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Draft Environmental Media and General Population Exposure for Diisodecyl Phthalate (DIDP)

Technical Support Document for the Draft Risk Evaluation

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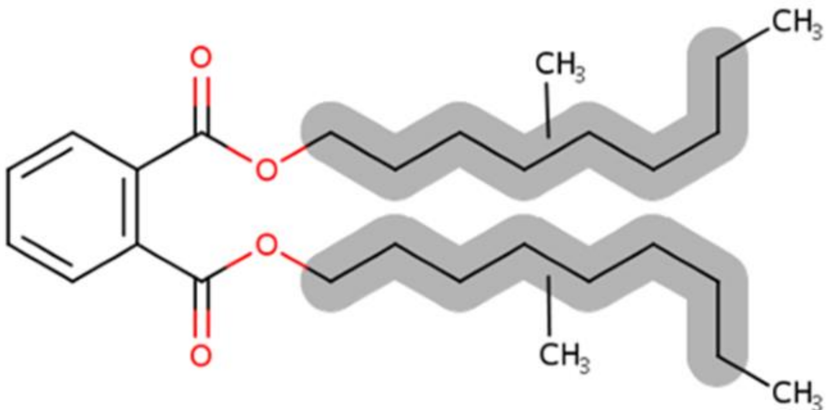

(Representative Structure)

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ABBREVIATIONS AND ACRONYMS

7Q10	Lowest 7-day flow in a 10 year period
ADD	Average daily dose
ADR	Acute dose rate
AERMOD	American Meteorological Society (AMS)/EPA Regulatory Model
BAF	Bioaccumulation factor
BCF	Bioconcentration factor
CDC	Centers for Disease Control and Prevention (U.S.)
CEM	Consumer Exposure Model
COU	Condition of use
DAD	Dermal absorbed dose
DI	Daily intake
DIDP	Diisodecyl phthalate
DINP	Diisononyl phthalate
ECHO	The EPA Enforcement and Compliance History Online Database
F_{ue}	Fractional urinary excretion
IIOAC	Integrated indoor-outdoor air calculator
EPA	Environmental Protection Agency (U.S.)
HEC	Human equivalent concentration
HED	Human equivalent dose
HM	Harmonic mean
K_{OA}	Octanol:air coefficient
K_{OC}	Organic carbon:water partition coefficent
K_p	Dermal permeability coefficient
LADD	Lifetime average daily dose
MCNP	Mono-(carboxynonyl) phthalate
MOE	Margin of exposure
NAICS	North American Industry Classification System
NHANES	National Health and Nutrition Examination Survey
NPDES	National Pollutant Discharge Elimination System
OCSPP	Office of Chemical Safety and Pollution Prevention
OES	Occupational exposure scenario
OPPT	Office of Pollution Prevention and Toxics
PESS	Potentially exposed or susceptible subpopulation(s)
POD	Point of departure
TSCA	Toxic Substances Control Act
WWTP	Wastewater treatment plant

SUMMARY

DIDP – Environmental Media Concentration and General Population Exposure: Key Points

EPA evaluated the reasonably available information for various environmental media concentrations and using a screening level approach estimated exposure through different exposure pathways for the general population. The key points are summarized below:

- EPA assessed environmental concentrations of DIDP in air, water, and land (soil, biosolids, and groundwater) for use in environmental exposure and general population exposure assessment.
  - For the land pathway, EPA determined that DIDP will not be persistent or mobile in soils. Therefore, soil and groundwater concentrations resulting from releases to the landfill or to agricultural lands via biosolid applications were not quantified but are discussed qualitatively.
  - For the water pathway, DIDP in water releases is expected to predominantly partition into sediment. The modeled total water column concentration of DIDP was 7,460 μg/L and benthic sediment concentrations of DIDP was 27,600 mg/kg. Both modeled values were orders of magnitude above any monitored value but were used for the purposes of a screening level analysis. Further refinement of the modeled values was not completed due to the water pathway not being identified as a pathway of concern for ecological receptors or the general population.
  - For the air pathway, DIDP in air releases is expected to predominantly partition into the soil or sediment compartments. The modeled soil concentrations of DIDP were 1.85 mg/kg at 100 m and 0.013 mg/kg at 1,000 m from the generic releasing facility.
- Based on the environmental concentrations, a screening level assessment for exposure to the general population through incidental ingestion to surface water from swimming, dermal contact to surface water from swimming, drinking water, fish ingestion, incidental soil ingestion from ambient air to soil deposition, and soil contact from ambient air to soil deposition was conducted and EPA concluded that there were no pathways of concern for the general population.

This technical document is in support of the TSCA *Draft Risk Evaluation for Diisodecyl Phthalate* (DIDP) (U.S. EPA, 2024h). DIDP is a common chemical name for the category of chemical substances that includes the following substances: 1,2-benzenedicarboxylic acid, 1,2-diisodecyl ester (CASRN 26761-40-0) and 1,2-benzenedicarboxylic acid, di-C9-11-branched alkyl esters, C10-rich (CASRN 68515-49-1). Both CASRNs contain mainly C10 dialkyl phthalate esters. See the draft risk evaluation for a complete list of all the technical support documents for DIDP.

This document describes the use of reasonably available information to estimate environmental concentration of DIDP in different environmental media and the use of the estimated concentrations to evaluate exposure to the general population. EPA evaluated the reasonably available information for releases of DIDP from facilities that use, manufacture, or process DIDP under industrial and/or commercial conditions of use (COUs) subject to TSCA regulations detailed in the *Draft Release and Occupational Exposure Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024c). As described in Section 1, using the release data, EPA modeled predicted concentrations of DIDP in surface water and sediment (Section 4.1), ambient air (Section 8.1), and soil from air to soil deposition (Section 8.3) in the

United States. When possible, the modeled concentrations were compared to environmental monitoring data. Concentrations of DIDP in soil and groundwater resulting from releases to the landfill (Section 3.2) or via biosolids (Section 3.1) were not quantified but discussed qualitatively because DIDP is not expected to be persistent or mobile in soils.

High-end estimates of DIDP concentration in the various environmental media presented in this document were used for a screening level assessment for an environmental and general population exposure assessment. Environmental exposures assessed using the predicted concentrations of DIDP is presented elsewhere in the *Draft Environmental Exposure Assessment for DIDP* (U.S. EPA, 2024b). General population exposure is discussed in this document using a screening level approach detailed in Section 2. EPA used a margin of exposure (MOE) approach discussed in Section 2.1 using high-end exposure estimates to determine if there were potential non-cancer risks for various exposure pathways. High-end exposure estimates were defined as those associated with the industrial and commercial releases from a COU and occupational exposure scenario (OES) that resulted in the highest environmental media concentrations. Table 1-1 provides a crosswalk between COUs and OESs. More details on defining high-end exposure estimates are found in Section 2.2. Plainly, if there is no risk for an individual identified as having the potential for the highest exposure associated with a COU for a given pathway of exposure, then that pathway was determined not to be a pathway of concern and not assessed further. If any pathways were identified as a pathway of concern for the general population, further exposure assessments for that pathway would be conducted to include higher tiers of modeling when available, refinement of exposure estimates, and exposure estimates for additional subpopulations and OES/COUs.

Table ES-1 summarizes the exposure pathways assessed for the general population. For DIDP, exposures to the general population via surface water, drinking water, fish ingestion, and ambient air deposition to soil were quantified, while exposures via the land pathway (biosolids and landfills) were qualitatively assessed. Further description of the qualitative and quantitative assessments for each exposure pathway can be found in the sections linked in Table ES-1. As summarized in Table ES-1, results described in further detail in the sections linked within the table indicate that biosolids, landfills, surface water, drinking water, fish ingestion, and ambient air are not pathways of concern for DIDP for highly exposed populations based on the OES leading to high-end concentrations of DIDP in environmental media. Therefore, EPA did not further refine the general population exposure assessment to include higher tiers of modeling, additional subpopulations, and additional COUs.

Table ES-1. Exposure Pathways Assessed for General Population Screening Level Assesment

Occupational Exposure Scenario[a]	Exposure Pathway	Exposure Route	Exposure Scenario	Pathway of Concern[b]
All	Biosolids (Section 3.1)	No specific exposure scenarios were assessed for qualitative assessments		No
All	Landfills (Section 3.2)	No specific exposure scenarios were assessed for qualitative assessments		No
Use of Lubricants and Functional Fluids	Surface Water	Dermal	Dermal exposure to DIDP in surface water during swimming (Section 5.1.1)	No
		Oral	Incidental ingestion of DIDP in surface water during swimming (Section 5.1.2)	No
Use of Lubricants and Functional Fluids	Drinking Water	Oral	Ingestion of drinking water (Section 6.1.1)	No
All	Fish Ingestion	Oral	Ingestion of fish for General Population (Section 7.1)	No
			Ingestion of fish for subsistence fishers (Section 7.2)	No
			Ingestion of fish for tribal populations (Section 7.3)	No
PVC Plastics Compounding	Ambient Air	Oral	Ingestion of DIDP in soil resulting from air to soil deposition (Section 9.1)	No
		Dermal	Dermal exposure to DIDP in soil resulting from air to soil deposition (Section 9.1.2)	No

[a] Table 1-1 provides a crosswalk of industrial and commercial COUs to OES.
[b] Using the MOE approach, an exposure pathway was determined to not be a pathway of concern if the MOE was equal to or exceeded the benchmark MOE of 30.

1 ENVIRONMENTAL MEDIA CONCENTRATION OVERVIEW

EPA assessed environmental concentrations of DIDP in air, water, and land (soil, biosolids and groundwater) using monitoring and modeled data for use in an environmental exposure assessment presented elsewhere in the *Draft Environmental Exposure Assessment for DIDP* (U.S. EPA, 2024b) and general population exposure assessment described in detail in Section 2 and presented throughout the document.

Modeling efforts utilized reasonably available information for releases of DIDP from facilities that use, manufacture, or process DIDP under industrial and/or commercial conditions of use (COUs) subject to TSCA regulations detailed in the *Draft Release and Occupational Exposure Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024c). EPA categorized the COUs into occupational exposure scenarios (OESs). Table 1-1 provides a crosswalk between COUs and OESs. Briefly, each OES is developed based on a set of occupational activities and conditions such that similar environmental releases are expected from the use(s) covered under the OES. For each OES, EPA provided environmental release results, which are expected to be representative of all sites for the given OES in the United States. There was no location-specific information available. The type of release resulting from each OES is categorized in Table 1-2. In some cases, EPA defined only a single OES for multiple COUs, while in other cases EPA developed multiple OESs for a single COU. EPA made this determination by considering variability in release and use conditions and whether the variability required discrete scenarios or could be captured as a distribution of exposures. The *Draft Release and Occupational Exposure Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024c) provides further information on each specific COU and OES.

Table 1-1. Crosswalk of Conditions of Use to Assessed Occupational Exposure Scenarios

Life Cycle Stage	Category	Subcategory	OES
Manufacturing	Domestic manufacturing	Domestic manufacturing	Manufacturing
	Importing	Importing	Import and Repackaging
Processing	Repackaging	Repackaging	Import and Repackaging
	Incorporation into formulation, mixture, or reaction product	Adhesives and sealants manufacturing	Incorporation into Adhesives and Sealants
		Laboratory chemicals manufacturing	Incorporation into Other Formulations, Mixtures, or Reaction Products
		Petroleum lubricating oil manufacturing; Lubricants and lubricant additives manufacturing	Incorporation into Other Formulations, Mixtures, or Reaction Products
		Surface modifier in paint and coating manufacturing	Incorporation into Paints and Coatings
		Plastic material and resin manufacturing	PVC Plastics Compounding; Non-PVC Material Compounding
		Plasticizers (paint and coating manufacturing; colorants (including pigments); rubber manufacturing)	Incorporation into Paints and Coatings; Non-PVC Material Compounding;

Life Cycle Stage	Category	Subcategory	OES
		Processing aids, specific to petroleum production (oil and gas drilling, extraction, and support activities)	Incorporation into Other Formulations, Mixtures, or Reaction Products
		Other (part of the formulation for manufacturing synthetic leather)	PVC Plastics Compounding; Non-PVC Material Compounding
	Incorporation into articles	Abrasives manufacturing	Application of Adhesives and Sealants
		Plasticizers (asphalt paving, roofing, and coating materials manufacturing; construction; automotive products manufacturing, other than fluids; electrical equipment, appliance, and component manufacturing; fabric, textile, and leather products manufacturing; floor coverings manufacturing; furniture and related product manufacturing; plastics product manufacturing; rubber product manufacturing; textiles, apparel, and leather manufacturing; transportation equipment manufacturing; ink, toner, and colorant (including pigment) products manufacturing; photographic supplies manufacturing; sporting equipment manufacturing)	PVC Plastics Converting Non-PVC Material Converting;
	Recycling	Recycling	Recycling
Disposal	Disposal	Disposal	Disposal
Distribution in commerce	Distribution in commerce	Distribution in commerce	Distribution in Commerce
Industrial uses	Abrasives	Abrasives (surface conditioning and finishing discs; semi-finished and finished goods)	Fabrication or Use of Final Products or Articles
	Adhesive and sealants	Adhesives and sealants	Application of Adhesives and Sealants
	Functional fluids (closed systems)	Functional fluids (closed systems) (SCBA compressor oil)	Use of Lubricants and Functional Fluids
	Lubricant and lubricant additives	Lubricants and lubricant additives	Use of Lubricants and Functional Fluids
	Solvents (for cleaning or	Solvents (for cleaning or degreasing)	Use of Lubricants and Functional Fluids

Life Cycle Stage	Category	Subcategory	OES
	degreasing)		
Commercial uses	Automotive, fuel, agriculture, outdoor use products	Automotive products, other than fluids	Fabrication or Use of Final Products or Articles
		Lubricants	Use of Lubricants and Functional Fluids
	Construction, paint, electrical, and metal products	Adhesives and sealants (including plasticizers in adhesives and sealants)	Application of Adhesives and Sealants
		Building/construction materials (wire or wiring systems; joint treatment, fire-proof insulation)	Fabrication or Use of Final Products or Articles
		Electrical and electronic products	Fabrication or Use of Final Products or Articles
		Paints and coatings (including surfactants in paints and coatings)	Application of Paints and Coatings
		Lacquers, stains, varnishes, and floor finishes (as plasticizer)	Application of Paints and Coatings; Application of Adhesives and Sealants
	Furnishing, cleaning, treatment/care products	Furniture and furnishings	Fabrication or Use of Final Products or Articles
		Construction and building materials covering large surface areas including stone, plaster, cement, glass and ceramic articles; fabrics, textiles, and apparel (as plasticizer) (Floor coverings (vinyl tiles, PVC-backed carpeting, scraper mats))	Fabrication or Use of Final Products or Articles
		Ink, toner, and colorant products	Application of Paints and Coatings
		PVC film and sheet	Fabrication or Use of Final Products or Articles
		Plastic and rubber products (textiles, apparel, and leather; vinyl tape; flexible tubes; profiles; hoses)	Fabrication or Use of Final Products or Articles
	Other uses	Laboratory chemicals	Use of Laboratory Chemicals
		Inspection fluid/penetrant	Use of Inspection Fluid and Penetrant

Table 1-2. Type of Release to the Environment by Occupational Exposure Scenario

Occupational Exposure Scenario (OES) [a]	Type of Discharge, [b] Air Emission, [c] or Transfer for Disposal [d]
Manufacturing	Fugitive Air
	Stack Air
	Wastewater to Onsite treatment or Discharge to POTW
	Onsite Wastewater Treatment, Incineration, or Landfill
	Landfill
Import and repackaging	Fugitive Air
	Wastewater to Onsite Treatment, Discharge to POTW, or Landfill
PVC plastics compounding	Fugitive or Stack Air
	Wastewater, Incineration, or Landfill
	Wastewater
	Fugitive air, Wastewater, Incineration, or landfill
	Incineration or Landfill
PVC plastics converting	Fugitive or Stack Air
	Wastewater, Incineration, or Landfill
	Wastewater
	Fugitive air, Wastewater, Incineration, or Landfill
	Incineration or Landfill
Non-PVC material compounding	Fugitive or Stack Air
	Wastewater, Incineration, or Landfill
	Wastewater
	Fugitive Air, Wastewater, Incineration, or Landfill
	Incineration or Landfill
Non-PVC material converting	Fugitive or Stack Air
	Wastewater, Incineration, or Landfill
	Wastewater
	Fugitive Air, Wastewater, Incineration, or Landfill
	Incineration or Landfill
Incorporation into adhesives and sealants	Fugitive Air
	Stack Air
	Wastewater, Incineration, or Landfill
Incorporation into paints and coatings	Fugitive Air
	Stack Air
	Wastewater, Incineration, or Landfill
Incorporation into other formulations, mixtures, and reaction products not covered elsewhere	Fugitive Air
	Stack Air
	Wastewater, Incineration, or Landfill

Occupational Exposure Scenario (OES) [a]	Type of Discharge,[b] Air Emission,[c] or Transfer for Disposal[d]
Application of paints and coatings with overspray controls [No Overspray Controls]	Fugitive Air
	Stack Air
	Wastewater, Incineration, or Landfill
Application of Adhesives and Sealants	Fugitive or Stack Air
	Wastewater, Incineration, or Landfill
Use of Laboratory Chemicals – Liquid	Fugitive or Stack Air
	Wastewater, Incineration, or Landfill
Use of Laboratory Chemicals – Solid	Stack Air
	Wastewater, Incineration, or Landfill
Use of Lubricants and Functional Fluids	Wastewater
	Landfill
	Recycling
	Fuel Blending (Incineration)
Use of Penetrants and Inspection Fluids	Fugitive Air
	Wastewater, Incineration, or Landfill
	Fugitive Air
	Wastewater, Incineration, or Landfill
Recycling and Disposal	Stack Air
	Fugitive Air, Wastewater, Incineration, or Landfill
	Wastewater

[a] Table 1-1 provides the crosswalk of OES to COUs
[b] Direct discharge to surface water; indirect discharge to non-POTW; indirect discharge to POTW
[c] Emissions via fugitive air or stack air, or treatment via incineration
[d] Transfer to surface impoundment, land application, or landfills

All releases from all OESs listed in Table 1-2 were considered, but EPA focused on estimating high-end concentrations of DIDP from the largest estimated releases for the purpose of its screening level assessment for environmental and general population exposures. This means that EPA considered the environmental concentration of DIDP in a given environmental media resulting from the OES that had the highest release compared to the other OES for the same releasing media. The OES resulting in the highest environmental concentration of DIDP varied by environmental media as shown in Table 2-2.

Additionally, EPA relied on its fate assessment to determine which environmental pathways to consider for its screening level analysis. Details on the environmental partitioning and media assessment can be found in *Draft Fate Assessment for DIDP* (U.S. EPA, 2024d). Briefly, based on DIDP's fate parameters, EPA anticipated DIDP to be expected predominantly in water, soil, and sediment, with DIDP in soils attributable to air to soil deposition and land application of biosolids. Therefore, EPA quantitatively assessed concentrations of DIDP in surface water, sediment, and soil from air to soil deposition. Ambient air concentrations were quantified for the purpose of estimating soil concentrations from air to soil deposition but was not used for the exposure assessment as DIDP was not assumed to be persistent in the air ($t_{1/2}$ = 7.6 hours (Mackay et al., 2006)) and partitioning analysis showed DIDP partitions primarily to soil, compared to air, water, and sediment, even in air releases. Soil concentration of DIDP from land applications were not quantitatively assessed in the screening level analysis as DIDP was expected to have limited persistence potential and mobility in soils receiving biosolids.

Screening-level assessment approaches are described in further detail in Section 2. Based on the types of releases and fate parameters of DIDP, EPA modeled high-end predicted concentrations of DIDP in surface water and sediment (Section 4.1), ambient air (Section 8.1), and soil from air to soil deposition (Section 8.3) for the in the United States. The COU and OES associated with the high-end concentration of each media type is described in each section. When possible, the modeled concentrations were compared to environmental monitoring data presented in Sections 4.2.1, 4.2.2, 8.2, and 8.3.1 for surface water, sediment, ambient air, and soil, respectively. Based on DIDP's fate parameters detailed in *Draft Fate Assessment for DIDP* (U.S. EPA, 2024d), concentrations of DIDP in soil and groundwater resulting from releases to the landfill (Section 3.2) or via biosolids (Section 3.1) were not quantified but discussed qualitatively.

2 SCREENING LEVEL ASSESSMENT OVERVIEW

Screening level assessments are useful when there is little location- or scenario-specific information available. EPA began its DIDP exposure assessment using a screening level approach because of limited environmental monitoring data for DIDP and lack of location data for DIDP releases. A screening-level analysis relies on conservative assumptions, including default input parameters for modeling exposure, to assess exposures that would be expected to be on the high end of the expected exposure distribution. Details on the use of screening-level analyses in exposure assessment can be found in EPA's *Guidelines for Human Exposure Assessment* (U.S. EPA, 2019b).

For the general population screening level assessment, EPA used a margin of exposure (MOE) approach using high-end exposure estimates to determine if exposure pathways were pathways of concern for potential non-cancer risks. Using the MOE approach, an exposure pathway associated with a COU was determined to not be a pathway of concern if the MOE was equal to or exceeded the benchmark MOE of 30. Further details of the MOE approach are described in Section 2.1.

High-end exposure estimates used for screening level analyses were defined as those associated with the industrial and commercial releases from a COU and OES that resulted in the highest environmental media concentrations. Additionally, individuals with the greatest intake rate of DIDP per body weight were considered to be those at the upper end of the exposure. Taken together, these exposure estimates are conservative because they were determined using the highest environmental media concentrations and greatest intake rate of DIDP per kilogram of body weight. These exposure estimates are also protective of individuals having less exposure either due to lower intake rate or exposure to lower environmental media concentration. This is explained further in Section 2.2.

Plainly, if there is no risk for an individual identified as having the potential for the highest exposure associated with a COU for a given pathway of exposure, then that pathway was determined not to be a pathway of concern. If any pathways were identified as having potential for risk to the general population, further exposure assessments for that pathway would be conducted to include higher tiers of modeling, additional subpopulations, and OES/COUs.

2.1 Margin of Exposure Approach

EPA used a MOE approach using high-end exposure estimates to determine if the pathway analyzed is a pathway of concern. The MOE is the ratio of the non-cancer hazard value (or point of departure (POD)) divided by a human exposure dose. Acute, intermediate, and chronic MOEs for non-cancer inhalation and dermal risks were calculated using the following equation:

Equation 2-1. Margin of Exposure Calculation

$$MOE = \frac{Non - cancer\ Hazard\ Value\ (POD)}{Human\ Exposure}$$

Where:

MOE	=	Margin of exposure for acute, short-term, or chronic risk comparison (unitless)
$Non\text{-}cancer\ Hazard\ Value\ (POD)$	=	Human equivalent concentration (HEC, mg/m^3) or human equivalent dose (HED, in units of mg/kg-day)
$Human\ Exposure$	=	Exposure estimate (mg/m^3 or mg/kg-day)

MOE risk estimates may be interpreted in relation to benchmark MOEs. Benchmark MOEs are typically the total uncertainty factor for each non-cancer POD. The MOE estimate is interpreted as a human health risk of concern if the MOE estimate is less than the benchmark MOE (*i.e.*, the total uncertainty factor). On the other hand, for this screening level analysis, if the MOE estimate is equal to or exceeds the benchmark MOE, the exposure pathway is not analyzed further. Typically, the larger the MOE, the more unlikely it is that a non-cancer adverse effect occurs relative to the benchmark. When determining whether a chemical substance presents unreasonable risk to human health or the environment, calculated risk estimates are not "bright-line" indicators of unreasonable risk, and EPA has the discretion to consider other risk-related factors in addition to risks identified in the risk characterization.

The non-cancer hazard values used for the MOE approach are described in detail in the *Draft Human Health Hazard Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024f), and are summarized in Table 2-1.

Table 2-1. Non-cancer HECs and HEDs Used to Estimate Risks

Exposure Scenario	Point of Departure (mg/kg-day)	Human Equivalent Concentration (mg/m^3) [ppm]	Human Equivalent Dose (mg/kg-day)	Benchmark Margin of Exposure	References
Acute, intermediate, and chronic	NOAEL = 38	49 [2.7]	9.0	UF_A= 3 UF_H=10 *Total UF=30*	(Hushka et al., 2001; Exxon Biomedical, 2000)
NOAEL = no-observed-adverse-effect level					

Using the MOE approach in a screening level analysis, an exposure pathway associated with a COU was determined to not be a pathway of concern if the MOE was equal to or exceeded the benchmark MOE of 30.

2.2 Estimating High-End Exposure

General population exposures occur when DIDP is released into the environment and the environmental media is then a pathway for exposure. As described in the *Draft Release and Occupational Exposure Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024c) and summarized in Table 1-2, releases of DIDP are expected occur to air, water, and land. Figure 2-1 provides a graphic representation of where and in which media DIDP is estimated to be found due to environmental releases and the corresponding route of exposure.

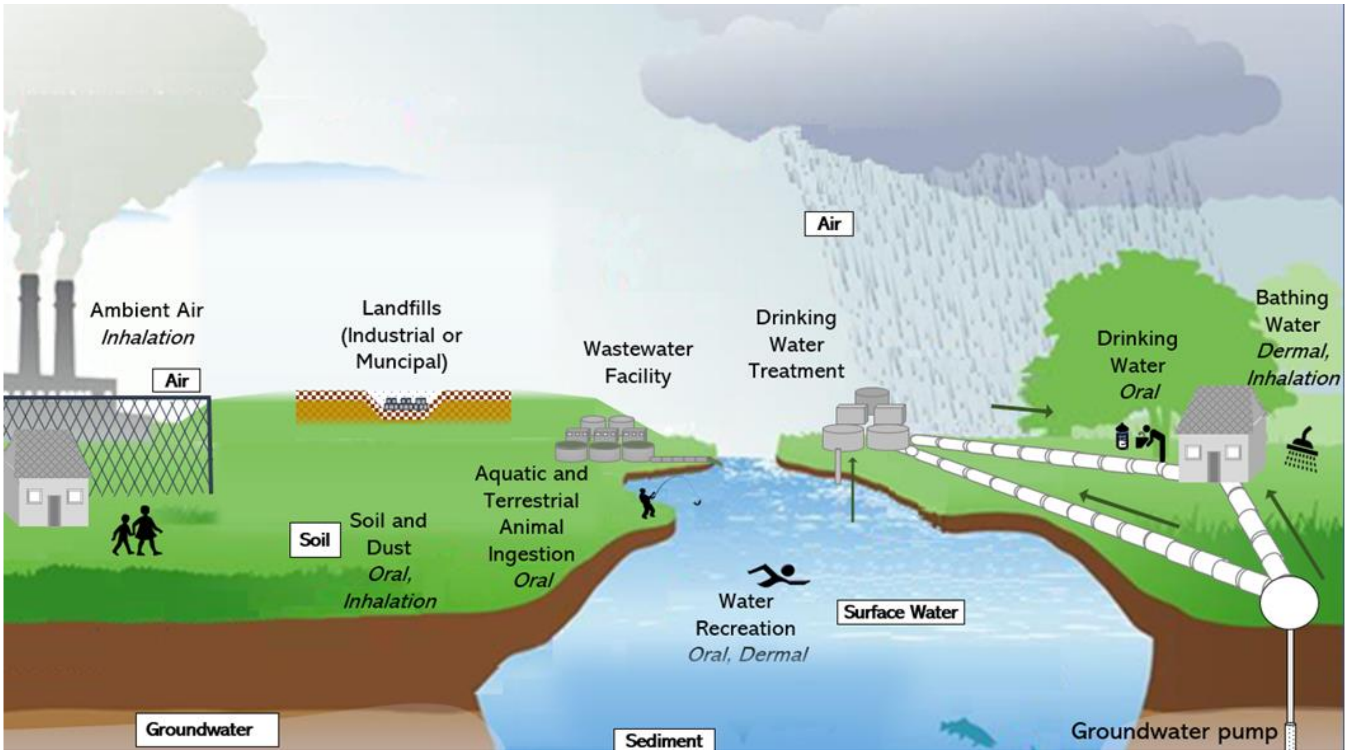

Figure 2-1. Potential Human Exposure Pathways for the General Population
The diagram presents the media (white text boxes) and routes of exposure (italics for oral, inhalation, or dermal) for the general population. Sources of drinking water from surface or water pipes is depicted with grey arrows.

For purposes of a screening level analysis, high-end exposures were estimated for each exposure pathway assessed. *EPA's Guidelines for Human Exposure Assessment* defined high-end exposure estimates as a "plausible estimate of individual exposure for those individuals at the upper end of an exposure distribution, the intent of which is to convey an estimate of exposure in the upper range of the distribution while avoiding estimates that are beyond the true distribution." If risk is not found for these individuals with high-end exposure, no risk is anticipated for central tendency exposures, which is defined as "an estimate of individuals in the middle of the distribution."

Identifying individuals at the upper end of an exposure distribution included consideration of high-end exposure scenarios defined as those associated with the industrial and commercial releases from a COU and OES that resulted in the highest environmental media concentrations. Additionally, individuals with the greatest intake rate of DIDP per body weight were considered to be those at the upper end of the exposure. Intake rate and body weight are dependent on lifestage as shown in Appendix A.

Table 2-2 summarizes the high-end exposure scenarios that were considered in the screening level analysis including the lifestage assessed as the most potentially exposed population based on intake rate and body weight. Exposure scenarios were assessed quantitatively only when environmental media concentrations were quantified for the appropriate exposure scenario. For example, exposure from soil or groundwater resulting from DIDP release to the environment via biosolids or landfills was not quantitatively assessed because DIDP concentrations to the environment from biosolids and landfills was not quantified. However, the scenarios were still assessed qualitatively for exposures potentially resulting from biosolids and landfills.

Table 2-2. Exposure Scenarios Assessed in Screening Level Analysis

OES	Exposure Pathway	Exposure Route	Exposure Scenario	Lifestage	Analysis (Quantitative or Qualitative)
All	Biosolids	No specific exposure scenarios were assessed for qualitative assessments			Qualitative Section 3.1
All	Landfills	No specific exposure scenarios were assessed for qualitative assessments			Qualitative Section 3.2
Use of Lubricants and Functional Fluids	Surface Water	Dermal	Dermal exposure to DIDP in surface water during swimming	Adults	Quantitative Section 5.1.1
		Oral	Incidental ingestion of DIDP in surface water during swimming	Youth	Quantitative Section 5.1.2
Use of Lubricants and Functional Fluids	Drinking Water	Oral	Ingestion of drinking water	Infants	Quantitative Section 6.1.1
All	Fish Ingestion	Oral	Ingestion of fish for General Population	Adult	Quantitative Section 7.1
			Ingestion of fish for subsistence fishers	Adult	Quantitative Section 7.2
			Ingestion of fish for tribal populations	Adult	Quantitative Section 7.3
PVC Plastic Compounding	Ambient Air	Oral	Ingestion of DIDP in soil resulting from air to soil deposition	Infant and Children	Quantitative Section 9.1
		Dermal	Dermal exposure to DIDP in soil resulting from air to soil deposition	Infant and Children	Quantitative Section 9.1.2

Modeled surface water concentrations (Section 4.1) were utilized to estimate oral drinking water exposures (Section 6.1.1), incidental dermal exposures (Section 5.1.1), and incidental oral exposures (Section 5.1.2) for the general population. Modeled soil concentrations from air to soil deposition (Section 8.3) were utilized to estimate oral (Section 9.1) and dermal (Section 9.1.2) exposures. If any pathways were identified as an exposure pathway of concern for the general population, further exposure assessments for that pathway would be conducted to include higher tiers of modeling when available and exposure estimates for additional subpopulations and COUs.

3 LAND PATHWAY

3.1 Biosolids

Biosolids generated during the treatment of industrial and municipal wastewater may be land applied to agricultural fields or pasturelands. During the wastewater treatment process, greater than 93 percent of DIDP is expected to be removed via sorption to wastewater sludge (U.S. EPA, 2024d). A study on DIDP concentrations in biosolids from wastewater treatment plants from the U.S. reported concentrations of DIDP ranging from 4.3 to 24.9 mg/kg (Armstrong et al., 2018). Additionally, concentrations of DIDP in sludge from sewage treatment plants outside of the U.S. have been reported as ranging from 3.8 to 83 mg/kg (Cousins et al., 2007; ECJRC, 2003). As a conservative estimate, it can be assumed that DIDP concentrations in soils receiving biosolids have the same concentrations as the biosolids; therefore, based on measured data, DIDP concentrations in soils receiving biosolids can be estimated as 83.0 mg/kg based off of the observed high-end monitoring data available.

High-end release scenarios were considered not to be applicable to the evaluation of land application of biosolids. More specifically, high-end releases of DIDP from industrial facilities are unlikely to be discharged directly to municipal wastewater treatment plants without pre-treatment, and biosolids from industrial facilities are unlikely to be directly land applied following on-site treatment.

Due to its low water solubility (0.00017 mg/L) and affinity for sorption to soil and organic constituents in soil (log K_{OC} = 5.09), DIDP is unlikely to migrate to groundwater via runoff after land application of biosolids. Additionally, the half-life of 28 to 52 days in aerobic soils (U.S. EPA, 2024d) indicates that DIDP will have low persistence potential in the aerobic environments associated with freshly applied biosolids. Since the physical and chemical properties of DIDP indicate that it is unlikely to migrate from land applied biosolids to groundwater via runoff, EPA did not model groundwater concentrations resulting from land application of biosolids.

Although DIDP is not expected to be solubilized by rainwater and conveyed as a solute in runoff during and after precipitation events, it is possible that DIDP sorbed to soil particles may be conveyed via overland flow of surface runoff to nearby surface water bodies and enter the water sorbed to suspended sediments. This sorbed DIDP may then be transported downstream, settle to the benthic environment, and be incorporated into the sediment.

There is limited measured data on concentrations of DIDP in biosolids or soils receiving biosolids and there is uncertainty that concentrations used in this analysis are representative of all types of environmental releases. However, the high-quality biodegradation rates and physical and chemical properties show that DIDP will have limited persistence potential and mobility in soils receiving biosolids.

3.1.1 Weight of Scientific Evidence Conclusions

There is considerable uncertainty in the applicability of using generic release scenarios and wastewater treatment plant modeling software to estimate concentrations of DIDP in biosolids. Additionally, there is uncertainty in the relevancy of the biosolids monitoring data to the COUs considered in this evaluation. Overall, due to the high confidence in the biodegredation rates and physical and chemical data, there is robust confidence that in soils receiving DIDP will not be mobile and will have low persistence potential.

3.2 Landfills

DIDP may biodegrade in the aerobic, upper portions of landfills and may be hydrolyzed under the high-temperature, caustic pH regimes that exist in the lower portions of landfills; however, DIDP is expected to be persistent in landfills due to its lack of biodegradation in anaerobic conditions, which predominate lower portions of landfills. Additionally, large amounts DIDP will likely be present in landfills as it is continually added from consumer products that use DIDP in their formulation.

Due to its low water solubility (0.00017 mg/L) and affinity for organic carbon (log Koc = 5.09), DIDP is expected to be present at low concentrations in landfill leachate. Measured concentrations of DIDP in landfill leachates collected from four landfills in Sweden were below detection for all samples analyzed (n = 11) (Kalmykova et al., 2013). Further, any DIDP that may present in landfill leachates will not be mobile in receiving soils and sediments due to its high affinity for organic carbon. Sediments near a landfill in Sweden were found to have a DIDP concentration of 290 µg/kg (Cousins et al., 2007). For comparison, the same study reported that sediment taken from background lakes had DIDP concentrations below the detection limit of 100 µg/kg for all samples and reported that sediments from urban locations had DIDP concentrations ranging from below detection to 3400 µg/kg (Cousins et al., 2007). Since the physical and chemical properties of DIDP indicate that it is unlikely to be present in landfill leachate or be mobile in soils, modeling of groundwater contamination due to landfill leachate containing DIDP was not performed.

While there is limited measured data on DIDP in landfill leachates, the data suggest that DIDP is unlikely to be present in landfill leachates. Further, the small amounts of DIDP that could potentially be in landfill leachates will have limited mobility and are unlikely to infiltrate groundwater due to high affinity of DIDP for organic compounds that would be present in receiving soil and sediment. Interpretation of the high-quality physical and chemical property data also suggest that DIDP is unlikely to be present in landfill leachate. Therefore, EPA concludes that further assessment of DIDP in landfill leachate is not needed.

3.2.1 Weight of Scientific Evidence Conclusion

There is uncertainty in the relevancy of the landfill leachate monitoring data to the COUs considered in this evaluation. Based on the biodegredation and hydrolysis data for conditions relevant to landfills, there is high confidence DIDP will be persistent in landfills. Overall, due high-quality physical and chemical property data, there is robust confidence that DIDP is unlikely to be present in landfill leachates.

4 SURFACE WATER CONCENTRATION

EPA searched peer-reviewed literature, gray literature, and databases of environmental monitoring data to obtain concentrations of DIDP in ambient surface water and aquatic sediments. Though the available monitoring data were limited, DIDP was found in detectable concentrations in ambient surface waters, raw and finished drinking water, and in aquatic sediments. Limited monitoring studies measuring DIDP within water and sediment are likely due to difficulties in quantifying DIDP within environmental samples (Chen et al., 2016; Lin et al., 2003). EPA conducted modeling of estimated industrial releases to surface water to assess the expected resulting environmental media concentrations from TSCA COUs presented in Table 1-1. Section 4.1 reports EPA modeled surface water concentrations and modeled sediment concentrations. Section 4.2.1 includes a summary of monitoring concentrations for ambient surface water, and Section 4.2.2 includes monitoring concentrations for sediment found from the systematic review process.

