, a trophic level that is not represented). • Decisions to increase strength for other considerations in this table should generally not be made if there are serious concerns for risk of bias; in other words, all the other considerations in this table are dependent upon the quality of the database.[a]
Consistency	Similarity of findings for a given outcome (*e.g.*, of a similar magnitude, direction) across independent studies or experiments increases strength, particularly when consistency is observed across species, life stage, sex, wildlife populations, and across or within aquatic and terrestrial exposure pathways.	• Unexplained inconsistency (*i.e.*, conflicting evidence; see (U.S. EPA, 2005b) decreases strength. • Strength should not be decreased if discrepant findings can be reasonably explained by study confidence conclusions; variation in population or species, sex, or life stage; frequency of exposure (*e.g.*, intermittent or continuous); exposure levels (low or high); or exposure duration.
Strength (effect magnitude) and precision	• Evidence of a large magnitude effect (considered either within or across studies) can increase strength. • Effects of a concerning rarity or severity can also increase strength, even if they are of a small magnitude. • Precise results from individual studies or across the set of studies increases strength, noting that biological significance is prioritized over statistical significance. • Use of probabilistic model (*e.g.*, Web-ICE, SSD) may increase strength.	Strength may be decreased if effect sizes that are small in magnitude are concluded not to be biologically significant, or if there are only a few studies with imprecise results.
Biological gradient/dose-response	• Evidence of dose-response increases strength. • Dose-response may be demonstrated across studies or within studies and it can be dose- or duration-dependent. • Dose-response may not be a monotonic dose-response (monotonicity should not necessarily be expected, *e.g.*, different outcomes may be expected at low vs. high doses due to activation of	• A lack of dose-response when expected based on biological understanding and having a wide range of doses/exposures evaluated in the evidence base can decrease strength. • In experimental studies, strength may be decreased when effects resolve under certain experimental conditions (*e.g.*, rapid reversibility after removal of exposure).

Consideration	Increased Evidence Strength (of the Apical Endpoints, Mechanistic, or Field Studies Evidence)	Decreased Evidence Strength (of the Apical Endpoints, Mechanistic, or Field Studies Evidence)
Biological gradient/dose-response (continued)	different mechanistic pathways or induction of systemic toxicity at very high doses). • Decreases in a response after cessation of exposure (*e.g.*, return to baseline fecundity) also may increase strength by increasing certainty in a relationship between exposure and outcome (this particularly applicable to field studies).	• However, many reversible effects are of high concern. Deciding between these situations is informed by factors such as the toxicokinetics of the chemical and the conditions of exposure, see (U.S. EPA, 1998), endpoint severity, judgments regarding the potential for delayed or secondary effects, as well as the exposure context focus of the assessment (*e.g.*, addressing intermittent or short-term exposures). • In rare cases, and typically only in toxicology studies, the magnitude of effects at a given exposure level might decrease with longer exposures (*e.g.*, due to tolerance or acclimation). • Like the discussion of reversibility above, a decision about whether this decreases evidence strength depends on the exposure context focus of the assessment and other factors. • If the data are not adequate to evaluate a dose-response pattern, then strength is neither increased nor decreased.
Biological relevance	Effects observed in different populations or representative species suggesting that the effect is likely relevant to the population or representative species of interest (*e.g.*, correspondence among the taxa, life stages, and processes measured or observed and the assessment endpoint).	An effect observed only in a specific population or species without a clear analogy to the population or representative species of interest decreases strength.
Physical/chemical relevance	Correspondence between the substance tested and the substance constituting the stressor of concern.	The substance tested is an analog of the chemical of interest or a mixture of chemicals that include other chemicals besides the chemical of interest.
Environmental relevance	Correspondence between test conditions and conditions in the region of concern.	The test is conducted using conditions that would not occur in the environment.

[a] Database refers to the entire dataset of studies integrated in the environmental hazard assessment and used to inform the strength of the evidence. In this context, database does *not* refer to a computer database that stores aggregations of data records such as the ECOTOX Knowledgebase.