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Draft Environmental Media and General Population Exposure for Diisononyl Phthalate (DINP)

Technical Support Document for the Draft Risk Evaluation

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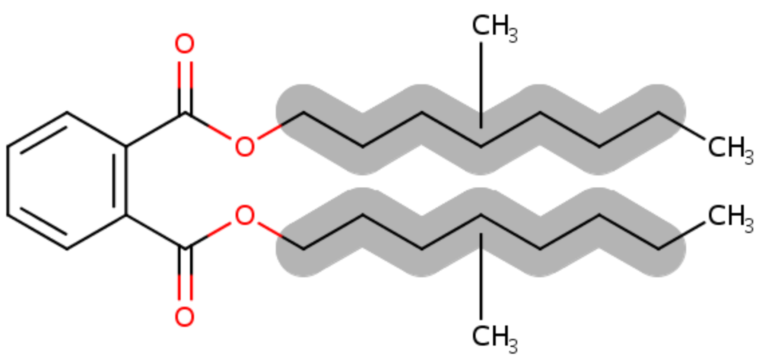


(Representative Structure)

August 2024

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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

DINP– 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 DINP 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 DINP will have low persistence potential and mobility in soils. Therefore, groundwater concentrations resulting from releases to the landfill or to agricultural lands via biosolids applications were not quantified but are discussed qualitatively.
  - For the water pathway, DINP in water releases is expected to predominantly partition into sediment. The high-end modeled total water column concentration of DINP for the acute human exposure scenarios was 13.2 µg/L and benthic sediment concentrations of DINP 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 for ecological receptors or for acute incidental human exposure due to not being identified as a pathway of concern. For the chronic human exposure via drinking water scenario, additional refinement of the modeled high-end release was conducted due to identified risk from the screening level analysis. In the refined scenarios, which are expected to be more representative of exposures than the high-end screening analysis, no risk was identified.
  - For the air pathway, DINP in air releases is expected to predominantly partition into the soil or sediment compartments. The modeled soil concentrations of DINP were 1.46 mg/kg at 100 m and 0.040 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 *Draft Risk Evaluation for Diisononyl Phthalate (DINP)* (U.S. EPA, 2024k). DINP is a common chemical name for the category of chemical substances that includes the following substances: 1,2-benzenedicarboxylic acid, 1,2-isononyl ester (CASRN 28553-12-0), and 1,2-benzenedicarboxylic acid, di-C9-11-branched alkyl esters, C9-rich (CASRN 68515-48-0). Both CASRNs contain mainly C9 dialkyl phthalate esters. See the draft risk evaluation for a complete list of all the technical support documents for DINP.

This document describes the use of reasonably available information to estimate environmental concentration of DINP 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 DINP from facilities that use, manufacture, or process DINP under industrial and/or commercial conditions of use (COUs) subject to TSCA regulations detailed in the *Draft Environmental Exposure Assessment for Diisononyl Phthalate (DINP)* (U.S. EPA, 2024c). As described in Section 1, using the release data, EPA modeled predicted concentrations of DINP 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. Based on DINP's fate parameters detailed in *Draft Fate Assessment for Diisononyl Phthalate (DINP)* (U.S. EPA, 2024g), concentrations of DINP 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 DINP is not expected to be persistent or mobile in soils.

High-end estimates of DINP concentration in the various environmental media presented in this document were used for risk screening purposes for an environmental and general population exposure assessment. Environmental exposures assessed using the predicted concentrations of DINP is presented elsewhere in the *Draft Environmental Exposure Assessment for Diisononyl Phthalate (DINP)* (U.S. EPA, 2024c). General population exposure is discussed in this document using a risk screening approach detailed in Section 2. EPA used a margin of exposure (MOE) approach discussed in Section 2.1 using high-end exposure estimates to screen for potential non-cancer risks. High-end exposure estimates were defined as those associated with the industrial and commercial releases from a condition of use (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 major pathway of exposure and not pursued further. If any pathways were identified as a major exposure pathway 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 1 summarizes the exposure pathways assessed for the general population. For DINP, 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 1. As summarized in Table 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 DINP for highly exposed populations based on the OES leading to high-end concentrations of DINP 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 1. Exposure Pathways Assessed for General Population Screening Level Assessment

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 DINP in surface water during swimming (Section 5.1.1)	No
		Oral	Incidental ingestion of DINP 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
Non-PVC plastics compounding	Ambient Air	Oral	Ingestion of DINP in soil resulting from air to soil deposition (Section 9.1)	No
		Dermal	Dermal exposure to DINP 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 DINP 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 Diisononyl Phthalate (DINP)* (U.S. EPA, 2024c) and general population exposure assessment described in detail in Section 2 and presented throughout this document.

Modeling efforts utilized reasonably available information for releases of DINP from facilities that use, manufacture, or process DINP under industrial and/or commercial conditions of use (COUs) subject to TSCA regulations detailed in the *Draft Environmental Release and Occupational Exposure Assessment for Diisononyl Phthalate (DINP)* (U.S. EPA, 2024e). 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 Environmental Release and Occupational Exposure Assessment for Diisononyl Phthalate (DINP)* (U.S. EPA, 2024e) provides further information on each specific COU and OES.

311 **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	Plasticizer (all other chemical product and preparation manufacturing; wholesale and retail trade; laboratory chemicals manufacturing)	Import and repackaging
	Other uses	Miscellaneous processing (petroleum refineries; wholesale and retail trade)	Incorporation into other formulations, mixtures, or reaction products
	Incorporation into formulation, mixture, or reaction product	Heat stabilizer and processing aid in basic organic chemical manufacturing	Incorporation into other formulations, mixtures, or reaction products
		Plasticizers (adhesives manufacturing, custom compounding of purchased resin; paint and coating manufacturing; plastic material and resin manufacturing; synthetic rubber manufacturing; wholesale and retail trade; all other chemical product and preparation manufacturing; ink, toner, and colorant manufacturing (including pigment))	Incorporation into adhesives and sealants; Incorporation into paints and coatings; Incorporation into other formulations, mixtures, or reaction products; PVC material compounding; Non-PVC material compounding
	Incorporation into articles	Plasticizers (playground and sporting equipment manufacturing; plastics products manufacturing; rubber product manufacturing; wholesale and retail trade; textiles, apparel, and leather manufacturing; electrical equipment, appliance, and component manufacturing; ink, toner, and colorant manufacturing (including pigment))	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

Life Cycle Stage	Category	Subcategory	OES
Industrial uses	Adhesive and sealant chemicals	Adhesive and sealant chemicals (sealant (barrier) in machinery manufacturing; computer and electronic product manufacturing; electrical equipment, appliance, component manufacturing; and adhesion/cohesion promoter in transportation equipment manufacturing)	Application of adhesives and sealants
	Automotive, fuel, agriculture, outdoor use products	Automotive products, other than fluids	Fabrication or use of final product or articles
	Construction, paint, electrical, and metal products	Building/construction materials (roofing, pool liners, window shades, flooring)	Fabrication or use of final product or articles
		Paints and coatings	Application of paints and coatings
	Other Uses	Hydraulic fluids	Use of lubricants and functional fluids
		Pigment (leak detection)	Application of paints and coatings

Life Cycle Stage	Category	Subcategory	OES
Commercial use	Automotive, fuel, agriculture, outdoor use products	Automotive products, other than fluids	Fabrication or use of final product or articles
	Construction, paint, electrical, and metal products	Adhesives and sealants	Application of adhesives and sealants
		Plasticizer in building/construction materials (roofing, pool liners, window shades); construction and building materials covering large surface areas, including paper articles; metal articles; stone, plaster, cement, glass and ceramic articles	Fabrication or use of final product or articles
		Electrical and electronic products	Fabrication or use of final product or articles
		Paints and coatings	Application of paints and coatings
	Furnishing, cleaning, treatment/care products	Foam seating and bedding products; furniture and furnishings including plastic articles (soft); leather articles	Fabrication or use of final product or articles
		Air care products	Incorporation into other formulations, mixtures, or reaction products
		Floor coverings; plasticizer in construction and building materials covering large surface areas including stone, plaster, cement, glass and ceramic articles; fabrics, textiles and apparel (vinyl tiles, resilient flooring, PVC-backed carpeting)	Fabrication or use of final product or articles
		Fabric, textile, and leather products (apparel and footwear care products)	Fabrication or use of final product or articles
	Packaging, paper, plastic, hobby products	Arts, crafts, and hobby materials	Fabrication or use of final product or articles
		Ink, toner, and colorant products	Application of paints and coatings
		Packaging, paper, plastic, hobby products (packaging [excluding food packaging], including rubber articles; plastic articles [(hard]; plastic articles [soft])	Fabrication or use of final product or articles
		Plasticizer (plastic and rubber products; tool handles, flexible tubes, profiles, and hoses)	Fabrication or use of final product or articles
		Toys, playground, and sporting equipment	Fabrication or use of final product or articles
	Other uses	Laboratory chemicals	Use of laboratory chemicals
	Solvents (for cleaning or degreasing)	Solvents (for cleaning or degreasing)	Use of lubricants and functional fluids

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

OES	Type of Discharge,[a] Air Emission,[b] or Transfer for Disposal[c]
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
	Fugitive Air, Wastewater, Incineration, or Landfill
	Wastewater, Incineration, or Landfill
	Wastewater
	Incineration or Landfill
PVC plastics converting	Fugitive or Stack Air
	Fugitive Air, Wastewater, Incineration, or Landfill
	Wastewater, Incineration, or Landfill
	Wastewater
	Incineration or Landfill
Non-PVC material compounding	Fugitive or Stack Air
	Fugitive Air, Wastewater, Incineration, or Landfill
	Wastewater, Incineration, or Landfill
	Wastewater
	Incineration or Landfill
Non-PVC material converting	Fugitive or Stack Air
	Fugitive Air, Wastewater, Incineration, or Landfill
	Wastewater, Incineration, or Landfill
	Wastewater
	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

OES	Type of Discharge,[a] Air Emission,[b] or Transfer for Disposal[c]
Application of paints and coatings with overspray controls [no overspray controls]	Fugitive Air
	Stack Air [Unknown]
	Wastewater, Incineration, or Landfill
Application of adhesives and sealants	Fugitive or Stack Air
	Wastewater, Incineration, or Landfill
Use of laboratory chemicals High Conc. Liquid [Low Conc. 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)
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 DINP 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 DINP 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 DINP 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 Diisononyl Phthalate (DINP)* (U.S. EPA, 2024g). Briefly, based on DINP's fate parameters, EPA anticipated DINP to be expected predominantly in water, soil, and sediment, with DINP in soils attributable to air to soil deposition and land application of biosolids. Therefore, EPA quantitatively assessed concentrations of DINP 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 DINP was not assumed to be persistent in the air ($t_{1/2}$ = 5.36 to 8.5 hours (U.S. EPA, 2017a; Lertsirisopon et al., 2009)) and partitioning analysis showed DINP partitions primarily to soil, compared to air, water, and sediment, even in air releases. Soil concentration of DINP from land applications were not quantitatively assessed in the screening level analysis as DINP 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 DINP, EPA modeled high-end predicted concentrations of DINP 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, 8.2, and 8.3.1 for surface water, sediment, ambient air, and soil, respectively. Based on DINP's fate parameters detailed in *Draft Fate Assessment for Diisononyl Phthalate (DINP)* (U.S. EPA, 2024g), concentrations of DINP 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 DINP exposure assessment using a screening level approach because of limited environmental monitoring data for DINP and lack of location data for DINP 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 DINP 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 DINP 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-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 to screen for risk are described in detail in the *Draft Non-cancer Human Health Hazard Assessment for Diisononyl Phthalate (DINP)* (U.S. EPA, 2024i). Briefly, after considering hazard identification and evidence integration, dose-response evaluation, and weight of scientific evidence of POD candidates, EPA chose two non-cancer endpoints—one for acute and intermediate exposure scenarios and a second one for chronic scenarios (Table 2-1). Human equivalent concentrations (HECs) are based on daily continuous (24-hour) exposure and human equivalent doses (HEDs) are daily values.

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

Exposure Scenario	Target Organ System	Species	Duration	POD (mg/kg-day)	Effect	HEC (mg/m^3) [ppm]	HED (mg/kg-day)	Benchmark MOE	Reference(s)
Acute and Intermediate	Development	Rat	5 to 14 days throughout gestation	BMDL5 = 49[a]	↓ fetal testicular testosterone	63 [3.7]	12	UF_A= 3 UF_H=10 *Total UF=30*	(NASEM, 2017)
Chronic	Liver	Rat	2 years	NOAEL = 15	↑ liver weight, ↑ serum chemistry, histopathology[b]	19 [1.1]	3.5	UF_A= 3 UF_H=10 *Total UF=30*	(Lington et al., 1997; Bio/dynamics, 1986)

[a] The $BMDL_5$ was derived by NASEM (2017) through meta-regression and BMD modeling of fetal testicular testosterone data from two studies of DINP with rats (Boberg et al., 2011; Hannas et al., 2011). R code supporting NASEM's meta-regression and BMD analysis of DINP is publicly available through GitHub.
[b] Liver toxicity included increased relative liver weight, increased serum chemistry (*i.e.*, AST, ALT, ALP), and histopathologic findings (*e.g.*, focal necrosis, spongiosis hepatis)) in F344 rats following 2 years of dietary exposure to DINP (Lington et al., 1997; Bio/dynamics, 1986).

In addition to screening for non-cancer risk, EPA also screened for cancer risk. Under the *Guidelines for Carcinogen Risk Assessment* (U.S. EPA, 2005), EPA reviewed the weight of the evidence and determined that DINP is Not Likely to Be Carcinogenic to Humans at doses below levels that do not result in PPARα activation (Key Event 1 in the PPARα mode of action). EPA determined that the most appropriate and scientifically defensible method for low-dose extrapolation is to apply a nonlinear threshold approach. Further, the non-cancer chronic POD (Table 2-1) will adequately account for all chronic toxicity, including carcinogenicity, which could potentially result from exposure to DINP. Additional details can be found in the *Draft Cancer Human Health Hazard Assessment for Diisononyl Phthalate (DINP)* (U.S. EPA, 2024b). Therefore, using the MOE approach using high-end exposure estimates to screen for potential non-cancer risks also screens for cancer risk. 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 for cancer or non-cancer risk if the MOE was equal to or exceeded the benchmark MOE of 30.

2.2 Estimating High-End Exposure

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

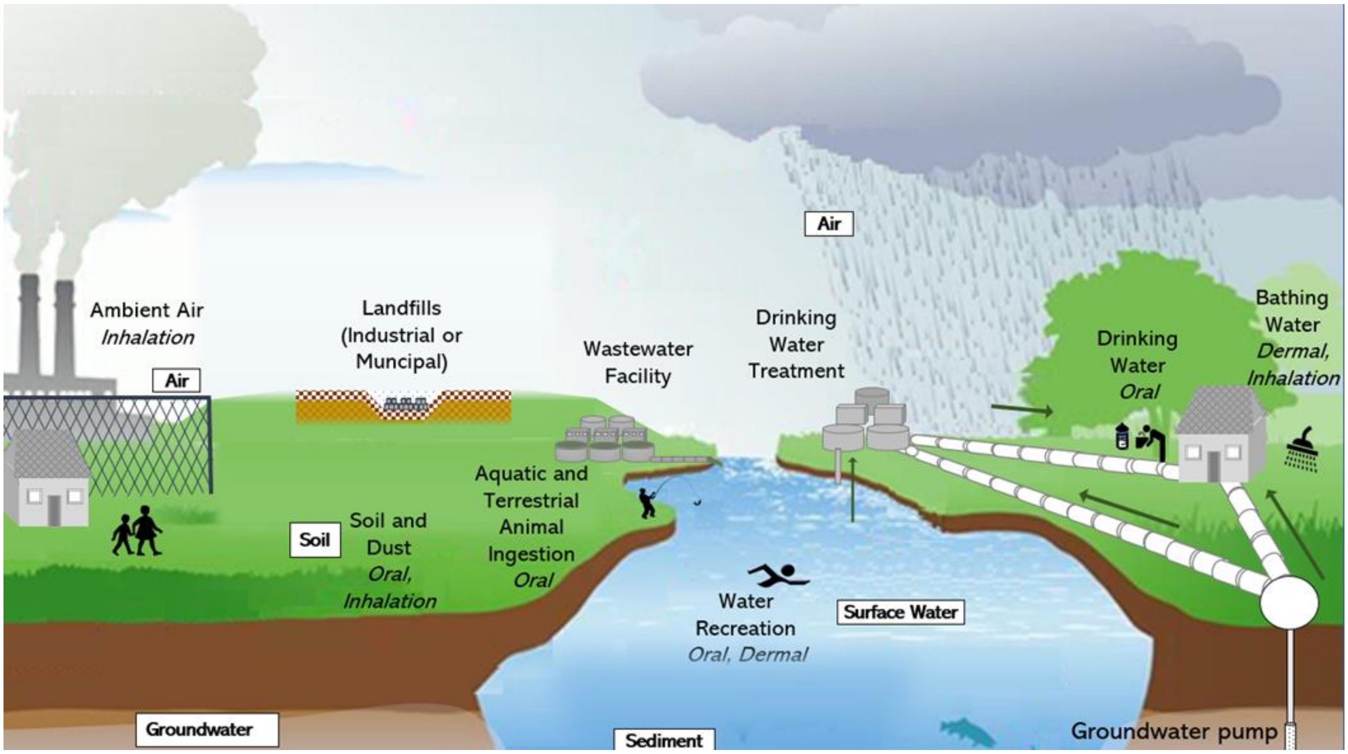


Figure 2-1. Potential Human Exposure Pathways for the General Population

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 DINP 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 DINP release to the environment via biosolids or landfills was not quantitatively assessed because DINP 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 Risk Screening

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 DINP in surface water during swimming	Adults	Quantitative Section 5.1.1
		Oral	Incidental ingestion of DINP 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
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
Non-PVC plastic compounding	Ambient Air	Oral	Ingestion of DINP in soil resulting from air to soil deposition	Infant and Children	Quantitative Section 9.1
		Dermal	Dermal exposure to DINP 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), 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 DINP is expected to be removed via sorption to wastewater sludge (U.S. EPA, 2024g). Multiple studies have reported DINP concentrations in urban and rural soils that have not received biosolids as ranging from not detectable to 172.2 mg/kg, with urban soils generally having higher concentrations than rural and agricultural soils (Huang et al., 2019; Tran et al., 2015; Zhang et al., 2015; Liu et al., 2010a; Zeng et al., 2009; Zeng et al., 2008; Vikelsøe et al., 2002). Urban soils generally do not receive biosolids; therefore, the maximum DINP concentration in rural and agricultural soils comes from a study conducted in China and was reported to be 0.17 mg/kg (Zhang et al., 2015).