4.1 Modeling Approach for Estimating Concentrations in Surface Water

EPA conducted modeling with the U.S. EPA's Variable Volume Water Model with Point Source Calculator tool (PSC), to estimate concentrations of DIDP within surface water and sediment. PSC considers model inputs of physical and chemical properties of DIDP (*i.e.*, K_{OW}, K_{OC}, water column half-life, photolysis half-life, hydrolysis half-life, and benthic half-life) allowing EPA to model predicted surface water concentrations (U.S. EPA, 2019d). The PSC model was also used to estimate settled sediment in the benthic region of streams.

Site-specific parameters influence how partitioning occurs over time. For example, the concentration of suspended sediments, water depth, and weather patterns all influence how a chemical may partition between compartments. Physical and chemical properties of the chemical itself also influence partitioning and half-lives into environmental media. DIDP has a log K_{OC} of 5.04 to 5.78, indicating a high potential to sorb to suspended particles in the water column and settled sediment in the benthic environment (U.S. EPA, 2012; Mackay et al., 2006; Williams et al., 1995).

Physical and chemical properties selected by EPA for this assessment were applied as inputs to the PSC model (Table 4-1).

Table 4-1. PSC Model Inputs (Chemical Parameters)

Parameter	Value
K_{OC}	145,000 mL/g
Water Colum Half-life	50 days at 25 °C
Photolysis Half-life	8 days at 30
Hydrolysis Half-life	1,200 days at 25 °C
Benthic Half-life	3,000 days at 25 °C
Molecular Weight	446.67
Vapor Pressure (torr)	0.0000001
Solubility	0.00017 mg/L
Heat of Henry	50,000 J/mol

Parameter	Value
Reference Temp	25 °C

A generic setup for the model environment and media parameters was applied consistently across all PSC runs. The standard EPA "farm pond" waterbody characteristics were used to parameterize the water column and sediment parameters (Table 4-2). Generic modeled waterbody parameters were also applied, with a standardized width of 5 m, length of 40 m, and depth of 1 m.

Table 4-2. PSC Model Inputs (Waterbody Characteristics)

Parameter	Value
DFAC	1.19
Water Column Suspended Sediment	30 mg/L
Chlorophyll	0.005 mg/L
Water Column foc	0.04
Water Column DOC	5.0 mg/L
Water Column Biomass	0.4 mg/L
Benthic Depth	0.05 m
Benthic Porosity	0.50
Benthic Bulk Density	1.35 g/cm^3
Benthic foc	0.04
Benthic DOC	5.0 mg/L
Benthic Biomass	0.006 g/m^2

A distribution of flow metrics was generated by collecting flow data for facilities across 20 North American Industry Classification System (NAICS) codes associated with DIDP-releasing facilities (Table 4-3). The EPA Enforcement and Compliance History Online (ECHO) database was accessed via the API and queried for facilities regulated under the Clean Water Act within each of the 20 relevant NAICS codes. All available National Pollutant Discharge Elimination System (NPDES) permit IDs were retrieved from the facilities returned by the query. An additional query of the DMR REST service was conducted via the ECHO API to return NHDPlus reach code associated with the receiving waterbody for each available facility. Modeled flow metrics were then extracted for the retrieved reach codes, from the NHDPlus V2.1 Flowline Network EROM Flow database. The EROM database provides modeled monthly average flows for each month of the year. While the EROM flow database represents averages across a 30-year time period, the lowest of the monthly average flows was selected as a substitute for the 30Q5 flow used in modeling, as both approximate the lowest observed monthly flow at a given location. The substitute 30Q5 flow was then plugged into the regression equation used by E-FAST to convert between these flow metrics and solved for the 7Q10 using Equation 4-1. In previous assessments, the EPA has selected the 7Q10 flow as a representative low flow scenario for biological impacts due to effluent in streams, while the harmonic mean represents a more average flow for assessing chronic drinking water exposure.

Equation 4-1. Calculating the 7Q10 Flow

$$\boldsymbol{7Q10} = \frac{\left(0.409\frac{cfs}{MLD} * \frac{\boldsymbol{30Q5}}{1.782}\right)^{1.0352}}{0.409\frac{cfs}{MLD}}$$

Where:

7Q10	=	the modeled 7Q10 flow, in MLD
30Q5	=	the lowest monthly average flow from NHD, in MLD

Further, the harmonic mean (HM) flow was calculated using Equation 4-2, derived from the relevant E-FAST regression.

Equation 4-2. Calculating the Harmonic Mean Flow

$$\boldsymbol{HM} = 1.194 * \frac{\left(0.409\frac{cfs}{MLD} * \boldsymbol{AM}\right)^{0.473} * \left(0.409\frac{cfs}{MLD} * \boldsymbol{7Q10}\right)^{0.552}}{0.409\frac{cfs}{MLD}}$$

Where:

HM	=	the modeled harmonic mean flow, in MLD
AM	=	the annual average flow from NHD, in MLD
7Q10	=	the modeled 7Q10 flow from the previous equation, in MLD

Table 4-3. Relevant NAICS Codes for Facilities Associated with DIDP Releases

NAICS Code	NAICS Name
322220	Paper Bag and Coated and Treated Paper Manufacturing
325110	Petrochemical Manufacturing
325199	All Other Basic Organic Chemical Manufacturing
325211	Plastics Material and Resin Manufacturing
325212	Synthetic Rubber Manufacturing
325320	Pesticide And Other Agricultural Chemical Manufacturing
325510	Paint and Coating Manufacturing
325520	Adhesive Manufacturing
325613	Surface Active Agent Manufacturing
325991	Custom Compounding of Purchased Resins
325998	All Other Miscellaneous Chemical Product and Preparation Manufacturing
326113	Unlaminated Plastics Film and Sheet (Except Packaging) Manufacturing
326220	Rubber And Plastics Hoses and Belting Manufacturing
336111	Automobile Manufacturing

NAICS Code	NAICS Name
422690	Other Chemical and Allied Products Wholesalers
423610	Electrical Apparatus and Equipment, Wiring Supplies, And Related Equipment Merchant Wholesalers
424610	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers
424690	Other Chemical and Allied Products Merchant Wholesalers
424910	Farm Supplies Merchant Wholesalers
444120	Paint And Wallpaper Stores

In addition to the hydrologic flow data retrieved from the NHDPlus database, information about the facility effluent rate was collected, as available, from the ECHO API. A minimum effluent flow rate of six cubic feet per second, derived from the average reported effluent flow rate acros facilities, was applied. The receiving waterbody 7Q10 flow was then calculated as the sum of the hydrologic 7Q10 flow estimated from regression, and the facility effluent flow. From the distributions of flow statistics reported, the median receiving waterbody represented a stream with minimal flow, dominated by the effluent from the facility, while the lower end of the distribution represented a stream with essentially no flow beyond the facility effluent. As there was little variation between the minimum and median stream conditions of the resulting receiving waterbody flow rates across the pooled flow data of all relevant NAICS codes, the median 7Q10 flow rate was selected to be applied as a conservative low flow condition across the modeled releases (Figure 4-1).

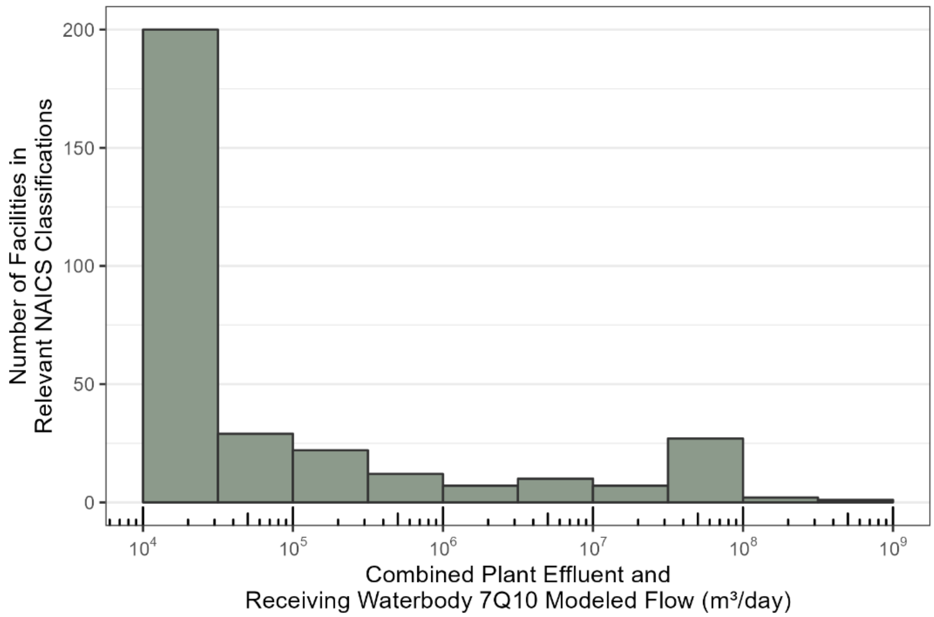

Figure 4-1. Distribution of Receiving Waterbody 7Q10 Modeled Flow for Facilities with Relevant NAICS Classifications

Quantified release estimates to surface water were evaluated with PSC modeling. For each COU with surface water releases, categorized as wastewater in Table 1-2, the highest estimated release to surface water was modeled. The total days of release associated with the highest COU release was applied as continuous days of release per year (for example, a scenario with 250 days of release per year was modeled as 250 consecutive days of release, followed by 115 days of no release, per year). Rather than incorporating assumptions about weekly or monthly release schedules, modeling the days of release as consecutive days in a year provides a more conservative approach in which sediment concentrations continue to build up without intermittent flushing. Raw daily concentration estimates from PSC were manually evaluated for the highest resulting concentrations in an averaging window equal to the total days of release (for example, a scenario with 250 days of release was evaluated for the highest 250-day average concentration).

Releases were evaluated for resulting environmental media concentrations at the point of release (*i.e.*, in the immediate receiving waterbody receiving the effluent). Due to uncertainty about the prevalence of wastewater treatment from DIDP-releasing facilities, all releases are assumed initially to be released to surface water without treatment. However, due to the partitioning of the compound to sediment, waste water treatment is expected to be highly effective at removing DIDP from the water column prior to discharge, with treated effluent showing over 93 percent removal (U.S. EPA, 2024c). High-end and central tendency release modeling is shown in Table 4-4. This first tier analysis includes some notably high estimated concentrations in the receiving waterbody and sediment. These likely represent a mismatch of higher release amounts with lower flows, due to the generic nature of the release assessment and hydrologic flow data, and lack of site-specific data. These values are carried through to the ecological risk assessment for further evaluation as a conservative high-end approach to screen for ecological risk discussed in the *Draft Environmental Exposure Assessment for DIDP* (U.S. EPA, 2024b).

Table 4-4. High-End PSC Modeling Results by COU for Total Water Column, Benthic Pore Water, and Benthic Sediment in the Receiving Waterbody, Applying a 7Q10 Flow

Occupational Exposure Scenario[a]	Number of Operating Days Per Year	Daily Release (kg/day)	7Q10 Total Water Column Concentration (µg/L)	7Q10 Benthic Pore Water Concentration (µg/L)	7Q10 Benthic Sediment Concentration (µg/m³)
Manufacturing	180	0.03	1.47	0.861	4990
Use of Lubricants and Functional Fluids	4	189.96	10,200	495	2,870,000
Non-PVC Plastic Compounding	280	96.32	5,410	3,540	20,500,000
Non-PVC Plastic Converting	251	2.65	149	94.7	549,000
PVC Plastic Compounding	254	133.02	7,460	4,760	27,600,000
PVC Plastic Converting	251	6.19	348	221	1,280,000
Recycling and Disposal	254	1.42	79.9	51	296,000

[a] Table 1-1 provides the crosswalk of OES to COUs

The OES with the highest total water column concentration (Use of Lubricants and Functional Fluids) was additionally run under harmonic mean and 30Q5 flow conditions (Table 4-5). These additional results were selected to screen for risks to human health. Two scenarios were run for this high-end release: one without any wastewater treatment applied to reduce DIDP concentrations (as in the modeling shown previously in this section), and another with a wastewater treatment removal efficiency of 93 percent applied (Tran et al., 2014), substantially reducing the modeled concentrations in the receiving waterbody.

Table 4-5. High-End PSC Modeling Results for Total Water Column, Applying 30Q5 and Harmonic Mean Flows

Scenario	Release Estimate (kg/day)	Median 30Q5 Flow (m³/d)	Median Harmonic Mean Flow (m³/d)	Removal Efficiency Applied (%)	Harmonic Mean Concentration (µg/L)	30Q5 Concentration (µg/L)
Use of Lubricants and Functional Fluids[a] *Without Wastewater Treatment*	189.96	19,879.8	24,221.47	0.00	7,540	9,110
Use of Lubricants and Functional Fluids[a] *With Wastewater Treatment*	189.96	19,879.8	24,221.47	94	452	547

[a] Table 1-1 provides the crosswalk of OES to COUs

4.2 Measured Concentrations

4.2.1 Measured Concentrations in Surface Water

Eight studies within the pool of reasonably available information reported DIDP concentrations within surface water. No U.S. studies were identified. However, primary studies were identified as reporting DIDP in surface waters from Europe (Tran et al., 2014; Björklund et al., 2009) and China (Cheng et al., 2019; Wen et al., 2018; Shi et al., 2012). The highest concentrations of DIDP reported within these studies includes values collected from the Fontenay-les-Briis wastewater treatment plant (WWTP) inputs and outputs of 23.4 ± 19.7 µg/L and 0.26 ± 0.22 µg/L, respectively, demonstrating a 98.9 percent removal efficiency from influent to effluent (Tran et al., 2014). Among the three studies in China, Wen et al. (2018) reported maximum and median concentrations of DIDP (64 percent detection frequency) within surface waters of the Songhua River watershed of 0.88 µg/L and 0.43 µg/L, respectively. The post-WWTP concentration reported by (Tran et al., 2014) and median concentration reported in (Wen et al., 2018) are the same order of magnitude as the water solubility limit for DINP reported as 0.17 µg/L (see *Draft Physical Chemistry Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024g)).

4.2.2 Measured Concentrations in Sediment

Thirteen studies within the pool of reasonably available information reported DIDP concentrations within sediment. Limited information was available on measured concentrations of DIDP in sediment in the U.S. with one study on sediments from the Chester River, Maryland (Peterson and Freeman, 1984). Sediment was sampled for several phthalate esters, including DIDP, at sites along Morgan Creek and Chester River approximately six years after a possible hurricane related spill at industrial sites. DIDP in sediment was recorded at concentrations of 690 ± 220 µg/kg from a retention pond near the site and 540 ± 170 µg/kg 2 km downstream from the site, Frye Farm. The nearest collection site after Frye Farm was 8 km downstream and DIDP concentrations in sediment were reported to be below detection limits for quantification. The study demonstrates that DIDP has limited long range transport from an initial release site, however, the development of identification and quantification methodology has improved greatly since its initial publication.

The Swedish National Screening Program for phthalates analyzed DIDP in sediments collected from areas within the country representing 1) national background lakes; 2) a diffuse urban source; 3) a point source for phthalates (Cousins et al., 2007). No DIDP was detected at the background lake serving as reference site up to the limit of detection (100 µg/kg). However, DIDP in urban sediments ranged from less than 100 to 3,400 µg/kg and sediments near a suspected point source landfill site were recorded at a maximum DIDP concentration of 290 µg/kg. Chen et al. (2016) reported a maximum concentration of DIDP within sediments collected from Kaohsiung Harbor, Taiwan. DIDP was detected at all 20 collection sites within the harbor with a maximum mean concentration detected at Site 4 of 3,796 ± 1,171 µg/kg.

Mackintosh et al. (2006) sampled sediment from False Creek Harbor, Vancouver, British Columbia, Canada, characterized by the authors as an urbanized marine ecosystem, reported maximum DIDP concentration in the sediment from twelve samples at 589 µg/kg with a geometric mean of 385 µg/kg. The same study reported the geometric mean concentration of DIDP within suspended solids at 43,200 µg/kg attributing the difference between suspended solid and sediment concentrations to rates of desorption and biodegradation exceeding the rate of decrease in organic carbon between suspended solids and sediment. Mackintosh et al. (2006) indicated that these observations further support observations associated with phthalate diesters inability to magnify within aquatic food webs. Sediment collections at similar sample sites from False Creek by Blair et al. (2009) were graphically represented as less than 120 µg/kg.

Sediment associated with urban stormwater runoff collected within an underground sedimentation facility in Göteborg, Sweden, represents the highest concentration of DIDP within sediment at 60,000 µg/kg (Björklund et al., 2009). The nature of the sedimentation facility is to isolate and retain sediments from stormwater runoff within a treatment facility and not representative of sediments associated with surface waters.

4.3 Evidence Integration for Surface Water and Sediment

4.3.1 Strengths, Limitations, and Sources of Uncertainty for Modeled and Monitored Surface Water Concentration

EPA conducted modeling with PSC to estimate concentrations of DIDP within surface water and sediment. PSC considers model inputs of physical and chemical properties of DIDP (*i.e.*, K_{OW}, K_{OC}, water column half-life, photolysis half-life, hydrolysis half-life, and benthic half-life) allowing EPA to model predicted sediment concentrations. The use of vetted physical and chemical properties of DIDP increases confidence in the application of the PSC model. Only the chemical release amount, days-on of chemical release, and the receiving water body hydrologic flow were changed for each COU/OES. A standard EPA waterbody was used to represent a consistent and conservative receiving waterbody scenario. Uncertainty associated with location-specific model inputs (*e.g.*, flow parameters and meteorological data) is present as no facility locations were identified for DIDP releases.

The modeled data represent estimated concentrations near hypothetical facilities that are actively releasing DIDP to surface water, while the reported measured concentrations represent sampled ambient water concentrations of DIDP. Differences in magnitude between modeled and measured concentrations may be due to measured concentrations not being geographically or temporally close to known releases of DIDP. No U.S.-based studies were identified for surface water and sediment concentrations of DIDP. In addition, when modeling with PSC, EPA assumed all releases were directly discharged to surface waters without prior treatment, and that no releases were routed through publicly owned treatment works (POTWs) prior to release. EPA recognizes that this is a conservative assumption that results in no removal of DIDP prior to release to surface water.

Concentrations of DIDP within the sediment were estimated using the highest 2015 to 2020 annual releases and estimates of 7Q10 hydrologic flow data for the receiving water body that were derived from National Hydrography Dataset (NHD) modeled (EROM) flow data. The 7Q10 flow represents the lowest 7-day flow in a 10-year period and is a conservative approach for examining a condition where a potential contaminant may be predicted to be elevated due to periodic low flow conditions. Surrogate flow data collected via the EPA ECHO API and the NHDPlus V2.1 EROM flow database include self-reported hydrologic reach codes on NPDES permits and the best available flow estimations from the EROM flow data. The confidence in the flow values used, with respect to the universe of facilities for which data were pulled, should be considered moderate-to-robust. However, there is uncertainty in how representative the median flow rates are as applied to the facilities and COUs represented in the DIDP release modeling. Additionally, a regression-based calculation was applied to estimate flow statistics from NHD-acquired flow data, which introduces some additional uncertainty. EPA assumes that the results presented in this section include a bias toward over-estimation of resulting environmental concentrations due to conservative assumptions in light of the uncertainties.

4.4 Weight of Scientific Evidence Conclusions

Due to the lack of release data for facilities discharging DIDP to surface waters, releases were modeled, and the high-end estimate for each COU was applied for surface water modeling. Additionally, due to site-specific release information, a generic distribution of hydrologic flows was developed from facilities which had been classified under relevant NAICS codes, and which had NPDES permits. The median flow rates selected from the generated distributions represented conservative low flow rates. When coupled with high-end release scenarios, these low flow rates result in high modeled concentrations. The high-end modeled concentrations in surface water and sediment exceed the highest values available from monitoring studies by about three orders of magnitude. EPA has slight confidence in the modeled concentrations as being representative of actual releases as no U.S. monitoring studies were identified for comparison. For the purpose of a screening assessment, EPA has robust confidence that no surface water release scenarios result in instream concentrations that exceed the concentrations presented in this evaluation, due to the bias toward over-estimation based on many conservative estimates used for modeling. Other model inputs were derived from reasonably available literature collected and evaluated through EPA's systematic review process for TSCA risk evaluations. All monitoring and experimental data included in this analysis were from articles rated "medium" or "high" quality from this process.

5 SURFACE WATER EXPOSURE

Concentrations of DIDP in surface water can lead to different exposure scenarios including dermal exposure (Section 5.1.1) or incidental ingestion exposure (Section 5.1.2) to the general population swimming in affected waters. Additionally, surface water concentrations may impact drinking water exposure (Section 6) and fish ingestion exposure (Section 7).

For the purpose of a screening level analysis, exposure scenarios were assessed using the highest concentration of DIDP in surface water based on highest releasing OES (Use of Lubricants and Functional Fluids) as estimated in Section 4.1 for various lifestages (*e.g.*, adult, youth, children).

5.1 Modeling Approach

5.1.1 Dermal

The general population may swim in affected surface waters (streams and lakes) that are affected by DIDP contamination. Modeled surface water concentrations estimated in Section 4.1 were used to estimate acute doses (ADR) from dermal exposure while swimming.

The following equation was used to calculate incidental dermal (swimming) doses for adults, youth, and children:

Equation 5-1. Acute Incidental Dermal Calculation

$$ADR = \frac{SWC \times K_p \times SA \times ET \times CF1 \times CF2}{BW}$$

A summary of inputs utilized for these exposure estimates are provided in Appendix A.1.

EPA used the dermal permeability coefficient (*Kp*) (0.0071cm/hr). EPA utilized the Consumer Exposure Model (CEM) (U.S. EPA, 2022) to estimate the steady-state aqueous permeability coefficient of DIDP.

Table 5-1 shows a summary of the estimates of ADRs due to dermal exposure while swimming for adults, youth, and children for the highest end release value of Use of Lubricants and Functional Fluids. The modeled concentrations are included with and without a wastewater treatment removal efficiency of 94 percent applied. Both treated and untreated scenarios were assessed due to uncertainty about the prevalence of wastewater treatment from discharging facilities, and to demonstrate the hypothetical disparity in exposures between treated and untreated effluent in the generic release scenarios. In addition to these modeled concentrations, the monitored concentrations from Tran et al. (2014) representing pre- and post- wastewater treatment conditions were included for comparison. The monitored values represent concentrations roughly two orders of magnitude less than the high-end modeled counterparts.

Table 5-1. Modeled Dermal (Swimming) Doses for Adults, Youths, and Children, for the High-End Release Estimate from Modeling and Monitoring Results

Scenario	Water Column Concentrations	Adult (≥21 years)	Youth (11–15 years)	Child (6–10 years)
	30Q5 Conc. (µg/L)	ADR_{POT} (mg/kg-day)	ADR_{POT} (mg/kg-day)	ADR_{POT} (mg/kg-day)
Use of Lubricants and Functional Fluids [a] *Without Wastewater Treatment*	9,110	4.73E−02	3.62E−02	2.20E−02
Use of Lubricants and Functional Fluids [a] *With Wastewater Treatment*	547	2.84E−03	2.17E−03	1.32E−03
High from Monitoring (Tran et al., 2014) *Without Wastewater Treatment*	23.4	1.21E−04	9.30E−05	5.64E−05
High from Monitoring (Tran et al., 2014) *With Wastewater Treatment*	0.26	1.35E−06	1.03E−06	6.27E−07

[a] Table 1-1 provides the crosswalk of OES to COUs.

5.1.1.1 Risk Screening

Based on the estimated dermal doses in Table 5-1, EPA screened for risk to adults, youth, and children. Table 5-2 summarizes the acute MOEs based on the dermal doses. Using acute dose based on the highest modeled 95th percentile, the MOEs are greater than the benchmark of 30. Based on the conservative modeling parameters for surface water concentration and exposure factors parameters, risk for non-cancer health effects for dermal absorption through swimming is not expected.

Table 5-2. Risk Screen for Modeled Incidental Dermal (Swimming) Doses for Adults, Youths, and Children, for the High-End Release Estimate from Modeling and Monitoring Results

Scenario	Water Column Concentrations	Adult (≥21 years)	Youth (11–15 years)	Child (6–10 years)
	30Q5 Conc. (µg/L)	Acute MOE	Acute MOE	Acute MOE
Use of Lubricants and Functional Fluids [a] *Without Wastewater Treatment*	9,110	1.90E02	2.49E02	4.10E02
Use of Lubricants and Functional Fluids [a] *With Wastewater Treatment*	547	3.17E03	4.14E03	6.83E03
High from Monitoring *Without Wastewater Treatment*	23.4	7.41E04	9.68E04	1.60E05
High from Monitoring *With Wastewater Treatment*	0.26	6.67E06	8.71E06	1.44E07

[a] Table 1-1 provides the crosswalk of OES to COUs.

5.1.2 Oral Ingestion

The general population may swim in affected surfaces waters (streams and lakes) that are affected by DIDP contamination. Modeled surface water concentrations estimated in Section 4.1 were used to estimate acute doses (ADR) due to ingestion exposure while swimming.

The following equation was used to calculate incidental oral (swimming) doses for all COUs for adults, youth, and children:

Equation 5-2. Acute Incidental Ingestion Calculation

$$ADR = \frac{SWC \times IR \times CF1}{BW}$$

A summary of inputs utilized for these estimates are present in Appendix A.1.

Table 5-3. Modeled Incidental Ingestion Doses for Adults, Youths, and Children, for the High-End Release Estimate from Modeling and Monitoring Results

Scenario	Water Column Concentrations	Adult (≥21 years)	Youth (11–15 years)	Child (6–10 years)
	30Q5 Conc. (µg/L)	ADR_{POT} (mg/kg-day)	ADR_{POT} (mg/kg-day)	ADR_{POT} (mg/kg-day)
Use of Lubricants and Functional Fluids[a] *Without Wastewater Treatment*	9,110	3.14E−02	4.88E−02	2.75E−02
Use of Lubricants and Functional Fluids[a] *With Wastewater Treatment*	547	1.89E−03	2.93E−03	1.65E−03
High from Monitoring *Without Wastewater Treatment*	23.4	8.07E−05	1.25E−04	7.06E−05
High from Monitoring *With Wastewater Treatment*	0.26	8.97E−07	1.39E−06	7.85E−07

[a] Table 1-1 provides the crosswalk of OES to COUs

5.1.2.1 Risk Screening

Based on the estimated incidental ingestion doses in Table 5-3, EPA screened for risk to adults, youth, and children. Table 5-4 summarizes the acute and chronic MOEs based on the incidental ingestion doses. Using the acute dose based on the highest modeled 95th percentile, the MOEs are greater than the benchmark of 30. Based on the conservative modeling parameters for surface water concentration and exposure factors parameters, risk for non-cancer health effects for incidental ingestion through swimming is not expected.

Table 5-4. Risk Screen for Modeled Incidental Ingestion Doses for Adults, Youths, and Children, for the High-End Release Estimate from Modeling and Monitoring Results

Scenario	Water Column Concentrations	Adult (≥21 years)	Youth (11–15 years)	Child (6–10 years)
	30Q5 Conc. (µg/L)	Acute MOE	Acute MOE	Acute MOE
Use of Lubricants and Functional Fluids[a] *Without Wastewater Treatment*	9,110	286	185	327
Use of Lubricants and Functional Fluids[a] *With Wastewater Treatment*	547	4,770	3,070	5,450
High from Monitoring *Without Wastewater Treatment*	23.4	111,000	71,900	127,000
High from Monitoring *With Wastewater Treatment*	0.26	10,000,000	6,470,000	11,500,000

[a] Table 1-1 provides the crosswalk of OES to COUs.

5.2 Weight of Scientific Evidence Conclusions

No site-specific information was reasonably available when estimating release of DIDP to the environment. Release estimates were provided for generic scenarios. As such, there is considerable uncertainty in the production volume estimate and the resulting environmental release estimates. In addition, there is uncertainty in the relevancy of the monitoring data to the modeled estimates presented in this evaluation. As stated in Section 4.4 there is slight confidence in the modeled concentrations as being representative of actual releases, due to the bias toward over-estimation. Therefore, there is robust confidence that no surface water release scenarios exceed the concentrations presented in this evaluation.

Swimming Ingestion/Dermal Estimates

Two scenarios (youth being exposed dermally and through incidental ingestion while swimming in surface water) were assessed as high-end potential exposures to DIDP in surface waters. EPA's *Exposure Factors Handbook* provided detailed information on the youth skin surface areas and event per day of the various scenarios (U.S. EPA, 2017b). Non-diluted surface water concentrations were used when estimating dermal exposures to youth swimming in streams and lakes. DIDP concentrations will dilute when released to surface waters, but it is unclear what level of dilution will occur when the general population swims in waters with DIDP releases.

6 DRINKING WATER EXPOSURE

Drinking water in the United States typically comes from surface water (*i.e.*, lakes, rivers, reservoirs) and groundwater. The source water then flows to a treatment plant where it undergoes a series of water treatment steps before being dispersed to homes and communities. In the U.S., public water systems relying on surface water often use conventional treatment processes that include coagulation, flocculation, sedimentation, filtration, and disinfection, as required by law.

Very limited information is available on the removal of DIDP in drinking water treatment plants. As stated in the *Draft Fate Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024d), no data were identified by the EPA for DIDP in drinking water in the U.S. Based on the low water solubility and log K_{OW}, DIDP in water it is expected to mainly partition to suspended solids present in water. The available information suggest that the use of flocculants and filtering media could potentially help remove DIDP during drinking water treatment by sorption into suspended organic matter, settling, and physical removal.

6.1 Modeling Approach for Estimating Concentrations in Drinking Water

6.1.1 Drinking Water Ingestion

Drinking Water Intake Estimates via Modeled Surface Water Concentrations

Modeled surface water concentrations estimated in Section 4.1 were used to estimate drinking water exposures. For risk screening purposes, only the OES scenario resulting in the highest modeled surface water concentrations, Use of Lubricants and Functional Fluids, was included in the drinking water exposure analysis, alongside the highest monitored surface water concentrations. A wastewater treatment efficiency of 94 percent removal efficiency was assumed for treatment of facility effluent before discharge to the receiving waterbody, before becoming influent at a downstream drinking water treatment plant. A range of drinking water treatment removal rates from 63.1 percent to over 99 percent removal was observed in (Shi et al., 2012), and a conservative 63.1 percent removal was applied for the scenario with drinking water treatment. The drinking water scenario presented here with both wastewater treatment on the facility effluent, and further drinking water treatment applied, is expected to be the scenario most representative of actual high-end drinking water exposure in the general population.

Drinking water doses were calculated using the following equations:

Equation 6-1. Acute Drinking Water Ingestion Calculation

$$ADR_{POT} = \frac{SWC \times \left(1 - \frac{DWT}{100}\right) \times IR_{dw} \times RD \times CF1}{BW \times AT}$$

Equation 6-2. Average Daily Drinking Water Ingestion Calculation

$$ADD_{POT} = \frac{SWC \times \left(1 - \frac{DWT}{100}\right) \times IR_{dw} \times ED \times RD \times CF1}{BW \times AT \times CF2}$$

Where:

ADR_{POT} = Potential Acute Dose Rate (mg/kg/day)
ADD_{POT} = Potential Average Daily Dose (mg/kg/day)

SWC	=	Surface water concentration (ppb or µg/L; 30Q5 conc for ADR, harmonic mean for ADD, LADD, LADC)
DWT	=	Removal during drinking water treatment (percent)
IRdw	=	Drinking water intake rate (L/day)
RD	=	Release days (days/yr for ADD, LADD and LADC; 1 day for ADR)
ED	=	Exposure duration (years for ADD, LADD and LADC; 1 day for ADR)
BW	=	Body weight (kg)
AT	=	Exposure duration (years for ADD, LADD and LADC; 1 day for ADR)
CF1	=	Conversion factor (1.0×10^{-3} mg/µg)
CF2	=	Conversion factor (365 days/year)

The ADR and ADD for chronic non-cancer were calculated using the 95th percentile ingestion rate for drinking water. The lifetime average daily dose (LADD) was not estimated because available data are insufficient to determine the carcinogenicity of DIDP. Therefore, EPA is not evaluating DIDP for carcinogenic risk. Table 6-1 summarizes the drinking water doses for adults, youth, and children for water applying only wastewater treatment and water applying both wastewater treatment and drinking water treatment. These estimates do not incorporate additional dilution beyond the point of discharge and in this case, it is assumed that the surface water outfall is located very close (within a few km) to the drinking water intake location. Applying dilution factors would decrease the dose for all scenarios.

Table 6-1. Modeled Drinking Water Doses for Adults, Youths, and Children for the High-end Release Estimate from Modeling and Monitoring Results

	Surface Water Concentrations		Adult (≥21 years)		Youth (11–15 years)		Infant (birth to <1 year)	
	30Q5 Conc. (µg/L)	Harmonic Mean Conc. (µg/L)	ADR_{POT} (mg/kg-day)	ADD (mg/kg-day)	ADR_{POT} (mg/kg-day)	ADD (mg/kg-day)	ADR_{POT} (mg/kg-day)	ADD (mg/kg-day)
Use of Lubricants and Functional Fluids [a] *With Wastewater Treatment*	547	452	2.19E−02	1.36E−05	1.69E−02	6.87E−06	7.71E−02	3.48E−05
Use of Lubricants and Functional Fluids [a] *With Wastewater Treatment and Drinking Water Treatment*	202	167	8.11E−03	5.03E−06	6.25E−03	2.54E−06	2.84E−02	1.28E−05
High from Monitoring *With Wastewater Treatment*	0.26	0.26	1.05E−05	7.83E−09	8.06E−06	3.95E−09	3.67E−05	2.00E−08

[a] Table 1-1 provides the crosswalk of OES to COUs.

6.1.1.1 Risk Screening

Based on the estimated drinking water doses in Table 6-1, EPA screened for risk to adults, youth, and children. Table 6-2 summarizes the acute and chronic MOEs based on the drinking water doses. Using the acute and chronic dose based on the highest modeled 95th percentile, the MOEs are greater than the benchmark of 30. Based on the conservative modeling parameters for drinking water concentration and exposure factors parameters, risk for non-cancer health effects for drinking water ingestion is not expected.

This assessment assumes that concentrations at the point of intake for the drinking water system are equal to the concentrations in the receiving waterbody at the point of release, where treated effluent is being discharged from a facility. In reality some distance between the point of release and a drinking water intake would be expected, providing space and time for additional reductions in water column concentrations via degradation, partitioning, and dilution. Some form of additional treatment would typically be expected for surface water at a drinking water treatment plant, including coagulation, flocculation, and sedimentation, and/or filtration. This treatment would likely result in even greater reductions in DIDP concentrations prior to releasing finished drinking water to customers.

Table 6-2. Risk Screen for Modeled Drinking Water Exposure for Adults, Youths, and Children, for the High-End Release Estimate from Modeling and Monitoring results

	Surface Water Concentrations		Adult (≥21 years)		Youth (11–15 years)		Infant (birth to <1 year)	
	30Q5 Conc. (µg/L)	Harmonic Mean Conc. (µg/L)	Acute MOE	Chronic MOE	Acute MOE	Chronic MOE	Acute MOE	Chronic MOE
Use of Lubricants and Functional Fluids [a] *With Wastewater Treatment*	547	452	409	660,000	531	131,000	117	258,000
Use of Lubricants and Functional Fluids [a] *With Wastewater Treatment and Drinking Water Treatment*	202	167	1,110	1,790,000	1,440	3,550,000	316	701,000
High from Monitoring *With Wastewater Treatment*	0.26	0.26	860,000	1,150,000,000	1,120,000	2,280,000,000	245,000	450,000,000

[a] Table 1-1 provides the crosswalk of OES to COUs.

Drinking Water via Leaching of Landfills to Groundwater

DIDP is expected to biodegrade in the upper, aerobic portions of landfills. In lower-landfills where anaerobic conditions are likely, DIDP is not expected to biodegrade, but may be hydrolysed under elevated temperature and more caustic pH regimes. Despite the degradation of DIDP in landfills, DIDP is still expected to be persistent as it leached from consumer products disposed of in landfills which use DIDP in their formulation. Due to this, DIDP is likely to be present in landfill leachate up to its aqueous limit of solubility (0.00017 mg/L). However, due to its affinity for organic carbon, DIDP is expected to be immobile in groundwater. Even in cases where landfill leachate containing DIDP were to migrate to groundwater, DIDP would likely partition from groundwater to organic carbon present in the subsurface, limiting its likelihood for migration to drinking water sources.

6.2 Measured Concentrations in Drinking Water

Shi et al. (2012) reported DIDP concentrations in untreated and treated drinking water sampled from five main cities in the Yangtze River Delta area of China in 2010. DIDP concentrations in source water for the various cities ranged from $3.4\times10^{1} \pm 2.7$ ng/L to $2.8\times10^{2} \pm 8.8$ ng/L while DIDP concentration in tap water ranged from $1.8 \pm 5\times10^{-1}$ ng/L to $9.6\times10^{1} \pm 1.7$ ng/L. No drinking water studies in the United State were identified.

6.3 Evidence Integration for Drinking Water

EPA estimates low potential exposure to DIDP via drinking water, when considering expected treatment removal efficiencies, even under high-end release scenarios. Additional qualitative considerations suggest that actual measured concentrations in raw and finished water would decrease further. While monitoring data in the United States were not identified, available finished drinking water concentrations reported from China were less than 1 µg/L, corroborating the expectation of very little exposure to the general population via treated drinking water.

6.4 Weight of Scientific Evidence Conclusions

EPA has moderate confidence in the treated surface water as drinking water exposure scenario. As described in Section 3.2, EPA did not assess drinking water estimates as a result of leaching from landfills to groundwater and subsequent migration to drinking water wells.

7 FISH INGESTION EXPOSURE

Surface water concentrations for DIDP associated with a particular COU were modeled using PSC by COU/OES water release as described in Section 4.1. However, modeled surface water concentrations exceeded the estimates of the water solubility limit for DIDP (approximately 1.7×10^{-4} mg/L) by 1 to 5 orders of magnitude (see *Draft Physical Chemistry Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024g)). Additionally, as described in the *Draft Environmental Exposure Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024a), based on the sorption and physical and chemical properties, DIDP within suspended solids is not expected to be bioavailable. Therefore, DIDP concentrations in fish is calculated in the *Draft Environmental Exposure Assessment for DIDP* (U.S. EPA, 2024b) based on a solubility of 1.7×10^{-4} mg/L and a predicted bioconcentration factor (BCF) (Arnot-Gobas method) of 1.29 L/kg. The calculated concentration of DIDP in fish using a BCF is 2.2×10^{-4} mg/kg, which is two orders of magnitude lower than the highest DIDP concentrations reported within aquatic biota (see Table 7-1).

For estimating exposure to humans from fish ingestion, calculating fish concentration using a bioaccumulation factor (BAF) is preferred because it considers the animal's uptake of a chemical from both diet and the water column. For DIDP, a BAF of 9.9 L/kg was estimated using the Arnot-Gobas method for upper trophic organisms (see *Draft Fate Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024d)). Table 7-1 compares the fish tissue concentration calculated using a BAF with the measured fish tissue concentrations obtained from literature. For comparison, Table 7-1 also includes fish tissue concentrations that were derived from a BCF. Fish tissue concentration calculated with a predicted BAF were greater than the concentration calculated with a predicted BCF but was still lower than that reported within published literature.

In addition, EPA calculated fish tissue concentrations using the highest monitored surface water concentrations. As described in Section 4.2.1, the highest concentrations of DIDP were reported for the influent of the Fontenay-les-Briis WWTP in France at 23.4 ± 19.7 μg/L ($2.34 \times 10^{-2} \pm 1.97 \times 10^{-2}$ mg/L) (Tran et al., 2014). This monitored concentration corresponds to untreated wastewater and does not consider the nearly 99 percent removal efficiency of DIDP measured in the study. Furthermore, DIDP within suspended solids found in wastewater could result in concentrations greater than the water solubility limit. However, DIDP is not expected to be bioavailable for uptake by aquatic organisms due to its strong sorption to organic matter and hydrophobicity (see *Draft Fate Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024d)). EPA still calculated fish tissue concentrations using the measured concentration from the Fontenay-les-Briis WWTP plus one standard deviation as a worst-case scenario. Fish tissue concentrations calculated with monitored surface water concentrations are one to two orders of magnitude higher than that reported within published literature (Table 7-1).

Table 7-1. Fish Tissue Concentrations Calculated from Modeled Surface Water Concentrations and Monitoring Data

Data Approach	Data Description	Surface Water Concentration	Fish Tissue Concentration (wet weight)
Modeled Surface Water Concentration	Predicted BCF (Arnot-Gobas method) of 1.29 L/kg (U.S. EPA, 2017a)	Estimates of the water solubility limit for DIDP that is approximately 1.7E−04 mg/L	2.2E−04 mg/kg
	Predicted BAF (Arnot-Gobas method) of 9.9 L/kg (U.S. EPA, 2017a)	Estimates of the water solubility limit for DIDP which is approximately 1.7E−04 mg/L	1.68E−03 mg/kg

Data Approach	Data Description	Surface Water Concentration	Fish Tissue Concentration (wet weight)
Monitored Surface Water Concentration	Predicted BCF (Arnot-Gobas method) of 1.29 L/kg (U.S. EPA, 2017a)	4.31E−02 mg/L	5.56E−02 mg/kg
	Predicted BAF (Arnot-Gobas method) of 9.9 L/kg (U.S. EPA, 2017a)	4.31E−02 mg/L	4.27E−01 mg/kg
Fish Tissue Monitoring Data (Wild-Caught)	Two studies measured DIDP in juvenile shiner perch.	N/A	8.40E−03 mg/kg (Mackintosh et al., 2004) 5.7E−02 mg/kg (McConnell, 2007)

7.1 General Population Fish Ingestion Exposure

EPA estimated exposure from fish consumption for all lifestages by using age-specific ingestion rates (Table_Apx A-2). This section presents exposure estimates for only adults 16 years or older to allow for comparison with subsistence and tribal fishers, which also only estimate exposure for adults. However, as shown in Table_Apx A-2, the highest 90th percentile fish ingestion rate per kilogram of body weight is for a young toddler between 1 and 2 years old. While results are not shown, the exposure estimates for a young toddler are within the same magnitude as for adults (U.S. EPA, 2024e).

The 50th percentile (central tendency) and 90th percentile ingestion rate (IR) for adults is 5.04 g/day and 22.2 g/day, respectively. The ADR and ADD for chronic non-cancer were calculated using the 90th percentile and central tendency IR, respectively. The LADD was not estimated because available data are insufficient to determine the carcinogenicity of DIDP (U.S. EPA, 2024f). Therefore, EPA is not evaluating DIDP for carcinogenic risk. Acute and chronic non-cancer exposure estimates via fish ingestion were calculated according to the following equation:

Equation 7-1. Fish Ingestion Calculation

$$ADR\ or\ ADD = \frac{SWC \times BAF \times IR \times CF1 \times CF2 \times ED}{AT\ \times BW}$$

Where:

ADR	=	Acute Dose Rate (mg/kg/day)
ADD	=	Average Daily Dose (mg/kg/day)
SWC	=	Surface water (dissolved) concentration (µg/L)
BAF	=	Bioaccumulation factor (L/kg wet weight)
IR	=	Fish ingestion rate (g/day)
CF1	=	Conversion factor (0.001 mg/µg)
CF2	=	Conversion factor for kg/g (0.001 kg/g)
ED	=	Exposure duration (year)
AT	=	Averaging time (year)
BW	=	Body weight (80 kg)

The years within an age group (*i.e.*, 62 years for adults) was used for the exposure duration and averaging time to characterize non-cancer risks.
The exposures calculated using the water solubility limit, monitored surface water concentrations, and BAF are presented in Table 7-2. Risks were not characterized using the general population fish ingestion

doses because the sentinel exposure scenario (*i.e.*, tribal fish ingestion) did not result in any risk estimates below their corresponding benchmark. Risk estimates for the general population are also above benchmark because their fish ingestion rate is much lower than that for tribal populations. Section 7.4 provides more details.

Table 7-2. Adult General Population Fish Ingestion Doses by Surface Water Concentration

	ADR (mg/kg-day)	ADD (mg/kg-day)
Water solubility limit (1.7E−04 mg/L)	4.66E−07	1.06E−07
Monitored SWC from a WWTP's influent (4.31E−02 mg/L)	1.18E−04	2.69E−05

7.2 Subsistence Fish Ingestion Exposure

Subsistence fishers represent a potentially exposed or susceptible subpopulation(s) (PESS) group due to their greatly increased exposure via fish ingestion (142.4 g/day compared to a 90th percentile of 22.2 g/day for the general population) (U.S EPA, 2000). The ingestion rate for subsistence fishers apply to only adults aged 16 to less than 70 years. EPA is unable to determine subsistence fisher exposure estimates specific to younger lifestages based on reasonably available information. EPA calculated exposure for subsistence fishers using Equation 7-1 and the same inputs as the general population except for the ingestion rate. Furthermore, unlike the general population fish ingestion rates, there is no central tendency or 90th percentile ingestion rate for the subsistence fisher. The same value was used to estimate both the ADD and ADR.

The exposures calculated using the water solubility limit, monitored surface water concentrations, and BAF are presented in Table 7-3. Risks were not characterized using the subsistence fisher doses because the sentinel exposure scenario (*i.e.*, tribal fish ingestion) did not result in any risk estimates below their corresponding benchmark. Risk estimates for the subsistence fisher are also above benchmark because their fish ingestion rate is lower than that for tribal populations. Section 7.4 provides more details.

Table 7-3. Adult Subsistence Fisher Doses by Surface Water Concentration

	ADR/ADD (mg/kg-day)
Water solubility limit (1.7E−04 mg/L)	2.99E−06
Monitored SWC from a WWTP's influent (4.31E−02 mg/L)	7.60E−04

7.3 Tribal Fish Ingestion Exposure

Tribal populations represent another PESS group. In the United States there are a total of 574 federally recognized American Indian Tribes and Alaska Native Villages and 63 state recognized tribes. Tribal cultures are inextricably linked to their lands, which provide all their needs from hunting, fishing, food gathering, and grazing horses to commerce, art, education, health care, and social systems. These services flow among natural resources in continuous interlocking cycles, creating a multi-dimensional relationship with the natural environment and forming the basis of *Tamanwit* (natural law) (Harper et al., 2012). Such an intricate connection to the land and the distinctive lifeways and cultures between individual tribes create many unique exposure scenarios that can expose tribal members to higher doses of contaminants in the environment. However, EPA quantitatively evaluated only the tribal fish ingestion pathway for DIDP because of data limitations and recognizes that this overlooks many other unique exposure scenarios.

U.S. EPA (2011) (Chapter 10, Table 10-6) summarizes relevant studies on current tribal-specific fish ingestion rates that covered 11 tribes and 94 Alaskan communities. The daily ingestion rates for the 94 Alaskan communities are reported as a minimum, median, and maximum. However, those values were not considered because the study did not report the sampled age group, which precludes calculation of an ingestion rate per kilogram of body. The median value is also lower than the mean ingestion rate per kilogram of body weight reported in a 1997 survey of adult members (16 years and older) of the Suquamish Tribe in Washington. Adults from the Suquamish Tribe reported a mean ingestion rate of 2.7 g/kg-day, or 216 g/day assuming an adult body weight of 80 kg. This value is also the highest among all central tendency values in the Exposure Factors Handbook (U.S. EPA, 2011). In comparison, the ingestion rates for the adult subsistence fisher and general population are 142.2 and 22.2 g/day, respectively. A total of 92 adults responded to the survey funded by the Agency for Toxic Substances and Disease Registry (ATSDR) through a grant to the Washington State Department of Health, of which 44 percent reported consuming less fish/seafood today compared to 20 years ago. One reason for the decline is restricted harvesting caused by increased pollution and habitat degradation (Duncan, 2000).

Because current fish consumption rates are suppressed by contamination, degradation, or loss of access, EPA reviewed existing literature for ingestion rates that reflect heritage rates. Heritage rates refer to those that existed prior to non-indigenous settlement on tribal fisheries resources, as well as changes in culture and lifeways (U.S. EPA, 2016). Heritage ingestion rates were identified for four tribes, all located in the Pacific Northwest region. The highest heritage ingestion rate was reported for the Kootenai Tribe in Idaho at 1,646 g/day (Ridolfi, 2016) (that study was funded through an EPA contract). The authors conducted a comprehensive review and evaluation of ethnographic literature, historical accounts, harvest records, archaeological and ecological information, as well as other studies of heritage consumption. The heritage ingestion rate is estimated for Kootenai members living in the vicinity of Kootenay Lake in British Columbia, Canada; the Kootenai Tribe once occupied territories in parts of Montana, Idaho, and British Columbia. It is based on a 2,500 calorie per day diet, assuming 75 percent of the total caloric intake comes from fish and using the average caloric value for fish. Notably, the authors acknowledged that assuming 75 percent of caloric intake comes from fish may overestimate fish intake.

EPA calculated exposure via fish consumption for tribes using Equation 7-1 and the same inputs as the general population except for the ingestion rate. Two ingestion rates were used: 216 g/day for current consumption and 1,646 g/day for heritage consumption. Similar to the subsistence fisher, EPA used the same ingestion rate to estimate both the ADD and ADR. The heritage ingestion rate is assumed to be applicable to adults. For current ingestion rates, U.S. EPA (2011) provides values specific to younger lifestages, but adults still consume higher amounts of fish per kilogram of body weight. An exception is for the Squaxin Island Tribe in Washington that reported an ingestion rate of 2.9 g/kg-day for children under 5 years old. That ingestion rate for children is nearly the same as the adult ingestion rate of 2.7 g/kg-day for the Suquamish Tribe. As a result, exposure estimates based on current ingestion rates (IR) focused on adults (Table 7-4).

Table 7-4. Adult Tribal Fish Ingestion Doses by Surface Water Concentration

	ADR/ADD (mg/kg-day)	
	Current IR	**Heritage IR**
Water solubility limit (1.7E−04 mg/L)	4.54E−06	2.62E−05
Monitored SWC from a WWTP's influent (4.31E−02 mg/L)	1.15E−03	6.64E−03

7.4 Risk Screening

Exposure estimates are the highest for tribal populations because of their elevated fish ingestion rates compared to the general population and subsistence fisher. As such, tribal populations represent the sentinel exposure scenario. Risk estimates calculated from the water solubility limit of DIDP as the surface water concentration were four-to-five orders of magnitude above its non-cancer risk benchmark using both the current and heritage fish ingestion rate (Table 7-5). Using the highest measured DIDP levels from the influent of the Fontenay-les-Briis WWTP in France as the surface water concentration, risk estimates for tribal populations were still two orders of magnitude above its corresponding benchmark for both fish ingestion rates. Exposure estimates based on conservative values such as surface water concentration from untreated wastewater still resulted in risk estimates that are above their benchmarks. Therefore, these results indicate that fish ingestion is not a pathway of concern for DIDP for tribal members, subsistence fisher, and the general population.

Table 7-5. Risk Screen for Fish Ingestion Exposure for Tribal Populations

Calculation Method	Acute and Chronic Non-cancer MOEs (Total Uncertainty Factor = 30)	
	Current mean IR	Heritage IR
Water solubility limit (1.7E−04 mg/L)	1,980,000	344,000
Monitored SWC from a WWTP's influent (4.31E−02 mg/L)	7,810	1,360

7.5 Weight of Scientific Evidence Conclusions

7.5.1 Strength, Limitations, Assumptions, and Key Sources of Uncertainty

To account for the variability in fish consumption across the United States, fish intake estimates were considered for both general population, subsistence fishing populations and tribal populations. In estimating fish concentrations, diluted surface water concentrations were not considered. It is unclear what level of dilution may occur between the surface water at the facility outfall and habitats where fish reside. No monitoring data were available indicating the consumption of fish containing DIDP. EPA did find very limited monitoring data indicating DIDP concentrations in fish tissue. The reported fish tissue concentrations in the monitoring data are higher than the modeled estimates but lower than the concentrations calculated with monitored surface water concentrations. Based on this, EPA has moderate confidence in its estimations of fish ingestion.

8 AMBIENT AIR CONCENTRATION

Based on its physical and chemical properties DIDP is expected to predominantly partition into the soil or sediment compartments when released into air. Release estimates indicated release of DIDP into fugitive or stack air. Additionally, EPA searched peer-reviewed literature, gray literature, and databases to obtain concentrations of DIDP in ambient air from monitoring studies. Section 8.1 and 8.3 reports EPA modeled ambient air concentrations and deposition fluxes used to estimate soil concentrations from air to soil deposition, respectively. Section 8.2 displays the aggregated results of reported monitoring concentrations for ambient air found in the peer-reviewed and gray literature from the systematic review.

8.1 Modeling Approach for Estimating Concentrations in Ambient Air

EPA used the American Meteorological Society (AMS)/EPA Regulatory Model (AERMOD) to estimate ambient air concentrations and air deposition of DIDP from EPA estimated releases. AERMOD was utilized to incorporate refined parameters for gaseous concentrations as well as particle deposition. AERMOD is a steady-state Gaussian plume dispersion model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources and both simple and complex terrain. More specifically, AERMOD can incorporate a variety of emission source characteristics, chemical deposition properties, complex terrain, and site-specific hourly meteorology to estimate air concentrations and deposition amounts at user-specified population distances and at a variety of averaging times. More details about AERMOD, equations within the model, input, and output parameters, and supporting documentation in the *AERMOD Users' Guide* (U.S. EPA, 2018).

AERMOD was run under two land categories: urban and rural, and for two meteorology conditions using Sioux Falls, South Dakota, for central tendency meteorology and Lake Charles, Louisiana, for higher-end meteorology, 10 distances, and 3 percentiles (10th, 50th and 95th percentiles). A full description of the input parameters selected for AERMOD and details regarding post-processing of the results are provided in Appendix C. Additional, input parameters for deposition, partitioning factors between the gaseous and particulate phases, particle sizes, meteorological data, urban/rural designations, and physical source specifications were required to run the higher tier model to obtain particle deposition rates.

Based on its physical and chemical properties and short half-life in the atmosphere, $t_{1/2}$ = 7.6 hours (Mackay et al., 2006). DIDP is assumed to not be persistent in the air. However, the AEROWIN*TM* module in EPI Suite*TM* estimates that a large fraction of DIDP could be sorbed to airborne particulates. Therefore, EPA focused on modeled air concentrations and deposition rates for the distances: 100 meters (m), 100 to 1000 m, and 1000 m. These distances are also consistent with the fenceline and community populations as described in the fenceline methodology (Draft Screening Level Approach for Assessing Ambient Air and Water Exposures to Fenceline Communities Version 1.0). The deposition results are covered in Section 8.3.

Full tables of all annual and daily modeled concentrations for all OESs and distances (10 m to 10,000 m) are provided in Appendix C. However, only the highest modeled annual air concentrations used for the environmental and general population exposure assessment are shown in this section. The highest modeled annual air concentrations resulted from high-end fugitive air releases from the PVC Plastics Compounding OES (COU to OES crosswalk provided in Table 1-1). Table 8-1 is an excerpt of the 95th percentile modeled annual air concentrations based on high-end estimated releases for fugitive modeled emissions. A maximum annual ambient air concentration of 4.7×10^{2} µg/m^{3} at 100 m from the facility was modeled for PVC plastic compounding OES, based on higher-end meteorology and rural land category scenario.

Table 8-1. 95th Percentile Modeled Annual Concentrations (µg/m^3) based on Fugitive Source, High-end Facility Release

Occupational Exposure Scenario[a]	Meteorology	Land	Distance									
			10 M	**30 M**	**30-60 M**	**60 M**	**100 M**	**100-1000 M**	**1000 M**	**2500 M**	**5000 M**	**10000 M**
PVC Plastic Compounding	Central Tendency	Rural	1.2E03	1.0E03	8.5E02	5.9E02	3.3E02	6.6E01	1.0E01	1.7E00	4.2E−01	9.9E−02
		Urban	2.9E03	9.1E02	7.3E02	3.5E02	1.5E02	2.4E01	3.0E00	6.1E−01	1.8E−01	5.0E−02
	High-End	Rural	2.8E03	1.7E03	1.3E03	8.7E02	**4.7E02**	8.6E01	1.3E01	2.2E00	5.5E−01	1.3E−01
		Urban	4.6E03	1.4E03	1.1E03	4.9E02	2.1E02	2.8E01	4.0E00	8.0E−01	2.4E−01	6.5E−02

[a] Table 1-1 provides the crosswalk of OES to COUs.
Bold – Indicates highest modeled concentration within 100 to 1,000 m from facility release.

8.2 Measured Concentrations in Ambient Air

EPA searched peer-reviewed literature, gray literature, and databases to obtain concentrations of DIDP in ambient air. Ambient air concentrations of DIDP were measured in one study in Sweden (Cousins et al., 2007). This study was given a medium rating during the systematic review. See *Draft Risk Evaluation for Diisodecyl Phthalate (DIDP) – Systematic Review Supplemental File: Data Quality Evaluation Information for General Population, Consumer, and Environmental Exposure* (U.S. EPA, 2024i). The Sweden sampling program measured both background areas and in areas near identified possible sources of DIDP. Background air samples were collected at Rao, which is a station in the Sweden national monitoring program and part of the co-operative program for the monitoring and evaluation of long-range transmission of air pollutants in Europe (EMEP) network. Two industrial sites were selected: Gislaved and Stenungsund, which were a plastics and former rubber production facility and chemicals/plastics production facility, respectively. Cousins et al. (2007) recorded a detection rate of 67 percent for DIDP with a range of 3.0×10^{-4} to 5.5×10^{-3} µg/m^3 which were within the range of the EPA's modeled concentrations (4.0×10^{-12} to 4.7×10^{2} µg/m^3) between the 100 m to 1000 m distances. EPA's modeled concentration for its highest release scenario (plastic compounding OES) was many orders of magnitude higher than the monitored value. However, this may be attributed to the conservative assumptions and inputs that went into the modeling. Please see Sections 8.4 and 8.5 for further details on evidence integration and weight of scientific evidence conclusions.

8.3 Modeling Approach for Estimating Concentrations in Soil from Air Deposition

Based on its physical and chemical properties and short half-life in the atmosphere, DIDP is assumed to not be persistent in the air and estimated that a large fraction of DIDP could be sorbed to airborne particulates. Therefore, EPA focused on modeled air concentrations and deposition rates for the distances: 100 m, 100 to 1000 m and 1000 m. Refer to Section 8.1 for details on modeling approach for air concentrations. Due to uncertainties about a generic characterization of particulates for use in all modeling scenarios for DIDP, AERMOD's "Method 2" was selected for modeling of particle deposition, as that method requires less information about the distribution of particle sizes. Method 2 requires the fraction by mass of emitted particles that is 2.5 micrometers (µm) or smaller in aerodynamic diameter (*i.e.*, the mass fraction which is $PM_{2.5}$) and the mass-mean particle diameter. Based the $PM_{2.5}$ mass fraction on information presented in EPA's 2019 Integrated Science Assessment for Particulate Matter (U.S. EPA, 2019c) the atmospheric $PM_{2.5}$ mass fraction was assumed to be 0.14 and the mass-mean diameter was 10 µm.

8.3.1 Air Deposition to Soil

Table 8-2 is excerpts of the 95th percentile modeled daily deposition rates based on high-end estimated releases for fugitive emissions. A maximum daily deposition rate of 3.2×10^{-1} g/m^2-day at 100 m from the facility was modeled for PVC Plastic Compounding OES, based on higher-end meteorology and rural land category scenario. Tables of all annual and daily modeled deposition rates for all OESs and distances (10 m to 10,000 m) are provided in Appendix C.

Table 8-2. 95th Percentile Modeled Daily Deposition (g/m²-day) Based on Fugitive Source, High-End Facility Release

Occupational Exposure Scenario[a]	Meteorology	Land	Distance									
			10 M	30 M	30-60 M	60 M	100M	100-1000 M	1000 M	2500 M	5000 M	10000 M
Plastic Compounding	Central Tendency	Rural	1.0E00	9.7E−01	6.1E−01	4.3E−01	2.3E−01	1.9E−02	7.2E−03	1.3E−03	3.5E−04	9.1E−05
		Urban	1.8E00	1.2E00	7.3E−01	4.6E−01	1.9E−01	8.7E−03	3.0E−03	6.3E−04	2.0E−04	6.3E−05
	High-End	Rural	2.1E00	1.3E00	8.3E−01	5.8E−01	**3.2E−01**	2.4E−02	8.5E−03	1.6E−03	4.3E−04	1.0E−04
		Urban	3.3E00	1.6E00	8.8E−01	5.2E−01	2.1E−01	1.0E−02	3.4E−03	7.0E−04	2.1E−04	6.6E−05

[a] Table 1-1 provides the crosswalk of OES to COUs.

Bold – Indicates highest modeled concentration within 100 to 1,000 m from facility release.

Since the octanol:air coefficient (K_{OA}) indicates that DIDP will favor the organic carbon present in airborne particles, particle deposition can be a significant pathway for DIDP to be transported to other environmental compartments, such as soil and surface water. Soil concentrations from air deposition were also estimated for the COU scenarios with air releases. Using the daily deposition rates, the DIDP concentration in soil was calculated with the following equations based on EPA's Office of Pesticide Programs standard farm pond scenario (U.S. EPA, 1999) and European Chemicals Bureau Technical Guidance Document (ECB, 2003):

Equation 8-1. Total Deposition to Soil Calculation

$$\boldsymbol{TotDep} = Daily\boldsymbol{Dep} \times \boldsymbol{Ar} \times \boldsymbol{CF}$$

Where:

$TotDep$	=	Total daily deposition to soil (µg)
$DailyDep$	=	Daily deposition flux to soil (g/m^2)
Ar	=	Area of soil (90,000 m^2)
CF	=	Conversion of grams to micrograms

Equation 8-2. Soil Concentration Calculation

$$\boldsymbol{SoilConc} = \boldsymbol{TotDep}\ /(\boldsymbol{Ar} \times \boldsymbol{Mix} \times \boldsymbol{Dens})$$

Where:

$SoilConc$	=	Daily-average concentration in soil (µg/kg)
$TotDep$	=	Total daily deposition to soil (µg
Mix	=	Mixing depth (m); default = 0.1 m; from (ECB, 2003)
Ar	=	Area of soil (90,000 m^2)
$Dens$	=	Density of soil; default = 1,700 kg/m^3; from (ECB, 2003)

The above equations assume instantaneous mixing with no degradation or other means of chemical reduction in soil over time and that DIDP loading in soil is only from direct air-to-surface deposition (*i.e.*, no runoff).

Using maximum modeled deposition rates from fugitive releases and the equations above, high-end concentration of DIDP in soil from modeled air to soil deposition at 100 m and 1,000 m from a hypothetical release site for the PVC plastics compounding OES was 1.85 mg/kg and 0.051 mg/kg per day. Comparatively, the highest reported soil concentration of DIDP reported within the reasonably available literature is from (Tran et al., 2015), reporting a DIDP concentration of 0.013 mg/kg in rural soil (Doue, Seine-et-Marne, France; population 1,029).

Air deposition can also lead to DIDP concentrations in water and sediment. EPA modeled surface water and sediment concentrations of DIDP resulting from air deposition and provides the results in Appendix C.3.1. However, modeling results indicate a rapid decline in DIDP concentrations from air to surface water and sediment at distances greater than 100 m from fugitive releases. Even at a 10 m distance, surface water and sediment concentrations resulting from water releases as described in Section 4.1 were many orders of magnitude higher and used as the primary concentrations for the environmental and general population exposure assessment.

8.4 Evidence Integration

8.4.1 Strengths, Limitations, and Sources of Uncertainty for Modeled Air and Deposition Concentrations

AERMOD

AERMOD is an EPA regulatory model and has been thoroughly peer reviewed (U.S. EPA, 2003); therefore, the general confidence in results from the model is high but relies on the integrity and quality of the inputs used and interpretation of the results. For the full analysis, EPA used estimated releases as direct inputs to AERMOD.

Since EPA estimated generic release scenarios were used for emissions input, AERMOD runs do not include latitude/longitude information. Therefore, there is some uncertainty associated with the modeled distances from each release point and the associated exposure concentrations to which hypothetical fenceline communities may be exposed. Additionally, based on the generic release scenarios, air releases were categorized into two categories: (1) fugitive or stack air and (2) fugitive air, water, incineration, or landfill with the former being a combined estimate of vapor releases from fugitive and stack air and the latter being a combined estimate of particulate release via all of the listed waste streams. EPA modeled stack air using the combined release estimate categorized as fugitive or stack air while modeling fugitive air using the combined release estimate categorized as fugitive air, water, incineration, or landfill. Specifically, plastic compounding releases, which were identified as having the highest air releases from fugitive emissions, and used for environmental and general population exposure, were categorized as releasing to fugitive air, water, incineration, or landfill, with no distinction to a specific waste stream. As such, there may be an overestimation of air concentration associated with plastic compounding that was used for screening level analysis purposes as release estimates provided combined releases.

In addition, estimated release scenarios do not include source specific stack parameters that can affect plume characteristics and associated dispersion of the plume. Therefore, EPA used pre-defined stack parameters defined by integrated indoor-outdoor air calculator (IIOAC), to represent stack parameters of all facilities modeled using each of these methodologies. Those stack parameters include a stack height 10 m above ground with a 2-meter inside diameter, an exit gas temperature of 300 degrees Kelvin, and an exit gas velocity of 5 m per second (see Table 6 of the User's Guide: Integrated Indoor-Outdoor Air Calculator (IIOAC), 2019, 5205690). These parameters were selected since they represent a slow-moving, low-to-the-ground plume with limited dispersion which results in a more conservative estimate of exposure concentrations at the distances evaluated. As such, these parameters may result in some overestimation of emissions for certain facilities modeled. Additionally, the assumption of a 10×10 area source for fugitive releases may impact the exposure estimates very near a releasing facility (*i.e.*, 10 m from a fugitive release). This assumption places the 10-meter exposure point just off the release point that may result in either an over or underestimation of exposure depending on other factors like meteorological data, release heights, and plume characteristics.

AERMOD was used to model daily and annual air concentration and deposition rates from air to land and water from each EPA estimated release scenario. Based on physical and chemical properties of DIDP (see *Draft Physical Chemistry Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024g)), EPA considered only particle deposition and for the purposes of modeling, it was assumed that 100 percent of the emitted mass of DIDP immediately adsorbs to atmospheric particles for air exposure concentrations and air deposition. EPA used chemical-specific parameters as input values for AERMOD deposition modeling but due to limited data and relied on AERMOD's method 2 for particle distribution. A full description of the input parameters selected for AERMOD and details regarding post-processing of the results are provided in Appendix C.

8.5 Weight of Scientific Evidence Conclusions

Although the range of reported measured concentrations ($3.0x10^{-4}$ to $5.5x10^{-3}$ µg/m^3) for ambient air found in the only monitoring study identified from the systematic review, Cousins et al. (2007), falls within range of the ambient air modeled concentrations ($4.0x10^{-12}$ to $4.7x10^{2}$ µg/m^3) from AERMOD, the highest modeled concentrations of DIDP in ambient air were many orders of magnitude higher than any monitored value. In addition, this is the only study from systematic review with monitoring ambient air data that was collected in Sweden, which affects the representativeness when comparing to modeled concentrations based on reported releases in the United States. Taken together with the moderate confidence in the release data detailed in *Draft Release and Occupational Exposure Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024c) and conservative assumptions used for modeled air dispersion and particle distribution inputs, EPA has slight confidence in the air and deposition concentrations modeled based on EPA estimated releases using AERMOD with a bias towards overestimation.

9 AMBIENT AIR EXPOSURE

9.1 Modeling Approach

DIDP is a liquid at environmental temperatures with a melting point of −50°C (Haynes, 2014) and a vapor pressure of 5.28×10^{-7} mm Hg at 25°C (NLM, 2020). Based on its physical and chemical properties and short half-life in the atmosphere, $t_{1/2}$ = 7.6 hours (Mackay et al., 2006), DIDP was assumed to not be persistent in the air. The AEROWIN™ module in EPI Suite™ estimates that a large fraction (75 to 80 percent) of DIDP could be sorbed to airborne particulates and these particulates may be resistant to atmospheric oxidation.

The Level III Fugacity model in EPI Suite™ (LEV3EPI™) was used for the DIDP Tier II Fate analysis to predict DIDP's behavior in different environmental compartments. The model utilizes inputs on an organic chemical's physical chemistry characteristics and degradation rates to predict partitioning of chemicals between environmental compartments and the persistence of a chemical in a model environment. See the *Draft Fate Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024d) for the fate assessment for DIDP.

Under all emission scenarios, DIDP is expected to predominantly partition into the soil or sediment compartments. Based on this information, exposure to DIDP via the inhalation route is not expected. However, there may be exposure via soil ingestion and soil contact resulting from air to soil deposition which is modeled in Section 8.3.1 and used to calculate soil ingestion and dermal doses in Sections 9.1.1 and Section 9.1.2, respectively. For this screening exercise, only the highest modeled facility release was included in the exposure analysis.

9.1.1 Oral – Soil Ingestion

The acute dose rate (ADR) for soil ingestion can be calculated using Equation 9-1 below.

Equation 9-1. Acute Dose Rate Calculation for Soil Ingestion

$$Acute\ Dose\ Rate(ADR) = \frac{C_{soil}\ x\ CF\ x\ IR}{BW\ x\ AT_{EF}}$$

Where:

C_{soil}	=	Chemical concentration in soil (mg/kg)
CF	=	Conversion factor (1.0E−03 kg/mg)
IR	=	Ingestion rate of soil (mg/day)
BW	=	Body weight (kg)
AT_{EF}	=	Averaging time for exposure frequency (basis for hazard POD; 1 day for acute)

ADR is calculated using the highest modeled 95th percentile soil concentration of 1.85E03 µg/kg (1.85 mg/kg) at 100 m from PVC Plastic Compounding OES from Section 8.3.1 and exposure parameters from the EPA Exposure Factors Handbook (U.S. EPA, 2017b), which are also summarized in Table_Apx A-3. To maximize the ADR, a conservative exposure scenario was developed using a high soil ingestion rate and low body weight from the following parameters:

- Infant to youth (6 months to <12 years)
  - IR = 200 mg/day
- Toddler (Age 1 to 5)
  - BW = 16.2 kg

$$Acute\ Dose\ Rate\ (ADR)\ =\ \frac{1.85\frac{\text{mg}}{\text{kg}}\ x\ 1.0E^{-03}\frac{kg}{mg}\ x\ 200mg/day}{16.2\ kg\ x\ 1\ day} = 0.0228\ \frac{mg}{kg-day}$$

9.1.2 Dermal – Soil Contact

The acute dose rate for soil dermal contact (*i.e.*, the dermal absorbed dose (DAD)) can be calculated using Equation 9-2 below.

Equation 9-2. Acute Soil Dermal Calculation

$$Dermal\ Absorbed\ Dose\ (DAD) = \frac{C_{soil}\ x\ CF\ x\ AF\ x\ ABS_d\ x\ SA_{soil}\ x\ EV}{BW\ x\ AT_{EF}}$$

Where:

C_{soil}	=	Chemical concentration in soil (mg/kg)
CF	=	Conversion factor (1.0E−03 kg/mg)
AF	=	Adherence factor of soil to skin (mg/cm^2-event)
ABS_d	=	Dermal absorption fraction (Assume 1 = 100 percent)
SA	=	Skin surface area (cm^2)
EV	=	Events per day
BW	=	Body weight (kg)
AT_{EF}	=	Averaging time for exposure frequency (basis for hazard POD; 1 day for acute)

DAD is calculated using the highest modeled 95th percentile soil concentration of 1.85×10^3 µg/kg (1.85 mg/kg) at 100 m from PVC Plastic Compounding OES and parameters from the EPA Exposure Factors Handbook (U.S. EPA, 2017b), which are also summarized in Table_Apx A-3, using a similar exposure scenario from the previous ADR, exposure parameters were:

- Child
  - AF = 0.2
  - SA = 2,700 cm^2
  - BW = 16.2 kg
  - EV = 1 event

$$Dermal\ Absorbed\ Dose\ (DAD) = \frac{1.85\frac{mg}{kg}\ x\ 1.0E^{-03}\frac{kg}{mg}\ x\ 0.2\frac{mg}{cm^2 - event}\ x\ 1\ x\ 2{,}700\ cm^2\ \ x\ 1\ event}{16.2\ kg\ x\ 1\ day}$$

$$Dermal\ Absorbed\ Dose\ (DAD) = 0.0617\frac{mg}{kg - day}$$

9.2 Risk Screening

9.2.1 Oral Ingestion and Dermal Absorption Margin of Exposure

The ADR (0.0228 mg/kg-day) and DAD (0.0617 mg/kg-day) are calculated based on the highest modeled 95th percentile soil concentration of 1.85×10^3 µg/kg (1.85 mg/kg) at 100 m from PVC Plastic Compounding OES in Sections 9.1 and 9.1.2, respectively, and the HED of 9.0 mg/kg-day and benchmark of 30 provided in Table 2-1:

$$Margin\ of\ Exposure\ (MOE) = \frac{\text{HED}}{ADR + DAD}$$

$$Margin\ of\ Exposure\ (MOE) = \frac{9.0\frac{mg}{kg-day}}{\left(0.0228\frac{mg}{kg-day} + 0.0617\frac{mg}{kg-day}\right)}$$

$$Margin\ of\ Exposure\ (MOE) = 106.5$$

Using the acute dose based on the highest modeled 95th percentile soil concentration at 100 m, the resulting MOE is 106.5, which is greater than the benchmark of 30. Based on the conservative modeling parameters for air deposition rate and exposure factors parameters, risk for non-cancer health effects for oral ingestion and dermal absorption through ambient air deposition is not expected.

9.3 Weight of Scientific Evidence Conclusions

There is robust confidence in the exposure factors inputs (U.S. EPA, 2017b) used for modeling exposure for soil ingestion and soil contact. However, as stated in Section 8.5 there EPA has slight confidence in the air and deposition concentrations modeled based on EPA estimated releases being representative of actual releases, but for the purposed of a screening level assessment, EPA has robust confidence that it's modeled releases used for estimating air to soil deposition is appropriately conservative for a screening level analysis. Therefore, **EPA has robust confidence that no exposure scenarios will lead to greater doses than presented in this evaluation.**

10 HUMAN BIOMONITORING

The use of human biomonitoring data is an important tool for determining total exposure to a chemical for real world populations. Reverse dosimetry using human biomonitoring data can provide an estimate of the total dose (or aggregate exposure) responsible for the measured biomarker. Intake doses estimated using reverse dosimetry is not source apportionable and is therefore not directly comparable to the exposure estimates presented throughout this document associated with specific COUs. However, the total intake dose estimated from reverse dosimetry can help contextualize the exposure estimates from TSCA COUs as being potentially underestimated or overestimated.

This section discusses monitoring and modeling results for human milk (Section 10.1) and urinary biomonitoring (Section 10.2). Human milk biomonitoring data provides information for infant exposure to DIDP from human milk ingestion, while urinary biomonitoring provides total exposure from all sources for different life stages.