No studies evaluating DINP in biosolids in the United States were identified, therefore studies from other countries were relied on for this assessment. Studies measuring concentrations of DINP in municipal sludge and biosolids from multiple countries outside the United States reported concentrations ranging from 0.37 to 48 mg/kg dry weight (Lee et al., 2019; Tran et al., 2015; Cousins et al., 2007; ECJRC, 2003; Vikelsøe et al., 2002). Additionally, biosolids from wastewater treatment plants in Sweden receiving primarily industrial wastewater were reported to have DINP concentrations ranging from 1.5 to 250 mg/kg (Lee et al., 2019). Generally, concentrations of DINP in soils receiving biosolids will be lower than in the biosolids themselves due to dilution during the incorporation process. For example, DINP concentrations in soils receiving a relatively high biosolids loading rate of 17 tons dry weight per hectare per year for 25 years were reported to be as high as 0.91 mg/kg dry weight eight years after application ceased (ECJRC, 2003). As a conservative estimate, it can be assumed that DINP concentrations in soils receiving biosolids have the same concentrations as the biosolids; therefore, based on measured data, DINP concentrations in soils receiving biosolids can be estimated as 250 mg/kg.

High-end release scenarios were considered not to be applicable to the evaluation of land application of biosolids. More specifically, high-end releases of DINP 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. Further, modeling of high-end generic release scenarios using the wastewater treatment plant modeling software SimpleTreat produced concentrations of DINP in biosolids that are significantly greater than the monitoring data.

Due to water solubility (0.00061 mg/L) and affinity for sorption to soil and organic constituents in soil (log K_{OC} = 5.5), DINP 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, 2024g) indicates that DINP will have low persistence potential in the aerobic environments associated with freshly applied biosolids. Since the physical and chemical properties of DINP 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 DINP is not expected to be solubilized by rainwater and conveyed as a solute in runoff during and after precipitation events, it is possible that DINP 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 DINP may then be transported downstream, settle to the benthic environment, and be incorporated into the sediment.

While there is a moderate amount of measured data on concentrations of DINP in biosolids and soils receiving biosolids, it remains uncertain 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 DINP will have limited persistence potential and low 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 DINP 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 biodegradation rates and physical and chemical data, there is robust confidence that DINP will not be mobile after land application of biosolids and will be unlikely to persist in soils. Further, due to the limited mobility of DINP and low persistence potential, humans are not anticipated to be exposed to DINP via land application of biosolids.

3.2 Landfills

DINP 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, DINP 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 of DINP will likely be present in landfills as it is continually added from consumer products that use DINP in their formulation.

Due to its water solubility (0.00061 mg/L) and affinity for organic carbon (log K_{OC} = 5.5), DINP is expected to be present at low concentrations in landfill leachate. Concentrations of DINP in landfill leachates outside of the United States ranged from 1 to 70 µg/L (Duyar et al., 2021; Kalmykova et al., 2013). Further, any DINP 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 DINP concentration of 290 µg/kg (Cousins et al., 2007). For comparison, the same study reported that sediment taken from background lakes had DINP concentrations below the detection limit of 100 µg/kg for all samples and reported that sediments from urban locations had DINP concentrations ranging from below detection to 3,400 µg/kg (Cousins et al., 2007). Another study reported DINP concentrations in soil from an urban area in China contaminated with leachate from a solid waste landfill to be up to 0.18 µg/kg (Liu et al., 2010b). The same study also reported that DINP was only found in topsoil near the landfill and was not found in the surface water or groundwater near the landfill. Since the physical and chemical properties of DINP indicate that it is unlikely to be present in landfill leachate and unlikely to be mobile in soils or groundwater, modeling of groundwater contamination due to landfill leachate containing DINP was not performed.

While there is limited measured data on DINP in landfill leachates, the data suggest that DINP is unlikely to be present the leachate. Further, the small amounts of DINP that could potentially be in leachates from poorly managed landfills or landfills without liners will have limited mobility and are unlikely to infiltrate groundwater due to the high affinity of DINP 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 DINP is unlikely to be present in landfill leachate. Therefore, EPA concludes that further assessment id DINP 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 DINP will be persistent in landfills. Overall, due to high confidence in the quality physical and chemical property data, there is robust confidence that DINP will not be present in landfill leachates and will not be mobile in groundwater for landfills without liners. Furthermore, due to its physical and chemical properties, humans are not expected to be exposed to DINP via leachates from landfills without liners.

4 SURFACE WATER CONCENTRATION

EPA searched peer-reviewed literature, gray literature, and databases of environmental monitoring data to obtain concentrations of DINP in ambient surface water and aquatic sediments. Although the available monitoring data were limited, DINP was found in detectable concentrations in ambient surface waters, finished drinking water, and in aquatic sediments. Limited monitoring studies measuring DINP within water and sediment are likely due to difficulties in quantifying DINP within environmental samples (Chen et al., 2016). 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 Modeled Concentrations

4.1.1 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 DINP within surface water and sediment. PSC considers model inputs of physical and chemical properties of DINP (*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. DINP has a log K_{OC} of 5.5 to 5.7, indicating a high potential to sorb to suspended particles in the water column and settled sediment in the benthic environment (U.S. EPA, 2017a).

Physical chemical and fate 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}	310,000 mL/g
Water Column Half-life	10 days at 25 °C
Photolysis Half-life	140 days at 34N
Hydrolysis Half-life	1,533 days at 25 °C
Benthic Half-life	90 days at 25 °C
Molecular Weight	418.62
Vapor Pressure	0.00000054 torr
Solubility	0.00061 mg/L
Heat of Henry	65,700 J/mol
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 [a]	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/cm³
Benthic foc	0.04
Benthic DOC	5.0 mg/L
Benthic Biomass	0.006 g/m²

[a] DFAC = Diffusion factor, a unitless ratio of optical path length to vertical depth

A distribution of flow metrics was generated by collecting flow data for facilities across 6 North American Industry Classification System (NAICS) codes associated with DINP-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. Flow statistics applied for this exposure assessment include the lowest 7-day flow in a 10-year period (7Q10), the lowest 30-day flow in a 5-year period (30Q5), and harmonic mean (HM). 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 HM represents a more average flow for assessing chronic drinking water exposure.

Equation 4-1. Estimating 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 HM flow was calculated using Equation 4-2, derived from the relevant E-FAST regression.

Equation 4-2. Estimating the Harmonic Mean Flow

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

Where:

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

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

NAICS Code	NAICS Name
325520	Adhesive Manufacturing
325211	Plastics Material and Resin Manufacturing
336111	Automobile Manufacturing
325110	Petrochemical Manufacturing
325199	All Other Basic Organic Chemical Manufacturing
325998	All Other Miscellaneous Chemical Product and Preparation

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 across 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 distribution of resulting receiving waterbody flow rates across the pooled flow data of all relevant NAICS codes, the median (P50) 7Q10 flow rate was applied as a conservative low flow condition across the modeled releases (Figure 4-1). Additional refined analyses were conducted for the scenarios resulting in the greatest environmental concentrations by applying the 75th and 90th percentile (P75 and P90, respectively) flow metrics from the distribution, which were expected to be more representative of the flow conditions associated with high-end releases.

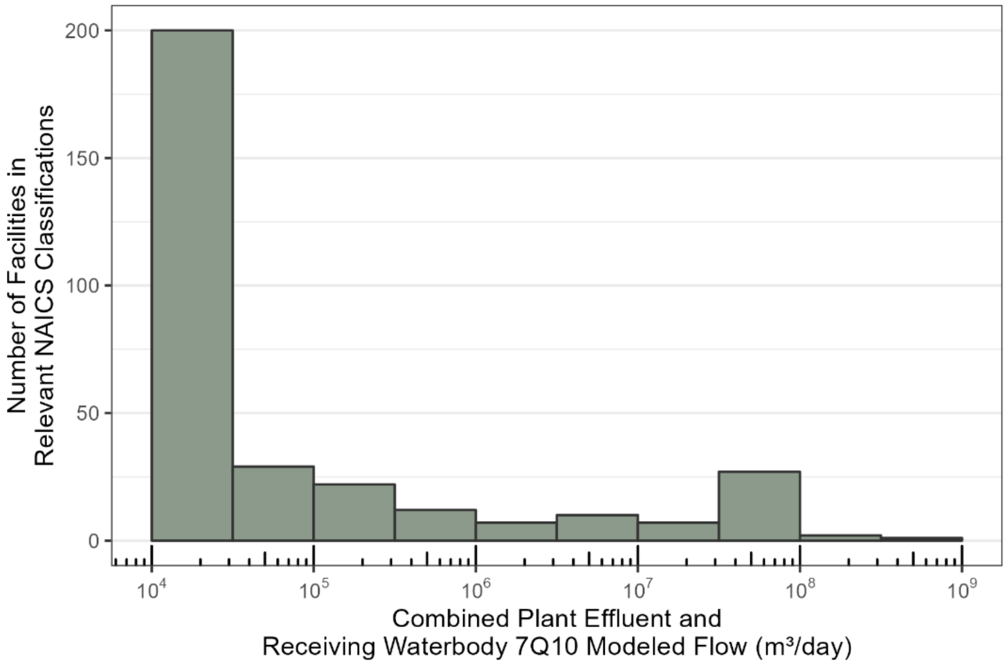


Figure 4-1. Distribution of Receiving Waterbody 7Q10 Modeled Flow for Facilities with Relevant NAICS Classifications

Quantified release estimates to surface water were evaluated with PSC modeling. For each COU with surface water releases, categorized as wastewater in Table 4-4, 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). 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). The frollmean function in the data.table package in R was used to calculate the rolling averages. The function takes in the concentration values to be averaged (extracted from the PSC Daily Output File) and the number of values to include in the averaging window which was total days of release (extracted from the PSC Summary Output File). The function outputs a list of averages from consecutive averaging windows (*e.g.*, the first average will be for values 1 − total days of release and the second average will be for values 2 − total days of release +1).

4.1.2 Modeled Concentrations in Surface Water

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 DINP-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, wastewater treatment is expected to be highly effective at removing DINP from the water column prior to discharge, with treated effluent showing up to a 98.0 percent reduction in one study (Tran et al., 2014). 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 DINP* (U.S. EPA, 2024d). The median 7Q10 flow applied is 24,822 m³/day.

Table 4-4. Water and Benthic Sediment Concentrations in the Receiving Waterbody, Applying a P50 7Q10 Flow

Occupational Exposure Scenario	Number of Operating Days Per Year	Daily Release (kg/day)	Median 7Q10 Total Water Column Concentration (µg/L)	Median 7Q10 Benthic Pore Water Concentration (µg/L)	Median 7Q10 Benthic Sediment Concentration (µg/kg)
Manufacturing	180	22.6	890	376	4,670,000
Manufacturing	180	608	24,000	10,100	126,000,000
Manufacturing	180	0.037	14.6	6.16	76,400
Use of lubricants and functional fluids	4	269	10,200	380	4,710,000
Non-PVC polymer compounding	280	186	7,370	3,310	41,100,000
Non-PVC polymer converting	251	5.32	210	92.6	1,150,000
PVC plastic compounding	254	164	6,490	2,860	35,500,000
PVC plastic converting	251	7.85	310	137	1,690,000
Recycling or disposal	254	3.19	126	55.6	690,000

The scenario of the OES with the highest benthic sediment concentrations (Manufacturing) was additionally run with the 75th and 90th percentile 7Q10 flows to further characterize the distribution of potential environmental concentrations resulting from this release (Table 4-5). These higher-end 7Q10 flows are expected to be more appropriate for pairing with the high-end release estimate modeled. The P75 and P90 flows applied are 178,000 m³/day and 15,490,000 m³/day, respectively.

Table 4-5. Refinement for the Manufacturing OES: Water and Benthic Sediment Concentrations in the Receiving Waterbody, Applying a P75 and P90 7Q10 Flow

Occupational Exposure Scenario	Number of Operating Days Per Year	Daily Release (kg/day)	7Q10 Flow Statistic	Total Water Column Concentration (µg/L)	Benthic Pore Water Concentration (µg/L)	Benthic Sediment Concentration (µg/kg)
Manufacturing	180	608	P75	3,410	1,440	17,800,000
Manufacturing	180	608	P90	39.2	16.5	205,400

The OES with the highest total water column concentrations (Use of lubricants and functional fluids) was additionally run under the 50th percentiles of harmonic mean and 30Q5 flow conditions (Table 4-6) to screen for risks to human health. Two scenarios were run for this high-end release: one without any wastewater treatment applied to reduce DINP concentrations (as in the modeling shown previously in this section), and another with a wastewater treatment removal efficiency of 98 percent applied, substantially reducing the modeled concentrations in the receiving waterbody.

Table 4-6. High-End PSC Modeling Results for Total Water Column, Applying P50 Harmonic Mean Flow and 30Q5 Flow

Scenario	Release Estimate (kg/day)	P50 Harmonic Mean Flow (m^3/d)	P50 30Q5 Flow (m^3/d)	Removal Efficiency Applied (%)	Harmonic Mean Concentration (µg/L)	30Q5 Concentration (µg/L)
Use of lubricants and functional fluids *Without Wastewater Treatment*	269	31,624	27,166	0.00	8,100	9,350
Use of lubricants and functional fluids *With Wastewater Treatment*	5.38	31,624	27,166	98.0	187	162

4.2 Measured Concentrations

4.2.1 Measured Concentrations in Surface Water

One dataset from the Water Quality Portal included measurements of DINP in surface water in the United States. The University of Washington Tacoma Center for Urban Waters reported concentrations of DINP in surface water ranging from 0.37 ng/L at the Silverdale, Dyes Inlet to 179.5 ng/L at the Everett Boat Launch in Washington state.

Five studies identified through systematic review reported DINP concentrations in surface water (Table 4-7). None of these studies reported DINP concentrations in surface water in the United States; however, two studies reported DINP concentrations in surface water in Europe (Tran et al., 2014; Björklund et al., 2009). Björklund et al. (2009) collected stormwater samples from three urban stormwater catchment areas in Sweden and reported the largest range of values from all studies. The maximum reported concentration was 85 µg/L and the minimum reported concentration was below the limit of detection (LOD) 0.10 µg/L. Tran et al. (2014) reported concentrations of DINP in wastewater treatment plant (WWTP) input and output samples collected from Fontenay-les-Briis. The concentrations showed a 98 percent removal efficiency from the WWTP inputs 27.9 ± 10.3 µg/L to the outputs 0.56 ± 0.61 µg/L; however, phthalates were still detected in the Charmoise River upstream, downstream, and far downstream of the WWTP discharge.

Three studies reported DINP concentrations in surface water in China (Li et al., 2017b; Li et al., 2017a; Shi et al., 2012). The minimum and maximum values were reported in Li et al. (2017b) which collected samples from the Jiulong River watershed in Southeast China. The concentrations ranged from a minimum of ND (not detectable) to a maximum of 0.524 µg/L with a mean of 0.29 µg/L and a median of 0.23 µg/L along an river estuary.

Table 4-7. Summary of Measured DINP Concentrations in Surface Water

Reference	Sampling Location (Country)	DINP Concentration (µg/L)	Sampling Notes
University of Washington Tacoma Center for Urban Waters	United States	Max: 0.1795 Min: 0.00037	Max from Everett Boat Launch in WA; min from Silverdale, Dyes Inlet
Björklund et al. (2009)	Sweden	Max: 85 Min: <LOD (0.10)	Urban stormwater catchment basins
Tran et al. (2014)	France	Max mean (Input): 27.9 Min mean (Output): 0.56	Wastewater treatment plant
Li et al. (2017b)	China	Max mean: 0.524 Min mean: ND	Jiulong River watershed

4.2.2 Measured Concentrations in Sediment

One dataset from the Water Quality Portal included measurements of DINP in sediment in the United States. The Washington Department of Ecology reported concentrations of DINP in sediment ranging from 30.1 ug/kg in an estuary sediment in Washington state to 608 ug/kg at Elliot Bay.

Twelve studies within the pool of reasonably available information reported DINP concentrations in sediment (Table 4-8). None of these studies reported DINP concentrations in sediment in the United States, however four studies reported DINP concentrations in sediment in Europe. One study was conducted in Germany (Nagorka and Koschorreck, 2020), and three were conducted in Sweden (Björklund et al., 2009; Cousins et al., 2007; Parkman and Remberg, 1995). The maximum reported concentration from these studies was reported by (Björklund et al., 2009). This study collected samples from stormwater sedimentation chambers in Sweden capturing urban runoff with a maximum value of 212,220 µg/kg and an average of 163,000 µg/kg. The minimum reported values were from (Cousins et al., 2007). The samples came from a national lake as background, a point source, and an urban diffuse source. No DINP was detected in the national background lake. The minimum concentration recorded in this study was 130 µg/kg at an industrial point source, and the maximum concentration recorded in this study was 3,200 µg/kg at an urban diffuse source. (Nagorka and Koschorreck, 2020) reported concentrations of DINP in suspended particulate matter (SPM) from several large river basins in Germany. In this study, suspended particles were collected in sedimentation boxes, then, after 12 monthly samples were pooled to create a single, annual sample, particles were sieved (<2 mm), homogenized, and freeze-dried before analysis. Concentrations in samples collected from 2005 to 2006 ranged from 157 to 6,340 ng DINP/g dry weight (dw) of SPM.

Eight studies reported DINP concentrations in sediment in Asia. Three studies reported concentrations in Taiwan (Chen et al., 2017; Chen et al., 2016; Yang et al., 2015), three reported concentrations in China (Cheng et al., 2019; Li et al., 2017b; Li et al., 2017a), and two reported concentrations in Korea (Kim et al., 2020b; Lee et al., 2020). Chen et al. (2016) collected samples at 20 locations in the Kaohsiung Harbor in Taiwan at four separate times throughout the year. The average reported concentration of DINP in sediment at the Love River port site was 26,500 (SD ± 13,810) ng/g which was the maximum reported concentration for studies conducted in Asia. The average concentration at the Harbor entrance site was 392 ± 223 ng/g which was the minimum average concentration from the Kaohsiung Harbor samples. Li et al. (2017b) reported some of the lowest DINP concentration values from the studies assessing sediment in Asia. The samples were collected from along the Jiulong River in Southeast China. The north river samples ranged from ND to 470 µg/kg, the west river had concentrations from 16 µg/kg to 210 µg/kg, and the estuary had DINP concentrations from 21 µg/kg to 110 µg/kg.
Yang et al. (2015) collected samples at five bridge sites downstream from three industrial parks that are

along the Dianbao River in Taiwan. Samples were collected during the dry (November through April) and rainy (May through October) seasons. The maximum reported value was collected during the rainy season with an average concentration of 3,730 µg/kg with a standard deviation of 2,383 µg/kg. Li et al. (2017a) also collected samples from a wet (August) and dry (January) seasons as well as a sample from the normal season (April). The samples were collected along the Jiulong River in Southeast China and had reported concentrations of ND to 67.3 µg/kg, ND to 29.4 µg/kg, and ND to 110.5 µg/kg from the wet, normal, and dry seasons, respectively.