10.1 Human Milk Biomonitoring

Infants are a potentially susceptible lifestage because of their higher exposure per body weight, immature metabolic systems, and the potential for chemical toxicants to disrupt sensitive developmental processes, among other reasons. Reasonably available information from studies of experimental rodent models also indicates that DIDP is a developmental toxicant, and that developmental toxicity occurs following gestational exposure to DIDP (U.S. EPA, 2024f). EPA considered exposure (Section 10.1.1) and hazard (Section 10.1.2) information, as well as pharmacokinetic models (Section 10.1.3), to determine how to evaluate infant exposure to DIDP from human milk ingestion. EPA concluded that the most scientifically supportable approach is to use human health hazard values that are based on maternal exposure over two generations. It is thus expected to incorporate potential risks to infants from exposure through milk even though human milk concentrations were not modeled, as the subsequent sections will explain in more detail.

10.1.1 Biomonitoring Information

While the physical and chemical properties of DIDP indicate a potential for accumulation in human milk (molecular weight of 446.68 g/mol and lipophilic with log K_{ow} of 10.21), biomonitoring data, albeit limited, have not demonstrated the presence of DIDP in human milk. One study of 78 German mothers who were not occupationally exposed to phthalates did not measure DIDP in milk samples above its limit of detection (0.1 ng/g lipid weight) (Fromme et al., 2011). A study from China by Chen et al. (2008) similarly did not measure DIDP above its limit of detection (0.05 μg/L wet weight) among the samples collected from 40 women with no known history of occupational exposure to DIDP. No U.S. biomonitoring studies of DIDP in human milk were identified. Since available biomonitoring studies did not detect DIDP in milk, infant exposure through this route could be not estimated with measured data.

10.1.2 Hazard Information

Several studies of experimental rodent models have characterized the developmental and reproductive toxicity from exposure to DIDP (U.S. EPA, 2024f). The most sensitive adverse effect is observed in fetal and infant lifestages that result from maternal and/or paternal exposure via oral administration of DIDP. The critical effect for DIDP is reduced F2 offspring (*i.e.*, offspring produced by the second parental generation) survival on postnatal days one and four in a two-generation study of reproduction of rats (Hushka et al., 2001; Exxon Biomedical, 2000). There are uncertainties as to whether effects on F2 offspring survival resulted from gestational, lactational, or combined gestational and lactational exposure to DIDP, or even if the effect was mediated via maternal and/or paternal exposure to DIDP. No studies have evaluated only lactational exposure from quantified levels of DIDP in milk. The human health hazard values used in this assessment are based on developmental toxicity following maternal exposures over two generations and are therefore expected to incorporate any effect that may result from offspring exposure through milk. The hazard values also correspond to maternal exposure to the parent phthalate (DIDP) and not metabolites of DIDP.

10.1.3 Modeling Information

EPA identified a pharmacokinetic model as the best available model to estimate transfer of lipophilic chemicals from mother to infants during gestation and lactation, hereafter referred to as the Kapraun model (Kapraun et al., 2022). The only chemical-specific parameter required by the Kapraun model is the elimination half-life in the animal species of interest. However, significant uncertainties in establishing an appropriate half-life value for DIDP does not support using the model to quantify lactational transfer and exposure for TSCA COUs.

One of the key uncertainties in identifying an appropriate half-life is selecting a value that is sensitive and specific. DIDP is rapidly metabolized to its primary metabolite MIDP (a monoester), which undergoes further oxidation reactions to produce multiple secondary metabolites (see the toxicokinetics summary in the *Draft Human Health Hazard Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024f) for further details). Secondary metabolites are frequently detected in urine samples, whereas DIDP and MIDP are not (Saravanabhavan and Murray, 2012). This indicates that neither the parent compound nor the primary metabolite is a sensitive biomarker of exposure to DIDP. A secondary metabolite will be more appropriate, but secondary metabolites may also overlap with other parent phthalates (Saravanabhavan and Murray, 2012). Lastly, half-life can vary by not only the measured substance (*i.e.*, parent versus any of the metabolites) but also by the tissue matrix. Half-lives have been reported to be 1 to 2 orders of magnitudes longer in epididymal fat than in plasma, liver, or other less fatty tissues for the related di(2-ethylhexyl) phthalate (DEHP) after controlling for dose and exposure route in rats (Domínguez-Romero and Scheringer, 2019; Oishi and Hiraga, 1982). While similar studies were not identified for DIDP, it may follow the same pattern as DEHP whereby half-lives in fatty tissues like the mammary gland may be longer than those measured in urine or blood. In summary, existing studies do not provide a half-life value that is both sensitive and specific to the metabolites. Some studies have measured the half-life for DIDP, but given its relatively fast metabolism, modeling infant exposure via human milk ingestion using DIDP's half-life may underestimate doses.

Limitations in hazard data also support EPA's conclusion that modeling exposure estimates will not be informative. No studies have evaluated only lactational exposure, and hazard values are based on maternal exposure to the parent phthalate. In other words, the hazard studies do not elucidate the toxic moiety for DIDP and assume it can be any of the metabolites because of the parent compound's rapid metabolism. EPA is unable to calculate hazard values for the secondary metabolites in the absence of such studies. Thus, even if there are robust data measuring the half-life of all DIDP's metabolites, allowing EPA to then estimate exposure to metabolites via human milk ingestion, there are no corresponding hazard values for risk characterization.

The human health hazard values used in this assessment are based on developmental toxicity following maternal exposures over two generations and are therefore expected to incorporate any effect that may result from offspring exposure through milk. Risk estimates presented throughout *Draft Risk Evaluation for Diisodecyl Phthalate* (U.S. EPA, 2024h) are based on this hazard value and are expected to incorporate risks to infants that may result from exposure through milk.

10.1.4 Weight of Scientific Evidence Conclusions

The uncertainties associated with the window of exposure for hazard values and the lack of sensitive and specific half-life data precluded EPA from modeling human milk concentrations by COU. However, EPA has robust confidence that using the human health hazard values for maternal exposure over two generations will incorporate potential risks to a nursing infant.

10.2 Urinary Biomonitoring

Reverse dosimetry is an approach, as shown in Figure 10-1, of estimating an external exposure or intake dose to a chemical using biomonitoring data (U.S. EPA, 2019b). In the case of phthalates, U.S. Centers for Disease Control and Prevention's (CDC) National Health and Nutrition Examination Survey (NHANES) dataset provides a relatively recent (data available through 2017 to 2018) and robust source of urinary biomonitoring data that is considered a national, statistically representative sample of the non-institutionalized, U.S. civilian population. Phthalates have elimination half-lives on the order of several hours and are quickly excreted from the body in urine and to some extent feces (ATSDR, 2022; EC/HC, 2015a). Therefore, the presence of phthalate metabolites in NHANES urinary biomonitoring data indicates recent phthalate exposure.

Reverse dosimetry is a powerful tool for estimating exposure, but reverse dosimetry modeling does not distinguish between routes or pathways of exposure and does not allow for source apportionment (*i.e.*, exposure from TSCA COUs cannot be isolated). Instead, reverse dosimetry provides an estimate of the total dose (or aggregate exposure) responsible for the measured biomarker. Therefore, intake doses estimated using reverse dosimetry is not directly comparable the exposure estimates from the various environmental media presented in this document. However, the total intake dose estimated from reverse dosimetry can help contextualize the exposure estimates from TSCA COUs as being potentially underestimated or overestimated.

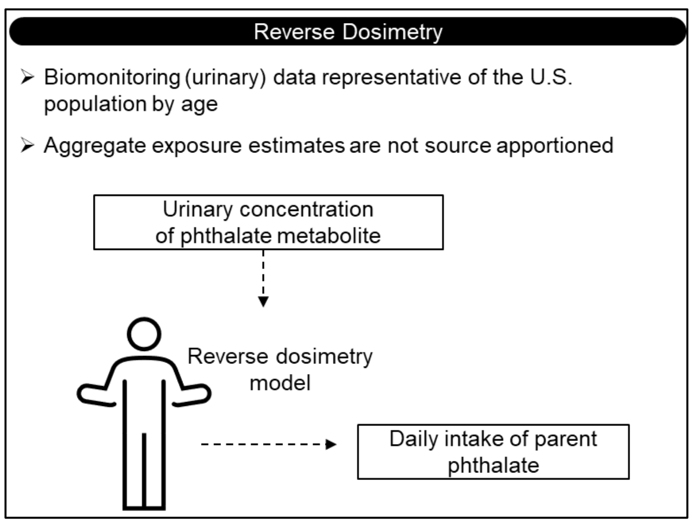

Figure 10-1. Reverse Dosimetry Approach for Estimating Daily Intake

10.2.1 Approach for Analyzing Biomonitoring Data

EPA analyzed urinary biomonitoring data from NHANES, which reports urinary concentrations for 15 phthalate metabolites specific to individual phthalate diesters. Specifically, EPA analyzed data for mono-(carboxynonyl) phthalate (MCNP), a metabolite of DIDP, which has been reported in the 2005 to 2018 NHANES survey years. Sampling details can be found in Appendix B. Urinary concentrations of MCNP were quantified for different lifestages. The lifestages assessed included: women of reproductive age (16 to 49 years old), adults (16 years old and up), adolescents (11 to less than 16 years old), children (6 to less than 11 years old), and toddlers (3 to less than 6 years old) when data were available. Urinary concentrations of MCNP were analyzed for all available NHANES survey years to examine the temporal trend of DIDP exposure. However, intake doses using reverse dosimetry were calculated for the most recent NHANES cycle (2017 to 2018) as being most representative of current exposures.

NHANES uses a multi-stage, stratified, clustered sampling design that intentionally oversamples certain demographic groups; to account for this, all data was analyzed using the survey weights provided by NHANES and analyzed using weighted procedures in SAS and SUDAAN statistical software. Median and 95th percentile concentrations were calculated in SAS and reported for lifestages of interest. Median and 95th percentile concentrations are provided in Table_Apx B-2. Statistical analyses of MCNP trends over time were performed with PROC DESCRIPT using SAS-callable SUDAAN.

To maximize comparability with existing phthalate assessments from the U.S. Consumer Product Safety Commission (U.S. CPSC, 2014) and Health Canada (ECCC/HC, 2020), the urinary phthalate concentrations calculated in the present analysis were not creatinine corrected. Although comparability between existing assessments is beneficial, the urinary phthalate concentrations must be interpreted with caution, as men have higher creatinine levels than women due to differences in muscle mass. As a result, phthalate concentrations among men may appear artificially higher than concentrations among women.

10.2.1.1 Temporal Trend of MCNP

Figure 10-2 and Figure 10-3 show urinary MCNP concentrations plotted over time for the various populations to visualize the temporal trends of DIDP exposure. **Overall, MCNP concentrations have decreased over time for all lifestages.**

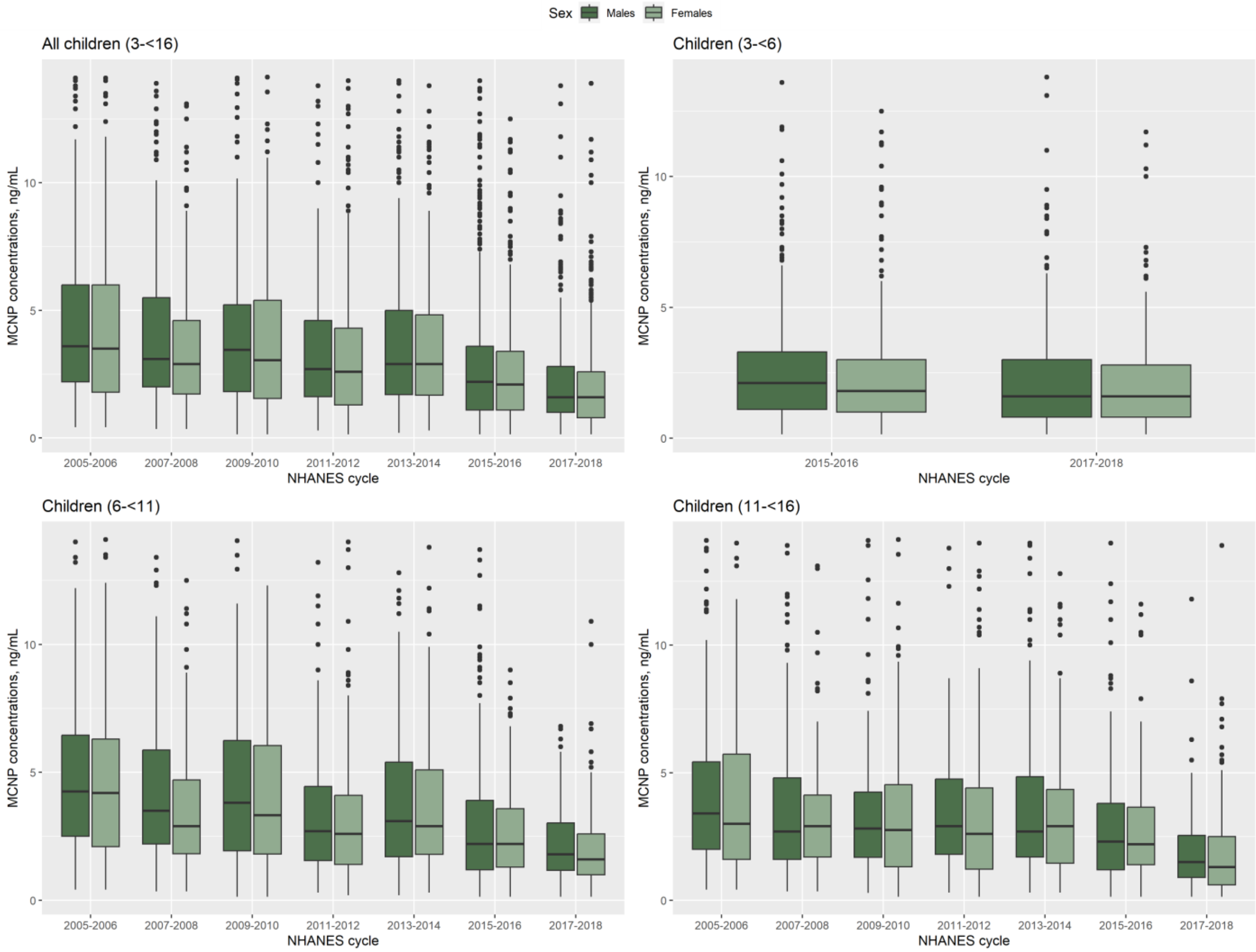

Figure 10-2. Urinary MCNP Concentrations for Children (3 to <16 Years) by Age Group
Maximum values in the boxplots represent the 95th percentile of the data. Values represented as dots are outliers that are greater than 1.5 the interquartile range of the data.

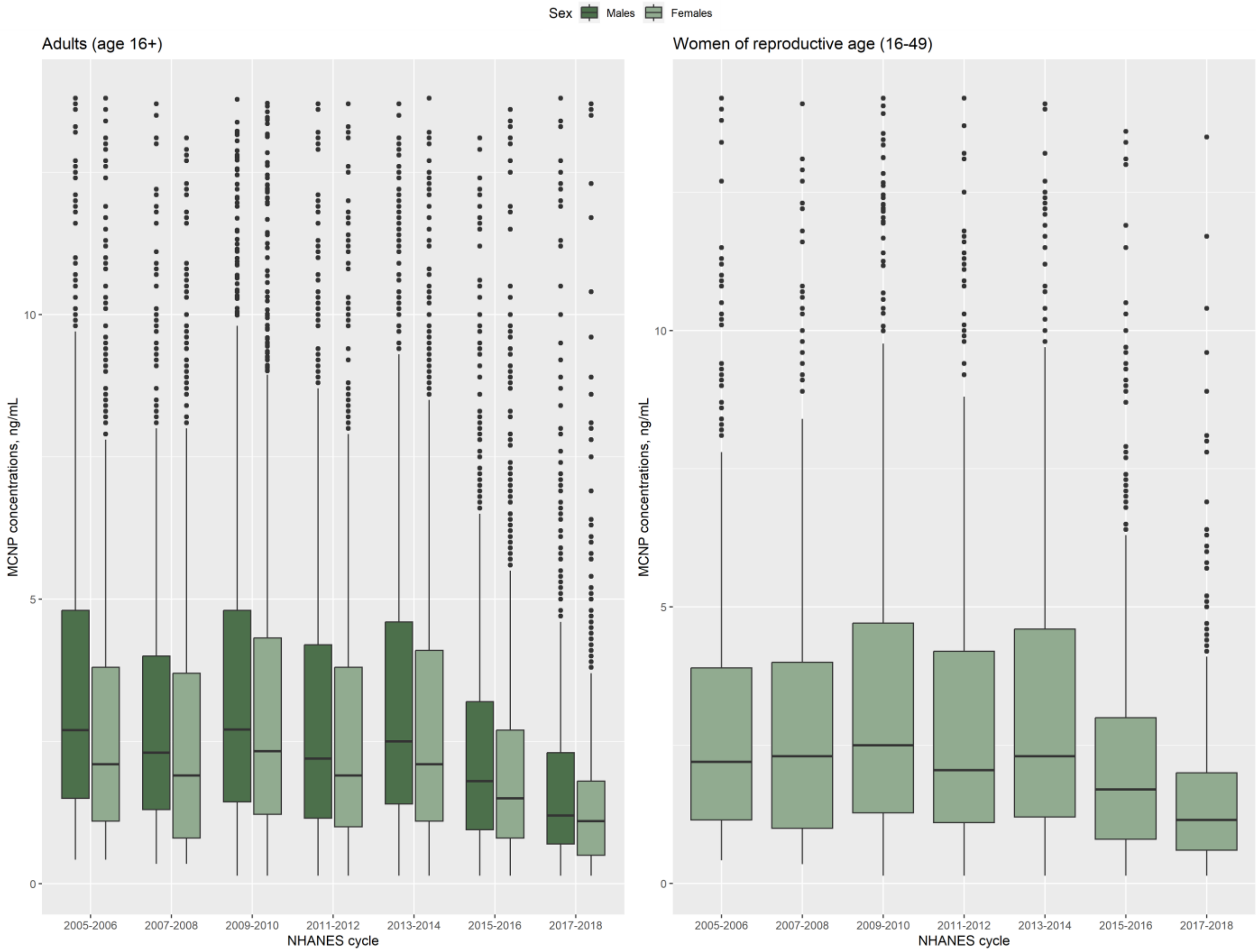

Figure 10-3. Urinary MCNP Concentrations for Adults (16+ Years) and Women of Reproductive Age (16 to 49 Years)

Maximum values in the boxplots represent the 95th percentile of the data. Values represented as dots are outliers that are greater than 1.5 the interquartile range of the data.

Overall urinary concentrations among all children under 16 have significantly decreased over time at both the 50th and 95th percentile (50th percentile, $p < 0.001$; 95th percentile, $p < 0.001$) (Figure 10-2). Among age groups, statistically significant decreases of the 50th and 95th percentile of urinary MCNP concentrations over time were observed for children aged 3 to less than 6 years of age (50th percentile, $p < 0.001$; 95th percentile, $p < 0.001$), 6 to less than 11 years of age (50th percentile, $p < 0.001$; 95th percentile, $p < 0.001$, and 11 to less than 16 years of age (50th percentile, $p < 0.001$; 95th percentile, $p < 0.001$) (Figure 10-2).

Similarly, among adults, MCNP concentrations significantly decreased over time for all adults and for women of reproductive age (adjusted p-values were both <0.001) (Figure 10-3). Additionally, among all adult participants, the total urinary MCNP concentration for all years was significantly higher among men than among women ($p < 0.001$) (Figure 10-3).

10.2.1.2 Daily Intake of DIDP from NHANES

Using MCNP concentrations measured in the most recently available sampling cycle (2017 to 2018), EPA estimated the daily intake of DIDP through reverse dosimetry. Reverse dosimetry approaches that incorporate basic pharmacokinetic information are available for phthalates (Koch et al., 2007; Koch et al., 2003; David, 2000) and have been used in previous phthalate risk assessments conducted by U.S. CPSC (2014) and Health Canada (ECCC/HC, 2020) to estimate daily intake values for exposure assessment. For phthalates, reverse dosimetry can be used to estimate a daily intake (DI) value for a parent phthalate diester based on phthalate monoester metabolites measured in human urine using Equation 10-1 (Koch et al., 2007). For DIDP, the phthalate monoester metabolite would be MCNP.

Equation 10-1. Calculating the Daily Intake Value from Urinary Biomonitoring Data

$$Phthalate\ DI = \frac{(\mathrm{UE}_{Sum} \times \mathrm{CE})}{\mathrm{Fue}_{sum}} \times MW_{Parent}$$

Where:

- Phthalate DI = Daily intake (µg/kg_{bw}/day) value for the parent phthalate diester
- UE_{sum} = The sum molar concentration of urinary metabolites associated with the parent phthalate diester (in units of µmole per gram creatinine).
- CE = The creatinine excretion rate normalized by body weight (in units of mg creatinine per kg bodyweight per day). CE can be estimated from the urinary creatinine values reported in biomonitoring studies (*i.e.*, NHANES) using the equations of Mage et al. (2008) based on age, gender, height, and race, as was done by Health Canada (ECCC/HC, 2020) and U.S. CPSC (2014).
- Fue_{sum} = The summed molar fraction of urinary metabolites. The molar fraction describes the molar ratio between the amount of metabolite excreted in urine and the amount of parent compound taken up.
- MW_{parent} = The molecular weight of the parent phthalate diester (in units of g/mole).

Daily intake values were calculated for each participant from NHANES. A creatinine excretion rate for each participant was calculated using equations provided by Mage et al. (2008). The applied equation is dependent on the participant's age, height, race, and sex to accommodate variances in urinary excretion rates. Creatinine excretion rate equations were only reported for people who are non-Hispanic Black and non-Hispanic White, so the creatinine excretion rate for participants of other races were calculated using the equation for non-Hispanic White adults or children, in accordance with the approach used by U.S. CPSC (2015).

No controlled human exposure studies of DIDP have been conducted and no fractional urinary excretion (F_{ue}) values for DIDP are available. To estimate daily intake of DIDP from NHANES urinary MCNP biomonitoring data, EPA used an F_{ue} value of 0.099 for mono-(carboxyoctyl) phthalate (MCOP), a metabolite of diisononyl phthalate (DINP). The use of the DINP F_{ue} value as a surrogate for DIDP is supported by the structural similarity of the two phthalates. Further, DINP F_{ue} values have been used as a surrogate for DIDP in existing assessments of DIDP by Health Canada (ECCC/HC, 2020; EC/HC, 2015b). U.S. CPSC (2014) used a F_{ue} value of 0.04 but did not provide a citation for this value; as such, EPA replicated Health Canada's approach of using the DINP F_{ue} value for DIDP.

The calculated daily intake values in this analysis shown in Table 10-1 for the various lifestages at the 50th and 95th exposure percentile are similar to those reported by U.S. CPSC (2014) and Health Canada (ECCC/HC, 2020). The daily intake values in the present analysis are calculated with 2017 to 2018 NHANES data, while daily intake estimates by U.S. CPSC and Health Canada were based on 2005 to 2006 and 2009 to 2010 NHANES survey data, respectively.

Daily intake values in the U.S. CPSC (2014) report were estimated for men and women of reproductive age (15 to 45) and reported at the 99th percentile rather than the 95th percentile, so the results are similar but not directly comparable to those in the present analysis. U.S. CPSC reports a median daily intake value for adults aged 15 to 45 as 1.1 µg/kg-day and a 99th percentile daily intake value of 35 µg/kg-day using NHANES data from 2005 to 2006.

The Health Canada (ECCC/HC, 2020) assessment reports median and 95th percentile daily intake values for male children aged 6 to 11 as 1.4 and 4.4 µg/kg-day, respectively. The reported median and 95th percentile daily intake values for adults (age 20 or older) were 0.76 and 4.4 µg/kg-day for males and 0.65 and 4.9 µg/kg-day for females.

Table 10-1. Daily Intake Values for Select Demographics for the 2017 to 2018 NHANES Cycle

Demographic	Exposure Percentile	Daily Intake Value (Median [95% CI]) (µg/kg-bw-day)
Women of reproductive age	50	1.17 (0.80-1.54)
Women of reproductive age	95	3.50[a]
Adults (16+)	50	1.29 (0.92-1.66)
Adults (16+)	95	7.18[a]
Female adults	50	1.17 (0.80-1.54)
Female adults	95	3.50[a]
Male adults	50	1.59 (1.06-2.12)
Male adults	95	7.41[a]
Adolescents (11-<16 years old)	50	1.37 (1.10-1.64)
Adolescents (11-<16 years old)	95	4.27 (0.65-7.88)
Female adolescents	50	1.32 (0.94-1.70)
Female adolescents	95	3.38 (2.01-4.76)
Male adolescents	50	1.51 (1.19-1.83)
Male adolescents	95	9.66[a]
Children (6-<11 years old)	50	1.19 (1.07-1.30)
Children (6-<11 years old)	95	6.35 (-4.37-17.07)
Female children	50	1.25 (0.99-1.51)
Female children	95	13.14[a]
Male children	50	1.14 (1.00-1.28)
Male children	95	2.70 (2.18-3.23)
Toddlers (3-5 years old)	50	1.00 (0.91-1.10)
Toddlers (3-5 years old)	95	4.65 (1.52-7.79)
Female toddlers	50	0.97 (0.82-1.12)
Female toddlers	95	7.32 (-0.38-15.02)

Demographic	Exposure Percentile	Daily Intake Value (Median [95% CI]) (µg/kg-bw-day)
Male toddlers	50	1.02 (0.88-1.16)
Male toddlers	95	3.60 (0.10-7.10)
[a] 95% confidence intervals (CI) could not be calculated due to small sample size or a standard error of zero.		

As described earlier, reverse dosimetry modeling does not distinguish between routes or pathways of exposure and does not allow for source apportionment (*i.e.*, exposure from TSCA COUs cannot be isolated). Therefore, general population exposure estimates from exposure to ambient air, surface water, and soil are not directly comparable. However, in contrasting the general population exposures estimated for a screening level analysis with the NHANES biomonitoring data, many of the acute dose rates or average daily doses from a single exposure scenario exceed the total daily intake values estimated using NHANES. Taken together with results from U.S. CPSC (2014) stating that DIDP exposure comes primarily from diet for women, infants, toddlers, and children and that the outdoor environment did not contribute to DIDP exposures, the exposures to the general population via ambient air, surface water, and drinking water quantified in this document are likely overestimates, as estimates from individual pathways exceed the total intake values measured even at the 95th percentile of the U.S. population for all ages.

10.2.2 Limitations and Uncertainties of Reverse Dosimetry Approach

Controlled human exposure studies have been conducted and provide estimates of the urinary molar excretion factor (*i.e.*, the F_{ue}) to support use of a reverse dosimetry approach. These studies most frequently involve oral administration of an isotope-labelled (*e.g.*, deuterium or carbon-13) phthalate diester to a healthy human volunteer and then urinary excretion of monoester metabolites is monitored over 24 to 48 hours. F_{ue} values estimated from these studies have been used by both U.S. CPSC (2014) and Health Canada (ECCC/HC, 2020) to estimate phthalate daily intake values using urinary biomonitoring data. To estimate the daily intake value for DIDP, the F_{ue} value for MCOP, a DINP metabolite was used (ECCC/HC, 2020). Use of analogue to estimate DIDP daily intake values is a source of uncertainty.

Use of reverse dosimetry and urinary biomonitoring data to estimate daily intake of phthalates is consistent with approaches employed by both U.S. CPSC (2014) and Health Canada (ECCC/HC, 2020). However, there are challenges and sources of uncertainty associated with the use of reverse dosimetry approaches. U.S. CPSC considered several sources of uncertainty associated with use of human urinary biomonitoring data to estimate daily intake values and conducted a semi-quantitative evaluation of uncertainties to determine the overall effect on daily intake estimates (see Section 4.1.3 of (U.S. CPSC, 2014)). Identified sources of uncertainty include: (1) analytical variability in urinary metabolite measurements; (2) human variability in phthalate metabolism and its effect on metabolite conversion factors (*i.e.*, the F_{ue}); (3) temporal variability in urinary phthalate metabolite levels; (4) variability in urinary phthalate metabolite levels due to fasting prior to sample collection; (5) variability due to fast elimination kinetics and spot samples; and (6) creatinine correction models for estimating daily intake values.

In addition to some of the limitations and uncertainties discussed above and outlined by U.S. CPSC (2014), the short half-lives of phthalates can be a challenge when using a reverse dosimetry approach. Phthalates have elimination half-lives on the order of several hours and are quickly excreted from the body in urine and to some extent feces (ATSDR, 2022; EC/HC, 2015a). Therefore, spot urine samples, as collected through NHANES and many other biomonitoring studies, are representative of relatively recent exposures. Spot urine samples were used by Health Canada (ECCC/HC, 2020) and U.S. CPSC (2014) to estimate daily intake values. However, due to the short half-lives of phthalates, a single spot sample may not be representative of average urinary concentrations that are collected over a longer term or calculated using pooled samples (Shin et al., 2019; Aylward et al., 2016). Multiple spot samples provide a better characterization of exposure, with multiple 24-hour samples potentially leading to better characterization but are less feasible to collect for large studies (Shin et al., 2019). Due to rapid elimination kinetics, U.S. CPSC concluded that spot urine samples collected at a short time (2 to 4 hours) since last exposure may overestimate human exposure, while samples collected at a longer time (greater than 14 hours) since last exposure may underestimate exposure (see Section 4.1.3 of (U.S. CPSC, 2014) for further discussion).

10.2.3 Weight of Scientific Evidence Conclusions

For the urinary biomonitoring data, despite the uncertainties discussed in Section 10.2.2, overall U.S. CPSC (2014) concluded that factors that might lead to an overestimation of daily intake seem to be well balanced by factors that might lead to an underestimation of daily intake. Therefore, reverse dosimetry approaches "provide a reliable and robust measure of estimating the overall phthalate exposure." Given similar approach and estimated daily intake values, EPA has robust confidence in the estimated daily intake values presented in this document. Again, reverse dosimetry modeling does not distinguish between routes or pathways of exposure and does not allow for source apportionment (*i.e.*, exposure from TSCA COUs cannot be isolated), but EPA has robust confidence in the use of its total daily intake value to contextualize the exposure estimates from TSCA COUs as being overestimated as described in Section 10.2.1.2.

11 CONCLUSIONS OF ENVIRONMENTAL MEDIA CONCENTRATION AND GENERAL POPULATION SCREENING LEVEL ANALYSIS

11.1 Environmental Media Conclusions

Based off the environmental release assessment presented in the *Draft Release and Occupational Exposure Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024c) DIDP is expected to be released to the environment via air, water, biosolids, and landfills. Environmental media concentrations were quantified in ambient air, soil from ambient air deposition, surface water, and sediment. Given the physical and chemical properties and fate parameters of DIDP, concentrations of DIDP in soil and groundwater from releases to biosolids and landfills were not assessed quantitatively and instead discussed qualitatively.

High-end concentration of DIDP in surface water, sediment, and soil from air to soil deposition were estimated for the purpose of a screening level analysis for environmental exposure described in the *Draft Environmental Exposure Assessment for DIDP* (U.S. EPA, 2024b) and for general population exposure described in this document. Table 11-1 summarizes the highest concentrations of DIDP estimated in different environmental media based on releases to the environment from various COUs. The summary table also indicates whether the high-end estimate was used for environmental exposure assessment or general population exposure assessment.

Table 11-1. Summary of High-End DIDP Concentrations in Various Environmental Media from Environmental Releases

OES [a]	Release Media	Environmental Media	DIDP Concentration	Environmental or General Population
PVC plastics compounding	Water	Total Water Column (7Q10)	7,460 µg/L	Environmental
		Benthic Pore Water (7Q10)	4,760 µg/L	Environmental
		Benthic Sediment (7Q10)	27,600 mg/kg	Environmental
	Fugitive Air	Soil (Air to Soil Deposition 100 m)	1.85E03 µg/kg	General Population
		Soil (Air to Soil Deposition 1,000 m)	13 µg/kg	Environmental
Use of lubricants and functional fluids	Water	Surface Water (30Q5)	9,110 µg/L	General Population
		Surface Water (Harmonic Mean)	7,450 µg/L	General Population

[a] Table 1-1 provides the crosswalk of OES to COUs.

11.2 General Population Screening Level Assessment Conclusion

The general population can be exposed to DIDP from various exposure pathways. As shown in Table 2-2, exposures to the general population via surface water, drinking water, fish ingestion, and soil from air to soil deposition were quantified while exposures via the land pathway (biosolids and landfills) were qualitatively assessed. Based on the high-end estimates of environmental media concentrations summarized in Table 11-1, general population exposures were estimated for the lifestage that would be most exposed based on intake rate and body weight.

Table 11-2 summarizes the general population exposure from surface water and drinking water. The exposure routes assessed included incidental dermal and incidental ingestion from swimming in surface water and ingestion of drinking water for adults. The MOE for each exposure scenario assessed for water was greater than the benchmark of 30, indicating that surface water and drinking water are not pathways of concern for non-cancer risk.

Table 11-2. General Population Water Exposure Summary

Occupational Exposure Scenario[a]	Water Column Concentrations		Incidental Dermal Surface Water[b]		Incidental Ingestion Surface Water[c]		Drinking Water[d]	
	30Q5 Conc. (µg/L)	Harmonic Mean Conc. (µg/L)	ADR_{POT} (mg/kg-day)	Acute MOE	ADR_{POT} (mg/kg-day)	Acute MOE	ADD_{POT} (mg/kg-day)	Chronic MOE
Use of Lubricants and Functional Fluids *Without Wastewater Treatment*	9,110	7,540	4.73E−02	190	3.62E−02	286	N/A	N/A
Use of Lubricants and Functional Fluids *With Wastewater Treatment*	100	83	5.20E−04	17,300	3.98E−04	26,000	636	1,410,000
Use of Lubricants and Functional Fluids *With Wastewater and Drinking Water Treatment*	N/A	N/A	N/A	N/A	N/A	N/A	1,724	3,820,000

N/A = not applicable
[a] Table 1-1 provides a crosswalk of industrial and commercial COUs to OES.
[b] Most exposed age group: Adults (≥21 years)
[c] Most exposed age group: Youth (11–15 years)
[d] Most exposed age group: Infant (birth to <1 year)

Table 11-3 summarizes the fish ingestion exposures for adults in tribal populations. Because of higher ingestion rates, tribal populations were selected as the subpopulation with the greatest exposure, greater than that of the general population. The MOE even for heritage ingestion rates in tribal populations were greater than the benchmark of 30, indicating that fish ingestion is not a pathways of concern for non-cancer risk.

Table 11-3. Tribal Fish for Adult Ingestion Summary

Calculation Method	Current Mean Ingestion Rate		Heritage Ingestion Rate	
	ADR/ADD (mg/kg-day)	MOE	ADR/ADD (mg/kg-day)	MOE
Water solubility limit (1.7E−04 mg/L)	4.54E−06	1,980,000	2.62E−05	344,000
Monitored SWC from a WWTP's influent (4.31E−02 mg/L)	1.15E−03	7,810	6.64E−03	1,360

Table 11-4 summarizes the soil ingestion and dermal contact to soil exposure resulting from air to soil deposition for infants and children (ages 6 months to less than 12 years). The MOE for each exposure scenario assessed was greater than the benchmark of 30, indicating that ingestion and dermal contact to soil from air to soil deposition is not a pathways of concern for non-cancer risk.

Table 11-4. General Population Soil from Air to Soil Deposition Exposure Summary

Occupational Exposure Scenario[a]	Soil Ingestion			Dermal Soil Contact		
	Soil Concentration[b] (mg/kg)	ADD (mg/kg-day)	MOE[c]	Soil Concentration[b] (mg/kg)	DAD (mg/kg-day)	MOE[c]
PVC Plastic Compounding	1.85	0.0228	106.5	1.85	0.0617	106.5

[a] Table 1-1 provides a crosswalk of industrial and commercial COUs to OES.
[b] Air and soil concentrations are 95th percentile at 100m from the emitting facility
[c] MOE for soil ingestion and dermal contact represent aggregated exposure

Table 11-5 summarizes the conclusions from above for surface water, drinking water, fish ingestion, and ambient air but also includes the conclusions for biosolids and landfills which were assessed qualitatively in Section 3.1 and 3.2, respectively. Results indicate that ambient air, surface water, drinking water, biosolids, landfills, and fish ingestion are not pathways of concern for DIDP for the highest exposed populations. Therefore, EPA did not further refine the general population exposure assessment to include higher tiers of modeling, additional subpopulations, or additional COUs.

Table 11-5. Screening Level Analysis for High-End Exposure Scenarios for Highest Exposed Populations

OES[a]	Exposure Pathway	Exposure Route	Exposure Scenario	Lifestage	Pathway of Concern[b]
All	Biosolids (Section 3.1)	No specific exposure scenarios were assessed for qualitative assessments			No
All	Landfills (Section 3.2)	No specific exposure scenarios were assessed for qualitative assessments			No
Use of Lubricants and Functional Fluids	Surface Water	Dermal	Dermal exposure to DIDP in surface water during swimming (Section 5.1.1)	Adults (>21 years)	No
		Oral	Incidental ingestion of DIDP in surface water during swimming (Section 5.1.2)	Youth (11-15 years)	No
Use of Lubricants and Functional Fluids	Drinking Water	Oral	Ingestion of drinking water (Section 6.1.1)	Infants (<1 year)	No
All	Fish Ingestion	Oral	Ingestion of fish for General Population (Section 7.1)	Adult (>21 years)	No
			Ingestion of fish for subsistence fishers (Section 7.2)	Adult (>21 years)	No
			Ingestion of fish for tribal populations (Section 7.3)	Adult (>21 years)	No
PVC Plastic Compounding	Ambient Air	Oral	Ingestion of DIDP in soil resulting from air to soil deposition	Infant and Children (6 month-12	No

OES[a]	Exposure Pathway	Exposure Route	Exposure Scenario	Lifestage	Pathway of Concern[b]
			(Section 9.1)	years)	
		Dermal	Dermal exposure to DIDP in soil resulting from air to soil deposition (Section 9.1.2)	Infant and Children (6 month-12 years)	No

[a] Table 1-1 provides a crosswalk of industrial and commercial COUs to OES.
[b] Using the MOE approach, an exposure pathway was determined to not be a pathway of concern if the MOE was equal to or exceeded the benchmark MOE of 30.

11.3 Weight of Scientific Evidence Conclusions for General Population Exposure

The weight of scientific evidence supporting the exposure estimate is decided based on the strengths, limitations, and uncertainties associated with the exposure estimates, which are discussed in detail for biosolids (3.1.1), landfills (3.2.1), surface water (4.3.1), drinking water (6.3), fish ingestion (7.5.1), ambient air (8.4.1), and biomonitoring (10.2.3). EPA summarized its weight of scientific evidence using confidence descriptors: robust, moderate, slight, or indeterminate confidence descriptors. EPA used general considerations (i.*e*., relevance, data quality, representativeness, consistency, variability, uncertainties) as well as chemical-specific considerations for its weight of scientific evidence conclusions.

EPA determined robust confidence in its qualitative assessment of biosolids (3.1.1) and landfills (3.2.1). For its quantitative assessment, EPA modeled exposure due to various exposure scenarios resulting from different pathways of exposure. Exposure estimates utilized high-end inputs for the purpose of a screening level analysis. When available, monitoring data was compared to modeled estimates to evaluate overlap, magnitude, and trends. For its quantitative assessment of surface water (4.3.1), drinking water (6.3), fish ingestion (7.5.1), soil from ambient air to soil deposition (8.4.1), and urinary biomonitoring (10.2.3) EPA has robust confidence that the screening level analysis was appropriately conservative e to determine that no environmental pathway has the potential for non-cancer risk to the general population. Despite slight and moderate confidence in the estimated absolute values themselves, confidence in exposure estimates capturing high-end exposure scenarios was robust given the many conservative assumptions which yielded modeled values exceeding those of monitored values and exceeding total daily intake values calculated from NHANES biomonitoring data. Furthermore, risk estimates for high-end exposure scenarios were still consistently above the benchmarks, adding to confidence that non-cancer risks are not expected.

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APPENDICES

Appendix A EXPOSURE FACTORS

Table_Apx A-1. Body Weight by Age Group

Age Group[a]	Mean Body Weight (kg)[b]
Infant (<1 year)	7.83
Young toddler (1 to <2 years)	11.4
Toddler (2 to <3 years)	13.8
Small child (3 to <6 years)	18.6
Child (6 to <11 years)	31.8
Teen (11 to <16 years)	56.8
Adults (>16 years)	80.0

[a] Age group weighted average
[b] See Table 8-1 of (U.S. EPA, 2011)

Table_Apx A-2. Fish Ingestion Rates by Age Group

Age Group	Fish Ingestion Rate (g/kg-day)[a]	
	50th Percentile	90th Percentile
Infant (<1 year)[b]	N/A	N/A
Young toddler (1 to <2 years)[b]	0.053	0.412
Toddler (2 to <3 years)[b]	0.043	0.341
Small child (3 to <6 years)[b]	0.038	0.312
Child (6 to <11 years)[b]	0.035	0.242
Teen (11 to <16 years)[b]	0.019	0.146
Adult (>16 years)[c]	0.063	0.277
Subsistence fisher (adult)[d]	1.78	

[a] Age group weighted average, using body weight from Table_Apx A-1.
[b] See Table 20a of (U.S. EPA, 2014)
[c] See Table 9a of (U.S. EPA, 2014)
[d] (U.S EPA, 2000)

Table_Apx A-3. Recommended Default Values for Common Exposure Factors

Symbol	Definition	Recommended Default Value	Recommended Default Value	Source
		Occupational	**Residential**	
ED	Exposure Duration (hrs/day)	8	24	
EF	Exposure Frequency (days/year)	250	365	
EY	Exposure Years (years)	40	33 Adult 1 Infant (birth to <1 year) 5 Toddler (1 to 5 years) 5 Child (6 to 10 years) 5 Youth (11 to 15 years) 5 Youth (16 to 20 years)	Number of years in age group, up to the 95th percentile residential occupancy period. See Table 16-5 of U.S. EPA Exposure Factors Handbook (U.S. EPA, 2011). Note: These age bins may vary for different measurements and sources
AT	Averaging Time Non-cancer	Equal to total exposure duration or 365 days/yr × EY; whichever is greater	Equal to total exposure duration or 365 days/yr × EY; whichever is greater	See pg. 6-23 of Risk assessment guidance for superfund, volume I: Human health evaluation manual (Part A). (U.S. EPA, 1989)
	Averaging Time Cancer	78 years (28,470 days)	78 years (28,470 days)	See Table 18-1 of EPA Exposure Factors Handbook (U.S. EPA, 2011)
BW	Bodyweight (kg)	80	80 Adult 7.83 Infant (birth to <1 year) 16.2 Toddler (1 to 5 years) 31.8 Child (6 to 10 years) 56.8 Youth (11 to 15 years) 71.6 Youth (16 to 20 years) 65.9 Adolescent woman of childbearing age (16 to <21) – apply to all developmental exposure scenarios	See Table 8-1 of EPA Exposure Factors Handbook (U.S. EPA, 2011) (Refer to Figure 31 for age-specific BW) Note: These age bins may vary for different measurements and sources See Table 8-5 of EPA Exposure Factors Handbook (U.S. EPA, 2011)

Symbol	Definition	Recommended Default Value Occupational	Recommended Default Value Residential	Source
$IR_{dw\text{-}acute}$	Drinking Water Ingestion Rate (L/day) - acute	3.219 Adult	3.219 Adult 1.106 Infant (birth to <1 year) 0.813 Toddler (1 to 5 years) 1.258 Child (6 to 10 years) 1.761 Youth (11 to 15 years) 2.214 Youth (16 to 20 years)	See Tables 3-15 and 3-33; weighted average of 90th percentile consumer-only ingestion of drinking water (birth to <6 years) (U.S. EPA, 2011)
$IR_{dw\text{-}chronic}$	Drinking Water Ingestion Rate (L/day) - chronic	0.880 Adult	0.880 Adult 0.220 Infant (birth to <1 year) 0.195 Toddler (1 to 5 years) 0.294 Child (6 to 10 years) 0.315 Youth (11 to 15 years) 0.436 Youth (16 to 20 years)	U.S. EPA Exposure Factors Handbook Chapter 3 (U.S. EPA, 2011), Table 3-9 per capita mean values; weighted averages for adults (years 21 to 49 and 50+), for toddlers (years 1-2, 2-3, and 3-<6).
IR_{inc}	Incidental water Ingestion Rate (L/hr)		0.025 Adult 0.05 Child (6 to < 16 years)	U.S. EPA (2015), Evaluation of Swimmer Exposures Using the SWIMODEL Algorithms and Assumptions
IR_{fish}	Fish Ingestion Rate (g/day)		22 Adult	U.S. EPA (2014), Estimated Fish Consumption Rates for the U.S. Population and Selected Subpopulations This represents the 90th percentile consumption rate of fish and shellfish from inland and nearshore waters for the U.S. adult population 21 years of age and older, based on NHANES data from 2003 to 2010

Symbol	Definition	Recommended Default Value	Recommended Default Value	Source
		Occupational	Residential	
IR_{soil}	Soil Ingestion Rate (mg/day)	50 Indoor workers 100 Outdoor workers	100 Infant (<6 months) 200 Infant to Youth (6 months to <12 years) 100 Youth to Adult (12 years and up) 1,000 Soil Pica Infant to Youth (1 to <12 years) 50,000 Geophagy (all ages)	U.S. EPA Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (1991) U.S. EPA Exposure Factors Handbook Chapter 5 (2011), Table 5-1, Upper percentile daily soil and dust ingestion
SA_{water}	Skin Surface Area Exposed (cm^2) used for incidental water dermal contact		19,500 Adult 7,600 Child (3 to < 6 years) 10,800 Child (6 to < 11 years) 15,900 Youth (11 to < 16 years)	U.S. EPA Exposure Factors Handbook Chapter 7 (2011), Table 7-1, Recommended Mean Values for Total Body Surface Area, for Children (sexes combined) and Adults by Sex
Kp	Permeability Constant (cm/hr) used for incidental water dermal contact		0.001 Or calculated using Kp equation with chemical specific Kow and MW (see exposure formulas)	US EPA, 1992. Dermal Exposure Assessment: Principles and Applications. Office of Research and Development. Table 5-7, "Predicted Kp Estimates for Common Pollutants
SA_{soil}	Skin Surface Area Exposed (cm^2) used for soil dermal contact	3,300 Adult	5,800 Adult 2,700 Child	EPA Risk Assessment Guidance for Superfund RAGS Part E for Dermal Exposure (U.S. EPA, 2004)
AF_{soil}	Adherence Factor (mg/cm^2) used for soil dermal contact	0.2 Adult	0.07 Adult 0.2 Child	EPA Risk Assessment Guidance for Superfund RAGS Part E for Dermal Exposure (U.S. EPA, 2004)

A.1 Surface Water Exposure Activity Parameters

Table_Apx A-4. Incidental Dermal (Swimming) Modeling Parameters

Input	Description (Units)	Adult (≥21 years)	Youth (11–15 years)	Child (6–10 years)	Notes	Reference
BW	Body weight (kg)	80	56.8	31.8	EPA *Exposure Factors Handbook* Chapter 8 (2011), Table 8-1 mean body weight	(U.S. EPA, 2021)
SA	Skin surface area exposed (cm^2)	19,500	15,900	10,800	U.S. EPA Swimmer Exposure Assessment Model (SWIMODEL), 2015	(U.S. EPA, 2015)
ET	Exposure time (hr/day)	3	2	1	High-end default short-term duration from U.S. EPA Swimmer Exposure Assessment Model (SWIMODEL), 2015.	(U.S. EPA, 2015)
ED	Exposure duration (years for ADD)	33	5	5	Number of years in age group, up to the 95th percentile residential occupancy period. EPA *Exposure Factors Handbook* Chapter 16 (2011), Table 16-5.	(U.S. EPA, 2021)
AT	Averaging time (years for ADD)	33	5	5	Number of years in age group, up to the 95th percentile residential occupancy period. EPA *Exposure Factors Handbook* Chapter 16 (2011), Table 16-5.	(U.S. EPA, 2021)
Kp	Permeability coefficient (cm/hr)	0.0071 cm/hr			CEM estimate aqueous Kp	(U.S. EPA, 2022)

Table_Apx A-5. Incidental Oral Ingestion (Swimming) Modeling Parameters

Input	Description (Units)	Adult (≥ 21 years)	Youth (11–15 years)	Child (6–10 years)	Notes	Reference
IR_{inc}	Ingestion rate (L/hr)	0.092	0.152	0.096	EPA *Exposure Factors Handbook* Chapter 3 (2019), Table 3-7, upper percentile ingestion while swimming.	(U.S. EPA, 2019a)
BW	Body weight (kg)	80	56.8	31.8	EPA *Exposure Factors Handbook* Chapter 8 (2011), Table 8-1 mean body weight.	(U.S. EPA, 2021)
ET	Exposure time (hr/day)	3	2	1	High-end default short-term duration from U.S. EPA Swimmer Exposure Assessment Model (SWIMODEL), 2015; based on competitive swimmers in the age class.	(U.S. EPA, 2015)
$IR_{inc\text{-}daily}$	Incidental daily ingestion rate (L/day)	0.276	0.304	0.096	Calculation: ingestion rate × exposure time	
IR/BW	Weighted incidental daily ingestion rate (L/kg-day)	0.0035	0.0054	0.0030	Calculation: ingestion rate/body weight	
ED	Exposure duration (years for ADD)	33	5	5	Number of years in age group, up to the 95th percentile residential occupancy period. EPA *Exposure Factors Handbook* Chapter 16 (2011), Table 16-5.	(U.S. EPA, 2021)
AT	Averaging time (years for ADD)	33	5	5	Number of years in age group, up to the 95th percentile residential occupancy period. EPA *Exposure Factors Handbook* Chapter 16 (2011), Table 16-5.	(U.S. EPA, 2021)

Input	Description (Units)	Adult (≥ 21 years)	Youth (11–15 years)	Child (6–10 years)	Notes	Reference
CF1	Conversion factor (mg/µg)	1.00E−03				
CF2	Conversion factor (days/year)	365				

Appendix B BIOMONITORING METHODS AND RESULTS

Mono-(carboxynonyl) phthalate (MCNP), a metabolite of DIDP, has been reported in the 2005 to 2018 U.S. Centers for Disease Control and Prevention (CDC) National Health and Nutrition Evaluation Surveys (NHANES) datasets. MCNP was measured in 24,549 members of the general population, including 7084 children aged 15 and under and 17,465 adults aged 16 and older. MCNP was quantified in urinary samples from a one-third subsample of all participants aged six and older. Beginning with the 2005 to 2006 cycle of NHANES, all participants between three to five years were eligible for MCNP urinary analysis. Urinary MCNP concentrations were quantified using high performance liquid chromatography-electrospray ionization-tandem mass spectrometry. Limits of detection (LOD) for each cycle on NHANES are provided in Table_Apx B-1. Values below the LOD were replaced by the lower limit of detection divided by the square root of two (NCHS, 2021).

Table_Apx B-1. Limit of Detection of Urinary MCNP by NHANES Cycle

NHANES Cycle	LOD (ng/mL)
2005-2006	0.6
2007-2008	0.5
2009-2010	0.2
2011-2012	0.2
2013-2014	0.2
2015-2016	0.2
2017-2018	0.2

Table_Apx B-2. Summary of Urinary MCNP Concentrations (ng/mL) from all NHANES Cycles Between 2005 and 2018[a]

NHANES Cycle	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95%CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)
2005-2006	Adults	All adults	1,831	1,646 (89.90%)	2.8 (2.4-3.3)	18.2 (10-36.8)
2005-2006	Adults	Females	935	819 (87.59%)	2.1 (1.8-2.8)	11.3 (8.3-17.2)
2005-2006	Adults	Males	896	827 (92.30%)	2.7 (2.4-3.4)	18.3 (9.6-36.8)
2005-2006	Children	11-15 years	412	385 (93.45%)	3.6 (3-4.1)	18.5 (13.1-21.2)
2005-2006	Children	6-10 years	305	289 (94.75%)	4.6 (3.8-5.6)	21.5 (14.7-37.9)
2005-2006	Children	All children	717	674 (94.00%)	4 (3.4-4.4)	19.1 (14.7-25.7)
2005-2006	Children	Females	343	322 (93.88%)	3.9 (3-4.5)	19.1 (14.4-24.7)

NHANES Cycle	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95%CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)
2005-2006	Children	Males	374	352 (94.12%)	4 (3.4-4.7)	19.1 (13.2-30.1)
2005-2006	Women of reproductive age	All women	616	538 (87.34%)	2.1 (1.8-2.8)	11.3 (8.3-17.2)
2007-2008	Adults	All adults	2021	1792 (88.67%)	2.5 (2.2-2.8)	16.1 (10-29.1)
2007-2008	Adults	Females	1030	880 (85.44%)	2.5 (2.2-3.1)	12.2 (8.9-18.8)
2007-2008	Adults	Males	991	912 (92.03%)	2.4 (2.2-2.9)	16.2 (10-29.1)
2007-2008	Children	11-15 years	265	257 (96.98%)	2.8 (2.4-3)	16.3 (11.6-48.8)
2007-2008	Children	6-10 years	318	306 (96.23%)	3.2 (2.7-3.8)	10.8 (8.6-16.7)
2007-2008	Children	All children	583	563 (96.57%)	2.9 (2.7-3.4)	16.8 (12.7)
2007-2008	Children	Females	280	269 (96.07%)	2.9 (2.4-3.8)	13.1 (8.9-32.4)
2007-2008	Children	Males	303	294 (97.03%)	2.8 (2.6-3.3)	24.7 (11.6-54.7)
2007-2008	Women of reproductive age	All women	571	501 (87.74%)	2.5 (2.2-3.1)	12.2 (8.9-18.8)
2009-2010	Adults	All adults	2127	2101 (98.78%)	3.12 (2.58-3.65)	19.88 (13.05-26.65)
2009-2010	Adults	Females	1040	1023 (98.37%)	2.8 (2.46-3.44)	23.66 (17.19-28.71)
2009-2010	Adults	Males	1087	1087 (100.00%)	3.13 (2.56-3.68)	19.9 (12.8-26.65)
2009-2010	Children	11-15 years	281	280 (99.64%)	2.75 (2.24-3.52)	12.56 (7.64-17.32)
2009-2010	Children	6-10 years	341	338 (99.12%)	3.79 (2.89-4.7)	15.7 (10.58-23.24)
2009-2010	Children	All children	622	618 (99.36%)	3.34 (2.69-3.97)	14.94 (12.04-18.3)
2009-2010	Children	Females	310	308 (99.35%)	3.25 (2.52-4.04)	16.46 (11.21-18.44)
2009-2010	Children	Males	312	310 (99.36%)	3.48 (2.5-4.19)	14.05 (9.13-40.22)
2009-2010	Women of reproductive age	All women	608	597 (98.19%)	2.8 (2.46-3.44)	23.66 (17.19-28.71)

NHANES Cycle	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95%CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)
2011-2012	Adults	All adults	1894	1876 (99.05%)	2.9 (2.5-3.3)	20.8 (15.2-28.5)
2011-2012	Adults	Females	933	926 (99.25%)	2 (1.7-2.3)	11.3 (8.5-14.3)
2011-2012	Adults	Males	961	950 (98.86%)	3.1 (2.6-3.5)	20.8 (16.2-31.3)
2011-2012	Children	11-15 years	265	264 (99.62%)	2.5 (2-3.2)	11.4 (7.3-13.8)
2011-2012	Children	6-10 years	330	330 (100.00%)	2.5 (2-3)	13 (7.9-16.6)
2011-2012	Children	All children	595	594 (99.83%)	2.4 (2.1-3)	11.3 (8.7-13.8)
2011-2012	Children	Females	297	296 (99.66%)	2.4 (1.7-3)	12 (9.1-14.2)
2011-2012	Children	Males	298	298 (100.00%)	2.3 (2-3)	9 (8.1-13.8)
2011-2012	Women of reproductive age	All women	536	530 (98.88%)	2 (1.7-2.3)	11.3 (8.5-14.3)
2013-2014	Adults	All adults	2,040	2,007 (98.38%)	3.4 (2.8-3.8)	19.4 (16.1-25.7)
2013-2014	Adults	Females	1,076	1,052 (97.77%)	2.6 (2.3-2.8)	20.6 (11.9-33.6)
2013-2014	Adults	Males	964	955 (99.07%)	3.4 (2.8-3.8)	19.1 (16.1-25.7)
2013-2014	Children	11-15 years	299	299 (100.00%)	2.9 (2.4-3.4)	15.4 (10.4-20.9)
2013-2014	Children	6-10 years	346	346 (100.00%)	3.2 (2.6-4.1)	20.5 (10.4-54)
2013-2014	Children	All children	645	645 (100.00%)	3.2 (2.8-3.8)	16.9 (12.8-22.5)
2013-2014	Children	Females	324	324 (100.00%)	2.9 (2.7-3.7)	14.1 (10.4-17.6)
2013-2014	Children	Males	321	321 (100.00%)	3.2 (2.6-4)	20.5 (11.4-37.6)
2013-2014	Women of reproductive age	All women	599	581 (96.99%)	2.6 (2.3-2.8)	20.6 (11.9-33.6)
2015-2016	Adults	All adults	1,880	1,830 (97.34%)	1.9 (1.5-2.3)	12.2 (8.9-13.1)
2015-2016	Adults	Females	984	956 (97.15%)	1.4 (1.2-1.7)	13.95 (5.8-27.5)
2015-2016	Adults	Males	896	874 (95.87%)	1.9 (1.6-2.4)	11.9 (8.2-14.1)

NHANES Cycle	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95%CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)
2015-2016	Children	11-15 years	284	281 (98.94%)	2.2 (1.9-2.7)	11 (6.1-15.9)
2015-2016	Children	3-5 years	465	461 (99.14%)	2.4 (2-2.8)	6.3 (5.3-9.7)
2015-2016	Children	6-10 years	346	343 (99.13%)	2.3 (2.1-2.5)	8.5 (6.8-11.5)
2015-2016	Children	All children	1,095	1,085 (99.09%)	2.2 (2-2.5)	8.7 (7-11.6)
2015-2016	Children	Females	517	513 (99.23%)	2.2 (1.9-2.6)	8.5 (6.2-15.9)
2015-2016	Children	Males	578	572 (98.96%)	2.2 (2-2.5)	9 (6.3-12.4)
2015-2016	Women of reproductive age	All women	564	550 (97.52%)	1.4 (1.2-1.7)	13.95 (5.8-27.5)
2017-2018	Adults	Males	944	905 (95.87%)	1.3 (1.1-1.5)	13.3 (5.2-31.9)
2017-2018	Adults	All adults	1,896	1,804 (95.15%)	1.3 (1.1-1.5)	13.3 (5.2-31.9)
2017-2018	Adults	Females	952	899 (94.43%)	1.2 (0.8-1.5)	4.5 (3.9-5.8)
2017-2018	Children	11-<16 years	213	208 (97.65%)	1.2 (1.1-1.5)	7.7 (3.1-14.6)
2017-2018	Children	3-<6 years	379	375 (98.94%)	1.6 (1.2-2)	9.6 (3.1-16.5)
2017-2018	Children	6-<11 years	274	271 (98.91%)	1.8 (1.5-2.1)	30.4 (4.1-43.8)
2017-2018	Children	All children	866	854 (98.61%)	1.5 (1.4-1.7)	9.1 (4.9-31.1)
2017-2018	Children	Females	447	440 (98.43%)	1.5 (1.2-1.7)	10.9 (4.6-43.8)
2017-2018	Children	Males	419	419 (98.81%)	1.5 (1.4-1.9)	6.3 (4.1-14.6)
2017-2018	Women of reproductive age	All women	496	467 (94.15%)	1.2 (0.8-1.5)	4.5 (3.9-5.8)

Appendix C AMBIENT AIR MODELING RESULTS

C.1 AERMOD Modeling Inputs, Parameters and Outputs

C.1.1 Meteorological Data

Because the scenarios are not at real locations, scenarios were modeled twice with two different meteorological stations. In the development of EPA's Integrated Indoor-Outdoor Air Calculator (IIOAC),[1] meteorological stations were used for each region of the country. From that set, it was determined that meteorological conditions from Sioux Falls, SD led to central-tendency modeled concentrations and particle deposition, and those from Lake Charles, LA led to higher-end modeled concentrations (though more central-tendency results for particle deposition), relative to the other regional stations (see Sections 5.4 and 5.7.4 of that User Guide for more information on the stations). These two meteorological stations were utilized for modeling DIDP (Sioux Falls, SD for central-tendency meteorology; Lake Charles, LA for higher-end meteorology), with the same data from years 2011 to 2015 used for IIOAC.

No new processing of meteorological data was done—all data had been previously processed with version 16216 of AERMOD's meteorological preprocessor (AERMET).[2,3] Following EPA guidance,[4] all processing utilized sub-hourly wind measurements (to calculate hourly-averaged wind speed and wind direction; see Section 8.4.2 of the guidance). The "ADJ_U*" option (for mitigating modeling issues during light-wind, stable conditions) was not used, which could lead to model overpredictions of ambient concentrations during those particular conditions. All processing also used automatic substitutions for small gaps in data for cloud cover and temperature.

C.1.2 Urban/Rural Designations

Air emissions taking place in an urbanized area are subject to the effects of urban heat islands, particularly at night. When sources are set as urban in AERMOD, the model will modify the boundary layer to enhance nighttime turbulence, often leading to higher nighttime air concentrations. AERMOD uses urban-area population as a proxy for the intensity of this effect.

Each scenario once as urban and once as not urban. There is no recommended default urban population for AERMOD modeling, so an urban population of one million people was assumed—this is the same population used with IIOAC.[1]

C.1.3 Physical Source Specifications

All of a scenario's emissions were centered on one location. The same default physical parameters as in IIOAC: stack emissions released from a point source at 10 meters (m) above ground from a 2-m inside diameter, with an exit gas temperature of 300 Kelvin and an exit gas velocity of 5 m per second (see Table 6 of the IIOAC User Guide[1]), and fugitive emissions released at 3.05 m above ground from a square area source 10 m on a side (see Table 7 of the IIOAC User Guide[1]).

C.1.4 Temporal Emission Patterns

Table_Apx C-1 contains assumptions for intraday release duration, for the durations seen in the DIDP

[1] IIOAC page: https://www.epa.gov/tsca-screening-tools/iioac-integrated-indoor-outdoor-air-calculator.
[2] AERMET page: https://www.epa.gov/scram/meteorological-processors-and-accessory-programs#aermet.
[3] Note: The RTR program's inhalation-risk modeling now uses data mostly from year 2019 and a more updated version of AERMET (see The HEM4 User's Guide: https://www.epa.gov/system/files/documents/2021-09/hem4_1_users_guide_0.pdf). However, we do not anticipate the modeling used here to be sensitive to these differences.
[4] EPA Guideline on Air Quality Models: https://www.epa.gov/sites/default/files/2020-09/documents/appw_17.pdf.

scenarios. These assumptions are based on consultation with EPA. The hours shown conform to AERMOD's notation scheme of using hours 1 to 24, where hour 1 is the hour ending at 1 am and hour 24 is the final hour of the same day ending at midnight. Note that some durations provided in EPA's air-release workbooks were decimal values, which were rounded to the nearest whole number for modeling (*e.g.*, 4.58 hours per day mapped to 5 hours per day).

Table_Apx C-1. Assumptions for Intraday Emission-Release Duration

Hours per Day of Emissions	Implemented for Modeling: Assumed Hours of the Day Emitting (Inclusive)
4	Hours 13–16 (hour ending at 1 pm through hour ending at 4 pm; *i.e.,* 12 to 4 pm)
5	Hours 13–17 (hour ending at 1 pm through hour ending at 5 pm; *i.e.,* 12 to 5 pm)
6	Hours 12–17 (hour ending at 12 pm through hour ending at 5 pm; *i.e.,* 11 am to 5 pm)
7	Hours 11–17 (hour ending at 11 am through hour ending at 5 pm; *i.e.,* 10 am to 5 pm)
9	Hours 9–17 (hour ending at 9 am through hour ending at 5 pm; *i.e.,* 8 am to 5 pm)
10	Hours 9–18 (hour ending at 9 am through hour ending at 6 pm; *i.e.,* 8 am to 6 pm)
14	Hours 7–20 (hour ending at 7 am through hour ending at 8 pm; *i.e.,* 6 am to 8 pm)
15	Hours 6–20 (hour ending at 6 am through hour ending at 8 pm; *i.e.,* 5 am to 8 pm)
16	Hours 6–21 (hour ending at 6 am through hour ending at 9 pm; *i.e.,* 5 am to 9 pm)
24	All (Hours 1–24)

Table_Apx C-2 contains assumptions for interday release frequency. The estimated releases prescribed 18 different release frequencies. To simplify the modeling, 18 release frequencies were mapped to 7 release frequencies that were previously used on other chemical modeling for general population and co-located receptors, plus 1 frequency (180 days per year) newly created for this current effort. Those mapped to higher frequencies (more days per year; 7 such cases) means somewhat less health protection because the emissions are spread out over more days (*e.g.,* 235 instead of 219, or 286 instead of 280). Those mapped to lower frequencies (fewer days per year; 5 such cases) means somewhat more health protection because the emissions are spread out over fewer days (*e.g.*, 180 instead of 208, or 300 instead of 325). There were six frequencies modeled as-is with their EPA-prescribed frequency.

Table_Apx C-2. Assumptions for Interday Emission-Release Frequency

EPA Prescribed Release Frequency (days per year)	Mapped Release Frequency for Modeling (days per year)	Implemented for Modeling: Days When Emissions Are on (format of month number/day number)
180 and 208	180	The first 15 days of each month
219, 223, 232, 234, and 235	235	All Mon.–Fri. except NOT 1/1–1/8, 4/1–4/7, 7/1–7/7, 10/1–10/7, and 12/25–12/31 (and also NOT 12/24 in 2012)
247, 249, 250, 251, 254, and 257	250	All Mon.–Fri. except NOT 1/1–1/5 and 12/21–12/31 (and also NOT 1/4 in 2011 and 2013–2015)
258	258	All Mon.–Fri. except NOT 12/24–12/26 (and also NOT 12/27 in 2011 and 2014–2015, and also NOT 12/28 in 2015)
260	260	All Mon.–Fri. except NOT 12/25 in 2012 and 1/1 in 2013–2015
280	286	The first 24 days of each month, except NOT 1/24 and 2/24
287	287	The first 24 days of each month, except NOT 12/24
325	300	All days except NOT 12/27–12/31 and the first 5 days of each month (and also NOT 12/26 in 2012)
Fri. = Friday ; Mon. = Monday		

C.1.5 Emission Rates and Sorption

Emission rates (kilograms per year) were estimated for each scenario, for fugitive and stack sources as appropriate. For each scenario and source, the annual emissions were allocated evenly to each hour and day when emissions were "on" in the model. Rates were converted to those needed by AERMOD (grams per second for stack sources; grams per second per m^2 for fugitive sources). The fugitive sources were modeled as 100 m^2 (see Appendix C.1.3). Indirect photochemical half-life values for each chemical: 7.68 hours for DIDP and 5.36 hours for DINP, which were converted to seconds (27,648 and 19,296 s, respectively) for AERMOD modeling.

Based on physical and chemical properties and short half-life values, EPA concluded in their Tier 1 analyses that DIDP and DINP are assumed to be not persistent in air, but a large fraction of each chemical could sorb to airborne particles which may be resistant to atmospheric oxidation. For the purposes of modeling, it was assumed that 100 percent of the emitted mass of DIDP and DINP immediately sorbs to atmospheric particles. While this is a health-protective assumption for chemical exposure through deposition, it is supported by our estimations of fraction mass sorbed (1.00 for DIDP and 0.95 for DINP). We based these estimations on EPA-provided values of octanol-air partition coefficient (K_{OA} = 1.08E13 and 7.94E11 for DIDP and DINP, respectively), suggested values from EPA's Consumer Exposure Model for airborne particles' fraction organic matter and density (f_{om} = 0.4 and density = 1E9 milligrams per cubic meter [m^3])[5], and the suggested value for atmospheric

[5] Suggested values for atmospheric particle fraction organic matter and density, and the formula for calculating K_P, are

concentration of total suspended particulates at residential sites from California's CalTOX model (TSP = 6.15×10^{-8} kilograms [kg] per m^3).[6] We estimated fraction mass sorbed as (K_P * TSP) / [1 + (K_P * TSP)], where K_P is the particle-air partition coefficient estimated as f_{om} * K_{OA} / density.[5]

C.1.6 Deposition Parameters

The characteristics of ambient atmospheric particles may vary widely by location, based on site-specific activities like agriculture, industry, and mobile sources as well as site-specific characteristics like land cover. The characteristics of emitted particulates may vary widely based on facility- and emission-unit-specific aspects.

Due to uncertainties about a generic characterization of particulates for use in all modeling scenarios for DIDP, EPA used AERMOD's "Method 2" for modeling of particle deposition, as that method requires less information about the distribution of particle sizes. Method 2 requires the fraction by mass of emitted particles that is 2.5 micrometers (µm) or smaller in aerodynamic diameter (*i.e.*, the mass fraction which is PM2.5) and the mass-mean particle diameter.

It was assumed that the atmospheric PM2.5 mass fraction was 0.14 and the mass-mean diameter was 10 µm. In assuming instantaneous sorption of emitted DIDP to atmospheric particles, this effectively characterized the DIDP releases and transport as 14 percent PM2.5 by mass with a mass-mean diameter of 10 µm.

The PM2.5 mass fraction was based on information presented in EPA's 2019 Integrated Science Assessment for Particulate Matter.[7] Specifically, the assessment's Table 2-4 presents summary statistics for PM2.5 concentrations across various U.S. monitors (for years 2013 to 2015), indicating a mean annual PM2.5 concentration of 8.6 µg/m^3. That value was divided by the value of TSP concentration discussed above in Appendix C.1.5 (*i.e.*, 6.15E8 kg/m^3 or 61.5 µg/m^3) to estimate a PM2.5 mass fraction of 0.14.

The mass-mean diameter was based on information from the assessment's Table 2-4 discussed above, Table 2-6, and other assumptions. Table 2-6 presents summary statistics for PM2.5 to PM10 concentrations across various U.S. monitors (for years 2013 to 2015), indicating a mean daily PM2.5 to PM10 concentration of 7.8 µg/m^3. Dividing that value by the assumed TSP concentration yields a PM2.5 to PM10 mass fraction of 0.13. This suggests that 0.73 by mass of TSP is particles 10 µm or larger (1 – [0.13 PM2.5 to PM10] – [0.14 PM2.5] = 0.73). It was assumed a mass-mean diameter of 0.1 µm for PM2.5, 4 µm for PM2.5 to PM10, and 15 to 20 µm for PM larger than 10 µm. Thus, the assumed mass-mean diameter is between 11 and 15 µm (calculated as [0.1 µm * 0.14] + [4 µm * 0.13] + [15 to 20 µm] * 0.73). Based on this, a mass-mean particle diameter of 10 µm was assumed.

C.1.7 Receptors

All modeling scenarios utilized regions of gridded receptors and several rings/radials of receptors. The rings had receptors placed every 22.5 degrees (starting due north of the source) for distances 10, 30, and

provided in Section 3 of the User Guide for EPA's Consumer Exposure Model: https://www.epa.gov/sites/default/files/2019-06/documents/cem_2.1_user_guide.pdf.

[6] The suggested value of concentration of TSP at California residential sites is provided in version 1.5 of the CalTOX model (see Table VI of: CalEPA (California Environmental Protection Agency), Department of Toxic Substances Control. 1993. Parameter Values and Ranges for CalTOX. Draft (July)). This value also is used in EPA's multimedia modeling for the Risk and Technology Review Program using their TRIM.FaTE model.

[7] EPA's 2019 Integrated Science Assessment for Particulate Matter: https://assessments.epa.gov/isa/document/&deid=347534.

60 m from the source for co-located receptors and 100, 1,000, 2,500, 5,000, and 10,000 m from the source for general-population receptors. Then, there was one grid for the co-located receptors and was regularly spaced (at 10 m intervals) between 30 and 60 m from the source. Another grid was for general-population receptors and was regularly spaced (at 100 m intervals) between 100 m and 1,000 m from the source—an area termed "community" in IIOAC[1]. All receptors were at 1.8 m above ground, as a proxy for breathing height for concentration estimations. A duplicate set of receptors was at ground level (0 m) for deposition estimations.

C.1.8 Other Model Settings

A flat terrain was assumed for all modeling scenarios. Daily- and period-average outputs were produced for every run, where the period was 5 years.

Since each scenario was modeled with two different meteorological scenarios, that means two separate runs (AERMOD cannot run two variations of meteorology in the same simulation). Additionally, the urban setting was toggled on/off for each scenario.

C.1.9 Model Outputs

Each simulation output daily- and period-average concentrations, and daily- and period-total deposition, at every receptor. All runs included outputs stratified by source type (*i.e.*, separate outputs for fugitive sources and stack sources). Post-processing scripts were used to summarize the outputs for each scenario and for each meteorological and land-cover scenario. AERMOD's concentration output units of $\mu g/m^3$ were converted to parts per million (ppm), using the formula: ppm = 24.45 * ($\mu m/m^3$ / 1,000) / chemical molecular weight in grams per mole, where the molecular weight is 446.7 for DIDP and 418.62 for DINP. Deposition units are g/m^2. For each modeling scenario, the following statistics were calculated for daily and period results at each of the receptor groups identified in Section C.1.7 (*i.e.*, each ring and grid of receptors):

- Minimum;
- Maximum;
- Average;
- Standard Deviation; and
- 10th, 25th, 50th, 75th, and 95th percentiles.

At the 60-m distance for a given scenario, for example, there is a period-average concentration at each of the 16 receptors at that distance. The average statistic calculated is the average of those 16 values (*i.e.*, the average concentration at 60 m), which incorporates lower values from locations typically upwind from the source and higher values from locations typically downwind. The 50th percentile is the median of those 16 values. The maximum value is the highest period-average concentration from among the 16 values (*i.e.*, the one receptor with the highest value).

Staying with that same example, there also is a set of daily-average concentrations at each of the 16 receptors at the 60-m distance—1,826 values at each receptor. The average statistic we calculated is the average of those 16*1,826 values (*i.e.*, the average daily concentration at 60 m), which incorporates lower values (from days when the receptor location largely was upwind from the source) and higher values (from days when the receptor location largely was downwind from the source); this will be close to the average of the period-average values discussed above. The 50th percentile is the median of those 16*1,826 values. The maximum value is the highest daily-average concentration estimated at any location on any day at the 60-m distance.
Fugitive sources were modeled fairly low to the ground (3.05 m above ground) and with no buoyancy or

momentum to their emissions; therefore, in most scenarios, it was expected that concentrations and deposition from fugitive emissions to be highest close to the source, near the 10-m distance, and decrease exponentially at farther distances. Since stack sources are emitted at a height of 10 m, with some momentum (5 m per second) and at a temperature (300 Kelvin) frequently warmer than ambient air, concentrations resulting from stack emissions frequently will peak farther away (*e.g.*, near the 100-m distance) and that peak often will be lower relative to fugitive concentrations. The day-by-day meteorological conditions will control the distance and magnitude of these concentration and deposition peaks—for example, low winds will bring the peak closer to the source and increase its magnitude, while unstable conditions or high mixing heights can dilute the pollutant concentrations.