Maximum values reported for samples collected in Korea ranged from 553 ng/g dw in samples collected along the Korean coast (Lee et al., 2020) to 22,700 ng/g which was collected from the semi enclosed Masan Bay in Korea (Kim et al., 2020b).

Table 4-8. Summary of Measured DINP Concentrations in Sediment

Reference	Sampling Location (Country)	DINP Concentration (ng/g)	Sampling Notes
Washington Department of Ecology	United States	Max: 608 Min: 30.1	Max from Elliot Bay; Min from an estuary sediment (both WA)
Björklund et al. (2009)	Sweden	Max: 212,220 Min: 89,490	Urban stormwater catchment basins
Cousins et al. (2007)	Sweden	Max: 3,200 Min: <LOD	Max from urban diffuse source; min from national lake
Nagorka and Koschorreck, (2020)	Germany	Max: 6340 Min: 101	Suspended soils material dry weight
Chen et al. (2016)	Taiwan	Max mean: 26,500 Min mean: 392	Max from Love River port; min from Kaohsiung Harbor entrance
Yang et al. (2015)	Taiwan	Max mean: 3730 Min mean: 258	Samples from industrial parks along the Dianbao River during wet season
Li et al. (2017a)	China	Max: 110.5 Min: ND	Samples from the Jiulong River during dry season
Lee et al. (2020)	South Korea	Min: 553 Max: 21.3	Samples collected from coast
Kim et al. (2020b)	South Korea	Max: 22,700 Min: 27.1	Samples collected from Mansan Bay

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 DINP within surface water and sediment. PSC considers model inputs of physical and chemical properties of DINP (*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 systematic review process and selection of physical and chemical properties of DINP increases confidence in the inputs applied within 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

DINP releases.

The modeled data represent estimated concentrations near hypothetical facilities that are actively releasing DINP to surface water, while the reported measured concentrations represent sampled ambient water concentrations of DINP. High-end modeled concentrations tended to be orders of magnitude higher than the highest monitored concentrations. Differences in magnitude between modeled and measured concentrations may be due to measured concentrations not being geographically or temporally close to releases of DINP, as information about the proximity of known releases did not accompany monitoring data. 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 prior to release. EPA recognizes that this is a conservative assumption that results in no removal of DINP prior to release to surface water.

Concentrations of DINP within the sediment were estimated using the generic release scenarios and estimates of hydrologic flow data from distributions of receiving water bodies that were derived from National Hydrography Dataset (NHD) modeled (EROM) flow data. 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 DINP 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 programmatic release data for facilities discharging DINP to surface waters, generic facility release scenarios were modeled, and the high-end estimate for each COU was applied to surface water modeling and used in the screening approach. Additionally, due to the lack of site-specificity with the generic release scenarios, a generic distribution of hydrologic flows was developed to contextualize the releases in a hypothetical waterbody. The generic distribution of hydrologic flows was developed from facilities which had been classified under relevant NAICS codes, and which had NPDES permits naming specific reach codes of receiving waterbodies. The flow rates selected from the generated distributions coupled with high-end (95th percentile) release scenarios, resulted in moderate confidence in modeled concentrations. EPA has moderate confidence in the modeled concentrations as being representative of actual releases, with a slight bias toward over-estimation, but robust confidence that no surface water release scenarios exceed the concentrations presented in this evaluation. 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.

The high-end modeled concentrations in the surface water and sediment exceeded the highest values available from monitoring studies by more than three orders of magnitude. This confirms EPA's expectation that modeled concentrations presented here are biased toward overestimation, to be applied as a screening evaluation.

5 SURFACE WATER EXPOSURE

Concentrations of DINP 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 risk screening, exposure scenarios were assessed using the highest concentration of DINP 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 DINP contamination. Modeled surface water concentrations estimated in Section 4.1 were used to estimate acute doses (ADR) and average daily doses (ADD) from dermal exposure while swimming. The following equations were used to calculate incidental dermal (swimming) doses for adults, youth, and children:

Equation 5-1. Acute Incidental Dermal Calculation

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

Equation 5-2. Average Daily Incidental Dermal Calculation

$$ADD = \frac{SWC \times K_p \times SA \times ET \times RD \times ET \times CF1 \times CF2}{BW \times AT \times CF3}$$

Where:

ADR	=	Acute Dose Rate (mg/kg-day)
AD	=	Average Daily Dose (mg/kg-day)
SWC	=	Chemical concentration in water (µg/L)
Kp	=	Permeability coefficient (cm/h)
SA	=	Skin surface area exposed (cm^2)
ET	=	Exposure time (h/day)
RD	=	Release days (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (years)
CF1	=	Conversion factor (1.0×10^{-3} mg/µg)
CF2	=	Conversion factor (1.0×10^{-3} L/cm^3)
CF3	=	Conversion factor (365 days/year)

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

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

Table 5-1 shows a summary of the estimates of ADRs and ADDs due to dermal exposure while swimming for adults, youth, and children for the highest end release value of Use of lubricants and functional fluids, at the 50th percentile flow values. The modeled concentrations are included with and without a wastewater treatment removal efficiency of 98.0 percent applied. 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)	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 *Without Wastewater Treatment*	9,350	4.85E−02	1.15E−04	3.72E−02	8.82E−05	2.25E−02	5.35E−05
Use of lubricants and functional fluids *With Wastewater Treatment*	187	9.71E−04	2.30E−06	7.43E−04	1.76E−06	4.51E−04	1.07E−06
High from Monitoring *Without Wastewater Treatment*	27.9	1.45E−04	3.97E−07	1.11E−04	3.04E−07	6.73E−05	1.84E−07
High from Monitoring *With Wastewater Treatment*	0.56	2.90E−06	7.94E−09	2.22E−06	6.08E−09	1.35E−06	3.69E−09

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 the total acute dose based on the highest modeled 95th percentile release and the 50th percentile 30Q5 flow, 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 *Without Wastewater Treatment*	9,350	247	323	532
Use of lubricants and functional fluids *With Wastewater Treatment*	187	12,300	16,100	26,600
High from Monitoring *Without Wastewater Treatment*	27.9	83,000	108,000	178,000
High from Monitoring *With Wastewater Treatment*	0.56	4,140,000	5,410,000	8,920,000

5.1.2 Oral Ingestion

The general population may swim in affected surfaces waters (streams and lakes) that are affected by DINP contamination. Modeled surface water concentrations estimated in Section 4.1 were used to estimate acute doses (ADR) and average daily doses (ADD) due to ingestion exposure while swimming. The following equations were used to calculate incidental oral (swimming) doses for all COUs, for adults, youth, and children:

Equation 5-3. Acute Incidental Ingestion Calculation

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

Equation 5-4. Average Daily Incidental Calculation

$$ADD = \frac{SWC \times IR \times ED \times RD \times CF1}{BW \times AT \times CF2}$$

Where:

ADR = Acute Dose Rate (mg/kg/day)
ADD = Average Daily Dose (mg/kg/day)
SWC = Surface water concentration (ppb or µg/L)
IR = Daily ingestion rate (L/day)
RD = Release days (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (years)
CF1 = Conversion factor (1.0×10^{-3} mg/µg)
CF2 = Conversion factor (365 days/year)

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

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) Expo		Youth (11–15 years)		Child (6–10 years)	
	30Q5 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 *Without Wastewater Treatment*	9,350	3.23E−02	7.66E−05	5.00E−02	1.19E−04	2.82E−02	6.70E−05
Use of lubricants and functional fluids *With Wastewater Treatment*	187	6.45E−04	1.53E−06	1.00E−03	2.38E−06	5.65E−04	1.34E−06
High from Monitoring *Without Wastewater Treatment*	27.9	9.63E−05	2.64E−07	1.49E−04	4.09E−07	8.42E−05	2.31E−07
High from Monitoring *With Wastewater Treatment*	0.56	1.93E−06	5.27E−09	2.99E−06	8.18E−09	1.68E−06	4.62E−09

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 MOEs based on the incidental ingestion doses. Using the total acute dose based on the highest modeled 95th percentile release and the 50th percentile 30Q5 flow, 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 Modeling 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 *Without Wastewater Treatment*	9,350	372	240	425
Use of lubricants and functional fluids *With Wastewater Treatment*	187	18,600	12,000	21,300
High from monitoring *Without Wastewater Treatment*	27.9	125,0000	80,400	142,000
High from monitoring *With Wastewater Treatment*	0.56	6,230,000	4,020,000	7,120,000

5.2 Weight of Scientific Evidence Conclusions

No site-specific information was reasonably available when estimating release of DINP 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 moderate confidence in the modeled concentrations as being representative of actual releases, with a slight 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 DINP 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. DINP 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 DINP 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 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 DINP in drinking water treatment plants. As stated in the *Draft Fate Assessment for Diisodecyl Phthalate* (U.S. EPA, 2024f), no data was identified by the EPA for DINP in drinking water in the United States. Based on the low water solubility and log K_{OW}, DINP 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 DINP 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 this screening exercise, only the highest modeled facility release was included in the drinking water exposure analysis, alongside the highest monitored surface water concentration. A wastewater treatment efficiency of 98 percent removal efficiency by degradation and decantation in Fontenay-les-Briis (Essonne-France) WWTP (Tran et al., 2014) 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 79 percent to over 96 percent removal was observed in (Shi et al., 2012), and a conservative 79 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 DINP. Therefore, EPA is not evaluating DINP 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. The scenario without any wastewater or drinking water treatment is included for reference, but is considered unlikely, given the high-end release modeled.

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

Scenario	Surface Water Concentrations		Adult (≥21 years)		Infant (birth to <1 year)		Toddler (1–5 years)	
	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 *Without Wastewater Treatment or Drinking Water Treatment*	9,350	8,100	3.8E−01	2.4E−04	1.3E00	6.2E−04	4.7E−01	2.7E−04
Use of lubricants and functional fluids *With Wastewater Treatment*	13.20	7.08	1.1E−05	4.3E−09	3.7E−05	1.1E−08	1.3E−05	4.7E−09
Use of lubricants and functional fluids *With Wastewater Treatment and Drinking Water Treatment*	0.26	0.14	2.2E−06	9.0E−10	7.8E−06	2.3E−09	2.8E−06	9.8E−10
High from Monitoring *With Wastewater Treatment*	0.56	0.56	2.2E−05	1.7E−08	7.9E−05	4.3E−08	2.8E−05	1.8E−08

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 total 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 actual fact, 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 DINP concentrations prior to releasing finished drinking water to customers. The scenario without any wastewater or drinking water treatment is included for reference. This untreated, high-end release, low-flow scenario is considered unlikely, and is not carried forward to the risk characterization conclusions.

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

Scenario	Water Column Concentrations		Adult (≥21 years)		Infant (birth to <1 year)		Toddler (1–5 years)	
	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 *Without Wastewater Treatment or Drinking Water Treatment*	9,350	8,100	32	49,200	9	19,300	26	44,900
Use of lubricants and functional fluids *With Wastewater Treatment*	13.20	7.08	1,130,000	2,810,000,000	322,000	1,100,000,000	905,000	2,570,000,000
Use of lubricants and functional fluids *With Wastewater Treatment and Drinking Water Treatment*	0.26	0.14	5,380,000	13,400,000,000	1,530,000	5,240,000,000	4,310,000	12,200,000,000
High from Monitoring *With Wastewater Treatment*	0.56	0.56	534,000	714,000,000	152,000	279,000,000	428,000	652,000,000

Drinking Water via Leaching of Landfills to Groundwater

DINP is expected to biodegrade in the upper, aerobic portions of landfills. In lower-landfills where anaerobic conditions are likely, DINP is not expected to biodegrade, but may be hydrolysed under elevated temperature and more caustic pH regimes. Despite the degradation of DINP in landfills, DINP is still expected to be persistent as it leached from consumer products disposed of in landfills which use DINP in their formulation. Due to this, DINP is likely to be present in landfill leachate up to its aqueous limit of solubility (0.00061 mg/L). However, due to its affinity for organic carbon, DINP is expected to be immobile in groundwater. Even in cases where landfill leachate containing DINP were to migrate to groundwater, DINP 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

Two studies within the pool of reasonably available information reported DINP concentrations in drinking water, one in Taiwan (Yang et al., 2014) and one in China (Shi et al., 2012) (Table 6-3).(Yang et al., 2014) collected samples in northern and southern Taiwan from tap water pipelines, drinking fountains, and water storage tanks. The minimum average reported concentration was from the drinking fountains in southern Taiwan, 17 ng/L, while the maximum average reported concentration was from drinking fountains in northern Taiwan, 147 ng/L. (Shi et al., 2012) collected samples in China from five cities in the Yangtze River Delta. The lowest concentration was reported in Yancheng as 0 ng/L with a standard deviation of 0.3 ng/L. The highest DINP concentration from this paper was reported as 29 ng/L in Wuxi with a standard deviation of 1.0 ng/L.

Table 6-3. Summary of Measured DINP Concentrations in Drinking Water

Reference	Sampling Location	DINP Concentration (µg/L)	Sampling Notes
Yang, et al. (2014)	Taiwan	Max mean: 0.147 Min mean: 0.017	Samples collected from drinking fountain
Shi et al. (2012)	China	Max mean: 0.029 Min mean: 0	Max from Wuxi; Min from Yancheng

6.3 Evidence Integration for Drinking Water

EPA estimates low potential exposure to DINP 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. High-end releases such as the one modeled in this screening exercise would more likely be discharged to waterbodies with more substantial flow, reducing the environmental concentrations 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 well.

7 FISH INGESTION EXPOSURE

Surface water concentrations for DINP associated with a particular COU were modeled using VVWM-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 DINP (approximately 6.1×10^{-4} mg/L) by five-to-eight orders of magnitude based on 7Q10 flow conditions (see *Draft Physical Chemistry Assessment for Diisononyl Phthalate (DINP)* (U.S. EPA, 2024j)). Additionally, as described in the *Draft Environmental Exposure Assessment for Diisononyl Phthalate* (U.S. EPA, 2024c), based on the sorption and physical and chemical properties, DINP within suspended solids is not expected to be bioavailable. Therefore, DINP concentrations in fish is calculated in the *Draft Environmental Exposure Assessment for Diisononyl Phthalate (DINP)* (U.S. EPA, 2024c) based on a solubility of 6.1×10^{-4} mg/L and a predicted bioconcentration factor (BCF) (Arnot-Gobas method) of 5.2 L/kg. The calculated concentration of DINP in fish using a BCF is 3.17×10^{-3} mg/kg, which is one order of magnitude lower than the highest DINP 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 DINP, a BAF of 21 L/kg was estimated using the Arnot-Gobas method for upper trophic organisms (see *Draft Fate Assessment for Diisononyl Phthalate (DINP)* (U.S. EPA, 2024g)). 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 and three orders of magnitude lower than that reported within published literature.

In addition, EPA calculated fish tissue concentrations using the highest measured DINP concentrations in surface water. As described in Section 4.2.1, the maximum concentration was 85 µg/L (8.5×10^{-2} mg/L) for stormwater samples collected across 13 storm events and from 3 urban stormwater catchment areas in Sweden (Björklund et al., 2009). Two of the catchment areas were urban residential or suburban residential, while the third was a high-density traffic area dominated by the E6 highway (Björklund et al., 2009). It is unclear if any fish reside in these urban catchment areas, and if they do, DINP is not expected to be bioavailable for uptake due to its strong sorption to organic matter and hydrophobicity (see *Draft Fate Assessment for Diisononyl Phthalate* (U.S. EPA, 2024g)). EPA still calculated fish tissue concentrations using this measured concentration 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
Modeled Surface Water Concentration	Predicted BCF (Arnot-Gobas method) of 5.2 L/kg (U.S. EPA, 2024g)	Estimates of the water solubility limit for DINP which is approximately 6.1E−04 mg/L	3.17E−03 mg/kg
	Predicted BAF (Arnot-Gobas method) of 21 L/kg (U.S. EPA, 2024g)	Estimates of the water solubility limit for DINP which is approximately 6.1E−04 mg/L	1.28E−02 mg/kg

Data Approach	Data Description	Surface Water Concentration	Fish Tissue Concentration
Monitored Surface Water Concentration	Predicted BCF (Arnot-Gobas method) of 5.2 L/kg (U.S. EPA, 2024g)	8.5E−02 mg/L	4.42E−01 mg/kg
	Predicted BAF (Arnot-Gobas method) of 21 L/kg (U.S. EPA, 2024g)	8.5E−02 mg/L	1.79E00 mg/kg
Fish Tissue Monitoring Data (Wild-Caught)	Measured in juvenile shiner perch. EPA calculated a whole fish value using the study's reported mean lipid concentration in fish and the equivalent lipid (log base 10) concentration.	N/A	1.24E−02 mg/kg Mackintosh et al. (2004)

7.1 General Population Fish 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. Adults have the highest 50th percentile fish ingestion rate per kilogram of body weight for the general population, as shown in Table_Apx A-2. However, the highest 90th percentile fish ingestion rate per kilogram of body weight is for a young toddler between 1 and 2 years old. Although the results are not shown, the exposure estimates for a young toddler are within the same magnitude as for adults (U.S. EPA, 2024h).

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 calculated because the selected non-cancer chronic liver POD is protective of both non-cancer and cancer liver effects (see Section 2.1). 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 estimate non-cancer exposure.

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 estimates below their corresponding benchmark. Risk estimates for the general population are expected to also be above benchmark because their fish ingestion rate is much lower than that for tribal populations. Section 7.3 provides more details.