The statistics on modeled concentrations and deposition for DIDP, for each scenario and averaging time were presented in the supplemental files: *Conc Memo Table 1 - Annual.CSV* and *Conc Memo Table 1 - Daily.CSV* present the range (minimum—maximum), mean, and standard deviation of values for period (annual) and daily concentrations, respectively, with matching files for deposition ("depo"). *Conc Memo Table 2 - Annual.CSV* and *Conc Memo Table 2 - Daily.CSV* present the 10th, 50th, and 95th percentile values, again with matching files for deposition.

C.2 DIDP COUs/OESs and AERMOD Concentration and Deposition Tables

Table_Apx C-3. Condition of Uses and Occupational Exposure Scenarios and Associated Releases

Condition of Use	Occupational Exposure Scenario	Media of Release
Manufacturing - Import	Import - Repackaging	fugitive air
Processing - Repackaging	Import - Repackaging	fugitive air
Domestic Manufacturing	Manufacturing	fugitive air
Domestic Manufacturing	Manufacturing	stack air
Plastic Compounding	Plastic Compounding	Fugitive air, water, incineration, or landfill
Plastic Converting	Plastic Converting	Fugitive air, water, incineration, or landfill
Non-PVC Plastic Compounding	Non-PVC Plastic Compounding	Fugitive air, water, incineration, or landfill
Non-PVC Plastic Converting	Non-PVC Plastic Converting	Fugitive air, water, incineration, or landfill
Adhesive and Sealant Manufacturing	Processing - Incorporation into formulation, mixture, or reaction product	fugitive air
Adhesive and Sealant Manufacturing	Processing - Incorporation into formulation, mixture, or reaction product	stack air
Paint and Coating Manufacturing	Processing - Incorporation into formulation, mixture, or reaction product	fugitive air
Paint and Coating Manufacturing	Processing - Incorporation into formulation, mixture, or reaction product	stack air

Condition of Use	Occupational Exposure Scenario	Media of Release
Incorporation into other articles not covered elsewhere	Processing - Incorporation into formulation, mixture, or reaction product	fugitive air
Incorporation into other articles not covered elsewhere	Processing - Incorporation into formulation, mixture, or reaction product	stack air
Use of Paints and Coatings	Use of Paints and Coatings	fugitive air
Use of Paints and Coatings	Use of Paints and Coatings	stack air
Use of Paints and Coatings	Use of Paints and Coatings w/o Engineering Controls	fugitive air
Use of Adhesives and Sealants	Use of Adhesives and Sealants	fugitive or stack air
Commercial Uses - Laboratory Chemicals	Use of Laboratory Chemicals	fugitive or stack air
Commercial Uses - Laboratory Chemicals	Use of Laboratory Chemicals	Stack air
Other Uses - Inspection Fluid/Penetrant	Use of Inspection Fluid/Penetrant (Aerosol)	fugitive air
Other Uses - Inspection Fluid/Penetrant	Use of Inspection Fluid/Penetrant (Non-Aerosol)	fugitive air

Table_Apx C-4. DIDP 95th Percentile Annual Concentrations (μg/m³) Modeled from High-End Fugitive Release Source

Scenario	Meteorology	Distance										
		Land	10M	30M	30-60M	60M	100M	100-1000M	1000M	2500M	5000M	10000M
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	1.7E−07	1.4E−07	1.2E−07	8.3E−08	4.7E−08	9.3E−09	1.5E−09	2.4E−10	6.0E−11	1.4E−11
		Urban	4.1E−07	1.3E−07	1.0E−07	4.9E−08	2.2E−08	3.3E−09	4.3E−10	8.7E−11	2.5E−11	7.1E−12
	High-End	Rural	4.0E−07	2.4E−07	1.9E−07	1.2E−07	6.7E−08	1.2E−08	1.9E−09	3.2E−10	7.8E−11	1.8E−11
		Urban	6.5E−07	1.9E−07	1.6E−07	7.0E−08	3.0E−08	3.9E−09	5.6E−10	1.1E−10	3.3E−11	9.2E−12
Commercial Uses Laboratory Chemicals_Scenario 1	Central Tendency	Rural	1.5E−08	1.4E−08	1.1E−08	7.8E−09	4.4E−09	8.8E−10	1.4E−10	2.3E−11	5.8E−12	1.4E−12
		Urban	3.9E−08	1.2E−08	9.7E−09	4.6E−09	2.1E−09	3.2E−10	4.1E−11	8.3E−12	2.4E−12	6.8E−13
	High-End	Rural	3.7E−08	2.2E−08	1.7E−08	1.2E−08	6.2E−09	1.1E−09	1.8E−10	2.9E−11	7.3E−12	1.7E−12
		Urban	6.0E−08	1.8E−08	1.5E−08	6.5E−09	2.8E−09	3.7E−10	5.2E−11	1.1E−11	3.1E−12	8.6E−13
Domestic Manufacturing, Manufacturing, Average PV	Central Tendency	Rural	3.1E−05	1.7E−05	1.4E−05	8.2E−06	4.5E−06	7.2E−07	1.5E−07	2.3E−08	5.7E−09	1.5E−09
		Urban	4.8E−05	1.7E−05	1.3E−05	6.3E−06	2.7E−06	3.5E−07	4.0E−08	8.2E−09	2.5E−09	7.7E−10
	High-End	Rural	6.9E−05	2.7E−05	1.8E−05	1.1E−05	4.9E−06	6.4E−07	9.7E−08	1.7E−08	4.7E−09	1.3E−09
		Urban	8.2E−05	2.4E−05	1.6E−05	8.2E−06	3.4E−06	3.2E−07	4.8E−08	8.9E−09	2.6E−09	7.6E−10
Domestic Manufacturing, Manufacturing, PV6: Troy Chemical Corp. Phoenix	Central Tendency	Rural	3.6E−06	1.6E−06	1.2E−06	6.6E−07	2.8E−07	3.3E−08	4.7E−09	8.2E−10	2.5E−10	7.9E−11
		Urban	4.0E−06	1.6E−06	1.2E−06	5.8E−07	2.4E−07	2.5E−08	2.7E−09	4.5E−10	1.4E−10	4.8E−11
	High-End	Rural	8.4E−06	2.4E−06	1.5E−06	7.6E−07	2.8E−07	2.3E−08	2.2E−09	3.4E−10	1.0E−10	3.8E−11
		Urban	8.4E−06	2.3E−06	1.5E−06	7.6E−07	2.8E−07	2.1E−08	2.1E−09	3.1E−10	9.2E−11	3.6E−11
Incorporation into other articles not covered elsewhere, Processing - Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	5.3E−06	4.5E−06	3.8E−06	2.6E−06	1.5E−06	2.9E−07	4.6E−08	7.7E−09	1.9E−09	4.4E−10
		Urban	1.3E−05	4.0E−06	3.2E−06	1.5E−06	6.8E−07	1.0E−07	1.3E−08	2.7E−09	8.0E−10	2.2E−10
	High-End	Rural	1.3E−05	7.4E−06	5.9E−06	3.9E−06	2.1E−06	3.8E−07	6.0E−08	9.9E−09	2.5E−09	5.8E−10
		Urban	2.0E−05	6.0E−06	4.9E−06	2.2E−06	9.5E−07	1.2E−07	1.8E−08	3.6E−09	1.0E−09	2.9E−10
Manufacturing - Import , Import - Repackaging, PV1: LG Hausys America, Inc.	Central Tendency	Rural	1.1E−08	4.6E−09	3.4E−09	1.7E−09	6.8E−10	7.1E−11	6.7E−12	1.1E−12	3.4E−13	1.2E−13
		Urban	1.2E−08	4.5E−09	3.3E−09	1.6E−09	6.4E−10	5.5E−11	5.6E−12	8.3E−13	2.5E−13	9.6E−14
	High-End	Rural	2.2E−08	6.0E−09	3.8E−09	1.9E−09	7.2E−10	5.1E−11	5.1E−12	6.5E−13	1.7E−13	7.3E−14
		Urban	2.2E−08	6.0E−09	3.8E−09	1.9E−09	7.1E−10	5.0E−11	5.0E−12	6.5E−13	1.7E−13	7.3E−14
Manufacturing - Import , Import - Repackaging, PV2:	Central Tendency	Rural	2.6E−08	1.1E−08	8.1E−09	4.1E−09	1.6E−09	1.7E−10	1.6E−11	2.7E−12	8.2E−13	2.9E−13
		Urban	2.8E−08	1.1E−08	7.9E−09	3.9E−09	1.5E−09	1.3E−10	1.3E−11	2.0E−12	6.0E−13	2.3E−13
	High-End	Rural	5.2E−08	1.4E−08	9.2E−09	4.6E−09	1.7E−09	1.2E−10	1.2E−11	1.6E−12	4.1E−13	1.7E−13

Scenario	Meteorology	Distance										
		Land	10M	30M	30-60M	60M	100M	100-1000M	1000M	2500M	5000M	10000M
Harwick Standard Distribution Corp.		Urban	5.2E−08	1.4E−08	9.2E−09	4.6E−09	1.7E−09	1.2E−10	1.2E−11	1.5E−12	4.1E−13	1.8E−13
Manufacturing - Import , Import - Repackaging, PV3: Tremco Incorporated	Central Tendency	Rural	6.9E−08	3.1E−08	2.3E−08	1.2E−08	4.9E−09	5.8E−10	7.2E−11	1.3E−11	3.6E−12	1.1E−12
		Urban	7.6E−08	3.0E−08	2.2E−08	1.1E−08	4.5E−09	4.5E−10	4.5E−11	7.8E−12	2.3E−12	7.8E−13
	High-End	Rural	1.5E−07	4.2E−08	2.7E−08	1.4E−08	5.2E−09	3.8E−10	3.9E−11	5.4E−12	1.6E−12	5.8E−13
		Urban	1.5E−07	4.2E−08	2.7E−08	1.4E−08	5.1E−09	3.5E−10	3.8E−11	5.1E−12	1.4E−12	5.4E−13
Manufacturing - Import , Import - Repackaging, PV4: Akrochem Corp.	Central Tendency	Rural	8.8E−09	3.7E−09	2.7E−09	1.4E−09	5.4E−10	5.7E−11	5.3E−12	9.1E−13	2.8E−13	9.6E−14
		Urban	9.3E−09	3.6E−09	2.6E−09	1.3E−09	5.2E−10	4.4E−11	4.5E−12	6.6E−13	2.0E−13	7.7E−14
	High-End	Rural	1.7E−08	4.8E−09	3.1E−09	1.6E−09	5.7E−10	4.1E−11	4.1E−12	5.2E−13	1.4E−13	5.8E−14
		Urban	1.7E−08	4.8E−09	3.1E−09	1.5E−09	5.7E−10	4.0E−11	4.0E−12	5.2E−13	1.4E−13	5.9E−14
Non-PVC Plastic Compounding	Central Tendency	Rural	5.9E01	4.9E01	4.2E01	2.9E01	1.7E01	3.4E00	5.5E−01	8.8E−02	2.2E−02	5.1E−03
		Urban	1.5E02	4.6E01	3.6E01	1.8E01	8.1E00	1.2E00	1.6E−01	3.2E−02	9.7E−03	2.8E−03
	High-End	Rural	1.4E02	8.5E01	6.6E01	4.4E01	2.4E01	4.4E00	6.8E−01	1.1E−01	2.8E−02	6.6E−03
		Urban	2.3E02	7.0E01	5.5E01	2.5E01	1.1E01	1.4E00	2.0E−01	4.1E−02	1.2E−02	3.4E−03
Non-PVC Plastic Converting	Central Tendency	Rural	1.5E00	1.3E00	1.1E00	7.3E−01	4.1E−01	8.3E−02	1.3E−02	2.2E−03	5.3E−04	1.2E−04
		Urban	3.6E00	1.1E00	9.1E−01	4.3E−01	1.9E−01	2.9E−02	3.8E−03	7.7E−04	2.2E−04	6.3E−05
	High-End	Rural	3.5E00	2.1E00	1.7E00	1.1E00	5.9E−01	1.1E−01	1.7E−02	2.8E−03	6.9E−04	1.6E−04
		Urban	5.7E00	1.7E00	1.4E00	6.2E−01	2.7E−01	3.5E−02	5.0E−03	1.0E−03	2.9E−04	8.1E−05
Other Uses - Inspection Fluid/Penetrant, Use of Inspection Fluid/Penetrant (Aerosol)	Central Tendency	Rural	2.4E−02	2.1E−02	1.7E−02	1.2E−02	6.7E−03	1.3E−03	2.1E−04	3.5E−05	8.6E−06	2.0E−06
		Urban	5.9E−02	1.8E−02	1.5E−02	7.0E−03	3.1E−03	4.8E−04	6.1E−05	1.2E−05	3.6E−06	1.0E−06
	High-End	Rural	5.7E−02	3.4E−02	2.7E−02	1.8E−02	9.6E−03	1.8E−03	2.7E−04	4.5E−05	1.1E−05	2.6E−06
		Urban	9.2E−02	2.8E−02	2.2E−02	1.0E−02	4.3E−03	5.6E−04	8.0E−05	1.6E−05	4.8E−06	1.3E−06
Other Uses - Inspection Fluid/Penetrant, Use of Inspection Fluid/Penetrant (Non-Aerosol)	Central Tendency	Rural	2.3E−08	1.9E−08	1.6E−08	1.1E−08	6.4E−09	1.3E−09	2.0E−10	3.3E−11	8.1E−12	1.9E−12
		Urban	5.6E−08	1.8E−08	1.4E−08	6.7E−09	3.0E−09	4.5E−10	5.8E−11	1.2E−11	3.5E−12	9.7E−13
	High-End	Rural	5.5E−08	3.2E−08	2.5E−08	1.7E−08	9.1E−09	1.7E−09	2.6E−10	4.3E−11	1.1E−11	2.5E−12
		Urban	8.8E−08	2.6E−08	2.1E−08	9.5E−09	4.1E−09	5.3E−10	7.6E−11	1.6E−11	4.5E−12	1.3E−12
Paint and Coating Manufacturing,	Central Tendency	Rural	8.0E−08	6.9E−08	5.8E−08	4.0E−08	2.3E−08	4.5E−09	7.1E−10	1.2E−10	2.9E−11	6.7E−12
		Urban	2.0E−07	6.2E−08	4.9E−08	2.4E−08	1.1E−08	1.6E−09	2.1E−10	4.2E−11	1.2E−11	3.4E−12

Scenario	Meteorology	Distance										
		Land	**10M**	**30M**	**30-60M**	**60M**	**100M**	**100-1000M**	**1000M**	**2500M**	**5000M**	**10000M**
Processing - Incorporation into formulation, mixture, or reaction product	High-End	Rural	1.9E−07	1.1E−07	8.9E−08	5.9E−08	3.2E−08	5.9E−09	9.1E−10	1.5E−10	3.8E−11	8.8E−12
		Urban	3.1E−07	9.2E−08	7.5E−08	3.4E−08	1.5E−08	1.9E−09	2.7E−10	5.5E−11	1.6E−11	4.4E−12
Plastic Compounding	Central Tendency	Rural	1.2E03	1.0E03	8.5E02	5.9E02	3.3E02	6.6E01	1.0E01	1.7E00	4.2E−01	9.9E−02
		Urban	2.9E03	9.1E02	7.3E02	3.5E02	1.5E02	2.4E01	3.0E00	6.1E−01	1.8E−01	5.0E−02
	High-End	Rural	2.8E03	1.7E03	1.3E03	8.7E02	4.7E02	8.6E01	1.3E01	2.2E00	5.5E−01	1.3E−01
		Urban	4.6E03	1.4E03	1.1E03	4.9E02	2.1E02	2.8E01	4.0E00	8.0E−01	2.4E−01	6.5E−02
Plastic Converting	Central Tendency	Rural	5.5E01	4.7E01	3.9E01	2.7E01	1.5E01	3.0E00	4.8E−01	7.9E−02	2.0E−02	4.6E−03
		Urban	1.3E02	4.2E01	3.4E01	1.6E01	7.1E00	1.1E00	1.4E−01	2.8E−02	8.3E−03	2.3E−03
	High-End	Rural	1.3E02	7.7E01	6.1E01	4.0E01	2.2E01	4.0E00	6.2E−01	1.0E−01	2.6E−02	6.0E−03
		Urban	2.1E02	6.3E01	5.1E01	2.3E01	9.9E00	1.3E00	1.8E−01	3.7E−02	1.1E−02	3.0E−03
Processing - Repackaging, Import - Repackaging, Average PV CAS 1	Central Tendency	Rural	1.7E−08	6.9E−09	5.1E−09	2.6E−09	1.0E−09	1.1E−10	1.0E−11	1.7E−12	5.2E−13	1.8E−13
		Urban	1.8E−08	6.8E−09	5.0E−09	2.5E−09	9.7E−10	8.3E−11	8.4E−12	1.3E−12	3.8E−13	1.4E−13
	High-End	Rural	3.3E−08	9.0E−09	5.8E−09	2.9E−09	1.1E−09	7.7E−11	7.6E−12	9.8E−13	2.6E−13	1.1E−13
		Urban	3.3E−08	9.0E−09	5.8E−09	2.9E−09	1.1E−09	7.6E−11	7.6E−12	9.7E−13	2.6E−13	1.1E−13
Processing - Repackaging, Import - Repackaging, Average PV CAS 2	Central Tendency	Rural	2.8E−05	2.4E−05	2.1E−05	1.4E−05	8.0E−06	1.6E−06	2.5E−07	4.2E−08	1.0E−08	2.4E−09
		Urban	7.1E−05	2.2E−05	1.8E−05	8.4E−06	3.7E−06	5.8E−07	7.4E−08	1.5E−08	4.4E−09	1.2E−09
	High-End	Rural	6.6E−05	3.9E−05	3.1E−05	2.1E−05	1.1E−05	2.1E−06	3.2E−07	5.3E−08	1.3E−08	3.1E−09
		Urban	1.1E−04	3.2E−05	2.6E−05	1.2E−05	5.1E−06	6.6E−07	9.4E−08	1.9E−08	5.6E−09	1.5E−09
Processing - Repackaging, Import - Repackaging, PV4: Akrochem Corp. (CT Release)	Central Tendency	Rural	6.0E−09	2.5E−09	1.9E−09	9.6E−10	3.9E−10	4.4E−11	4.2E−12	6.3E−13	2.0E−13	7.9E−14
		Urban	6.4E−09	2.4E−09	1.9E−09	8.7E−10	3.4E−10	3.7E−11	3.3E−12	5.4E−13	1.6E−13	6.0E−14
	High-End	Rural	1.3E−08	3.5E−09	2.3E−09	1.1E−09	4.2E−10	3.2E−11	3.0E−12	4.0E−13	1.2E−13	5.0E−14
		Urban	1.3E−08	3.5E−09	2.2E−09	1.1E−09	4.2E−10	3.1E−11	3.0E−12	3.9E−13	1.2E−13	5.0E−14
Processing - Repackaging, Import - Repackaging, PV5: Chemspec, Ltd.	Central Tendency	Rural	3.0E−08	1.2E−08	9.2E−09	4.6E−09	1.8E−09	1.9E−10	1.8E−11	3.1E−12	9.3E−13	3.2E−13
		Urban	3.2E−08	1.2E−08	8.9E−09	4.4E−09	1.7E−09	1.5E−10	1.5E−11	2.2E−12	6.8E−13	2.6E−13
	High-End	Rural	5.8E−08	1.6E−08	1.0E−08	5.2E−09	1.9E−09	1.4E−10	1.4E−11	1.8E−12	4.6E−13	2.0E−13
		Urban	5.9E−08	1.6E−08	1.0E−08	5.2E−09	1.9E−09	1.4E−10	1.4E−11	1.7E−12	4.6E−13	2.0E−13
Use of Adhesives and Sealants, Use of	Central Tendency	Rural	1.6E−07	1.3E−07	1.1E−07	7.5E−08	4.2E−08	8.8E−09	1.3E−09	2.2E−10	5.4E−11	1.4E−11
		Urban	3.8E−07	1.2E−07	9.2E−08	4.6E−08	2.1E−08	3.0E−09	4.0E−10	8.4E−11	2.5E−11	7.1E−12

Scenario	Meteorology	Distance										
		Land	**10M**	**30M**	**30-60M**	**60M**	**100M**	**100-1000M**	**1000M**	**2500M**	**5000M**	**10000M**
Adhesives and Sealants	High-End	Rural	3.6E−07	2.2E−07	1.7E−07	1.2E−07	6.2E−08	1.2E−08	1.8E−09	3.0E−10	7.4E−11	1.7E−11
		Urban	6.0E−07	1.8E−07	1.5E−07	6.5E−08	2.8E−08	3.7E−09	5.3E−10	1.1E−10	3.2E−11	8.7E−12
Use of Paints and Coatings, Use of Paints and Coatings	Central Tendency	Rural	3.5E−08	3.0E−08	2.5E−08	1.7E−08	1.0E−08	2.0E−09	3.3E−10	5.3E−11	1.3E−11	3.1E−12
		Urban	8.9E−08	2.8E−08	2.1E−08	1.1E−08	4.9E−09	7.0E−10	9.5E−11	2.0E−11	5.8E−12	1.7E−12
	High-End	Rural	8.4E−08	5.1E−08	4.0E−08	2.7E−08	1.5E−08	2.7E−09	4.1E−10	6.9E−11	1.7E−11	4.0E−12
		Urban	1.4E−07	4.2E−08	3.3E−08	1.5E−08	6.7E−09	8.4E−10	1.2E−10	2.5E−11	7.3E−12	2.0E−12
Use of Paints and Coatings, Use of Paints and Coatings w/o Engineering Controls	Central Tendency	Rural	3.5E−08	2.9E−08	2.5E−08	1.7E−08	9.9E−09	2.0E−09	3.3E−10	5.3E−11	1.3E−11	3.1E−12
		Urban	8.9E−08	2.8E−08	2.1E−08	1.1E−08	4.8E−09	7.0E−10	9.4E−11	1.9E−11	5.8E−12	1.7E−12
	High-End	Rural	8.3E−08	5.1E−08	4.0E−08	2.7E−08	1.4E−08	2.7E−09	4.1E−10	6.8E−11	1.7E−11	4.0E−12
		Urban	1.4E−07	4.2E−08	3.3E−08	1.5E−08	6.6E−09	8.4E−10	1.2E−10	2.5E−11	7.3E−12	2.0E−12
Summary Statistics		**Max**	4.6E03	1.7E03	1.3E03	8.7E02	4.7E02	8.6E01	1.3E01	2.2E00	5.5E−01	1.3E−01
		Mean	1.4E02	5.9E01	4.8E01	2.7E01	1.4E01	2.4E00	3.7E−01	6.4E−02	1.7E−02	4.1E−03
		Median	1.6E−07	8.0E−08	6.6E−08	3.7E−08	1.8E−08	2.8E−09	4.1E−10	7.6E−11	2.1E−11	5.6E−12
		Min	8.8E−09	3.6E−09	2.6E−09	1.3E−09	5.2E−10	4.0E−11	4.0E−12	5.2E−13	1.4E−13	5.8E−14

2283 **Table_Apx C-5. DIDP 95th Percentile Annual Concentrations (µg/m³) Modeled from High-End Stack Release Source**

Scenario	Meteorology	Distance										
		Land	10M	30M	30-60M	60M	100M	100-1000M	1000M	2500M	5000M	10000M
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	1.9E−12	1.5E−10	1.3E−09	1.8E−09	3.6E−09	1.2E−09	4.2E−10	1.2E−10	8.1E−11	7.3E−11
		Urban	8.8E−12	2.6E−10	1.5E−09	2.1E−09	3.8E−09	1.3E−09	4.7E−10	1.5E−10	5.3E−11	1.7E−11
	High-End	Rural	9.4E−13	2.0E−10	1.8E−09	2.6E−09	4.6E−09	2.1E−09	9.8E−10	3.1E−10	2.3E−10	1.0E−10
		Urban	6.7E−12	4.3E−10	2.8E−09	4.3E−09	7.1E−09	2.3E−09	7.8E−10	2.2E−10	7.4E−11	2.2E−11
Commerical Uses Laboratory Chemicals_Scenario 2	Central Tendency	Rural	5.5E−09	4.5E−07	3.8E−06	5.4E−06	1.1E−05	3.5E−06	1.3E−06	3.6E−07	2.5E−07	2.3E−07
		Urban	2.6E−08	7.8E−07	4.6E−06	6.2E−06	1.1E−05	3.8E−06	1.4E−06	4.6E−07	1.6E−07	5.2E−08
	High-End	Rural	2.8E−09	5.8E−07	5.4E−06	7.8E−06	1.4E−05	6.3E−06	2.9E−06	9.2E−07	7.0E−07	3.0E−07
		Urban	2.0E−08	1.3E−06	8.4E−06	1.3E−05	2.1E−05	7.0E−06	2.4E−06	6.8E−07	2.2E−07	6.8E−08
Domestic Manufacturing, Manufacturing, Average PV	Central Tendency	Rural	7.8E−03	5.6E−01	4.8E00	6.7E00	1.4E01	4.9E00	1.1E00	2.8E−01	1.4E−01	1.3E−01
		Urban	5.0E−02	1.2E00	6.7E00	8.7E00	1.5E01	5.1E00	1.1E00	3.2E−01	1.1E−01	3.8E−02
	High-End	Rural	5.3E−03	8.4E−01	8.3E00	1.3E01	2.3E01	7.7E00	2.1E00	5.6E−01	2.4E−01	1.1E−01
		Urban	4.6E−02	1.9E00	1.2E01	1.8E01	2.8E01	7.7E00	1.8E00	4.1E−01	1.3E−01	4.0E−02
Domestic Manufacturing, Manufacturing, PV6: Troy Chemical Corp. Phoenix	Central Tendency	Rural	9.1E−08	1.1E−04	1.4E−03	2.2E−03	4.3E−03	1.4E−03	2.4E−04	5.2E−05	2.0E−05	1.2E−05
		Urban	4.1E−07	1.4E−04	1.5E−03	2.5E−03	4.7E−03	1.5E−03	2.4E−04	5.1E−05	1.6E−05	5.9E−06
	High-End	Rural	2.0E−07	2.2E−04	2.5E−03	4.2E−03	7.9E−03	2.0E−03	2.8E−04	4.0E−05	1.3E−05	4.8E−06
		Urban	4.0E−07	2.4E−04	2.5E−03	4.3E−03	8.0E−03	2.0E−03	2.7E−04	3.8E−05	1.1E−05	4.3E−06
Incorporation into other articles not covered elsewhere, Processing - Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	1.2E−11	9.4E−10	7.9E−09	1.1E−08	2.2E−08	7.3E−09	2.6E−09	7.3E−10	5.0E−10	4.5E−10
		Urban	5.4E−11	1.6E−09	9.5E−09	1.3E−08	2.3E−08	7.7E−09	2.9E−09	9.3E−10	3.2E−10	1.0E−10
	High-End	Rural	5.8E−12	1.2E−09	1.1E−08	1.6E−08	2.8E−08	1.3E−08	6.0E−09	1.9E−09	1.5E−09	6.2E−10
		Urban	4.1E−11	2.6E−09	1.8E−08	2.7E−08	4.4E−08	1.4E−08	4.8E−09	1.4E−09	4.6E−10	1.4E−10
Paint and Coating Manufacturing, Processing - Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	1.2E−13	9.7E−12	8.1E−11	1.2E−10	2.3E−10	7.5E−11	2.7E−11	7.6E−12	5.2E−12	4.7E−12
		Urban	5.6E−13	1.7E−11	9.8E−11	1.3E−10	2.4E−10	8.0E−11	3.0E−11	9.6E−12	3.4E−12	1.1E−12
	High-End	Rural	6.0E−14	1.3E−11	1.2E−10	1.7E−10	2.9E−10	1.3E−10	6.2E−11	2.0E−11	1.5E−11	6.4E−12
		Urban	4.3E−13	2.7E−11	1.8E−10	2.8E−10	4.5E−10	1.5E−10	5.0E−11	1.4E−11	4.7E−12	1.4E−12
Use of Paints and Coatings, Use of	Central Tendency	Rural	3.1E−05	3.9E−03	3.4E−02	4.6E−02	9.1E−02	3.3E−02	1.1E−02	3.2E−03	2.2E−03	1.9E−03
		Urban	1.9E−04	6.5E−03	4.0E−02	5.3E−02	9.8E−02	3.5E−02	1.3E−02	4.0E−03	1.4E−03	4.6E−04

Scenario	Meteorology	Land	10M	30M	30-60M	60M	100M	100-1000M	1000M	2500M	5000M	10000M
Paints and Coatings	High-End	Rural	2.2E−05	4.6E−03	5.1E−02	6.8E−02	1.2E−01	5.4E−02	2.3E−02	7.3E−03	6.0E−03	2.6E−03
		Urban	1.5E−04	1.1E−02	7.6E−02	1.1E−01	1.8E−01	5.9E−02	2.1E−02	5.8E−03	2.0E−03	5.9E−04
Summary Statistics		**Max**	5.0E−02	1.9E00	1.2E01	1.8E01	2.8E01	7.7E00	2.1E00	5.6E−01	2.4E−01	1.3E−01
		Mean	3.9E−03	1.6E−01	1.1E00	1.7E00	2.9E00	9.1E−01	2.2E−01	5.7E−02	2.3E−02	1.2E−02
		Median	1.3E−08	6.8E−07	5.0E−06	7.0E−06	1.2E−05	5.0E−06	1.9E−06	5.7E−07	2.4E−07	1.5E−07
		Min	6.0E−14	9.7E−12	8.1E−11	1.2E−10	2.3E−10	7.5E−11	2.7E−11	7.6E−12	3.4E−12	1.1E−12

Table_Apx C-6. DIDP 95th Percentile Daily Concentrations (μg/m^3) Modeled from High-End Fugitive Release Source

Scenario	Meteorology	Distance										
		Land	10M	30M	30-60M	60M	100M	100-1000M	1000M	2500M	5000M	10000M
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	7.2E−07	5.9E−07	4.4E−07	3.3E−07	1.9E−07	1.5E−08	5.9E−09	1.0E−09	2.5E−10	5.7E−11
		Urban	1.5E−06	5.4E−07	3.2E−07	2.1E−07	9.4E−08	5.2E−09	1.9E−09	4.0E−10	1.2E−10	3.5E−11
	High-End	Rural	1.1E−06	9.0E−07	6.3E−07	4.6E−07	2.5E−07	1.9E−08	7.3E−09	1.3E−09	3.4E−10	7.7E−11
		Urban	2.3E−06	6.9E−07	4.1E−07	2.6E−07	1.1E−07	6.1E−09	2.2E−09	4.5E−10	1.3E−10	3.8E−11
Commerical Uses Laboratory Chemicals_Scenario 1	Central Tendency	Rural	6.6E−08	5.4E−08	4.1E−08	3.1E−08	1.8E−08	1.4E−09	5.7E−10	9.9E−11	2.4E−11	5.6E−12
		Urban	1.4E−07	5.0E−08	3.0E−08	2.0E−08	8.8E−09	4.9E−10	1.8E−10	3.8E−11	1.1E−11	3.3E−12
	High-End	Rural	1.0E−07	8.2E−08	5.8E−08	4.2E−08	2.3E−08	1.8E−09	6.7E−10	1.2E−10	3.1E−11	7.2E−12
		Urban	2.1E−07	6.4E−08	3.7E−08	2.4E−08	1.0E−08	5.7E−10	2.1E−10	4.2E−11	1.2E−11	3.5E−12
Domestic Manufacturing, Manufacturing, Average PV	Central Tendency	Rural	1.8E−04	9.3E−05	5.9E−05	3.9E−05	1.7E−05	5.8E−07	1.9E−07	3.0E−08	8.3E−09	2.4E−09
		Urban	2.4E−04	9.0E−05	5.1E−05	3.3E−05	1.4E−05	4.8E−07	1.8E−07	2.9E−08	8.0E−09	2.7E−09
	High-End	Rural	2.6E−04	1.1E−04	6.7E−05	4.3E−05	1.9E−05	6.6E−07	2.1E−07	3.1E−08	8.3E−09	2.6E−09
		Urban	3.2E−04	9.8E−05	5.4E−05	3.4E−05	1.4E−05	5.0E−07	1.9E−07	3.1E−08	8.4E−09	2.9E−09
Domestic Manufacturing, Manufacturing, PV6: Troy Chemical Corp. Phoenix	Central Tendency	Rural	2.2E−05	9.4E−06	5.0E−06	3.2E−06	1.2E−06	2.0E−08	7.0E−09	8.1E−10	1.9E−10	4.6E−11
		Urban	2.4E−05	9.4E−06	5.0E−06	3.2E−06	1.2E−06	2.1E−08	7.4E−09	9.1E−10	2.2E−10	6.1E−11
	High-End	Rural	3.3E−05	1.0E−05	5.1E−06	3.1E−06	1.1E−06	2.1E−08	7.0E−09	8.5E−10	2.3E−10	8.2E−11
		Urban	3.3E−05	1.0E−05	5.1E−06	3.1E−06	1.1E−06	2.1E−08	7.0E−09	8.7E−10	2.4E−10	8.5E−11
Incorporation into other articles not covered elsewhere,	Central Tendency	Rural	2.3E−05	1.9E−05	1.4E−05	1.0E−05	5.9E−06	4.7E−07	1.9E−07	3.2E−08	7.7E−09	1.8E−09
		Urban	4.8E−05	1.7E−05	1.0E−05	6.6E−06	3.0E−06	1.6E−07	6.0E−08	1.3E−08	3.8E−09	1.1E−09
	High-End	Rural	3.5E−05	2.8E−05	2.0E−05	1.4E−05	7.8E−06	6.1E−07	2.3E−07	4.1E−08	1.1E−08	2.4E−09

Scenario	Meteorology	Distance										
		Land	10M	30M	30-60M	60M	100M	100-1000M	1000M	2500M	5000M	10000M
Processing - Incorporation into formulation, mixture, or reaction product		Urban	7.2E−05	2.2E−05	1.3E−05	8.1E−06	3.5E−06	1.9E−07	7.0E−08	1.4E−08	4.1E−09	1.2E−09
Manufacturing - Import , Import - Repackaging, PV1: LG Hausys America, Inc.	Central Tendency	Rural	5.5E−08	2.3E−08	1.3E−08	8.1E−09	3.1E−09	6.2E−11	2.1E−11	2.7E−12	7.1E−13	2.3E−13
		Urban	5.7E−08	2.2E−08	1.2E−08	8.0E−09	3.0E−09	6.1E−11	2.1E−11	2.8E−12	7.6E−13	2.5E−13
	High-End	Rural	7.4E−08	2.3E−08	1.3E−08	7.5E−09	2.8E−09	5.9E−11	1.9E−11	2.5E−12	7.2E−13	2.8E−13
		Urban	7.4E−08	2.3E−08	1.2E−08	7.5E−09	2.7E−09	5.8E−11	1.9E−11	2.5E−12	7.3E−13	2.8E−13
Manufacturing - Import , Import - Repackaging, PV2: Harwick Standard Distribution Corp.	Central Tendency	Rural	1.3E−07	5.4E−08	3.0E−08	1.9E−08	7.4E−09	1.5E−10	5.0E−11	6.5E−12	1.7E−12	5.5E−13
		Urban	1.4E−07	5.3E−08	3.0E−08	1.9E−08	7.2E−09	1.5E−10	5.0E−11	6.7E−12	1.8E−12	6.0E−13
	High-End	Rural	1.8E−07	5.6E−08	3.0E−08	1.8E−08	6.6E−09	1.4E−10	4.5E−11	6.0E−12	1.7E−12	6.8E−13
		Urban	1.8E−07	5.6E−08	3.0E−08	1.8E−08	6.5E−09	1.4E−10	4.5E−11	6.0E−12	1.7E−12	6.8E−13
Manufacturing - Import , Import - Repackaging, PV3: Tremco Incorporated	Central Tendency	Rural	3.4E−07	1.5E−07	8.4E−08	5.4E−08	2.1E−08	4.6E−10	1.5E−10	2.0E−11	5.4E−12	1.8E−12
		Urban	3.7E−07	1.5E−07	8.3E−08	5.3E−08	2.1E−08	4.6E−10	1.5E−10	2.2E−11	5.8E−12	2.0E−12
	High-End	Rural	4.8E−07	1.5E−07	8.3E−08	5.0E−08	1.9E−08	4.3E−10	1.3E−10	1.7E−11	4.8E−12	1.9E−12
		Urban	4.8E−07	1.5E−07	8.2E−08	5.0E−08	1.9E−08	4.3E−10	1.3E−10	1.7E−11	4.9E−12	1.9E−12
Manufacturing - Import , Import - Repackaging, PV4: Akrochem Corp.	Central Tendency	Rural	4.4E−08	1.8E−08	1.0E−08	6.5E−09	2.5E−09	5.0E−11	1.7E−11	2.2E−12	5.7E−13	1.8E−13
		Urban	4.6E−08	1.8E−08	9.9E−09	6.4E−09	2.4E−09	4.9E−11	1.7E−11	2.3E−12	6.1E−13	2.0E−13
	High-End	Rural	5.9E−08	1.9E−08	1.0E−08	6.0E−09	2.2E−09	4.7E−11	1.5E−11	2.0E−12	5.8E−13	2.3E−13
		Urban	6.0E−08	1.9E−08	9.9E−09	6.0E−09	2.2E−09	4.7E−11	1.5E−11	2.0E−12	5.8E−13	2.3E−13
Non-PVC Plastic Compounding	Central Tendency	Rural	2.3E02	1.9E02	1.4E02	1.1E02	6.3E01	5.3E00	2.1E00	3.7E−01	9.3E−02	2.1E−02
		Urban	4.9E02	1.8E02	1.1E02	7.0E01	3.2E01	1.8E00	6.6E−01	1.4E−01	4.2E−02	1.2E−02
	High-End	Rural	3.6E02	2.9E02	2.1E02	1.5E02	8.3E01	6.7E00	2.5E00	4.5E−01	1.2E−01	2.6E−02
		Urban	7.4E02	2.3E02	1.3E02	8.4E01	3.7E01	2.1E00	7.5E−01	1.5E−01	4.5E−02	1.3E−02
Non-PVC Plastic Converting	Central Tendency	Rural	6.4E00	5.2E00	3.9E00	2.9E00	1.7E00	1.3E−01	5.2E−02	9.0E−03	2.2E−03	5.0E−04
		Urban	1.4E01	4.8E00	2.9E00	1.9E00	8.3E−01	4.6E−02	1.7E−02	3.6E−03	1.1E−03	3.1E−04
	High-End	Rural	9.8E00	7.9E00	5.6E00	4.0E00	2.2E00	1.7E−01	6.4E−02	1.2E−02	3.0E−03	6.8E−04
		Urban	2.0E01	6.1E00	3.6E00	2.3E00	1.0E00	5.4E−02	2.0E−02	4.0E−03	1.2E−03	3.3E−04
Other Uses - Inspection	Central Tendency	Rural	1.0E−01	8.4E−02	6.3E−02	4.7E−02	2.7E−02	2.1E−03	8.5E−04	1.5E−04	3.5E−05	8.1E−06
		Urban	2.2E−01	7.8E−02	4.6E−02	3.0E−02	1.4E−02	7.4E−04	2.8E−04	5.8E−05	1.7E−05	5.0E−06