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

	Adult ADR (mg/kg-day)	Young Toddler ADR (mg/kg-day)	Adult ADD (mg/kg-day)
Water solubility limit (6.10E−04 mg/L)	3.55E−06	5.28E−06	8.07E−07
Monitored SWC from catchment area for stormwater (8.50E−02 mg/L)	4.95E−04	7.35E−04	1.12E−04

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 calculated exposure for subsistence fishers using Equation 7-1 and the same inputs as the general population except for the ingestion rate. EPA is unable to determine subsistence fisher exposure estimates specific to younger lifestages based on reasonably available information. 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 expected to also be above benchmark because their fish ingestion rate is lower than that for tribal populations. Section 7.3 provides more details.

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

	ADR/ADD (mg/kg-day)
Water solubility limit (6.10E−04 mg/L)	2.28E−05
Monitored SWC from catchment area for stormwater (8.50E−02 mg/L)	3.18E−03

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 DINP 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 (6.10E−04 mg/L)	3.46E−05	2.64E−04
Monitored SWC from catchment area for stormwater (8.50E−02 mg/L)	4.82E−03	3.67E−02

7.4 Risk Characterization for Tribal Populations

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 DINP as the surface water concentration were three-to-six 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 DINP levels from a stormwater catchment area in Sweden as the surface water concentration, risk estimates for tribal populations were still one-to-three orders of magnitude above its corresponding benchmark for both fish ingestion rates. Exposure estimates based on conservative values such as surface water concentration from a stormwater catchment area still resulted in risk estimates that are above their benchmarks. Therefore, these results indicate that fish ingestion is not a pathway of concern for DINP for tribal members, subsistence fishers, and the general population.

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

	Acute Non-cancer MOE UFs = 30		Chronic Non-cancer MOE UFs = 30	
	Current IR	Heritage IR	Current IR	Heritage IR
Water solubility limit (6.10E−04 mg/L)	1,4200,000	186,000	434,000	56,900
Monitored SWC from stormwater catchment area (8.50E−02 mg/L)	10,200	1,330	3,110	408

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. Fish tissue concentrations were calculated using the water solubility limit of DINP, the highest monitored surface water concentrations, and a predicted BAF value. EPA found only limited monitoring data indicating DINP 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. It is unclear if fish reside in the urban stormwater catchment areas where the highest surface water concentrations were measured. Therefore, EPA has slight confidence in its fish ingestion estimates that used the monitored surface water concentrations and moderate confidence in estimates that used the water solubility limit of DINP.

8 AMBIENT AIR CONCENTRATION

Based on its physical and chemical properties DINP is expected to predominantly partition into the soil or sediment compartments when released into air. Release estimates indicated release of DINP into fugitive or stack air. Additionally, EPA searched peer-reviewed literature, gray literature, and databases to obtain concentrations of DINP 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 chemistry properties and short half-life in the atmosphere ($t_{1/2}$ = 5.36 hours (U.S. EPA, 2024f) DINP is assumed to not be persistent in the air. However, the AEROWIN^{TM} module in EPI Suite^{TM} estimates that a large fraction of DINP could be sorbed to airborne particulates. Therefore, EPA focused on modeled air concentrations and deposition rates for the distances: 100 meters (m), 100 to 1,000 m, and 1,000 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 non-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 4.0×10^2 µg/m^3 at 100 m from the facility was modeled for non-PVC plastic compounding OES, based on higher-end meteorology and rural land category scenario.

Table 8-1. 95th Percentile Modeled Annual Concentrations (µg/m³) 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	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Non-PVC plastic compounding	Central Tendency	Rural	1.0E03	8.3E02	7.1E02	4.9E02	2.8E02	5.7E01	9.1E00	1.5E00	3.4E−01	7.9E−02
		Urban	2.5E03	7.8E02	6.0E02	3.0E02	1.4E02	2.0E01	2.6E00	5.4E−01	1.6E−01	4.4E−02
	High-End	Rural	2.4E03	1.4E03	1.1E03	7.5E02	**4.0E02**	7.5E01	1.1E01	1.9E00	4.5E−01	1.0E−01
		Urban	3.9E03	1.2E03	9.3E02	4.3E02	1.9E02	2.3E01	3.4E00	6.8E−01	1.9E−01	5.1E−02

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

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

8.2 Measured Concentrations in Ambient Air

EPA searched peer-reviewed literature, gray literature, and databases to obtain concentrations of DINP in ambient air. Ambient air concentrations of DINP 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, 2024a). The Sweden sampling program measured both background areas and in areas near identified possible sources of DINP. 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 83 percent for DINP with a range of 0.3 to 1.1 ng/m^3 which were within the range of the EPA's modeled concentrations (5.1×10^{-14} to 4.0×10^{-2} µg/m^3) between the 100 to 1,000 m distances. EPA's modeled concentration for its highest release scenario (Non-PVC 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, DINP is assumed to not be persistent in the air and estimated that a large fraction of DINP could be sorbed to airborne particulates. Therefore, EPA focused on modeled air concentrations and deposition rates for the distances 100 m, 100 to 1,000 m, and 1,000 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 DINP, 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 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 an excerpt of the 95th percentile modeled daily deposition rates based on high-end estimated releases for fugitive emissions. A maximum daily deposition rate of 2.5×10^{-1} g/m^2-day at 100 m from the facility was modeled for Non-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 to 10,000 m) are provided in Appendix C.

Table 8-2. 95th Percentile Modeled Daily Deposition (g/m^2-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	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Non-PVC plastic compounding	Central Tendency	Rural	8.2E−01	7.5E−01	4.8E−01	3.4E−01	1.8E−01	1.6E−02	5.9E−03	1.1E−03	2.9E−04	7.4E−05
		Urban	1.5E00	9.6E−01	5.7E−01	3.6E−01	1.5E−01	7.3E−03	2.4E−03	5.1E−04	1.6E−04	4.8E−05
	High-End	Rural	1.6E00	1.0E00	6.5E−01	4.5E−01	**2.5E−01**	2.0E−02	6.8E−03	1.2E−03	3.2E−04	7.8E−05
		Urban	2.5E00	1.2E00	6.9E−01	4.1E−01	1.6E−01	8.4E−03	2.7E−03	5.5E−04	1.7E−04	4.9E−05

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

Because the octanol:air coefficient (K_{OA}) indicates that DINP will favor the organic carbon present in airborne particles, particle deposition can be a significant pathway for DINP to be transported to other environmental compartments, such as soil and surface water. Soil concentrations from air deposition were also estimated for the condition of use scenarios with air releases. Using the daily deposition rates, the DINP 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 DINP 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 DINP in soil from modeled air to soil deposition at 100 m and 1,000 m from a hypothetical release site for the non-PVC plastics compounding OES was 1.46 mg/kg and 0.04 mg/kg per day. Comparatively, the highest reported soil concentration of DINP reported within the reasonably available literature is from Zhang et al. (Zhang et al., 2015) reporting a DINP concentration of 0.17 mg/kg in urban soil. See Section 3.1 for more details on measured DINP concentrations in soil.

Air deposition can also lead to DINP concentrations in water and sediment. EPA modeled surface water and sediment concentrations of DINP resulting from air deposition and provides the results in Appendix C.3.1. However, modeling results indicate a rapid decline in DINP 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.

Because 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 risk screening 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 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) (U.S. EPA, 2019e)). 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 DINP (see *Draft Physical Chemistry Assessment for Diisononyl Phthalate* (U.S. EPA, 2024j)), EPA considered only particle deposition and for the purposes of modeling, it was assumed that 100 percent of the emitted mass of DINP 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 (3.0×10^{-4} to 1.1×10^{-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 (5.1×10^{-14} to 4.0×10^{2} μg/m^3) from AERMOD, the highest modeled concentrations of DINP 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 Environmental Release and Occupational Exposure Assessment for Diisononyl Phthalate* (U.S. EPA, 2024e) 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

DINP is a liquid at environmental temperatures with a melting point of −48 °C (O'Neil, 2013) and a vapor pressure of 5.40×10^{-7} mm Hg at 25°C (NLM, 2015). Based on its physical and chemical properties and short half-life in the atmosphere, $t_{1/2}$ = 5.3 hours (U.S. EPA, 2017a), DINP was assumed to not be persistent in the air. The AEROWIN™ module in EPI Suite™ estimated that a large fraction of DINP could be sorbed to airborne particles and these particulates may be resistant to atmospheric oxidation.

The Level III Fugacity model in EPI Suite™ (LEV3EPI™) was used for the DINP Tier II Fate analysis to predict DINP'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 Diisononyl Phthalate (DINP)* (U.S. EPA, 2024g) for the fate assessment for DINP.

Under all emission scenarios, DINP is expected to predominantly partition into the soil or sediment compartments. Based on this information, exposure to DINP 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 Sections 9.1.1 and 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 (1.0 x 10^{-3} 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 1.46×10^{3} µg/kg (1.46 mg/kg) at 100 m from Non-PVC plastic compounding OES 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

$$Acute\ Dose\ Rate\ (ADR) = \frac{1.46\frac{mg}{kg}\ x\ 1.0E^{-03}\frac{kg}{mg}\ x\ 200mg/day}{16.2\ kg\ x\ 1\ day} = 0.018\ \frac{mg}{kg-day}$$

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 (1.0×10^{-3}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 1.46×10^3 µg/kg (1.46 mg/kg) at 100 m from Non-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

$$Dermal\ Absorbed\ Dose\ (DAD) = \frac{1.46\frac{mg}{kg}\ x\ 1.0E^{-03}\frac{kg}{mg}\ x\ 0.2\frac{mg}{cm^2-event}\ x\ 1\ x\ 2{,}700\ cm^2\ \ x\ 1\ event}{16.2\ kg\ x\ 1\ day}$$

$$Dermal\ Absorbed\ Dose\ (DAD) = 0.0487\frac{mg}{kg-day}$$

9.2 Risk Screening

9.2.1 Oral Ingestion and Dermal Absorption Margin of Exposure

Using the ADR (0.018 mg/kg-day) and DAD (0.0487 mg/kg-day) that were calculated (1) based on the highest modeled 95th percentile soil concentration of 1.46×10^{-3} µg/kg (1.46 mg/kg) at 100 m from Non-PVC plastic compounding OES in Sections 9.1 and 9.1.2, respectively; (2) the acute and chronic HEDs of 12.0 mg/kg-day and 3.5 mg/kg-day, respectively; and (3) benchmarks of 30 provided in Table 2-1; the acute and chronic MOEs can be calculated:

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

$$Margin\ of\ Exposure\ (MOE) = \frac{12.0\,\frac{mg}{kg-day}\ (or\ 3.5\ \frac{mg}{kg-day})}{\left(0.018\,\frac{mg}{kg-day} + 0.0487\,\frac{mg}{kg-day}\right)}$$

$$Margin\ of\ Exposure\ (MOE) = 179.9\ \text{(or 52.5 for chronic)}$$

Using the acute dose; that is, the highest dose, for both acute and chronic exposure scenarios based on the highest modeled 95th percentile soil concentration at 100 m, the resulting MOEs are 179.9 and 52.5 for acute and chronic, respectively, which are greater than the benchmarks 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 is slight confidence in the modeled concentrations of ambient air and soil concentrations resulting from ambient air to soil deposition as being representative of actual releases with a bias toward overestimation. Therefore, EPA has slight confidence in the modeled exposure doses as being representative of actual doses, due to the bias toward over-estimation, but 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 DINP from human milk ingestion, while urinary biomonitoring provides total exposure from all sources for different life stages.

10.1 Human Milk Exposures

Infants are a potentially susceptible subpopulation 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 animal models also indicates that DINP is a developmental toxicant (U.S. EPA, 2024i). EPA considered exposure (10.1.1) and hazard (Section 10.1.2) information, as well as pharmacokinetic models (Section 10.1.3), to determine the most scientifically supportable appropriate approach to evaluate infant exposure to DINP from human milk ingestion. EPA concluded that the most scientifically supportable approach is to use human health hazard values that are based on gestational exposure, as the subsequent sections will explain in more detail.

10.1.1 Biomonitoring Information

DINP has the potential to accumulate in human milk because of its small mass (418.61 Daltons or g/mol) and lipophilicity (log K_{OW} = 8.8). EPA identified nine biomonitoring studies from reasonably available information that investigated if DINP or its metabolites were present in human milk. No U.S. biomonitoring studies were identified.

The highest concentrations were observed by Main et al. (2006), in which MINP (mono-isononyl phthalate) was measured in 65 milk samples collected from Danish mothers. The concentrations ranged from 27 to 469 µg/L, with a median of 101 µg/L. Another study measured similar levels of mINP in 36 milk samples from Danish mothers: median of 101 µg/L and range from 27 to 382 µg/L (Mortensen et al., 2005). In contrast, Kim et al. (2020a) measured mINP concentrations at only 0.1 µg/L (geometric mean) and 0.61 µg/L (95th percentile) among 221 first-time mothers in South Korea. For studies that targeted the parent phthalate, DINP was non-detectable (Fromme et al., 2011; Hogberg et al., 2008). Studies from Italy, Sweden, and Taiwan measured some of DINP's secondary metabolites and reported concentrations that were all much lower than those observed for mINP. Among the six secondary metabolites and across the three studies, the maximum reported concentration was 1.5 µg/L for OH-MiNP and 7OH-MMeOP, mono-hydroxyisononyl phthalate and mono-(4-methyl-7-hydroxy-octyl)phthalate, respectively (Lin et al., 2011; Schlumpf et al., 2010; Latini et al., 2009). None of the studies characterized the possibility of occupational exposure to DINP.

Infant exposure through human milk ingestion was calculated according to Equation 10-1 using the measured data. In particular, the highest DINP concentration in human milk (469 µg/L from (Main et al., 2006)) was used for risk screening purposes. Milk ingestion rates (IR) for multiple age groups within the first year of life were taken from the *Exposure Factors Handbook*, where a mean and upper 95th percentile) rate is presented for each (U.S. EPA, 2011) (Appendix A). Infant doses were calculated using both ingestion rates. The ingestion rates already factored in the exposure duration, body weight, and averaging time. Therefore, these parameters were not included in Equation 10-1.

Equation 10-1.

$$Exposure\ Estimate = MC \times IR \times CF1 \times CF2$$

Where:

MC = Milk concentration (469 μg/L)
IR = Milk ingestion rate (g/day)
CF1 = Conversion factor (0.001 mg/μg)
CF2 = Conversion factor for kg/g (0.001 kg/g)

Infant doses and risk estimates are presented in Table 10-1. EPA estimated intermediate and chronic non-cancer risks. Acute exposure was not estimated because there are no milk ingestion rates to characterize a peak daily exposure. While chronic exposure represents repeated exposures covering at least 10 percent of lifetime in adults, EPA estimated chronic risks to a nursing infant because of uncertainties as to whether exposure during the first year of life will result in developmental effects through adulthood. Chronic risks were thus considered for infant doses in the first year of life.

Non-cancer risk estimates for the first month were calculated with only the upper milk ingestion rate because it resulted in the highest exposure doses. The intermediate and chronic MOEs are one and three orders of magnitude above the corresponding benchmark, respectively. It is important to note that biomonitoring data do not distinguish between exposure routes or pathways and does not allow for source apportionment. The use of biomonitoring data to characterize a nursing infant's exposure to DINP thus aggregates exposure from all sources and pathways.

Table 10-1. Exposure and Risks Estimates from Human Milk Ingestion Based on Biomonitoring Data

Age Group	Exposure Estimates		Risk Estimates	
	Mean IR (mg/kg-day)	Upper IR (mg/kg-day)	Intermediate MOE Based on Upper[a] IR UFs = 30	Chronic MOE Based on Upper[a] IR UFs = 30
Birth to <1 month	7.04E−02	1.03E−01	475	NA
1 to <3 month	6.57E−02	8.91E−02	NA[b]	NA
3 to <6 month	5.16E−02	7.04E−02	NA[b]	NA
6 to <12 month	3.89E−02	6.10E−02	NA[b]	NA
Birth to <1 year	4.92E−02	7.15E−02	NA[b]	210

[a] If the intermediate MOE is above benchmark based on the upper milk IR, the intermediate MOE based on the mean milk IR will also be higher. As a result, an intermediate MOE was not calculated using the exposure estimates based on the mean milk IR.
[b] The exposure duration for an intermediate exposure is up to 30 days. The exposure duration for this age group exceeds 30 days. Furthermore, intermediate risks estimated based on the infant's first month of life, which had the highest doses because of the highest milk ingestion rate per kg of body weight, is most protective for estimating shorter exposures.

10.1.2 Hazard Information

Several experimental studies of animal models have characterized the liver, kidney, and developmental toxicity associated with oral exposure to DINP (see *Draft Human Health Hazard Assessment for Diisononyl Phthalate* (U.S. EPA, 2024i)). The critical effect for DINP is decreased fetal testicular testosterone that result from gestational exposure via oral administration of DINP. No studies have evaluated only lactational exposure from quantified levels of DINP in milk.

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 DINP 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. DINP is rapidly metabolized to its primary metabolite MINP (a monoester), which undergoes further oxidation reactions to produce multiple secondary metabolites (see the toxicokinetics summary in the *Draft Human Health Hazard Assessment for Diisononyl Phthalate* (U.S. EPA, 2024i) for further details). Secondary metabolites dominate the urinary metabolic profile of DINP, and DINP or MINP are often not measurable (Saravanabhavan and Murray, 2012). This indicates that neither the parent compound nor the primary metabolite is a sensitive biomarker of exposure to DINP. As a result, measured half-life values for DINP in plasma and urine that were reported in Domínguez-Romero and Scheringer (2019); Anderson et al. (2011); McKee et al. (2002) were not considered. A secondary metabolite may be more appropriate, but secondary metabolites can potentially overlap with other parent phthalates (Saravanabhavan and Murray, 2012).

Another uncertainty is that the half-life can vary by not only the measured substance (*i.e.*, parent vs. 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 DINP, 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 other less lipophilic matrices. 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 DINP, but given its relatively fast metabolism, modeling infant exposure via human milk ingestion using DINP's half-life may underestimate doses.

Limitations in hazard data also support EPA's conclusion that modeling exposure estimates will not be informative. As previously mentioned, no studies have evaluated only lactational exposure, and hazard values are based on gestational exposure to the parent phthalate. In other words, the hazard studies do not elucidate the toxic moiety for DINP 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 DINP's metabolites, allowing EPA to then estimate exposure to metabolites via human milk ingestion, there are no corresponding hazard values for risk characterization.

Instead, exposure estimates for workers, consumers, and the general population were compared against the hazard value based on developmental toxicity based on gestational exposure.

10.1.4 Weight of Scientific Evidence

The lack of studies evaluating lactational exposure to DINP 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 not modeling human milk concentrations is still protective of a nursing infant because biomonitoring data, which aggregates exposure sources and pathways, did not result in risk estimates below the corresponding benchmarks.

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, 2015). 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.

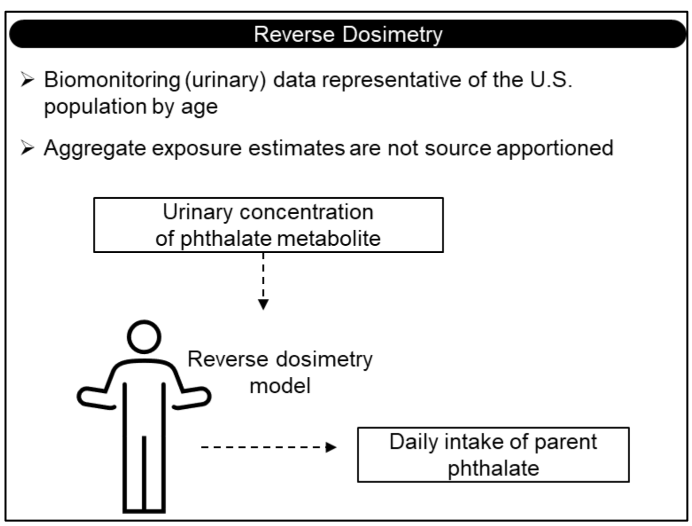


Figure 10-1. Reverse Dosimetry Approach for Estimating Daily Intake

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 three metabolites of DINP; Mono-isononyl phthalate (MiNP) (measured in the 1999 to 2018 NHANES cycles), Mono-oxoisononyl phthalate (MONP) (measured in the 2017 to 2018 NHANES cycle), and

Mono-(carboxyoctyl) phthalate (MCOP) (measured in the 2005 to 2018 NHANES cycles). Sampling details can be found in Appendix B. Urinary concentrations of DINP metabolites 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 DINP metabolites were analyzed for all available NHANES survey years to examine the temporal trend of DINP 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 Appendix B. Statistical analyses of DINP metabolite trends over time were performed with PROC DESCRIPT using SAS-callable SUDAAN.

10.2.1.1 Temporal Trends of MiNP

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

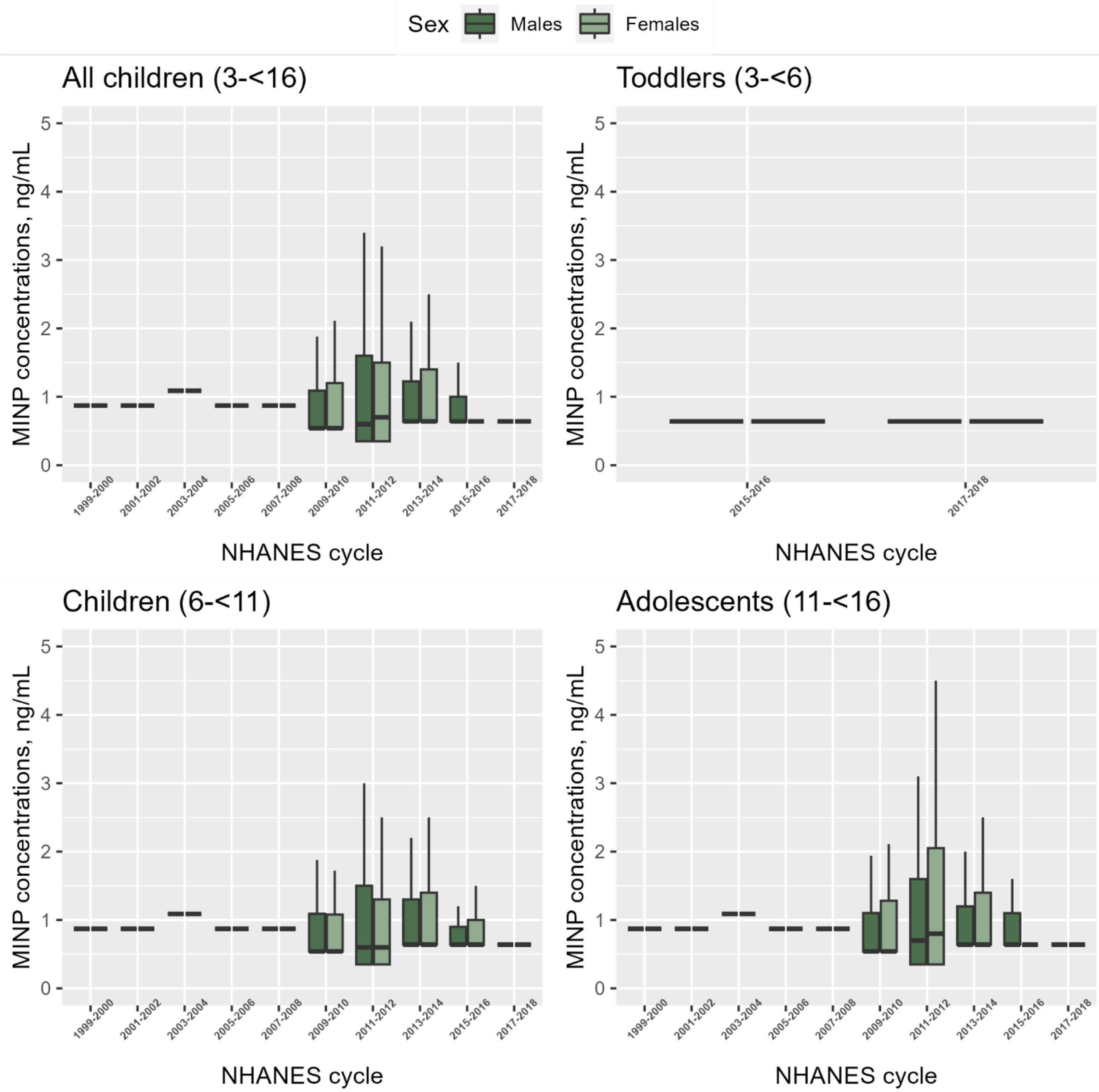


Figure 10-2. Urinary MiNP Concentrations for Children (3 to <16 Years) by Age Group

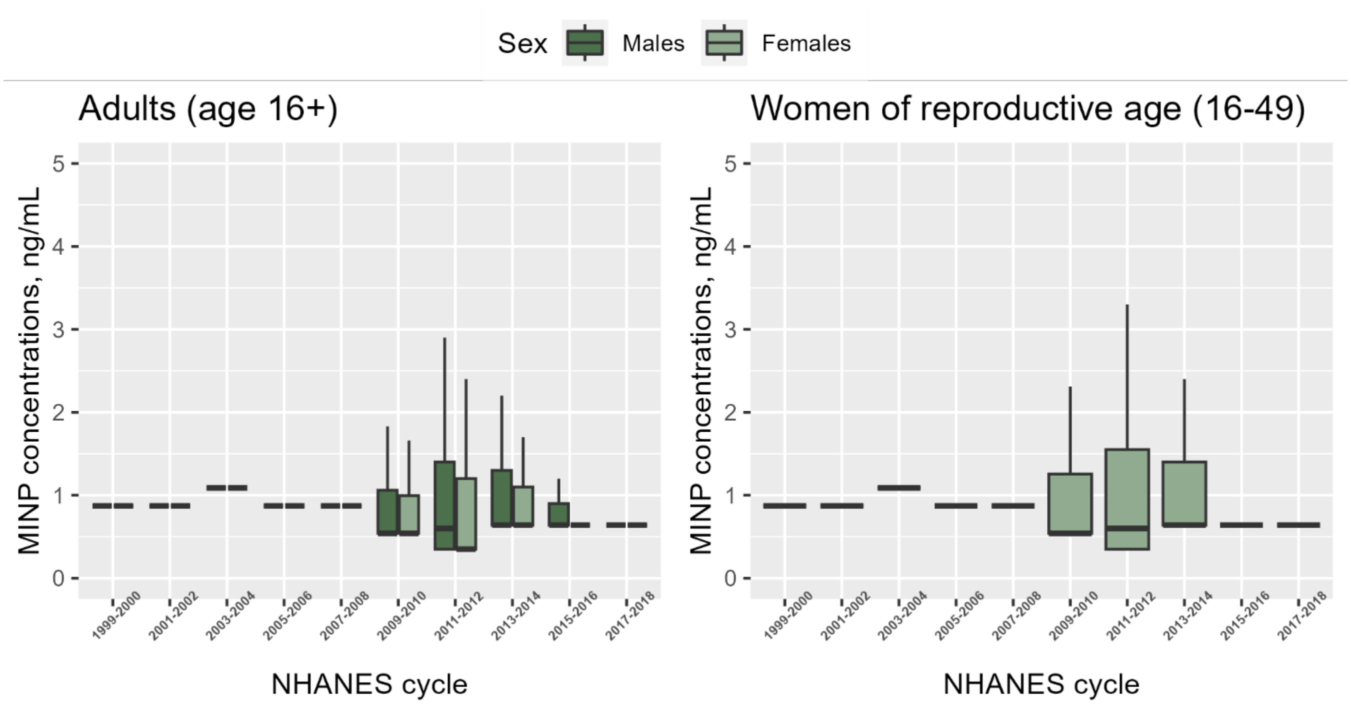


Figure 10-3. Urinary MiNP Concentrations for Adults (16+ Years) and Women of Reproductive Age (16 to 49 Years)

Among all children under 16, significant changes were observed in 50th and 95th percentile MiNP concentrations (50th percentile, $p < 0.001$; 95th percentile, $p < 0.001$), as well as a significant increase in 95th percentile concentrations among male children under 16 ($p < 0.001$), and a significant decrease among female children under 16 ($p < 0.001$) (Figure 10-2). Within age groups, MiNP concentrations significantly decreased among children age 3 to less than 6 years of age (95th percentile, $p < 0.001$) and significantly increased among adolescents 11 to less than 16 years of age (50th percentile, $p < 0.001$; 95th percentile, $p < 0.001$); no significant changes in 50th or 95th percentile MiNP concentrations over time were observed among children aged 6 to less than 11 (Figure 10-2).

MiNP concentrations significantly decreased among all adults (50th percentile, $p < 0.001$; 95th percentile, $p < 0.001$), adult males (95th percentile, $p < 0.001$), and adult females (50th percentile, $p < 0.001$) (Figure 10-3). A significant increase in MiNP concentrations were observed among adult females (50th percentile, $p < 0.001$; 95th percentile, $p < 0.001$) and in 50th percentile concentrations among women of reproductive age ($p = 0.03$) (Figure 10-3).

10.2.1.2 Temporal Trends of MCOP

Figure 10-4 and Figure 10-5 show urinary MCOP concentrations plotted over time for the various populations to visualize the temporal exposure trends. **Overall, median MCOP concentrations have decreased over time for all lifestages, but 95th percentile concentrations increased over time for all lifestages.**

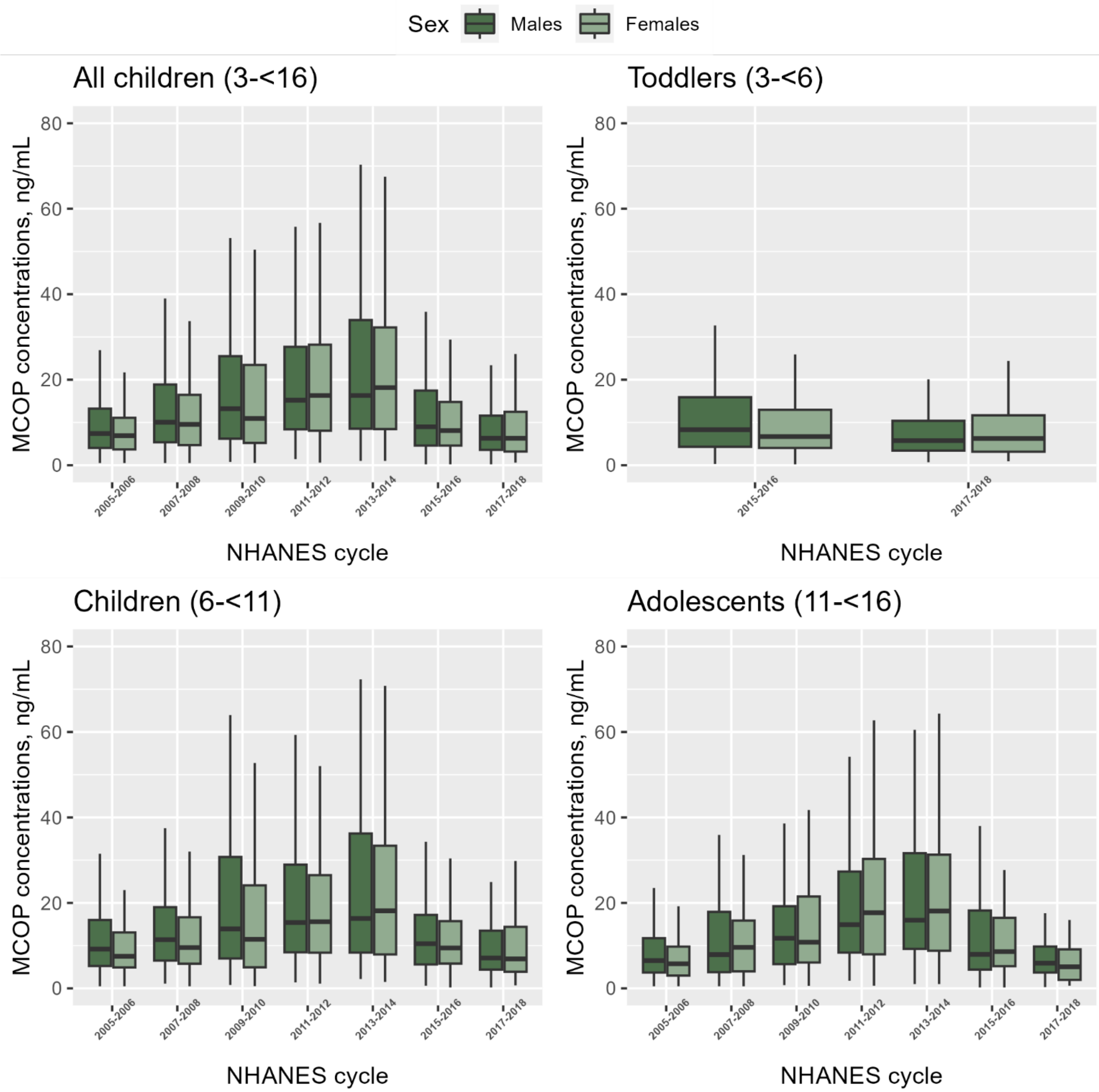


Figure 10-4. Urinary MCOP Concentrations for Children (3 to <16 Years) by Age Group

There was a significant decrease in median urinary MCOP concentrations among all children under 16 ($p < 0.001$), as well as among children aged 6 to less than 11 years ($p < 0.001$) (Figure 10-4). Increases in 95th percentile urinary MCOP concentrations were observed among all children under 16 ($p < 0.001$), all male children under 16 ($p < 0.001$), and all female children under 16 ($p < 0.001$). Additionally, a significant increase in 95th percentile concentrations over time was observed among toddlers aged 3 to less than 6, and a significant decrease in MCOP concentrations was observed among children aged 6 to less than 11 years old ($p < 0.001$) (Figure 10-4). At both the 50th and 95th percentile, significant differences in urinary MCOP concentrations were observed between male and female children under 16 over time (50th percentile, $p < 0.001$; 95th percentile, $p < 0.001$) (Figure 10-4).