Scenario	Meteorology	Distance										
		Land	10M	30M	30-60M	60M	100M	100-1000M	1000M	2500M	5000M	10000M
Fluid/Penetrant, Use of Inspection Fluid/Penetrant (Aerosol)	High-End	Rural	1.6E−01	1.3E−01	9.0E−02	6.5E−02	3.6E−02	2.8E−03	1.0E−03	1.9E−04	4.8E−05	1.1E−05
		Urban	3.3E−01	9.9E−02	5.8E−02	3.7E−02	1.6E−02	8.7E−04	3.2E−04	6.5E−05	1.9E−05	5.4E−06
Other Uses - Inspection Fluid/Penetrant, Use of Inspection Fluid/Penetrant (Non-Aerosol)	Central Tendency	Rural	9.8E−08	8.0E−08	6.0E−08	4.5E−08	2.5E−08	2.0E−09	8.0E−10	1.4E−10	3.3E−11	7.7E−12
		Urban	2.1E−07	7.4E−08	4.4E−08	2.9E−08	1.3E−08	7.0E−10	2.6E−10	5.5E−11	1.7E−11	4.8E−12
	High-End	Rural	1.5E−07	1.2E−07	8.6E−08	6.2E−08	3.4E−08	2.6E−09	9.9E−10	1.8E−10	4.5E−11	1.1E−11
		Urban	3.1E−07	9.4E−08	5.5E−08	3.5E−08	1.5E−08	8.3E−10	3.0E−10	6.1E−11	1.8E−11	5.1E−12
Paint and Coating Manufacturing, Processing - Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	3.5E−07	2.8E−07	2.1E−07	1.6E−07	8.9E−08	7.1E−09	2.8E−09	4.9E−10	1.2E−10	2.7E−11
		Urban	7.3E−07	2.6E−07	1.6E−07	1.0E−07	4.5E−08	2.5E−09	9.2E−10	1.9E−10	5.8E−11	1.7E−11
	High-End	Rural	5.3E−07	4.3E−07	3.0E−07	2.2E−07	1.2E−07	9.3E−09	3.5E−09	6.3E−10	1.6E−10	3.7E−11
		Urban	1.1E−06	3.3E−07	2.0E−07	1.2E−07	5.4E−08	2.9E−09	1.1E−09	2.2E−10	6.3E−11	1.8E−11
Plastic Compounding	Central Tendency	Rural	5.1E03	4.2E03	3.1E03	2.3E03	1.3E03	1.1E02	4.2E01	7.2E00	1.7E00	4.0E−01
		Urban	1.1E04	3.8E03	2.3E03	1.5E03	6.6E02	3.7E01	1.4E01	2.8E00	8.6E−01	2.5E−01
	High-End	Rural	7.8E03	6.3E03	4.5E03	3.2E03	1.8E03	1.4E02	5.1E01	9.3E00	2.4E00	5.5E−01
		Urban	1.6E04	4.9E03	2.9E03	1.8E03	8.0E02	4.3E01	1.6E01	3.2E00	9.3E−01	2.6E−01
Plastic Converting	Central Tendency	Rural	2.4E02	1.9E02	1.4E02	1.1E02	6.1E01	4.9E00	1.9E00	3.3E−01	8.0E−02	1.8E−02
		Urban	5.0E02	1.8E02	1.1E02	6.9E01	3.1E01	1.7E00	6.3E−01	1.3E−01	4.0E−02	1.2E−02
	High-End	Rural	3.6E02	2.9E02	2.1E02	1.5E02	8.1E01	6.3E00	2.4E00	4.3E−01	1.1E−01	2.5E−02
		Urban	7.5E02	2.3E02	1.3E02	8.4E01	3.7E01	2.0E00	7.3E−01	1.5E−01	4.3E−02	1.2E−02
Processing - Repackaging, Import - Repackaging, Average PV CAS 1	Central Tendency	Rural	8.2E−08	3.4E−08	1.9E−08	1.2E−08	4.6E−09	9.4E−11	3.2E−11	4.1E−12	1.1E−12	3.5E−13
		Urban	8.6E−08	3.4E−08	1.9E−08	1.2E−08	4.5E−09	9.2E−11	3.1E−11	4.2E−12	1.2E−12	3.8E−13
	High-End	Rural	1.1E−07	3.5E−08	1.9E−08	1.1E−08	4.2E−09	8.9E−11	2.8E−11	3.8E−12	1.1E−12	4.3E−13
		Urban	1.1E−07	3.5E−08	1.9E−08	1.1E−08	4.1E−09	8.8E−11	2.8E−11	3.8E−12	1.1E−12	4.3E−13
Processing - Repackaging, Import - Repackaging, Average PV CAS 2	Central Tendency	Rural	1.2E−04	9.8E−05	7.3E−05	5.5E−05	3.2E−05	2.6E−06	1.0E−06	1.8E−07	4.3E−08	1.0E−08
		Urban	2.5E−04	9.0E−05	5.4E−05	3.5E−05	1.6E−05	8.8E−07	3.3E−07	6.8E−08	2.1E−08	6.0E−09
	High-End	Rural	1.8E−04	1.5E−04	1.0E−04	7.6E−05	4.1E−05	3.3E−06	1.2E−06	2.2E−07	5.6E−08	1.3E−08
		Urban	3.8E−04	1.1E−04	6.7E−05	4.3E−05	1.9E−05	1.0E−06	3.7E−07	7.6E−08	2.2E−08	6.3E−09
Processing -	Central	Rural	3.7E−08	1.5E−08	7.9E−09	4.9E−09	1.8E−09	2.8E−11	9.2E−12	9.5E−13	1.7E−13	2.8E−14

Scenario	Meteorology	Distance										
		Land	**10M**	**30M**	**30-60M**	**60M**	**100M**	**100-1000M**	**1000M**	**2500M**	**5000M**	**10000M**
Repackaging, Import - Repackaging, PV4: Akrochem Corp. (CT Release)	Tendency	Urban	4.0E−08	1.5E−08	8.0E−09	5.0E−09	1.8E−09	2.9E−11	9.9E−12	1.1E−12	2.4E−13	4.4E−14
	High-End	Rural	5.5E−08	1.6E−08	8.4E−09	5.1E−09	1.8E−09	3.2E−11	1.0E−11	1.3E−12	3.4E−13	1.1E−13
		Urban	5.5E−08	1.6E−08	8.3E−09	5.1E−09	1.8E−09	3.1E−11	1.0E−11	1.3E−12	3.4E−13	1.2E−13
Processing - Repackaging, Import - Repackaging, PV5: Chemspec, Ltd.	Central Tendency	Rural	1.5E−07	6.1E−08	3.4E−08	2.2E−08	8.3E−09	1.7E−10	5.7E−11	7.4E−12	1.9E−12	6.2E−13
		Urban	1.6E−07	6.0E−08	3.3E−08	2.2E−08	8.1E−09	1.6E−10	5.6E−11	7.6E−12	2.1E−12	6.8E−13
	High-End	Rural	2.0E−07	6.3E−08	3.4E−08	2.0E−08	7.5E−09	1.6E−10	5.1E−11	6.8E−12	1.9E−12	7.7E−13
		Urban	2.0E−07	6.3E−08	3.4E−08	2.0E−08	7.4E−09	1.6E−10	5.0E−11	6.8E−12	2.0E−12	7.7E−13
Use of Adhesives and Sealants, Use of Adhesives and Sealants	Central Tendency	Rural	5.9E−07	4.8E−07	3.7E−07	2.8E−07	1.6E−07	1.4E−08	5.3E−09	9.4E−10	2.4E−10	5.6E−11
		Urban	1.2E−06	4.4E−07	2.7E−07	1.7E−07	7.9E−08	4.6E−09	1.6E−09	3.4E−10	1.0E−10	3.1E−11
	High-End	Rural	9.1E−07	7.4E−07	5.3E−07	3.8E−07	2.1E−07	1.8E−08	6.4E−09	1.2E−09	3.0E−10	7.0E−11
		Urban	1.8E−06	5.6E−07	3.4E−07	2.1E−07	9.4E−08	5.5E−09	1.9E−09	3.9E−10	1.2E−10	3.2E−11
Use of Paints and Coatings, Use of Paints and Coatings	Central Tendency	Rural	1.4E−07	1.1E−07	8.7E−08	6.6E−08	3.8E−08	3.2E−09	1.3E−09	2.2E−10	5.6E−11	1.3E−11
		Urban	3.0E−07	1.1E−07	6.4E−08	4.2E−08	1.9E−08	1.1E−09	3.9E−10	8.2E−11	2.5E−11	7.2E−12
	High-End	Rural	2.2E−07	1.8E−07	1.3E−07	9.1E−08	5.0E−08	4.1E−09	1.5E−09	2.7E−10	6.9E−11	1.6E−11
		Urban	4.4E−07	1.4E−07	8.0E−08	5.1E−08	2.2E−08	1.3E−09	4.5E−10	9.3E−11	2.7E−11	7.6E−12
Use of Paints and Coatings, Use of Paints and Coatings w/o Engineering Controls	Central Tendency	Rural	1.4E−07	1.1E−07	8.6E−08	6.5E−08	3.8E−08	3.2E−09	1.3E−09	2.2E−10	5.6E−11	1.3E−11
		Urban	3.0E−07	1.1E−07	6.4E−08	4.2E−08	1.9E−08	1.1E−09	3.9E−10	8.2E−11	2.5E−11	7.2E−12
	High-End	Rural	2.2E−07	1.8E−07	1.2E−07	9.0E−08	5.0E−08	4.0E−09	1.5E−09	2.7E−10	6.9E−11	1.6E−11
		Urban	4.4E−07	1.4E−07	8.0E−08	5.0E−08	2.2E−08	1.3E−09	4.5E−10	9.2E−11	2.7E−11	7.6E−12
Summary Statistics		**Max**	1.6E04	6.3E03	4.5E03	3.2E03	1.8E03	1.4E02	5.1E01	9.3E00	2.4E00	5.5E−01
		Mean	4.7E02	2.3E02	1.5E02	1.1E02	5.4E01	3.8E00	1.5E00	2.7E−01	7.0E−02	1.7E−02
		Median	5.6E−07	3.1E−07	2.0E−07	1.4E−07	6.7E−08	4.3E−09	1.6E−09	3.1E−10	8.7E−11	2.3E−11
		Min	3.7E−08	1.5E−08	7.9E−09	4.9E−09	1.8E−09	2.8E−11	9.2E−12	9.5E−13	1.7E−13	2.8E−14

Table_Apx C-7. DIDP 95th Percentile Daily Concentrations (µg/m³) Modeled from High-End Stack Release Source

Scenario	Meteorology	Distance										
		Land	**10M**	**30M**	**30-60M**	**60M**	**100M**	**100-1000M**	**1000M**	**2500M**	**5000M**	**10,000M**
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	2.6E−12	3.1E−10	2.0E−09	4.0E−09	9.0E−09	2.5E−09	1.4E−09	4.8E−10	3.3E−10	2.3E−10
		Urban	1.2E−11	1.1E−09	3.6E−09	6.0E−09	1.1E−08	3.0E−09	1.9E−09	6.3E−10	2.3E−10	7.4E−11
	High-End	Rural	1.6E−12	4.3E−10	2.9E−09	5.5E−09	1.2E−08	3.8E−09	2.0E−09	1.1E−09	8.3E−10	3.7E−10
		Urban	8.7E−12	1.6E−09	5.6E−09	9.4E−09	1.6E−08	5.1E−09	2.9E−09	8.4E−10	2.7E−10	8.3E−11
Commercial Uses Laboratory Chemicals_Scenario 2	Central Tendency	Rural	7.8E−09	9.3E−07	5.8E−06	1.2E−05	2.7E−05	7.6E−06	4.2E−06	1.5E−06	1.0E−06	7.6E−07
		Urban	3.6E−08	3.3E−06	1.1E−05	1.8E−05	3.1E−05	9.1E−06	5.7E−06	1.9E−06	7.0E−07	2.3E−07
	High-End	Rural	4.8E−09	1.3E−06	8.4E−06	1.6E−05	3.5E−05	1.1E−05	6.1E−06	3.2E−06	2.5E−06	1.1E−06
		Urban	2.6E−08	4.6E−06	1.6E−05	2.8E−05	4.9E−05	1.5E−05	8.8E−06	2.5E−06	8.2E−07	2.5E−07
Domestic Manufacturing, Manufacturing, Average PV	Central Tendency	Rural	3.5E−03	1.4E00	9.3E00	2.1E01	4.5E01	8.8E00	4.0E00	1.0E00	4.3E−01	1.7E−01
		Urban	2.0E−02	5.4E00	2.0E01	3.5E01	5.6E01	9.7E00	5.1E00	1.4E00	4.3E−01	1.4E−01
	High-End	Rural	2.3E−03	2.7E00	1.8E01	3.6E01	7.3E01	1.2E01	4.9E00	1.2E00	5.0E−01	1.7E−01
		Urban	2.2E−02	8.1E00	3.2E01	5.3E01	8.7E01	1.4E01	6.8E00	1.5E00	4.4E−01	1.4E−01
Domestic Manufacturing, Manufacturing, PV6: Troy Chemical Corp. Phoenix	Central Tendency	Rural	1.0E−09	1.8E−04	2.1E−03	6.1E−03	1.5E−02	2.1E−03	8.3E−04	1.2E−04	2.9E−05	1.1E−05
		Urban	3.7E−09	3.4E−04	3.3E−03	8.5E−03	1.8E−02	2.2E−03	8.9E−04	1.3E−04	3.4E−05	1.1E−05
	High-End	Rural	3.3E−08	5.3E−04	5.0E−03	1.1E−02	2.4E−02	2.6E−03	8.5E−04	1.1E−04	2.9E−05	1.1E−05
		Urban	3.5E−08	6.4E−04	5.4E−03	1.2E−02	2.5E−02	2.6E−03	8.6E−04	1.1E−04	3.0E−05	1.1E−05
Incorporation into other articles not covered elsewhere, Processing - Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	1.6E−11	1.9E−09	1.2E−08	2.5E−08	5.5E−08	1.6E−08	8.6E−09	3.0E−09	2.0E−09	1.4E−09
		Urban	7.5E−11	7.0E−09	2.2E−08	3.7E−08	6.5E−08	1.9E−08	1.2E−08	3.9E−09	1.4E−09	4.6E−10
	High-End	Rural	9.8E−12	2.7E−09	1.8E−08	3.4E−08	7.2E−08	2.3E−08	1.2E−08	6.7E−09	5.1E−09	2.3E−09
		Urban	5.4E−11	9.5E−09	3.4E−08	5.8E−08	1.0E−07	3.1E−08	1.8E−08	5.2E−09	1.7E−09	5.1E−10
Paint and Coating Manufacturing, Processing - Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	1.7E−13	2.0E−11	1.3E−10	2.6E−10	5.7E−10	1.6E−10	8.8E−11	3.1E−11	2.1E−11	1.5E−11
		Urban	7.7E−13	7.2E−11	2.3E−10	3.8E−10	6.7E−10	1.9E−10	1.2E−10	4.0E−11	1.4E−11	4.7E−12
	High-End	Rural	1.0E−13	2.7E−11	1.8E−10	3.5E−10	7.4E−10	2.4E−10	1.3E−10	6.9E−11	5.3E−11	2.3E−11
		Urban	5.5E−13	9.9E−11	3.5E−10	6.0E−10	1.0E−09	3.2E−10	1.9E−10	5.3E−11	1.7E−11	5.3E−12
Use of Paints and Coatings, Use of	Central Tendency	Rural	7.6E−05	8.4E−03	4.8E−02	9.9E−02	2.3E−01	6.3E−02	3.5E−02	1.2E−02	8.4E−03	6.6E−03
		Urban	3.2E−04	2.7E−02	8.4E−02	1.4E−01	2.6E−01	7.5E−02	4.6E−02	1.5E−02	5.5E−03	1.8E−03

Scenario	Meteorology	Land	10M	30M	30-60M	60M	100M	100-1000M	1000M	2500M	5000M	10,000M
Paints and Coatings	High-End	Rural	4.4E−05	1.1E−02	7.2E−02	1.4E−01	2.8E−01	9.9E−02	5.3E−02	2.7E−02	2.0E−02	9.4E−03
		Urban	2.1E−04	3.9E−02	1.4E−01	2.4E−01	4.1E−01	1.2E−01	7.2E−02	2.1E−02	6.7E−03	2.0E−03
Summary Statistics		**Max**	2.2E−02	8.1E00	3.2E01	5.3E01	8.7E01	1.4E01	6.8E00	1.5E00	5.0E−01	1.7E−01
		Mean	1.7E−03	6.3E−01	2.8E00	5.2E00	9.4E00	1.6E00	7.5E−01	1.8E−01	6.6E−02	2.3E−02
		Median	4.3E−09	2.3E−06	9.5E−06	1.7E−05	3.3E−05	1.0E−05	5.9E−06	2.2E−06	9.2E−07	5.0E−07
		Min	1.0E−13	2.0E−11	1.3E−10	2.6E−10	5.7E−10	1.6E−10	8.8E−11	3.1E−11	1.4E−11	4.7E−12

Table_Apx C-8. DIDP 95th Percentile Annual Deposition Rate (g/m^2) Modeled from High-End Fugitive Release Source

Scenario	Meteorology	Distance										
		Land	10M	30M	30-60M	60M	100M	100-1000M	1000M	2500M	5000M	10,000M
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	5.0E−08	5.2E−08	4.3E−08	2.5E−08	1.4E−08	3.2E−09	4.5E−10	7.4E−11	1.9E−11	4.9E−12
		Urban	1.1E−07	7.2E−08	5.6E−08	2.7E−08	1.1E−08	1.6E−09	1.8E−10	3.6E−11	1.1E−11	3.6E−12
	High-End	Rural	1.3E−07	9.0E−08	6.6E−08	3.9E−08	2.1E−08	4.3E−09	5.8E−10	9.9E−11	2.6E−11	6.6E−12
		Urban	2.1E−07	1.1E−07	8.7E−08	3.7E−08	1.5E−08	1.7E−09	2.3E−10	4.7E−11	1.4E−11	4.3E−12
Commercial Uses Laboratory Chemicals_Scenario 1	Central Tendency	Rural	4.6E−09	4.8E−09	4.0E−09	2.3E−09	1.3E−09	3.0E−10	4.3E−11	7.1E−12	1.9E−12	4.7E−13
		Urban	1.0E−08	6.7E−09	5.3E−09	2.6E−09	1.1E−09	1.4E−10	1.7E−11	3.4E−12	1.1E−12	3.3E−13
	High-End	Rural	1.2E−08	8.2E−09	6.1E−09	3.6E−09	2.0E−09	4.0E−10	5.4E−11	9.2E−12	2.4E−12	6.1E−13
		Urban	1.9E−08	1.0E−08	8.1E−09	3.5E−09	1.4E−09	1.6E−10	2.1E−11	4.4E−12	1.3E−12	4.0E−13
Domestic Manufacturing, Manufacturing, Average PV	Central Tendency	Rural	1.3E−05	1.1E−05	8.5E−06	4.5E−06	1.9E−06	3.2E−07	4.6E−08	7.4E−09	2.2E−09	6.7E−10
		Urban	1.9E−05	1.5E−05	1.1E−05	5.2E−06	2.0E−06	2.1E−07	2.2E−08	4.4E−09	1.5E−09	5.5E−10
	High-End	Rural	3.4E−05	1.8E−05	1.3E−05	6.3E−06	2.6E−06	3.0E−07	3.9E−08	7.1E−09	2.3E−09	7.1E−10
		Urban	4.0E−05	2.0E−05	1.5E−05	6.2E−06	2.3E−06	2.3E−07	2.6E−08	4.8E−09	1.6E−09	5.9E−10
Domestic Manufacturing, Manufacturing, PV6: Troy Chemical Corp. Phoenix	Central Tendency	Rural	1.4E−06	1.4E−06	1.1E−06	5.5E−07	2.1E−07	2.2E−08	2.0E−09	3.7E−10	1.2E−10	4.3E−11
		Urban	1.5E−06	1.7E−06	1.2E−06	6.1E−07	2.3E−07	2.2E−08	1.9E−09	3.2E−10	1.0E−10	3.9E−11
	High-End	Rural	5.0E−06	2.6E−06	1.6E−06	7.9E−07	2.8E−07	2.3E−08	2.0E−09	3.1E−10	1.0E−10	4.2E−11
		Urban	5.0E−06	2.6E−06	1.7E−06	7.9E−07	2.8E−07	2.3E−08	2.0E−09	2.9E−10	9.6E−11	4.1E−11
Incorporation into other articles not covered elsewhere,	Central Tendency	Rural	1.6E−06	1.6E−06	1.4E−06	7.7E−07	4.2E−07	1.0E−07	1.4E−08	2.3E−09	6.1E−10	1.5E−10
		Urban	3.4E−06	2.3E−06	1.8E−06	8.6E−07	3.5E−07	4.9E−08	5.5E−09	1.1E−09	3.5E−10	1.1E−10
	High-End	Rural	4.2E−06	2.8E−06	2.1E−06	1.2E−06	6.7E−07	1.4E−07	1.8E−08	3.1E−09	8.2E−10	2.1E−10

Scenario	Meteorology	Distance										
		Land	**10M**	**30M**	**30-60M**	**60M**	**100M**	**100-1000M**	**1000M**	**2500M**	**5000M**	**10,000M**
Processing - Incorporation into formulation, mixture, or reaction product		Urban	6.6E-06	3.4E-06	2.7E-06	1.2E-06	4.6E-07	5.3E-08	7.2E-09	1.5E-09	4.5E-10	1.4E-10
Manufacturing - Import , Import - Repackaging, PV1: LG Hausys America, Inc.	Central Tendency	Rural	4.1E−09	4.3E−09	3.3E−09	1.6E−09	5.7E−10	5.6E−11	4.6E−12	7.6E−13	2.6E−13	1.0E−13
		Urban	4.8E−09	4.9E−09	3.8E−09	1.7E−09	6.4E−10	5.9E−11	5.0E−12	7.6E−13	2.6E−13	1.1E−13
	High-End	Rural	1.3E−08	7.2E−09	4.8E−09	2.2E−09	7.8E−10	6.2E−11	5.3E−12	7.1E−13	2.3E−13	9.3E−14
		Urban	1.4E−08	7.3E−09	4.9E−09	2.2E−09	7.9E−10	6.2E−11	5.3E−12	7.2E−13	2.4E−13	9.8E−14
Manufacturing - Import , Import - Repackaging, PV2: Harwick Standard Distribution Corp.	Central Tendency	Rural	9.8E−09	1.0E−08	7.8E−09	3.7E−09	1.4E−09	1.3E−10	1.1E−11	1.8E−12	6.1E−13	2.4E−13
		Urban	1.1E−08	1.2E−08	9.0E−09	4.2E−09	1.5E−09	1.4E−10	1.2E−11	1.8E−12	6.3E−13	2.6E−13
	High-End	Rural	3.2E−08	1.7E−08	1.1E−08	5.3E−09	1.9E−09	1.5E−10	1.3E−11	1.7E−12	5.4E−13	2.2E−13
		Urban	3.2E−08	1.8E−08	1.2E−08	5.3E−09	1.9E−09	1.5E−10	1.3E−11	1.7E−12	5.7E−13	2.3E−13
Manufacturing - Import , Import - Repackaging, PV3: Tremco Incorporated	Central Tendency	Rural	2.5E−08	2.7E−08	2.0E−08	9.7E−09	3.7E−09	4.3E−10	3.8E−11	6.7E−12	2.0E−12	7.0E−13
		Urban	2.9E−08	3.0E−08	2.3E−08	1.1E−08	4.1E−09	3.9E−10	3.4E−11	6.1E−12	2.0E−12	7.3E−13
	High-End	Rural	8.5E−08	4.7E−08	3.0E−08	1.4E−08	5.1E−09	3.9E−10	3.6E−11	5.2E−12	1.6E−12	6.2E−13
		Urban	8.6E−08	4.7E−08	3.1E−08	1.4E−08	5.2E−09	3.9E−10	3.6E−11	4.9E−12	1.6E−12	6.1E−13
Manufacturing - Import , Import - Repackaging, PV4: Akrochem Corp.	Central Tendency	Rural	3.3E−09	3.4E−09	2.6E−09	1.2E−09	4.6E−10	4.5E−11	3.7E−12	6.1E−13	2.1E−13	8.1E−14
		Urban	3.8E−09	3.9E−09	3.0E−09	1.4E−09	5.2E−10	4.7E−11	4.0E−12	6.1E−13	2.1E−13	8.9E−14
	High-End	Rural	1.1E−08	5.8E−09	3.8E−09	1.8E−09	6.2E−10	5.0E−11	4.2E−12	5.7E−13	1.8E−13	7.5E−14
		Urban	1.1E−08	5.9E−09	3.9E−09	1.8E−09	6.3E−10	5.0E−11	4.3E−12	5.8E−13	1.9E−13	7.9E−14
Non-PVC Plastic Compounding	Central Tendency	Rural	1.7E01	1.8E01	1.4E01	8.7E00	4.7E00	1.2E00	1.7E−01	2.7E−02	7.1E−03	1.9E−03
		Urban	3.8E01	2.6E01	2.1E01	1.0E01	4.2E00	5.3E−01	6.7E−02	1.4E−02	4.4E−03	1.4E−03
	High-End	Rural	4.6E01	3.1E01	2.4E01	1.4E01	7.8E00	1.5E00	2.1E−01	3.6E−02	9.6E−03	2.4E−03
		Urban	7.4E01	4.0E01	3.1E01	1.4E01	5.4E00	6.1E−01	8.4E−02	1.7E−02	5.4E−03	1.6E−03
Non-PVC Plastic Converting	Central Tendency	Rural	4.4E−01	4.6E−01	3.8E−01	2.2E−01	1.2E−01	2.8E−02	3.9E−03	6.5E−04	1.7E−04	4.3E−05
		Urban	9.5E−01	6.3E−01	5.0E−01	2.4E−01	9.9E−02	1.4E−02	1.6E−03	3.2E−04	9.9E−05	3.1E−05
	High-End	Rural	1.2E00	7.9E−01	5.8E−01	3.4E−01	1.9E−01	3.8E−02	5.2E−03	8.7E−04	2.3E−04	5.8E−05
		Urban	1.9E00	9.5E−01	7.7E−01	3.3E−01	1.3E−01	1.5E−02	2.0E−03	4.2E−04	1.3E−04	3.8E−05
Other Uses - Inspection Fluid/Penetrant, Use of Inspection Fluid/Penetrant	Central Tendency	Rural	7.2E−03	7.5E−03	6.2E−03	3.5E−03	1.9E−03	4.6E−04	6.4E−05	1.1E−05	2.8E−06	7.0E−07
		Urban	1.5E−02	1.0E−02	8.1E−03	3.9E−03	1.6E−03	2.2E−04	2.5E−05	5.2E−06	1.6E−06	5.1E−07
	High-End	Rural	1.9E−02	1.3E−02	9.4E−03	5.5E−03	3.1E−03	6.1E−04	8.3E−05	1.4E−05	3.7E−06	9.5E−07
		Urban	3.0E−02	1.5E−02	1.3E−02	5.3E−03	2.1E−03	2.4E−04	3.3E−05	6.8E−06	2.1E−06	6.2E−07

Scenario	Meteorology	Distance										
		Land	10M	30M	30-60M	60M	100M	100-1000M	1000M	2500M	5000M	10,000M
(Aerosol)												
Other Uses - Inspection Fluid/Penetrant, Use of Inspection Fluid/Penetrant (Non-Aerosol)	Central Tendency	Rural	6.8E−09	7.1E−09	5.9E−09	3.3E−09	1.8E−09	4.3E−10	6.1E−11	1.0E−11	2.6E−12	6.6E−13
		Urban	1.5E−08	9.8E−09	7.7E−09	3.7E−09	1.5E−09	2.1E−10	2.4E−11	4.9E−12	1.5E−12	4.8E−13
	High-End	Rural	1.8E−08	1.2E−08	9.0E−09	5.3E−09	2.9E−09	5.8E−10	7.9E−11	1.3E−11	3.6E−12	9.0E−13
		Urban	2.9E−08	1.5E−08	1.2E−08	5.0E−09	2.0E−09	2.3E−10	3.1E−11	6.4E−12	2.0E−12	5.9E−13
Paint and Coating Manufacturing, Processing - Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	2.4E−08	2.5E−08	2.1E−08	1.2E−08	6.5E−09	1.5E−09	2.1E−10	3.5E−11	9.3E−12	2.3E−12
		Urban	5.2E−08	3.4E−08	2.7E−08	1.3E−08	5.4E−09	7.4E−10	8.5E−11	1.7E−11	5.4E−12	1.7E−12
	High-End	Rural	6.3E−08	4.3E−08	3.2E−08	1.9E−08	1.0E−08	2.1E−09	2.8E−10	4.7E−11	1.3E−11	3.2E−12
		Urban	1.0E−07	5.2E−08	4.2E−08	1.8E−08	7.0E−09	8.2E−10	1.1E−10	2.3E−11	6.9E−12	2.1E−12
Plastic Compounding	Central Tendency	Rural	3.5E02	3.7E02	3.0E02	1.7E02	9.5E01	2.3E01	3.2E00	5.2E−01	1.4E−01	3.4E−02
		Urban	7.6E02	5.1E02	4.0E02	1.9E02	7.9E01	1.1E01	1.2E00	2.5E−01	7.9E−02	2.5E−02
	High-End	Rural	9.3E02	6.3E02	4.7E02	2.7E02	1.5E02	3.0E01	4.1E00	7.0E−01	1.8E−01	4.7E−02
		Urban	1.5E03	7.6E02	6.1E02	2.6E02	1.0E02	1.2E01	1.6E00	3.3E−01	1.0E−01	3.1E−02
Plastic Converting	Central Tendency	Rural	1.6E01	1.7E01	1.4E01	8.0E00	4.4E00	1.0E00	1.5E−01	2.4E−02	6.3E−03	1.6E−03
		Urban	3.5E01	2.3E01	1.8E01	8.9E00	3.7E00	5.0E−01	5.7E−02	1.2E−02	3.7E−03	1.2E−03
	High-End	Rural	4.3E01	2.9E01	2.2E01	1.3E01	7.0E00	1.4E00	1.9E−01	3.2E−02	8.5E−03	2.2E−03
		Urban	6.8E01	3.5E01	2.8E01	1.2E01	4.8E00	5.5E−01	7.5E−02	1.5E−02	4.7E−03	1.4E−03
Processing - Repackaging, Import - Repackaging, Average PV CAS 1	Central Tendency	Rural	6.2E−09	6.4E−09	4.9E−09	2.3E−09	8.6E−10	8.5E−11	6.9E−12	1.2E−12	3.9E−13	1.5E−13
		Urban	7.2E−09	7.4E−09	5.7E−09	2.6E−09	9.7E−10	8.9E−11	7.5E−12	1.1E−12	4.0E−13	1.7E−13
	High-End	Rural	2.0E−08	1.1E−08	7.2E−09	3.3E−09	1.2E−09	9.3E−11	8.0E−12	1.1E−12	3.4E−13	1.4E−13
		Urban	2.0E−08	1.1E−08	7.4E−09	3.4E−09	1.2E−09	9.4E−11	8.0E−12	1.1E−12	3.6E−13	1.5E−13
Processing - Repackaging, Import - Repackaging, Average PV CAS 2	Central Tendency	Rural	8.2E−06	8.6E−06	7.2E−06	4.1E−06	2.3E−06	5.5E−07	7.7E−08	1.3E−08	3.3E−09	8.4E−10
		Urban	1.8E−05	1.2E−05	9.6E−06	4.6E−06	1.9E−06	2.6E−07	3.0E−08	6.2E−09	2.0E−09	6.2E−10
	High-End	Rural	2.2E−05	1.5E−05	1.1E−05	6.5E−06	3.6E−06	7.2E−07	9.7E−08	1.7E−08	4.4E−09	1.1E−09
		Urban	3.5E−05	1.8E−05	1.5E−05	6.2E−06	2.5E−06	2.9E−07	3.8E−08	7.9E−09	2.4E−09	7.2E−10
Processing - Repackaging, Import - Repackaging, PV4: Akrochem Corp. (CT Release)	Central Tendency	Rural	2.4E−09	2.5E−09	1.9E−09	9.3E−10	3.5E−10	3.3E−11	2.7E−12	4.5E−13	1.5E−13	5.9E−14
		Urban	2.8E−09	2.9E−09	2.1E−09	1.1E−09	3.9E−10	3.6E−11	2.8E−12	4.6E−13	1.5E−13	6.1E−14
	High-End	Rural	8.6E−09	4.3E−09	2.9E−09	1.3E−09	4.5E−10	3.9E−11	3.2E−12	4.5E−13	1.5E−13	6.5E−14
		Urban	8.7E−09	4.3E−09	3.0E−09	1.3E−09	4.6E−10	3.9E−11	3.2E−12	4.6E−13	1.5E−13	6.6E−14

Scenario	Meteorology	Distance										
		Land	**10M**	**30M**	**30-60M**	**60M**	**100M**	**100-1000M**	**1000M**	**2500M**	**5000M**	**10,000M**
Processing - Repackaging, Import - Repackaging, PV5: Chemspec, Ltd.	Central Tendency	Rural	1.1E−08	1.2E−08	8.9E−09	4.2E−09	1.5E−09	1.5E−10	1.2E−11	2.1E−12	6.9E−13	2.7E−13
		Urban	1.3E−08	1.3E−08	1.0E−08	4.7E−09	1.7E−09	1.6E−10	1.4E−11	2.1E−12	7.2E−13	3.0E−13
	High-End	Rural	3.6E−08	2.0E−08	1.3E−08	5.9E−09	2.1E−09	1.7E−10	1.4E−11	1.9E−12	6.1E−13	2.5E−13
		Urban	3.7E−08	2.0E−08	1.3E−08	6.0E−09	2.1E−09	1.7E−10	1.4E−11	1.9E−12	6.4E−13	2.7E−13
Use of Adhesives and Sealants, Use of Adhesives and Sealants	Central Tendency	Rural	4.5E−08	4.9E−08	3.8E−08	2.3E−08	1.2E−08	3.0E−09	4.0E−10	6.7E−11	1.9E−11	5.0E−12
		Urban	9.6E−08	6.9E−08	5.3E−08	2.7E−08	1.1E−08	1.4E−09	1.7E−10	3.6E−11	1.1E−11	3.5E−12
	High-End	Rural	1.2E−07	8.2E−08	6.0E−08	3.6E−08	2.0E−08	4.0E−09	5.4E−10	9.3E−11	2.5E−11	6.3E−12
		Urban	1.9E−07	1.0E−07	8.2E−08	3.5E−08	1.4E−08	1.6E−09	2.2E−10	4.4E−11	1.4E−11	4.1E−12
Use of Paints and Coatings, Use of Paints and Coatings	Central Tendency	Rural	1.0E−08	1.1E−08	8.6E−09	5.2E−09	2.9E−09	7.1E−10	9.9E−11	1.6E−11	4.3E−12	1.2E−12
		Urban	2.3E−08	1.6E−08	1.2E−08	6.1E−09	2.5E−09	3.2E−10	4.0E−11	8.3E−12	2.6E−12	8.3E−13
	High-End	Rural	2.8E−08	1.9E−08	1.4E−08	8.4E−09	4.7E−09	9.2E−10	1.3E−10	2.2E−11	5.8E−12	1.5E−12
		Urban	4.4E−08	2.4E−08	1.9E−08	8.2E−09	3.3E−09	3.7E−10	5.1E−11	1.1E−11	3.2E−12	9.8E−13
Use of Paints and Coatings, Use of Paints and Coatings w/o Engineering Controls	Central Tendency	Rural	1.0E−08	1.1E−08	8.5E−09	5.2E−09	2.8E−09	7.1E−10	9.9E−11	1.6E−11	4.2E−12	1.1E−12
		Urban	2.2E−08	1.6E−08	1.2E−08	6.1E−09	2.5E−09	3.2E−10	4.0E−11	8.3E−12	2.6E−12	8.3E−13
	High-End	Rural	2.7E−08	1.9E−08	1.4E−08	8.4E−09	4.7E−09	9.1E−10	1.3E−10	2.2E−11	5.7E−12	1.5E−12
		Urban	4.4E−08	2.4E−08	1.9E−08	8.2E−09	3.3E−09	3.7E−10	5.1E−11	1.1E−11	3.2E−12	9.7E−13
Summary Statistics		**Max**	1.5E03	7.6E02	6.1E02	2.7E02	1.5E02	3.0E01	4.1E00	7.0E−01	1.8E−01	4.7E−02
		Mean	4.2E01	2.7E01	2.1E01	1.1E01	5.1E00	9.0E−01	1.2E−01	2.2E−02	6.0E−03	1.6E−03
		Median	5.8E−08	4.7E−08	3.1E−08	1.6E−08	6.8E−09	1.2E−09	1.5E−10	2.9E−11	8.1E−12	2.2E−12
		Min	2.4E−09	2.5E−09	1.9E−09	9.3E−10	3.5E−10	3.3E−11	2.7E−12	4.5E−13	1.5E−13	5.9E−14