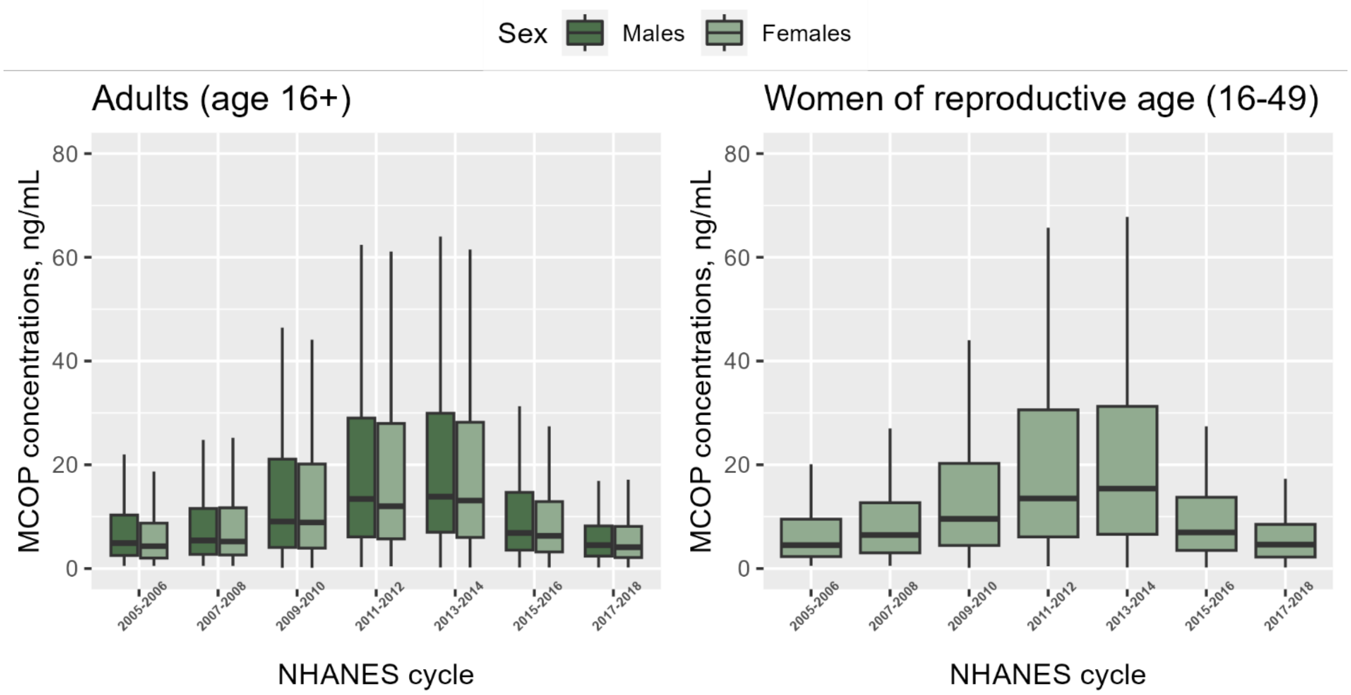
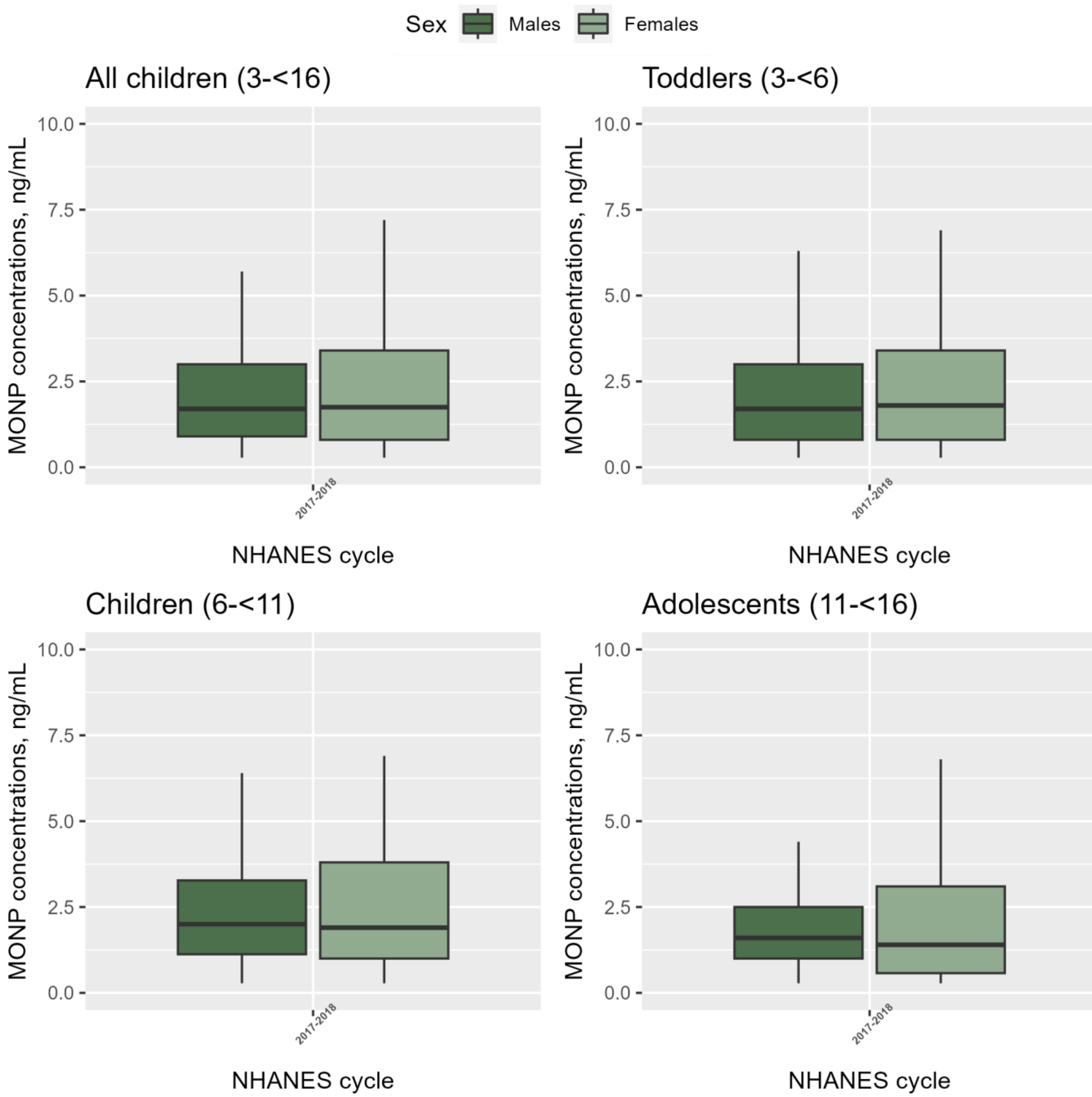


Figure 10-5. Urinary MCOP Concentrations for Adults (16+ Years) and Women of Reproductive Age (16 to 49 Years)

Among adults, 50th percentile MCOP concentrations significantly decreased over time for all adults ($p < 0.001$) but significantly increased over time for adults at the 95th percentile of exposure ($p < 0.001$). Significant decreases in MCOP were also observed among adult males (50th percentile, $p < 0.001$) and adult females (50th percentile, $p < 0.001$; 95th percentile, $p = 0.005$) but not for women of reproductive age (Figure 10-5). Additionally, a significant difference in 95th percentile MCOP concentrations were observed between adult men and women ($p < 0.001$), but no difference was observed for 50th percentile MCOP concentrations (Figure 10-5).

10.2.1.3 Temporal Trends of MONP

Figure 10-6 and Figure 10-7 show urinary MONP concentrations plotted for the 2017 to 2018 NHANES cycle. As MONP has only been measured in one NHANES cycle, there is insufficient data to determine temporal trends in MONP exposure. However, within the 2017 to 2018 cycle, significant differences were observed between male and female children under 16 for 95th percentile concentrations ($p < 0.001$) (Figure 10-6), as well as between adult males and adult females (50th percentile, $p = 0.009$; 95th percentile, $p < 0.001$) (Figure 10-7).



1813

1814 **Figure 10-6. Urinary MONP Concentrations for Children (3 to <16 Years) by Age Group**

1815

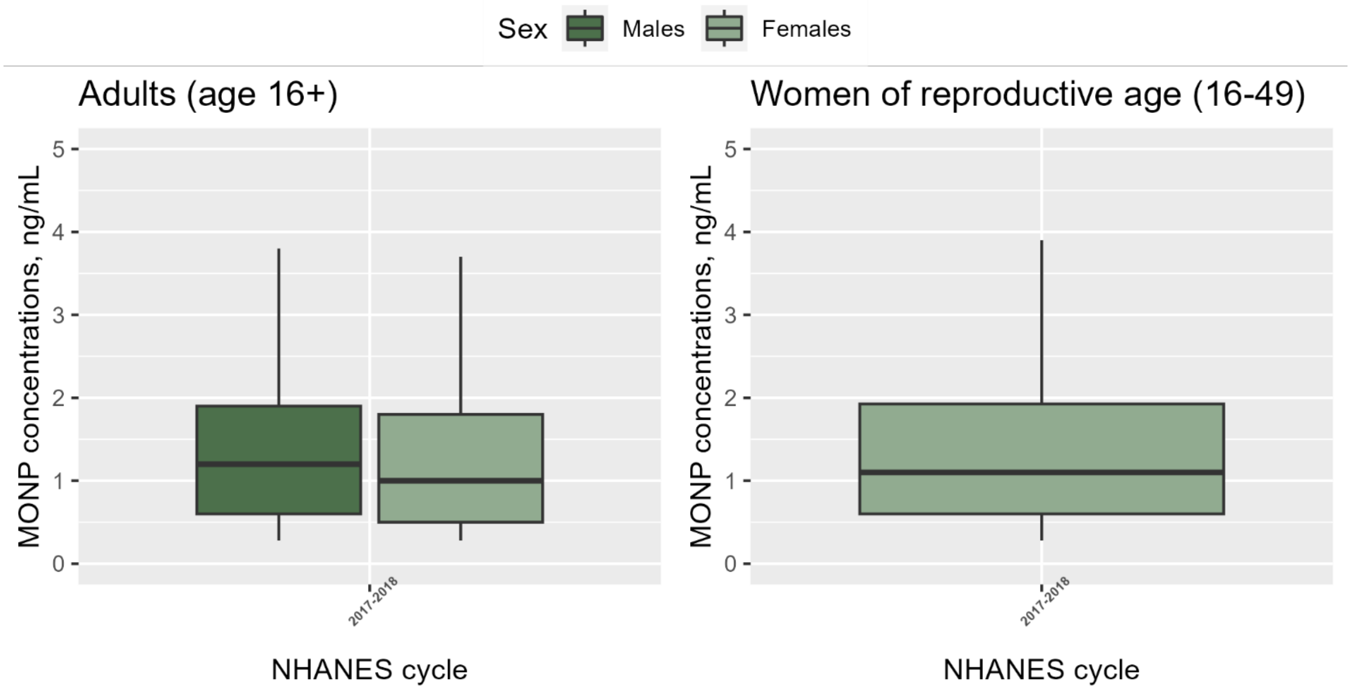


Figure 10-7. Urinary MONP Concentrations for Adults (16+ Years) and Women of Reproductive Age (16 to 49 Years)

10.2.1.4 Daily Intake of DIDP from NHANES

Using DINP metabolite concentrations measured in the most recently available sampling cycle (2017 to 2018), EPA estimated the daily intake of DINP 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 10-2 (Koch et al., 2007). For DINP, the phthalate monoester metabolites are MiNP, MONP, and MCOP.

Equation 10-2. 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} = Sum molar concentration of urinary metabolites associated with the parent phthalate diester (in units of µmole per gram creatinine).

CE = 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 performed by Health Canada (ECCC/HC, 2020) and U.S. CPSC (2014).

Fue_{sum} = 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. Fue values used for daily intake value calculations are reported in Table 10-2.

MW_{parent} = Molecular weight of the parent phthalate diester (in units of g/mole).

Table 10-2. Fue Values Used for the Calculation of Daily Intake Values by DINP

Metabolite	F_{ue} [a]	F_{ue} Sum	Reference	Study Population
MINP	0.030	0.192	(Anderson et al., 2011)	N = 10 men (20–42 years of age) and 10 women (18–77 years of age)
MONP	0.063			
MCOP	0.099			

[a] F_{ue} values are presented on a molar basis and were estimated by study authors based on metabolite excretion over a 24-hour period.

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). Daily intake values for DINP are reported in Table 10-3.

Table 10-3. Daily Intake Values for DINP Based on Urinary Biomonitoring from the 2017 to 2018 NHANES Cycle

Demographic	50th percentile Daily Intake Value (Median [95% CI]) (µg/kg-bw-day)	95th percentile Daily Intake Value (Median [95% CI]) (µg/kg-bw-day)
All	0.6 (0.6–0.7)	4 (3.3–4.8)
Females	0.7 (0.6–0.7)	4.4 (3–5.9)
Males	0.6 (0.6–0.7)	3.6 (2.7–4.6)
White non-Hispanic	0.6 (0.6–0.7)	3.6 (2.5–4.8)
Black non-Hispanic	0.6 (0.6–0.7)	4.5 (2.9–6.2)
Mexican-American	0.6 (0.6–0.7)	4.8 (2.1–7.5)
Other Race	0.7 (0.6–0.8)	4.7 (2.1–7.3)
Above Poverty Level	0.7 (0.6–0.8)	7.1 (3.9–10.2)
Below Poverty Level	0.6 (0.6–0.7)	3.7 (2.9–4.6)
3–5 years old	1.5 (1.4–1.6)	5.7 (0.2–11.2)
6–11 years old	1 (0.9–1.2)	6.2 (3.3–9.1)
12–15 years old	0.7 (0.5–0.8)	5.2 (1.1–11.5)
16–49 years old	0.7 (0.6–0.7)	4 (1.9–6.2)
16+ years old	0.6 (0.6–0.6)	3.5 (2.7–4.4)
Males 3–5 years old	1.4 (1.3–1.6)	4.8 (4.7–14.4)
Males 6–11 years old	1 (0.8–1.2)	3.4 (1.1–5.7)
Males 12–15 years old	0.6 (0.5–0.8)	4.7 [a]
Males 16–49 years old	0.6 (0.6–0.7)	3.4 (2–4.9)
Males 16+ years old	0.6 (0.5–0.6)	3.4 (2.4–4.4)
Females 3–5 years old	1.5 (1.3–1.7)	7.4 (0.7–15.5)
Females 6–11 years old	1 (0.9–1.2)	8.1 [a]

Demographic	50th percentile Daily Intake Value (Median [95% CI]) (µg/kg-bw-day)	95th percentile Daily Intake Value (Median [95% CI]) (µg/kg-bw-day)
Females 12–15 years old	0.7 (0.4–0.9)	5.2[a]
Females 16–49 years old	0.7 (0.6–0.8)	5.6 (2–9.3)
Females 16+ years old	0.6 (0.6–0.7)	3.6 (1.8–5.4)
[a] 95% confidence intervals (CI) could not be calculated due to small sample size or a standard error of zero.		

The calculated daily intake values in this analysis are similar to those reported by the U.S. CPSC (2014) and Health Canada (ECCC/HC, 2020). The daily intake values in the present analysis are calculated with all available NHANES data between 1999 and 2018, while the U.S. CPSC report only contains estimates for MCOP calculated with data from the 2005 to 2006 NHANES cycle and the Health Canada analysis used data from the 2009 to 2010 NHANES cycle.

Median and 95th percentile daily intake values in the U.S. CPSC (2014) report were estimated for men and women of reproductive age (15 to 45). U.S. CPSC reports a median daily intake value for adults aged 15 to 45 as 1.1 µg/kg-day and a 95th percentile daily intake value of 9.7 µg/kg-day.

The Health Canada (ECCC/HC, 2020) assessment reports median and 95th percentile daily intake values for children aged 6 to 11 as 4.6 and 25 µg/kg-day, respectively. Among 12 to 19 year-old males, the median daily intake value was 2.6 µg-kg/day and the 95th percentile was 33 µg-kg/day. The reported median and 95th percentile daily intake values for adults (age 20 or older) were 2.4 and 24 µg/kg-day for males and 1.9 and 23 µg/kg-day for females.

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. <u>Taken together with results from U.S. CPSC (2014) stating that DINP exposure comes (1) primarily from diet for women, infants, toddlers, and children; and (2) that the outdoor environment did not contribute to DINP exposures; the exposures to the general population via ambient air, surface water, and drinking water quantified in this document are likely overestimates. This is because estimates from individual pathways exceed the total intake values measured even at the 95th percentile of the U.S. population for all ages.</u>

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.

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, 2015). 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, the 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.

11 CONCLUSION OF ENVIRONMENTAL MEDIA CONCENTRATION AND GENERAL POPULATION EXPOSURE AND RISK SCREEN

11.1 Environmental Media Conclusions

Based on the environmental release assessment presented in the *Draft Environmental Release and Occupational Exposure Assessment for Diisononyl Phthalate (DINP)* (U.S. EPA, 2024e) DINP 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 DINP, concentrations of DINP in soil and groundwater from releases to biosolids and landfills were not assessed quantitatively and instead discussed qualitatively.

High-end concentration of DINP 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 Diisononyl Phthalate (DINP)* (U.S. EPA, 2024c) and for general population exposure described in this document. Table 11-1 summarizes the highest concentrations of DINP 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 DINP Concentrations in Various Environmental Media from Environmental Releases

OES [a]	Release Media	Environmental Media	DINP Concentration	Environmental or General Population
Manufacturing	Water	Total Water Column (7Q10)	24,000 µg/L	Environmental
		Benthic Pore Water (7Q10)	10,100 µg/L	Environmental
		Benthic Sediment (7Q10)	126,000 mg/kg	Environmental
Use of lubricants and functional fluids	Water	Surface Water (30Q5)	9,350 µg/L	General Population
		Surface Water (Harmonic Mean)	8,100 µg/L	General Population
Non-PVC Plastic Compounding	Fugitive Air	Soil (Air to Soil Deposition 100 m)	1.46E03 µg/kg	General Population
		Soil (Air to Soil Deposition 1,000 m)	40 µg/kg	Environmental

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

11.2 General Population Screening Conclusion

The general population can be exposed to DINP 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 carried forward for water was greater than the benchmark of 30, indicating that surface water and drinking water are not major pathways of exposure.

Table 11-2. General Population Water Exposure Summary

Occupational Exposure Scenario[a]	Water Column Conc.	Incidental Dermal Surface Water[b]		Incidental Ingestion Surface Water[c]		Drinking Water[d]	
	30Q5 Conc. (µg/L)	ADR_{POT} (mg/kg-day)	Acute MOE	ADR_{POT} (mg/kg-day)	Acute MOE	ADR_{POT} (mg/kg-day)	Acute MOE
Use of lubricants and functional fluids *Without Wastewater Treatment*	9,350	4.85E−02	247	5.00E−02	240	N/A	N/A
Use of lubricants and functional fluids *With Wastewater Treatment*	187	9.71E−04	12,300	1.00E−03	12,000	3.7E−05	322,000
Use of lubricants and functional fluids *With Wastewater and Drinking Water Treatment*	0.26	N/A	N/A	N/A	N/A	7.8E−06	1,530,000

[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 major pathway of concern.

Table 11-3. Tribal Fish for Adult Ingestion Summary

Calculation Method	Current Mean Ingestion Rate			Heritage Ingestion Rate		
	ADR/ADD (mg/kg-day)	Acute MOE UFs = 30	Chronic MOE UFs = 30	ADR/ADD (mg/kg-day)	Acute MOE UFs = 30	Chronic MOE UFs = 30
Water solubility limit (6.10E−04 mg/L)	3.46E−05	1,4200,000	434,000	1.99E−04	246,000	75,300
Monitored SWC from stormwater catchment area (8.50E−02 mg/L)	4.82E−03	10,200	3,110	2.78E−02	1,800	540

Table 11-4 summarizes the soil ingestion and dermal contact to soil exposure resulting from ambient air to soil deposition for infants and children (ages 6 months to <12 years). The MOEs for both acute and chronic exposure scenario assessed were greater than the benchmark of 30, indicating that ambient air to soil deposition is not a major pathway of exposure.

Table 11-4. General Population Ambient Air Exposure Summary

OES[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]
Non-PVC plastic compounding	1.46	0.018	179.9 (acute) 52.5 (chronic)	1.46	0.0487	179.9 (acute) 52.5 (chronic)

[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 major 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. Risk Screen for High-End Exposure Scenarios for Highest Exposed Populations

OES[a]	Exposure Pathway	Exposure Route	Exposure Scenario	Lifestage	Major Pathway[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)	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
Non-PVC plastic compounding	Ambient Air	Oral	Ingestion of DINP in soil resulting from air to soil deposition (Section 9.1)	Infant and Children (6 month to 12 years)	No
		Dermal	Dermal exposure to DINP in soil resulting from air to soil deposition (Section 9.1.2)	Infant and Children (6 month to 12 years)	No

[a] Table 1-1 provides a crosswalk of industrial and commercial COUs to OES.
[b] Using the MOE approach as a risk screening tool, an exposure pathway was determined to not be a major 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), human milk (10.1.4) 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 exposure assessment of surface water (5.2), drinking water (6.4), fish ingestion (7.5), ambient air (8.5), human milk (10.1.4) and biomonitoring (10.2.3) EPA has robust confidence that the screening level analysis was appropriately conservative to determine that no environmental pathway has the potential for non-cancer or 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 and 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: 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: Age bins may vary for different measurements and sources See Table 8-5 of EPA *Exposure Factors Handbook* (U.S. EPA, 2011)
$IR_{dw-acute}$	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)
$IR_{dw-chronic}$	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 to 2, 2 to 3, and 3 to <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

Symbol	Definition	Recommended Default Value	Recommended Default Value	Source
		Occupational	Residential	
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
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)

Table_Apx A-4. Mean and Upper Milk Ingestion Rates by Age

Age Group	Milk Ingestion (mL/kg day)	
	Mean	Upper (95th percentile)
Birth to <1 month	150	220
1 to <3 month	140	190
3 to <6 month	110	150
6 to <12 month	83	130
Birth to <1 year	104.8	152.5

A.1 Surface Water Exposure Activity Parameters

Table_Apx A-5. 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-6. 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)

Input	Description (Units)	Adult (≥21 years)	Youth (11–15 years)	Child (6–10 years)	Notes	Reference
$IR_{inc\text{-}daily}$	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)
CF1	Conversion factor (mg/µg)	1.00E−03				
CF2	Conversion factor (days/year)	365				

Appendix B BIOMONITORING METHODS AND RESULTS

EPA analyzed urinary biomonitoring data from the U.S. Centers for Disease Control and Prevention (CDC) National Health and Nutrition Evaluation Surveys (NHANES), which reports urinary concentrations for 15 phthalate metabolites specific to individual phthalate diesters. Three metabolites of DINP, mono-isononyl phthalate (MiNP), mono-oxoisononyl phthalate (MONP), and mono-(carboxyoctyl) phthalate (MCOP) have been reported in the NHANES data. MiNP has been reported in NHANES beginning with the 1999 cycle and measured in 26,740 members of the general public, including 7,331 children aged 15 and under and 19,409 adults aged 16 and over. MCOP was added starting in the 2005 to 2006 NHANES cycle and has been measured in 18,812 participants, including 5,123 children and 13,689 adults. Most recently, NHANES began reporting concentrations of MONP, which has been measured in 2,762 participants, including 866 children and 1,896 adults.

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

NHANES Cycle	MiNP	MCOP	MONP
1999–2000	0.79	–	–
2001–2002	0.79	–	–
2003–2004	1.54	–	–
2005–2006	1.232	0.7	–
2007–2008	1.232	0.7	–
2009–2010	0.770	0.2	–
2011–2012	0.5	0.2	–
2013–2014	0.9	0.3	–
2015–2016	0.9	0.3	–
2017–2018	0.9	0.3	0.4

2357 **Table_Apx B-2. Summary of Urinary DINP Metabolite Concentrations (ng/mL) from all NHANES Cycles between 1999 and 2018**