Table_Apx C-9. DIDP 95th Percentile Annual Deposition Rate (g/m²) Modeled from High-End Stack Release Source

Scenario	Meteorology	Distance										
		Land	**10M**	**30M**	**30-60M**	**60M**	**100M**	**100-1000M**	**1000M**	**2500M**	**5000M**	**10,000M**
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	8.7E−09	3.0E−09	2.4E−09	2.2E−09	3.0E−09	1.2E−09	2.3E−10	5.7E−11	3.0E−11	2.3E−11
		Urban	8.0E−09	3.1E−09	2.7E−09	2.7E−09	3.7E−09	1.3E−09	2.5E−10	7.3E−11	2.5E−11	8.4E−12
	High-End	Rural	9.5E−09	3.0E−09	3.1E−09	3.3E−09	4.7E−09	1.5E−09	3.8E−10	1.1E−10	7.6E−11	3.2E−11
		Urban	9.1E−09	3.5E−09	3.9E−09	4.4E−09	6.0E−09	1.8E−09	3.7E−10	9.7E−11	3.3E−11	1.0E−11
Commercial Uses Laboratory Chemicals_Scenario 2	Central Tendency	Rural	2.7E−05	9.0E−06	7.2E−06	6.5E−06	8.8E−06	3.4E−06	6.8E−07	1.8E−07	9.3E−08	7.0E−08
		Urban	2.5E−05	9.3E−06	8.2E−06	8.0E−06	1.1E−05	4.0E−06	7.7E−07	2.3E−07	7.8E−08	2.6E−08
	High-End	Rural	2.8E−05	8.8E−06	9.1E−06	9.9E−06	1.4E−05	4.6E−06	1.1E−06	3.2E−07	2.3E−07	9.6E−08
		Urban	2.7E−05	1.1E−05	1.2E−05	1.3E−05	1.8E−05	5.4E−06	1.1E−06	2.9E−07	9.8E−08	3.1E−08
Domestic Manufacturing, Manufacturing, Average PV	Central Tendency	Rural	1.3E01	5.3E00	5.5E00	6.9E00	1.3E01	4.7E00	7.1E−01	1.9E−01	7.6E−02	4.6E−02
		Urban	1.2E01	6.7E00	8.7E00	1.1E01	1.7E01	5.6E00	7.8E−01	1.9E−01	7.2E−02	2.7E−02
	High-End	Rural	4.3E01	1.4E01	1.5E01	1.6E01	2.4E01	7.3E00	1.2E00	2.6E−01	1.1E−01	4.7E−02
		Urban	4.1E01	1.7E01	1.9E01	2.1E01	2.9E01	8.2E00	1.1E00	2.4E−01	7.9E−02	2.9E−02
Domestic Manufacturing, Manufacturing, PV6: Troy Chemical Corp. Phoenix	Central Tendency	Rural	2.1E−03	7.8E−04	1.4E−03	2.0E−03	4.2E−03	1.6E−03	1.9E−04	3.5E−05	1.2E−05	5.6E−06
		Urban	1.8E−03	7.2E−04	1.6E−03	2.4E−03	4.9E−03	1.8E−03	2.1E−04	3.9E−05	1.2E−05	4.8E−06
	High-End	Rural	3.5E−03	1.5E−03	3.1E−03	4.8E−03	8.9E−03	2.5E−03	2.6E−04	3.9E−05	1.3E−05	5.2E−06
		Urban	3.3E−03	1.2E−03	3.1E−03	5.0E−03	9.1E−03	2.5E−03	2.7E−04	3.8E−05	1.2E−05	5.0E−06
Incorporation into other articles not covered elsewhere, Processing - Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	5.4E−08	1.8E−08	1.5E−08	1.3E−08	1.8E−08	7.1E−09	1.4E−09	3.5E−10	1.9E−10	1.4E−10
		Urban	5.0E−08	1.9E−08	1.7E−08	1.6E−08	2.3E−08	8.1E−09	1.6E−09	4.5E−10	1.6E−10	5.2E−11
	High-End	Rural	5.8E−08	1.8E−08	1.9E−08	2.1E−08	2.9E−08	9.5E−09	2.3E−09	6.7E−10	4.7E−10	2.0E−10
		Urban	5.6E−08	2.2E−08	2.4E−08	2.7E−08	3.7E−08	1.1E−08	2.3E−09	6.0E−10	2.0E−10	6.3E−11
Paint and Coating Manufacturing, Processing - Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	5.5E−10	1.9E−10	1.5E−10	1.4E−10	1.9E−10	7.4E−11	1.4E−11	3.7E−12	1.9E−12	1.4E−12
		Urban	5.1E−10	2.0E−10	1.7E−10	1.7E−10	2.3E−10	8.4E−11	1.6E−11	4.6E−12	1.6E−12	5.4E−13
	High-End	Rural	6.0E−10	1.9E−10	2.0E−10	2.1E−10	3.0E−10	9.8E−11	2.4E−11	6.9E−12	4.8E−12	2.0E−12
		Urban	5.8E−10	2.3E−10	2.5E−10	2.8E−10	3.8E−10	1.1E−10	2.4E−11	6.2E−12	2.1E−12	6.5E−13
Use of Paints and	Central	Rural	2.1E−01	7.4E−02	5.7E−02	5.2E−02	7.6E−02	2.8E−02	6.0E−03	1.5E−03	8.3E−04	6.0E−04

Scenario	Meteorology	Distance										
		Land	**10M**	**30M**	**30-60M**	**60M**	**100M**	**100-1000M**	**1000M**	**2500M**	**5000M**	**10,000M**
Coatings, Use of Paints and Coatings	Tendency	Urban	1.9E−01	7.5E−02	6.4E−02	6.7E−02	9.4E−02	3.3E−02	6.7E−03	2.0E−03	7.0E−04	2.3E−04
	High-End	Rural	2.6E−01	8.1E−02	8.2E−02	8.2E−02	1.2E−01	4.0E−02	9.3E−03	2.8E−03	2.0E−03	8.3E−04
		Urban	2.5E−01	9.5E−02	9.7E−02	1.1E−01	1.5E−01	4.6E−02	1.0E−02	2.6E−03	8.7E−04	2.8E−04
Summary Statistics		**Max**	4.3E01	1.7E01	1.9E01	2.1E01	2.9E01	8.2E00	1.2E00	2.6E−01	1.1E−01	4.7E−02
		Mean	3.9E00	1.5E00	1.7E00	2.0E00	3.0E00	9.3E−01	1.4E−01	3.2E−02	1.2E−02	5.4E−03
		Median	2.7E−05	9.2E−06	8.6E−06	8.9E−06	1.2E−05	4.3E−06	9.4E−07	2.6E−07	9.6E−08	5.1E−08
		Min	5.1E−10	1.9E−10	1.5E−10	1.4E−10	1.9E−10	7.4E−11	1.4E−11	3.7E−12	1.6E−12	5.4E−13

Table_Apx C-10. DIDP 95th Percentile Daily Deposition Rate (g/m^2) Modeled from High-End Fugitive Release Source

Scenario	Meteorology	Distance										
		Land	**10M**	**30M**	**30-60M**	**60M**	**100M**	**100-1000M**	**1000M**	**2500M**	**5000M**	**10,000M**
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	1.5E−10	1.4E−10	8.7E−11	6.1E−11	3.2E−11	2.7E−12	1.0E−12	1.9E−13	5.0E−14	1.3E−14
		Urban	2.6E−10	1.8E−10	1.0E−10	6.5E−11	2.6E−11	1.2E−12	4.2E−13	9.0E−14	2.9E−14	8.9E−15
	High-End	Rural	2.9E−10	1.8E−10	1.2E−10	8.2E−11	4.5E−11	3.4E−12	1.2E−12	2.3E−13	6.0E−14	1.5E−14
		Urban	4.6E−10	2.2E−10	1.3E−10	7.4E−11	3.0E−11	1.4E−12	4.8E−13	9.9E−14	3.0E−14	9.3E−15
Commercial Uses Laboratory Chemicals_Scenario 1	Central Tendency	Rural	1.3E−11	1.2E−11	7.9E−12	5.6E−12	3.0E−12	2.6E−13	9.7E−14	1.8E−14	4.8E−15	1.3E−15
		Urban	2.4E−11	1.6E−11	9.5E−12	6.0E−12	2.4E−12	1.2E−13	4.0E−14	8.4E−15	2.7E−15	8.3E−16
	High-End	Rural	2.7E−11	1.7E−11	1.1E−11	7.5E−12	4.1E−12	3.2E−13	1.1E−13	2.1E−14	5.6E−15	1.4E−15
		Urban	4.2E−11	2.0E−11	1.1E−11	6.8E−12	2.7E−12	1.3E−13	4.4E−14	9.2E−15	2.8E−15	8.6E−16
Domestic Manufacturing, Manufacturing, Average PV	Central Tendency	Rural	3.4E−08	3.4E−08	2.0E−08	1.3E−08	5.6E−09	1.9E−10	6.5E−11	1.1E−11	3.4E−12	1.1E−12
		Urban	5.5E−08	4.3E−08	2.4E−08	1.5E−08	5.7E−09	1.6E−10	6.0E−11	1.2E−11	3.9E−12	1.3E−12
	High-End	Rural	8.8E−08	4.9E−08	2.6E−08	1.6E−08	6.4E−09	2.3E−10	6.9E−11	1.2E−11	3.8E−12	1.3E−12
		Urban	1.1E−07	5.3E−08	2.8E−08	1.6E−08	5.9E−09	1.7E−10	6.1E−11	1.2E−11	4.2E−12	1.5E−12
Domestic Manufacturing, Manufacturing, PV6: Troy Chemical Corp.	Central Tendency	Rural	3.1E−09	4.6E−09	2.6E−09	1.7E−09	6.5E−10	1.1E−11	4.1E−12	5.2E−13	1.1E−13	2.6E−14
		Urban	4.1E−09	5.4E−09	3.0E−09	1.9E−09	7.0E−10	1.2E−11	4.6E−12	6.0E−13	1.4E−13	3.6E−14
	High-End	Rural	1.1E−08	6.8E−09	3.5E−09	2.1E−09	7.4E−10	1.4E−11	4.8E−12	6.3E−13	1.8E−13	5.9E−14

Scenario	Meteorology	Distance										
		Land	10M	30M	30-60M	60M	100M	100-1000M	1000M	2500M	5000M	10,000M
Phoenix		Urban	1.1E−08	6.9E−09	3.5E−09	2.1E−09	7.4E−10	1.4E−11	4.9E−12	6.5E−13	1.8E−13	6.2E−14
Incorporation into other articles not covered elsewhere, Processing - Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	4.6E−09	4.3E−09	2.7E−09	1.9E−09	1.0E−09	8.6E−11	3.2E−11	5.9E−12	1.6E−12	4.1E−13
		Urban	8.2E−09	5.5E−09	3.2E−09	2.0E−09	8.2E−10	3.9E−11	1.3E−11	2.8E−12	9.0E−13	2.8E−13
	High-End	Rural	9.2E−09	5.8E−09	3.7E−09	2.6E−09	1.4E−09	1.1E−10	3.8E−11	7.0E−12	1.9E−12	4.6E−13
		Urban	1.5E−08	6.9E−09	3.9E−09	2.3E−09	9.3E−10	4.5E−11	1.5E−11	3.1E−12	9.5E−13	2.9E−13
Manufacturing - Import , Import - Repackaging, PV1: LG Hausys America, Inc.	Central Tendency	Rural	1.0E−11	1.3E−11	7.3E−12	4.6E−12	1.7E−12	3.3E−14	1.2E−14	1.7E−15	4.5E−16	1.4E−16
		Urban	1.3E−11	1.5E−11	8.4E−12	5.1E−12	1.9E−12	3.7E−14	1.3E−14	1.9E−15	5.1E−16	1.6E−16
	High-End	Rural	2.7E−11	1.7E−11	9.1E−12	5.3E−12	1.9E−12	4.0E−14	1.3E−14	1.8E−15	5.4E−16	2.1E−16
		Urban	2.8E−11	1.7E−11	9.3E−12	5.4E−12	1.9E−12	4.0E−14	1.4E−14	1.9E−15	5.4E−16	2.1E−16
Manufacturing - Import , Import - Repackaging, PV2: Harwick Standard Distribution Corp.	Central Tendency	Rural	2.5E−11	3.1E−11	1.7E−11	1.1E−11	4.1E−12	8.0E−14	2.9E−14	4.1E−15	1.1E−15	3.2E−16
		Urban	3.0E−11	3.5E−11	2.0E−11	1.2E−11	4.4E−12	8.8E−14	3.2E−14	4.5E−15	1.2E−15	3.9E−16
	High-End	Rural	6.6E−11	4.1E−11	2.2E−11	1.3E−11	4.5E−12	9.5E−14	3.2E−14	4.4E−15	1.3E−15	5.0E−16
		Urban	6.7E−11	4.2E−11	2.2E−11	1.3E−11	4.5E−12	9.6E−14	3.2E−14	4.5E−15	1.3E−15	5.1E−16
Manufacturing - Import , Import - Repackaging, PV3: Tremco Incorporated	Central Tendency	Rural	6.5E−11	7.7E−11	4.5E−11	2.9E−11	1.1E−11	2.3E−13	8.2E−14	1.2E−14	3.2E−15	1.1E−15
		Urban	7.7E−11	8.8E−11	5.0E−11	3.1E−11	1.2E−11	2.5E−13	8.8E−14	1.3E−14	3.6E−15	1.3E−15
	High-End	Rural	1.6E−10	1.0E−10	5.5E−11	3.2E−11	1.2E−11	2.6E−13	8.4E−14	1.2E−14	3.5E−15	1.4E−15
		Urban	1.7E−10	1.0E−10	5.6E−11	3.2E−11	1.2E−11	2.6E−13	8.5E−14	1.2E−14	3.5E−15	1.4E−15
Manufacturing - Import , Import - Repackaging, PV4: Akrochem Corp.	Central Tendency	Rural	8.2E−12	1.0E−11	5.8E−12	3.7E−12	1.4E−12	2.7E−14	9.7E−15	1.4E−15	3.6E−16	1.1E−16
		Urban	1.0E−11	1.2E−11	6.7E−12	4.1E−12	1.5E−12	2.9E−14	1.1E−14	1.5E−15	4.1E−16	1.3E−16
	High-End	Rural	2.2E−11	1.4E−11	7.3E−12	4.3E−12	1.5E−12	3.2E−14	1.1E−14	1.5E−15	4.3E−16	1.7E−16
		Urban	2.3E−11	1.4E−11	7.4E−12	4.3E−12	1.5E−12	3.2E−14	1.1E−14	1.5E−15	4.4E−16	1.7E−16
Non-PVC Plastic Compounding	Central Tendency	Rural	4.9E−02	4.4E−02	2.8E−02	2.0E−02	1.0E−02	9.8E−04	3.6E−04	6.7E−05	1.8E−05	4.8E−06
		Urban	8.6E−02	5.7E−02	3.4E−02	2.1E−02	8.6E−03	4.3E−04	1.4E−04	3.1E−05	9.8E−06	3.0E−06
	High-End	Rural	9.7E−02	6.0E−02	3.8E−02	2.7E−02	1.5E−02	1.2E−03	4.1E−04	7.5E−05	2.0E−05	5.1E−06
		Urban	1.5E−01	7.1E−02	4.1E−02	2.4E−02	9.7E−03	5.0E−04	1.6E−04	3.4E−05	1.0E−05	3.2E−06
Non-PVC Plastic	Central	Rural	1.3E−03	1.2E−03	7.7E−04	5.4E−04	2.8E−04	2.4E−05	9.0E−06	1.7E−06	4.4E−07	1.1E−07

Scenario	Meteorology	Distance										
		Land	10M	30M	30-60M	60M	100M	100-1000M	1000M	2500M	5000M	10,000M
Converting	Tendency	Urban	2.3E−03	1.6E−03	9.1E−04	5.7E−04	2.3E−04	1.1E−05	3.7E−06	7.9E−07	2.5E−07	7.9E−08
	High-End	Rural	2.6E−03	1.6E−03	1.0E−03	7.2E−04	4.0E−04	3.0E−05	1.1E−05	2.0E−06	5.3E−07	1.3E−07
		Urban	4.1E−03	1.9E−03	1.1E−03	6.6E−04	2.6E−04	1.3E−05	4.2E−06	8.8E−07	2.7E−07	8.2E−08
Other Uses - Inspection Fluid/Penetrant, Use of Inspection Fluid/Penetrant (Aerosol)	Central Tendency	Rural	2.1E−05	2.0E−05	1.2E−05	8.7E−06	4.6E−06	3.9E−07	1.5E−07	2.7E−08	7.1E−09	1.9E−09
		Urban	3.7E−05	2.5E−05	1.5E−05	9.3E−06	3.8E−06	1.8E−07	6.0E−08	1.3E−08	4.1E−09	1.3E−09
	High-End	Rural	4.2E−05	2.6E−05	1.7E−05	1.2E−05	6.4E−06	4.9E−07	1.7E−07	3.2E−08	8.6E−09	2.1E−09
		Urban	6.6E−05	3.1E−05	1.8E−05	1.1E−05	4.2E−06	2.1E−07	6.8E−08	1.4E−08	4.3E−09	1.3E−09
Other Uses - Inspection Fluid/Penetrant, Use of Inspection Fluid/Penetrant (Non-Aerosol)	Central Tendency	Rural	2.0E−11	1.9E−11	1.2E−11	8.3E−12	4.4E−12	3.7E−13	1.4E−13	2.6E−14	6.8E−15	1.8E−15
		Urban	3.5E−11	2.4E−11	1.4E−11	8.8E−12	3.6E−12	1.7E−13	5.7E−14	1.2E−14	3.9E−15	1.2E−15
	High-End	Rural	4.0E−11	2.5E−11	1.6E−11	1.1E−11	6.1E−12	4.7E−13	1.6E−13	3.1E−14	8.2E−15	2.0E−15
		Urban	6.3E−11	3.0E−11	1.7E−11	1.0E−11	4.0E−12	2.0E−13	6.5E−14	1.4E−14	4.1E−15	1.3E−15
Paint and Coating Manufacturing, Processing - Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	7.0E−11	6.6E−11	4.2E−11	2.9E−11	1.5E−11	1.3E−12	4.9E−13	9.0E−14	2.4E−14	6.2E−15
		Urban	1.3E−10	8.4E−11	4.9E−11	3.1E−11	1.3E−11	5.9E−13	2.0E−13	4.3E−14	1.4E−14	4.3E−15
	High-End	Rural	1.4E−10	8.8E−11	5.6E−11	3.9E−11	2.1E−11	1.7E−12	5.8E−13	1.1E−13	2.9E−14	7.1E−15
		Urban	2.2E−10	1.1E−10	6.0E−11	3.6E−11	1.4E−11	6.9E−13	2.3E−13	4.8E−14	1.5E−14	4.5E−15
Plastic Compounding	Central Tendency	Rural	1.0E00	9.7E−01	6.1E−01	4.3E−01	2.3E−01	1.9E−02	7.2E−03	1.3E−03	3.5E−04	9.1E−05
		Urban	1.8E00	1.2E00	7.3E−01	4.6E−01	1.9E−01	8.7E−03	3.0E−03	6.3E−04	2.0E−04	6.3E−05
	High-End	Rural	2.1E00	1.3E00	8.3E−01	5.8E−01	3.2E−01	2.4E−02	8.5E−03	1.6E−03	4.3E−04	1.0E−04
		Urban	3.3E00	1.6E00	8.8E−01	5.2E−01	2.1E−01	1.0E−02	3.4E−03	7.0E−04	2.1E−04	6.6E−05
Plastic Converting	Central Tendency	Rural	4.7E−02	4.5E−02	2.8E−02	2.0E−02	1.0E−02	8.9E−04	3.3E−04	6.1E−05	1.6E−05	4.2E−06
		Urban	8.5E−02	5.7E−02	3.4E−02	2.1E−02	8.6E−03	4.0E−04	1.4E−04	2.9E−05	9.4E−06	2.9E−06
	High-End	Rural	9.5E−02	6.0E−02	3.8E−02	2.7E−02	1.5E−02	1.1E−03	3.9E−04	7.3E−05	2.0E−05	4.8E−06
		Urban	1.5E−01	7.1E−02	4.1E−02	2.4E−02	9.7E−03	4.7E−04	1.6E−04	3.2E−05	9.8E−06	3.0E−06
Processing - Repackaging, Import	Central Tendency	Rural	1.6E−11	1.9E−11	1.1E−11	7.0E−12	2.6E−12	5.0E−14	1.8E−14	2.6E−15	6.7E−16	2.0E−16
		Urban	1.9E−11	2.2E−11	1.3E−11	7.7E−12	2.8E−12	5.5E−14	2.0E−14	2.9E−15	7.7E−16	2.5E−16

Scenario	Meteorology	Distance										
		Land	10M	30M	30-60M	60M	100M	100-1000M	1000M	2500M	5000M	10,000M
- Repackaging, Average PV CAS 1	High-End	Rural	4.1E−11	2.6E−11	1.4E−11	8.0E−12	2.8E−12	6.0E−14	2.0E−14	2.8E−15	8.1E−16	3.1E−16
		Urban	4.2E−11	2.6E−11	1.4E−11	8.1E−12	2.9E−12	6.1E−14	2.0E−14	2.8E−15	8.2E−16	3.2E−16
Processing - Repackaging, Import - Repackaging, Average PV CAS 2	Central Tendency	Rural	2.4E−08	2.2E−08	1.4E−08	1.0E−08	5.3E−09	4.7E−10	1.7E−10	3.2E−11	8.7E−12	2.3E−12
		Urban	4.3E−08	2.9E−08	1.7E−08	1.1E−08	4.4E−09	2.1E−10	7.1E−11	1.5E−11	4.8E−12	1.5E−12
	High-End	Rural	4.8E−08	3.0E−08	1.9E−08	1.4E−08	7.4E−09	5.8E−10	2.0E−10	3.7E−11	1.0E−11	2.5E−12
		Urban	7.5E−08	3.6E−08	2.1E−08	1.2E−08	4.9E−09	2.4E−10	8.0E−11	1.7E−11	5.0E−12	1.6E−12
Processing - Repackaging, Import - Repackaging, PV4: Akrochem Corp. (CT Release)	Central Tendency	Rural	5.3E−12	7.8E−12	4.5E−12	2.9E−12	1.1E−12	1.7E−14	6.0E−15	6.4E−16	1.1E−16	1.5E−17
		Urban	7.03E−12	9.5E−12	5.2E−12	3.3E−12	1.2E−12	1.9E−14	7.0E−15	8.2E−16	1.6E−16	2.8E−17
	High-End	Rural	1.88E−11	1.19E−11	6.16E−12	3.65E−12	1.28E−12	2.23E−14	8.04E−15	1.06E−15	2.73E−16	9.03E−17
		Urban	1.92E−11	1.21E−11	6.27E−12	3.69E−12	1.29E−12	2.26E−14	8.16E−15	1.07E−15	2.79E−16	9.17E−17
Processing - Repackaging, Import - Repackaging, PV5: Chemspec, Ltd.	Central Tendency	Rural	2.8E−11	3.5E−11	2.0E−11	1.3E−11	4.6E−12	9.0E−14	3.3E−14	4.6E−15	1.2E−15	3.7E−16
		Urban	3.4E−11	4.0E−11	2.3E−11	1.4E−11	5.0E−12	9.9E−14	3.6E−14	5.1E−15	1.4E−15	4.4E−16
	High-End	Rural	7.4E−11	4.6E−11	2.5E−11	1.4E−11	5.1E−12	1.1E−13	3.6E−14	5.0E−15	1.5E−15	5.6E−16
		Urban	7.6E−11	4.7E−11	2.5E−11	1.5E−11	5.1E−12	1.1E−13	3.7E−14	5.0E−15	1.5E−15	5.8E−16
Use of Adhesives and Sealants, Use of Adhesives and Sealants	Central Tendency	Rural	1.3E−10	1.2E−10	7.3E−11	5.1E−11	2.7E−11	2.5E−12	8.9E−13	1.7E−13	4.7E−14	1.2E−14
		Urban	2.3E−10	1.4E−10	8.5E−11	5.3E−11	2.2E−11	1.1E−12	3.7E−13	7.9E−14	2.5E−14	7.9E−15
	High-End	Rural	2.5E−10	1.5E−10	9.6E−11	6.6E−11	3.7E−11	3.1E−12	1.1E−12	1.9E−13	5.2E−14	1.3E−14
		Urban	3.8E−10	1.8E−10	1.0E−10	6.0E−11	2.5E−11	1.3E−12	4.1E−13	8.5E−14	2.7E−14	8.2E−15
Use of Paints and Coatings, Use of Paints and Coatings	Central Tendency	Rural	2.9E−11	2.7E−11	1.7E−11	1.2E−11	6.3E−12	5.9E−13	2.1E−13	4.0E−14	1.1E−14	2.9E−15
		Urban	5.2E−11	3.4E−11	2.0E−11	1.3E−11	5.2E−12	2.6E−13	8.6E−14	1.8E−14	5.9E−15	1.8E−15
	High-End	Rural	5.8E−11	3.6E−11	2.3E−11	1.6E−11	8.9E−12	7.2E−13	2.5E−13	4.5E−14	1.2E−14	3.1E−15
		Urban	9.0E−11	4.3E−11	2.5E−11	1.5E−11	5.9E−12	3.0E−13	9.7E−14	2.0E−14	6.2E−15	1.9E−15
Use of Paints and Coatings, Use of Paints and Coatings w/o Engineering Controls	Central Tendency	Rural	2.9E−11	2.6E−11	1.7E−11	1.2E−11	6.2E−12	5.8E−13	2.1E−13	4.0E−14	1.1E−14	2.8E−15
		Urban	5.2E−11	3.4E−11	2.0E−11	1.3E−11	5.1E−12	2.6E−13	8.6E−14	1.8E−14	5.8E−15	1.8E−15
	High-End	Rural	5.8E−11	3.6E−11	2.3E−11	1.6E−11	8.8E−12	7.2E−13	2.5E−13	4.5E−14	1.2E−14	3.1E−15
		Urban	9.0E−11	4.3E−11	2.5E−11	1.4E−11	5.8E−12	3.0E−13	9.6E−14	2.0E−14	6.2E−15	1.9E−15
Summary Statistics		**Max**	3.3E00	1.6E00	8.8E−01	5.8E−01	3.2E−01	2.4E−02	8.5E−03	1.6E−03	4.3E−04	1.0E−04

Scenario	Meteorology	Distance										
		Land	**10M**	**30M**	**30-60M**	**60M**	**100M**	**100-1000M**	**1000M**	**2500M**	**5000M**	**10,000M**
		Mean	1.0E−01	6.3E−02	3.8E−02	2.5E−02	1.2E−02	7.8E−04	2.7E−04	5.3E−05	1.5E−05	4.0E−06
		Median	1.7E−10	1.1E−10	6.6E−11	4.5E−11	2.2E−11	1.3E−12	4.2E−13	8.8E−14	2.6E−14	7.5E−15
		Min	8.2E−12	1.0E−11	5.8E−12	3.7E−12	1.4E−12	2.7E−14	9.7E−15	1.4E−15	3.6E−16	1.1E−16

Table_Apx C-11. DIDP 95th Percentile Daily Deposition Rate (g/m^2) Modeled from High-End Stack Release Source

Scenario	Meteorology	Distance										
		Land	**10M**	**30M**	**30-60M**	**60M**	**100M**	**100-1000M**	**1000M**	**2500M**	**5000M**	**10000M**
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	8.7E−13	8.6E−13	2.1E−12	3.5E−12	6.3E−12	9.7E−13	4.4E−13	1.3E−13	7.5E−14	4.7E−14
		Urban	2.0E−12	3.1E−12	4.4E−12	5.7E−12	7.9E−12	1.1E−12	5.3E−13	1.5E−13	5.4E−14	1.9E−14
	High-End	Rural	2.1E−12	1.0E−12	3.1E−12	5.1E−12	8.2E−12	1.5E−12	6.0E−13	2.3E−13	1.5E−13	6.3E−14
		Urban	3.7E−12	3.2E−12	5.8E−12	7.8E−12	1.0E−11	1.6E−12	7.2E−13	1.9E−13	6.3E−14	2.0E−14
Commercial Uses Laboratory Chemicals_Scenario 2	Central Tendency	Rural	3.0E−09	2.6E−09	6.3E−09	1.1E−08	1.9E−08	2.9E−09	1.3E−09	4.0E−10	2.3E−10	1.5E−10
		Urban	6.3E−09	9.3E−09	1.3E−08	1.7E−08	2.4E−08	3.4E−09	1.6E−09	4.6E−10	1.7E−10	5.7E−11
	High-End	Rural	6.5E−09	3.1E−09	9.3E−09	1.5E−08	2.4E−08	4.5E−09	1.8E−09	7.0E−10	4.5E−10	1.9E−10
		Urban	1.2E−08	9.8E−09	1.7E−08	2.3E−08	3.1E−08	4.9E−09	2.2E−09	5.7E−10	1.9E−10	6.0E−11
Domestic Manufacturing, Manufacturing, Average PV	Central Tendency	Rural	5.8E−04	1.8E−03	7.8E−03	1.6E−02	3.4E−02	4.2E−03	1.8E−03	4.1E−04	1.6E−04	6.8E−05
		Urban	1.5E−03	8.2E−03	2.1E−02	3.1E−02	4.7E−02	4.7E−03	2.0E−03	4.9E−04	1.8E−04	6.7E−05
	High-End	Rural	2.8E−03	4.0E−03	1.8E−02	3.4E−02	5.5E−02	6.2E−03	2.3E−03	5.1E−04	2.0E−04	7.4E−05
		Urban	4.3E−03	1.3E−02	3.3E−02	4.9E−02	6.6E−02	6.5E−03	2.4E−03	5.3E−04	1.9E−04	7.2E−05
Domestic Manufacturing, Manufacturing, PV6: Troy Chemical Corp. Phoenix	Central Tendency	Rural	9.5E−10	1.4E−07	1.3E−06	4.0E−06	1.1E−05	1.2E−06	4.8E−07	6.9E−08	1.9E−08	6.9E−09
		Urban	1.6E−09	2.6E−07	2.2E−06	5.8E−06	1.4E−05	1.4E−06	5.4E−07	8.2E−08	2.3E−08	7.9E−09
	High-End	Rural	1.5E−07	6.9E−07	4.5E−06	9.7E−06	1.9E−05	1.7E−06	5.8E−07	8.0E−08	2.3E−08	8.6E−09
		Urban	1.7E−07	7.5E−07	4.9E−06	1.0E−05	2.0E−05	1.7E−06	5.9E−07	8.1E−08	2.3E−08	9.0E−09
Incorporation into other articles not covered elsewhere, Processing - Incorporation into formulation, mixture, or	Central Tendency	Rural	5.4E−12	5.3E−12	1.3E−11	2.2E−11	3.9E−11	6.0E−12	2.7E−12	8.0E−13	4.6E−13	2.9E−13
		Urban	1.2E−11	1.9E−11	2.7E−11	3.5E−11	4.9E−11	7.0E−12	3.3E−12	9.2E−13	3.4E−13	1.1E−13
	High-End	Rural	1.3E−11	6.3E−12	1.9E−11	3.1E−11	5.1E−11	9.2E−12	3.7E−12	1.4E−12	9.3E−13	3.9E−13
		Urban	2.3E−11	2.0E−11	3.6E−11	4.8E−11	6.4E−11	1.0E−11	4.5E−12	1.2E−12	3.9E−13	1.2E−13

Scenario	Meteorology	Distance										
		Land	**10M**	**30M**	**30-60M**	**60M**	**100M**	**100-1000M**	**1000M**	**2500M**	**5000M**	**10000M**
reaction product												
Paint and Coating Manufacturing, Processing - Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	5.5E−14	5.5E−14	1.3E−13	2.2E−13	4.0E−13	6.2E−14	2.8E−14	8.3E−15	4.8E−15	3.0E−15
		Urban	1.3E−13	2.0E−13	2.8E−13	3.7E−13	5.1E−13	7.2E−14	3.4E−14	9.5E−15	3.5E−15	1.2E−15
	High-End	Rural	1.3E−13	6.5E−14	2.0E−13	3.2E−13	5.2E−13	9.5E−14	3.8E−14	1.5E−14	9.6E−15	4.0E−15
		Urban	2.4E−13	2.1E−13	3.7E−13	5.0E−13	6.6E−13	1.1E−13	4.6E−14	1.2E−14	4.0E−15	1.3E−15
Use of Paints and Coatings, Use of Paints and Coatings	Central Tendency	Rural	4.0E−05	2.4E−05	5.4E−05	8.5E−05	1.5E−04	2.5E−05	1.1E−05	3.3E−06	1.9E−06	1.3E−06
		Urban	7.0E−05	8.4E−05	1.1E−04	1.4E−04	1.9E−04	2.8E−05	1.3E−05	3.7E−06	1.4E−06	4.6E−07
	High-End	Rural	7.1E−05	3.0E−05	8.2E−05	1.3E−04	2.0E−04	3.8E−05	1.6E−05	5.8E−06	3.7E−06	1.6E−06
		Urban	1.2E−04	8.5E−05	1.4E−04	1.9E−04	2.5E−04	4.1E−05	1.8E−05	4.6E−06	1.5E−06	4.9E−07
Summary Statistics		**Max**	4.3E−03	1.3E−02	3.3E−02	4.9E−02	6.6E−02	6.5E−03	2.4E−03	5.3E−04	2.0E−04	7.4E−05
		Mean	3.4E−04	9.6E−04	2.9E−03	4.6E−03	7.2E−03	7.7E−04	3.1E−04	7.0E−05	2.7E−05	1.0E−05
		Median	2.3E−09	6.2E−09	1.1E−08	1.6E−08	2.4E−08	3.9E−09	1.7E−09	5.1E−10	2.1E−10	1.1E−10
		Min	5.5E−14	5.5E−14	1.3E−13	2.2E−13	4.0E−13	6.2E−14	2.8E−14	8.3E−15	3.5E−15	1.2E−15

C.3 Air Deposition to Surface Water and Sediment

C.3.1 Modeling Results for Air Deposition to Surface Water

AERMOD modeled deposition rates were also used in conjunction with the Point Source Calculator to estimate DIDP concentrations in surface water and sediment. Direct deposition of DIDP to surface water from air releases were evaluated using deposition rates derived from the modeling described in Section 8.3 and the PSC methodology described in Section 4.1. As noted in Section 4.1, the standard EPA waterbody applied for the modeling has a surface of 5 m by 40 m, resulting in a surface area of 200 m^2. Area deposition rates estimated by AERMOD were multiplied by this surface area to generate localized loading values applied as point sources in PSC, for comparison with direct releases to surface water. Deposition rates were highest across the Plastic Compounding COU, and the highest deposition values at each radial distance for that COU were included in this analysis as a screening exercise.

Table_Apx C-12 shows the deposition rates and associated water column, pore water, and sediment concentrations in the receiving waterbody, applying a 7Q10 flow rate. The highest resulting concentrations occurred at the 10 m distance from the modeled facility and decreased with greater distance from the facility. The highest concentrations estimated due to air deposition at 10 m are less than half of the lowest concentrations estimated from direct, untreated facility releases reported in Table 4-4.

Table_Apx C-12. Modeling Results for Air Deposition to Surface Water

	Distance									
	10M	**30M**	**30-60M**	**60M**	**100 M**	**100-1000M**	**1000M**	**2500M**	**5000M**	**10000M**
Max Deposition Rate (g/m²/day)	3.3E00	1.6E00	8.8E−01	5.8E−01	3.2E−01	2.4E−02	8.5E−03	1.6E−03	4.3E−04	1.0E−04
Total Deposition over 200 m² (kg/day)	6.52E−01	3.10E−01	1.76E−01	1.15E−01	6.30E−02	4.86E−03	1.71E−03	3.16E−04	8.52E−05	2.08E−05
Media concentrations in receiving waterbody at distance										
Water Column (µg/L)	3.66E01	1.74E01	9.88E00	6.48E00	3.54E00	2.73E−01	9.57E−02	1.77E−02	4.78E−03	1.17E−03
Pore Water (µg/L)	2.33E01	1.11E01	6.30E00	4.13E00	2.26E00	1.74E−01	6.11E−02	1.13E−02	3.05E−03	7.45E−04
Sediment (µg/kg)	1.35E05	6.44E04	3.66E04	2.40E04	1.31E04	1.01E03	3.54E02	6.56E01	1.77E01	4.32E00

C.3.2 Measured Concentrations in Precipitation

Peters et al. (2008) reported DIDP concentrations within precipitation collected from 47 locations in the Netherlands and 3 three sites in Germany. DIDP was detected in 3 of the 50 collection sites with median and maximum concentrations of <0.1 µg/L and 98.4 µg/L, respectively. The other nine phthalates analyzed within the same study were reported at equal to or greater than 44 of the 50 total sites.