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2017–2018	MiNP	WRA	White non-Hispanic	151	127 (84.11%)	0.64 (0.64–0.64)	2.4 (0.64–9.3)	0.52 (0.41–0.65)	2.7 (1.49–3.05)
2017–2018	MiNP	WRA	Black non-Hispanic	109	90 (82.57%)	0.64 (0.64–0.64)	1.8 (1.2–5.1)	0.35 (0.29–0.41)	1.39 (0.77–3.8)
2017–2018	MiNP	WRA	Mexican American	86	74 (86.05%)	0.64 (0.64–0.64)	2.7 (0.64–5)	0.48 (0.42–0.56)	3.05 (0.97–3.62)
2017–2018	MiNP	WRA	Other	150	136 (90.67%)	0.64 (0.64–0.64)	1.3 (0.64–15.3)	0.71 (0.46–1)	3.82 (1.6–16.72)
2017–2018	MiNP	WRA	Below poverty level	124	107 (86.29%)	0.64 (0.64–0.64)	1.7 (1–3.9)	0.55 (0.44–0.75)	4.42 (1.74–16.72)
2017–2018	MiNP	WRA	At or above poverty level	311	272 (87.46%)	0.64 (0.64–0.64)	2 (0.64–5)	0.51 (0.46–0.6)	2.78 (1.83–3.29)
2017–2018	MiNP	WRA	Unkown income	61	48 (78.69%)	0.64 (0.64–0.64)	4.8 (1–15.3)	0.43 (0.31–0.55)	3.37 (1.07–16.09)
2017–2018	MiNP	WRA	WRA (16–49)	496	427 (86.09%)	0.64 (0.64–0.64)	2.3 (1.3–9.3)	0.6 (0.54–0.78)	4.89 (2.78–7.2)
2017–2018	MiNP	Adults	Females	952	849 (89.18%)	0.64 (0.64–0.64)	2.3 (1.3–9.3)	0.6 (0.54–0.78)	4.89 (2.78–7.2)
2017–2018	MiNP	Adults	Males	944	832 (88.14%)	0.64 (0.64–0.64)	1.8 (1.2–4.4)	0.5 (0.45–0.56)	2.86 (2.06–3.37)
2017–2018	MiNP	Adults	White non-Hispanic	648	580 (89.51%)	0.64 (0.64–0.64)	1.6 (0.64–4)	0.52 (0.41–0.65)	2.7 (1.49–3.05)
2017–2018	MiNP	Adults	Black non-Hispanic	438	382 (87.21%)	0.64 (0.64–0.64)	1.8 (0.64–51.5)	0.35 (0.29–0.41)	1.39 (0.77–3.8)
2017–2018	MiNP	Adults	Mexican American	278	246 (88.49%)	0.64 (0.64–0.64)	1.1 (0.64–1.3)	0.48 (0.42–0.56)	3.05 (0.97–3.62)
2017–2018	MiNP	Adults	Other	532	473 (88.91%)	0.64 (0.64–0.64)	2.5 (1.1–9.4)	0.71 (0.46–1)	3.82 (1.6–16.72)
2017–2018	MiNP	Adults	At or above poverty level	1,307	1171 (89.59%)	0.64 (0.64–0.64)	1.6 (1.1–4)	0.51 (0.46–0.6)	2.78 (1.83–3.29)
2017–2018	MiNP	Adults	Unknown income	252	217 (86.11%)	0.64 (0.64–0.64)	2.5 (0.9–51.5)	0.43 (0.31–0.55)	3.37 (1.07–16.09)
2017–2018	MiNP	Adults	Below poverty level	337	293 (86.94%)	0.64 (0.64–0.64)	4 (1.2–29.6)	0.55 (0.44–0.75)	4.42 (1.74–16.72)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2017–2018	MiNP	Adults	All adults (16+)	1,896	215 (11.34%)	0.64 (0.64–0.64)	2 (1.3–4.4)	0.5 (0.45–0.56)	2.91 (2.13–3.37)
2017–2018	MiNP	Children	All children (3 to <16 years)	866	710 (81.99%)	0.64 (0.64–0.64)	1.8 (1.2–3)	0.7 (0.62–0.78)	3.05 (2.22–4.53)
2017–2018	MiNP	Children	Children (6 to <11 years)	330	261 (79.09%)	0.64 (0.64–0.64)	1.9 (1.1–3.6)	0.91 (0.74–0.98)	2.66 (2.21–3.76)
2017–2018	MiNP	Children	Adolescents (11 to <16 years)	213	166 (77.93%)	0.64 (0.64–0.64)	1.7 (1.1–2.8)	0.66 (0.53–0.9)	2.95 (1.78–5.33)
2017–2018	MiNP	Children	Toddlers (3–5 years)	465	379 (81.51%)	0.64 (0.64–0.64)	1.2 (0.64–14.6)	0.48 (0.35–0.56)	2.7 (1.19–4.42)
2017–2018	MiNP	Children	Females	447	362 (80.98%)	0.64 (0.64–0.64)	1.8 (1.2–3)	0.6 (0.54–0.78)	4.89 (2.78–7.2)
2017–2018	MiNP	Children	White non-Hispanic	258	221 (85.66%)	0.64 (0.64–0.64)	1.2 (0.64–3.2)	0.52 (0.41–0.65)	2.7 (1.49–3.05)
2017–2018	MiNP	Children	Black non-Hispanic	207	159 (76.81%)	0.64 (0.64–0.64)	4.1 (1.2–207.7)	0.35 (0.29–0.41)	1.39 (0.77–3.8)
2017–2018	MiNP	Children	Mexican American	139	108 (77.7%)	0.64 (0.64–0.64)	1.8 (1–3.6)	0.48 (0.42–0.56)	3.05 (0.97–3.62)
2017–2018	MiNP	Children	Other	262	222 (84.73%)	0.64 (0.64–0.64)	1.5 (0.64–13.5)	0.71 (0.46–1)	3.82 (1.6–16.72)
2017–2018	MiNP	Children	Below poverty level	234	186 (79.49%)	0.64 (0.64–0.64)	3 (1.1–14.6)	0.55 (0.44–0.75)	4.42 (1.74–16.72)
2017–2018	MiNP	Children	At or above poverty level	547	467 (85.37%)	0.64 (0.64–0.64)	1.5 (1–3.9)	0.51 (0.46–0.6)	2.78 (1.83–3.29)
2017–2018	MiNP	Children	Unkown income	85	57 (67.06%)	0.64 (0.64–0.64)	1.4 (1–40.9)	0.43 (0.31–0.55)	3.37 (1.07–16.09)
2017–2018	MONP	WRA	WRA (16–49)	496	418 (84.27%)	1.3 (1.1–1.6)	10.3 (4.9–17.6)	1.25 (0.99–1.52)	9.78 (4.64–33.23)
2017–2018	MONP	WRA	White non-Hispanic	151	132 (87.42%)	1.3 (0.9–1.9)	9.4 (3.9–16.2)	1.26 (1.04–1.56)	9.2 (3.09–33.23)
2017–2018	MONP	WRA	Black non-Hispanic	109	97 (88.99%)	1.7 (1.2–2.5)	7.2 (5.7–41.7)	1.12 (0.85–1.34)	8.24 (2.99–13.63)
2017–2018	MONP	WRA	Mexican American	86	72 (83.72%)	0.9 (0.5–2.4)	18 (2.5–45)	1.08 (0.7–1.76)	13.04 (2.12–44.12)
2017–2018	MONP	WRA	Other	150	117 (78%)	1.4 (1–1.7)	9.7 (2.7–48)	1.2 (0.82–1.65)	14 (3.5–43.2)
2017–2018	MONP	WRA	Below poverty	124	103	1 (0.7–1.4)	11.7 (3.5–45)	1.22 (1–1.54)	4.86 (2.22–44.12)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
			level		(83.06%)				
2017–2018	MONP	WRA	At or above poverty level	311	263 (84.57%)	1.4 (1.1–1.7)	10.3 (4.4–24.3)	1.27 (0.98–1.52)	9.66 (3.09–33.23)
2017–2018	MONP	WRA	Unkown income	61	52 (85.25%)	1.4 (0.8–4.7)	17.6 (4–48)	1.2 (0.57–3.96)	11 (2.74–25.26)
2017–2018	MONP	Adults	All adults (16+)	1896	1607 (84.76%)	1.3 (1–1.4)	7.2 (6–9.1)	0.97 (0.93–1.04)	4.35 (3.2–7.59)
2017–2018	MONP	Adults	Males	944	834 (88.35%)	1.2 (1–1.4)	7.2 (6–9.1)	1.6 (1.25–1.93)	10.43 (5.73–20.81)
2017–2018	MONP	Adults	Females	952	773 (81.2%)	1.3 (1.1–1.6)	10.3 (4.9–17.6)	1.25 (0.99–1.52)	9.78 (4.64–33.23)
2017–2018	MONP	Adults	White non-Hispanic	648	552 (85.19%)	1.1 (1–1.6)	6.9 (3.5–16.2)	1.26 (1.04–1.56)	9.2 (3.09–33.23)
2017–2018	MONP	Adults	Black non-Hispanic	438	387 (88.36%)	1.7 (1.4–2)	9.4 (5.8–217.5)	1.12 (0.85–1.34)	8.24 (2.99–13.63)
2017–2018	MONP	Adults	Mexican American	278	237 (85.25%)	1.3 (1.1–1.4)	5.7 (3.6–20.8)	1.08 (0.7–1.76)	13.04 (2.12–44.12)
2017–2018	MONP	Adults	Other	532	431 (81.02%)	1.4 (0.9–1.8)	8.2 (4.7–22.2)	1.2 (0.82–1.65)	14 (3.5–43.2)
2017–2018	MONP	Adults	Below poverty level	337	289 (85.76%)	1 (0.8–1.8)	22.6 (3.2–112.6)	1.22 (1–1.54)	4.86 (2.22–44.12)
2017–2018	MONP	Adults	At or above poverty level	1,307	1,106 (84.62%)	1.3 (1–1.5)	7 (4.4–9.1)	1.27 (0.98–1.52)	9.66 (3.09–33.23)
2017–2018	MONP	Adults	Unkown income	252	212 (84.13%)	1.4 (0.8–1.9)	7.4 (3.5–11.8)	1.2 (0.57–3.96)	11 (2.74–25.26)
2017–2018	MONP	Children	All children (3 to <16 years)	866	800 (92.38%)	1.7 (1.2–2.3)	10.1 (7.5–18.4)	1.79 (1.56–1.99)	11.32 (10–14.16)
2017–2018	MONP	Children	Children (6 to <11 years)	274	265 (96.72%)	1.9 (1.5–2.6)	10.4 (8.1–23.3)	2.42 (2.12–2.73)	12.09 (6.63–16.5)
2017–2018	MONP	Children	Adolescents (11 to <16 years)	213	188 (88.26%)	1.4 (0.8–2.3)	14.3 (5.8–23.5)	1.58 (1.2–1.92)	10.95 (3.73–17.89)
2017–2018	MONP	Children	Toddlers (3–5 years)	379	347 (91.56%)	1.4 (0.8–3.9)	5 (2.4–70.4)	1.14 (0.96–1.43)	4.26 (2.53–21.33)
2017–2018	MONP	Children	Females	447	408 (91.28%)	1.7 (1.2–2.3)	10.1 (7.5–18.4)	1.25 (0.99–1.52)	9.78 (4.64–33.23)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2017–2018	MONP	Children	White non-Hispanic	258	237 (91.86%)	2 (0.8–2.8)	10.1 (6.1–23.3)	1.26 (1.04–1.56)	9.2 (3.09–33.23)
2017–2018	MONP	Children	Black non-Hispanic	207	199 (96.14%)	1.9 (1.4–2.8)	10.4 (6.4–70.4)	1.12 (0.85–1.34)	8.24 (2.99–13.63)
2017–2018	MONP	Children	Mexican American	139	129 (92.81%)	1.5 (1.3–2.1)	8.4 (4.4–11.5)	1.08 (0.7–1.76)	13.04 (2.12–44.12)
2017–2018	MONP	Children	Other	262	235 (89.69%)	1.2 (0.7–2.3)	15.8 (4.7–36)	1.2 (0.82–1.65)	14 (3.5–43.2)
2017–2018	MONP	Children	Below poverty level	234	219 (93.59%)	2.3 (1–4.1)	14.3 (5.9–70.4)	1.22 (1–1.54)	4.86 (2.22–44.12)
2017–2018	MONP	Children	At or above poverty level	547	503 (91.96%)	1.6 (1.1–2.1)	7.6 (4.7–18.7)	1.27 (0.98–1.52)	9.66 (3.09–33.23)
2017–2018	MONP	Children	Unkown income	85	78 (91.76%)	1.4 (0.5–6.1)	10.7 (6.1–833.3)	1.2 (0.57–3.96)	11 (2.74–25.26)
2017–2018	MCOP	WRA	White non-Hispanic	151	151 (100%)	4.7 (3.7–5.6)	26.8 (18.5–137.6)	4.18 (3.28–5.71)	64.62 (10.36–69.15)
2017–2018	MCOP	WRA	Black non-Hispanic	109	109 (100%)	5.8 (3.9–10.9)	26.3 (15.5–494.2)	4.26 (2.83–5.5)	13.81 (9.09–38.07)
2017–2018	MCOP	WRA	Mexican American	86	85 (98.84%)	4 (1.6–8.1)	49.2 (13.8–155.8)	3.17 (2.37–4.84)	57.62 (7.38–152.75)
2017–2018	MCOP	WRA	Other	150	149 (99.33%)	5.5 (3.2–5.8)	41.2 (12–349.2)	3.87 (2.47–5.5)	82.29 (14.33–183.79)
2017–2018	MCOP	WRA	Below poverty level	124	124 (100%)	3.8 (3–5.2)	116.5 (11.3–494.2)	4.36 (3.03–5.54)	68.46 (8.39–186.67)
2017–2018	MCOP	WRA	At or above poverty level	311	309 (99.36%)	5.1 (4.1–5.8)	26.8 (18.5–48.2)	4.07 (3.17–5.34)	57.62 (9.09–164.8)
2017–2018	MCOP	WRA	Unkown income	61	61 (100%)	5.1 (2.7–10)	65.7 (7–349.2)	3.87 (2.16–6.07)	42.17 (5.98–183.79)
2017–2018	MCOP	WRA	WRA (16–49)	496	494 (99.6%)	4.9 (4.1–5.7)	41.2 (20.9–69.8)	4.09 (3.38–4.96)	66.41 (11.82–164.8)
2017–2018	MCOP	Adults	All adults (16+)	1,896	1,883 (99.31%)	4.5 (3.8–5.3)	38.9 (27.5–73.8)	3.47 (3.05–3.81)	21.72 (15.53–51.43)
2017–2018	MCOP	Adults	Males	944	938 (99.36%)	4.5 (3.7–5.4)	39.4 (27.5–82.8)	3.44 (2.98–3.76)	20.66 (15.3–51.43)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2017–2018	MCOP	Adults	Females	952	945 (99.26%)	4.9 (4.1–5.7)	41.2 (20.9–69.8)	4.09 (3.38–4.96)	66.41 (11.82–164.8)
2017–2018	MCOP	Adults	White non-Hispanic	648	646 (99.69%)	4.4 (3.3–5.6)	37.8 (23.1–53.1)	4.18 (3.28–5.71)	64.62 (10.36–69.15)
2017–2018	MCOP	Adults	Black non-Hispanic	438	436 (99.54%)	6.3 (5.1–7.3)	46.9 (26.1–498.1)	4.26 (2.83–5.5)	13.81 (9.09–38.07)
2017–2018	MCOP	Adults	Mexican American	278	276 (99.28%)	4 (3.3–6.7)	22.4 (14.2–47.6)	3.17 (2.37–4.84)	57.62 (7.38–152.75)
2017–2018	MCOP	Adults	Other	532	525 (98.68%)	4.6 (3.5–5.6)	44.2 (22.1–150.7)	3.87 (2.47–5.5)	82.29 (14.33–183.79)
2017–2018	MCOP	Adults	Below poverty level	337	337 (100%)	4.2 (2.2–6.6)	69.5 (10.7–400.7)	4.36 (3.03–5.54)	68.46 (8.39–186.67)
2017–2018	MCOP	Adults	At or above poverty level	1,307	1,296 (99.16%)	4.4 (3.5–5.2)	39.4 (24–73.8)	4.07 (3.17–5.34)	57.62 (9.09–164.8)
2017–2018	MCOP	Adults	Unkown income	252	250 (99.21%)	7.2 (3.9–11.7)	32.95 (15.5–498.1)	3.87 (2.16–6.07)	42.17 (5.98–183.79)
2017–2018	MCOP	Children	All children (3 to <16 years)	915	914 (99.89%)	6 (4.3–7.5)	57.3 (21.5–62.9)	5.87 (5.1–6.85)	40 (25.66–67.59)
2017–2018	MCOP	Children	Children (6 to <11 years)	274	273 (99.64%)	6.7 (4.7–9.2)	58.3 (17.4–103.3)	8.21 (6.91–10)	60.48 (25.66–87.01)
2017–2018	MCOP	Children	Adolescents (11 to <16 years)	213	213 (100%)	5.1 (3–7.5)	40.5 (20.3–82.8)	5 (4–6.38)	34.79 (11.09–69.64)
2017–2018	MCOP	Children	Toddlers (3–5 years)	379	379 (100%)	6.4 (2.4–10)	19.8 (7.2–107.2)	4.06 (2.96–4.33)	19.79 (7.86–100.95)
2017–2018	MCOP	Children	Females	447	447 (100%)	6 (4.3–7.5)	57.3 (21.5–62.9)	4.09 (3.38–4.96)	66.41 (11.82–164.8)
2017–2018	MCOP	Children	White non-Hispanic	258	258 (100%)	6 (3–9.7)	58.3 (17.4–119)	4.18 (3.28–5.71)	64.62 (10.36–69.15)
2017–2018	MCOP	Children	Black non-Hispanic	207	207 (100%)	6.7 (4.6–8.4)	37.4 (19.1–107.2)	4.26 (2.83–5.5)	13.81 (9.09–38.07)
2017–2018	MCOP	Children	Mexican American	139	139 (100%)	5.1 (3.6–7.2)	26 (15.3–46.5)	3.17 (2.37–4.84)	57.62 (7.38–152.75)
2017–2018	MCOP	Children	Other	262	261 (99.62%)	4.9 (3.2–6.8)	40.5 (14.1–115.6)	3.87 (2.47–5.5)	82.29 (14.33–183.79)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2017–2018	MCOP	Children	Below poverty level	234	234 (100%)	6.8 (5.3–12.5)	62.9 (19.9–107.2)	4.36 (3.03–5.54)	68.46 (8.39–186.67)
2017–2018	MCOP	Children	At or above poverty level	574	546 (95.12%)	5.5 (3.4–8.1)	50.6 (19.4–61.2)	4.07 (3.17–5.34)	57.62 (9.09–164.8)
2017–2018	MCOP	Children	Unkown income	85	85 (100%)	6.7 (2.9–10.1)	29.8 (10.9–3346.1)	3.87 (2.16–6.07)	42.17 (5.98–183.79)
2015–2016	MiNP	WRA	White non-Hispanic	149	116 (77.85%)	0.64 (0.64–0.64)	5.6 (1.4–20.4)	0.77 (0.6–0.88)	5.8 (2.46–16.59)
2015–2016	MiNP	WRA	Black non-Hispanic	143	100 (69.93%)	0.64 (0.64–0.64)	13.3 (1.6–29.7)	0.43 (0.38–0.53)	4.91 (2.06–6.89)
2015–2016	MiNP	WRA	Mexican American	112	80 (71.43%)	0.64 (0.64–0.64)	9.5 (4.5–24.6)	0.79 (0.6–0.94)	8.22 (2.56–13.97)
2015–2016	MiNP	WRA	Other	160	115 (71.88%)	0.64 (0.64–0.64)	4.6 (1.4–9.2)	0.72 (0.53–1.03)	3.44 (2.56–10.71)
2015–2016	MiNP	WRA	Below poverty level	132	93 (70.45%)	0.64 (0.64–0.64)	10 (2–20.5)	0.59 (0.41–0.77)	4.71 (1.64–23.03)
2015–2016	MiNP	WRA	At or above poverty level	385	284 (73.77%)	0.64 (0.64–0.64)	6.6 (3.1–20.4)	0.74 (0.64–0.82)	5.8 (2.7–10.2)
2015–2016	MiNP	WRA	Unkown income	47	34 (72.34%)	0.64 (0.64–0.64)	1.9 (1.3–4.2)	0.55 (0.28–0.83)	7.01 (0.93–7.54)
2015–2016	MiNP	WRA	WRA (16–49)	564	411 (72.87%)	0.64 (0.64–0.64)	6.6 (3.2–20.4)	0.78 (0.67–0.98)	5.85 (3.22–13.95)
2015–2016	MiNP	Adults	Females	984	762 (77.44%)	0.64 (0.64–0.64)	6.6 (3.2-20.4)	0.78 (0.67-0.98)	5.85 (3.22-13.95)
2015–2016	MiNP	Adults	White non-Hispanic	571	447 (78.28%)	0.64 (0.64-0.64)	6.1 (3.8-12.3)	0.77 (0.6-0.88)	5.8 (2.46-16.59)
2015–2016	MiNP	Adults	Black non-Hispanic	427	307 (71.9%)	0.64 (0.64-0.64)	7.4 (2.6-23.1)	0.43 (0.38-0.53)	4.91 (2.06-6.89)
2015–2016	MiNP	Adults	Mexican American	342	249 (72.81%)	0.64 (0.64-0.64)	10 (2.6-19.7)	0.79 (0.6-0.94)	8.22 (2.56-13.97)
2015–2016	MiNP	Adults	Other	540	386 (71.48%)	0.64 (0.64-0.64)	4.9 (2.6-11.9)	0.72 (0.53-1.03)	3.44 (2.56-10.71)
2015–2016	MiNP	Adults	At or above poverty level	1,294	950 (73.42%)	0.64 (0.64-0.64)	7.4 (4.5–15.2)	0.74 (0.64-0.82)	5.8 (2.7-10.2)
2015–2016	MiNP	Adults	Unkown income	87	150 (172.41%)	0.64 (0.64-0.64)	4.5 (1-10.7)	0.55 (0.28-0.83)	7.01 (0.93-7.54)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2015–2016	MiNP	Adults	Below poverty level	399	289 (72.43%)	0.64 (0.64-0.64)	2.6 (1.6-20.5)	0.59 (0.41-0.77)	4.71 (1.64-23.03)
2015–2016	MiNP	Adults	All adults (16+)	1880	491 (26.12%)	0.64 (0.64-0.64)	6.8 (4.2-12.3)	0.7 (0.6-0.8)	5.56 (2.7-8.44)
2015–2016	MiNP	Adults	Males	896	627 (69.98%)	0.64 (0.64-0.64)	6.9 (4.2-12.3)	0.7 (0.6-0.8)	5.5 (2.67-10.2)
2015–2016	MiNP	Children	All children (3 to <16 years)	1095	793 (72.42%)	0.64 (0.64-0.64)	5.3 (2.1-14.3)	0.76 (0.69-0.88)	5.16 (3.05–9.14)
2015–2016	MiNP	Children	Children (6 to <11 years)	415	286 (68.92%)	0.64 (0.64-0.64)	5 (2.2-13.5)	0.97 (0.84-1.16)	5.45 (3.56-12.25)
2015–2016	MiNP	Children	Adolescents (11 to <16 years)	284	191 (67.25%)	0.64 (0.64-0.64)	5.7 (1.7-14)	0.68 (0.55–0.76)	6 (2.25–9.14)
2015–2016	MiNP	Children	Toddlers (3–5 years)	359	330 (91.92%)	0.64 (0.64-0.64)	25.7 (0.64-25.7)	0.63 (0.46-0.89)	2.72 (1.42-11.13)
2015–2016	MiNP	Children	Females	517	388 (75.05%)	0.64 (0.64-0.64)	5.3 (2.1-14.3)	0.78 (0.67-0.98)	5.85 (3.22-13.95)
2015–2016	MiNP	Children	White non-Hispanic	291	221 (75.95%)	0.64 (0.64-0.64)	5.2 (1.5–25.7)	0.77 (0.6-0.88)	5.8 (2.46-16.59)
2015–2016	MiNP	Children	Black non-Hispanic	271	181 (66.79%)	0.64 (0.64-0.64)	6.4 (1.2-16.3)	0.43 (0.38-0.53)	4.91 (2.06-6.89)
2015–2016	MiNP	Children	Mexican American	253	191 (75.49%)	0.64 (0.64-0.64)	2.5 (1.3-5.7)	0.79 (0.6-0.94)	8.22 (2.56-13.97)
2015–2016	MiNP	Children	Other	280	200 (71.43%)	0.64 (0.64-0.64)	11.1 (3-66.3)	0.72 (0.53-1.03)	3.44 (2.56-10.71)
2015–2016	MiNP	Children	Below poverty level	329	221 (67.17%)	0.64 (0.64-0.64)	13.7 (2.6-26.2)	0.59 (0.41-0.77)	4.71 (1.64-23.03)
2015–2016	MiNP	Children	At or above poverty level	670	498 (74.33%)	0.64 (0.64-0.64)	5 (1.9-25.6)	0.74 (0.64-0.82)	5.8 (2.7-10.2)
2015–2016	MiNP	Children	Unkown income	96	74 (77.08%)	0.64 (0.64-0.64)	1.8 (0.64-10.2)	0.55 (0.28–0.83)	7.01 (0.93–7.54)
2015–2016	MCOP	WRA	White non-Hispanic	149	149 (100%)	6.5 (3.5–8.6)	95.3 (21–158.8)	5.7 (3.65–8.75)	55.48 (16.07–125.04)
2015–2016	MCOP	WRA	Black non-Hispanic	143	142 (99.3%)	8.4 (4.2–18.9)	117.6 (61.7–268)	5.38 (3.91–8.94)	70.71 (31.94–260)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2015–2016	MCOP	WRA	Mexican American	112	112 (100%)	8.95 (6.3–12.4)	178 (37.6–216)	7.32 (6.21–10.95)	175.61 (70.94–570.56)
2015–2016	MCOP	WRA	Other	160	158 (98.75%)	5.3 (4.3–7.4)	73.6 (20.5–160.2)	6.26 (4.06–9.8)	59.35 (21.66–119.55)
2015–2016	MCOP	WRA	Below poverty level	132	131 (99.24%)	8.7 (6.5–12.4)	131.6 (34.6–216)	7.09 (4.51–9.59)	90.27 (30.8–117.97)
2015–2016	MCOP	WRA	At or above poverty level	385	383 (99.48%)	6.4 (4.3–8.1)	89.3 (44.6–158.8)	6.26 (4.36–8.75)	62.48 (34.91–125.04)
2015–2016	MCOP	WRA	Unkown income	47	47 (100%)	4.7 (2.2–9.2)	75.2 (8.9–125.9)	4.18 (2.57–7.11)	39.17 (7.23–68.8)
2015–2016	MCOP	WRA	WRA (16–49)	564	561 (99.47%)	6.7 (5–8.1)	95.3 (49.2–134.8)	6.17 (4.72–8.47)	70.75 (51.47–119.55)
2015–2016	MCOP	Adults	All adults (16+)	1,880	1,868 (99.36%)	7.8 (5.5–11.7)	130.6 (69.1–198.8)	5.75 (4.1–8.47)	74.71 (46.52–97.94)
2015–2016	MCOP	Adults	Males	896	891 (99.44%)	7.8 (5.5–12.1)	130.6 (72.8–200.1)	8.67 (6.6–10.69)	74.71 (46.52–97.94)
2015–2016	MCOP	Adults	Females	984	977 (99.29%)	6.7 (5–8.1)	95.3 (49.2–134.8)	6.17 (4.72–8.47)	70.75 (51.47–119.55)
2015–2016	MCOP	Adults	White non-Hispanic	571	570 (99.82%)	7.8 (4.5–13.4)	162.4 (44.7–200.9)	5.7 (3.65–8.75)	55.48 (16.07–125.04)
2015–2016	MCOP	Adults	Black non-Hispanic	427	424 (99.3%)	7 (4.9–14.3)	108.4 (64.2–209.6)	5.38 (3.91–8.94)	70.71 (31.94–260)
2015–2016	MCOP	Adults	Mexican American	342	342 (100%)	7.7 (5.8–10.6)	125.3 (62.5–145.9)	7.32 (6.21–10.95)	175.61 (70.94–570.56)
2015–2016	MCOP	Adults	Other	540	532 (98.52%)	7.9 (5–12.7)	73.6 (47.7–128.2)	6.26 (4.06–9.8)	59.35 (21.66–119.55)
2015–2016	MCOP	Adults	Below poverty level	399	398 (99.75%)	6.6 (5.5–9)	67.9 (34.6–184.9)	7.09 (4.51–9.59)	90.27 (30.8–117.97)
2015–2016	MCOP	Adults	At or above poverty level	1,294	1,284 (99.23%)	8.2 (5.2–12.9)	145.9 (66.2–200.1)	6.26 (4.36–8.75)	62.48 (34.91–125.04)
2015–2016	MCOP	Adults	Unkown income	187	186 (99.47%)	8.6 (4–12)	107.1 (23.3–144.4)	4.18 (2.57–7.11)	39.17 (7.23–68.8)
2015–2016	MCOP	Children	All children (3 to <16 years)	1,152	1,148 (99.65%)	9.2 (8.5–10.8)	100.9 (49.5–274.3)	9.03 (7.66–10.17)	75.76 (55.48–117.56)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2015–2016	MCOP	Children	Children (6 to <11 years)	346	345 (99.71%)	10.2 (8.6–12.1)	73.4 (42.3–152.5)	11.75 (9.71–14.42)	87.31 (63.24–119.26)
2015–2016	MCOP	Children	Adolescents (11 to <16 years)	284	282 (99.3%)	9 (6.4–13.3)	101.1 (45.9–274.3)	6.75 (4.88–9.72)	70.2 (44.65–117.56)
2015–2016	MCOP	Children	Toddlers (3–5 years)	465	464 (99.78%)	8.9 (5.1–14.3)	281.4 (15.1–281.4)	6.59 (4.28–14.53)	55.09 (20.7–121.82)
2015–2016	MCOP	Children	Females	517	514 (99.42%)	9.2 (8.5–10.8)	100.9 (49.5–274.3)	6.17 (4.72–8.47)	70.75 (51.47–119.55)
2015–2016	MCOP	Children	White non-Hispanic	291	287 (98.63%)	9 (8.1–10.8)	120.4 (38.6–281.4)	5.7 (3.65–8.75)	55.48 (16.07–125.04)
2015–2016	MCOP	Children	Black non-Hispanic	271	271 (100%)	12.8 (6–27.7)	111.6 (37.6–210.2)	5.38 (3.91–8.94)	70.71 (31.94–260)
2015–2016	MCOP	Children	Mexican American	253	253 (100%)	8.1 (5.3–12.8)	37.1 (19.9–64.5)	7.32 (6.21–10.95)	175.61 (70.94–570.56)
2015–2016	MCOP	Children	Other	280	280 (100%)	8.6 (6–12)	102.8 (33.5–385.7)	6.26 (4.06–9.8)	59.35 (21.66–119.55)
2015–2016	MCOP	Children	Below poverty level	329	328 (99.7%)	8.9 (6.9–22.3)	120.4 (54.6–274.3)	7.09 (4.51–9.59)	90.27 (30.8–117.97)
2015–2016	MCOP	Children	At or above poverty level	670	667 (99.55%)	9.2 (8.6–10.5)	91.8 (40.3–269.1)	6.26 (4.36–8.75)	62.48 (34.91–125.04)
2015–2016	MCOP	Children	Unkown income	96	96 (100%)	5.3 (4.1–17.5)	22.3 (13.3–102.8)	4.18 (2.57–7.11)	39.17 (7.23–68.8)
2013–2014	MiNP	WRA	White non-Hispanic	207	116 (56.04%)	0.64 (0.64–0.64)	15.2 (8.6–48.2)	0.85 (0.7–1.06)	8.69 (4.51–18.05)
2013–2014	MiNP	WRA	Black non-Hispanic	133	57 (42.86%)	1 (0.64–1.8)	22.4 (8.9–101.6)	0.53 (0.44–0.7)	10.05 (5.02–26.54)
2013–2014	MiNP	WRA	Mexican American	90	54 (60%)	0.64 (0.64–0.64)	20.9 (2.6–66.8)	0.78 (0.46–1.31)	8 (3.78–12.94)
2013–2014	MiNP	WRA	Other	169	96 (56.8%)	0.64 (0.64–0.64)	20.6 (5–46.3)	1.2 (0.9–1.49)	17.3 (7.28–41.33)
2013–2014	MiNP	WRA	Below poverty level	175	96 (54.86%)	0.64 (0.64–0.64)	17.3 (4.9–48.2)	0.64 (0.45–0.94)	8.46 (2.95–19.64)
2013–2014	MiNP	WRA	At or above poverty level	379	200 (52.77%)	0.64 (0.64–0.64)	19.3 (10.8–37.4)	0.96 (0.79–1.07)	11.3 (5.03–26.54)
2013–2014	MiNP	WRA	Unkown income	45	24 (53.33%)	1 (0.64–1.6)	10.6 (1.2–21.1)	0.67 (0.45–1.08)	5.02 (1.88–13.51)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2013–2014	MiNP	WRA	WRA (16–49)	599	320 (53.42%)	0.64 (0.64–0.64)	17.4 (13.4–27.9)	1.12 (1–1.33)	15.46 (7.94–27.07)
2013–2014	MiNP	Adults	Females	1,076	683 (63.48%)	0.64 (0.64–0.64)	17.4 (13.4–27.9)	1.12 (1–1.33)	15.46 (7.94–27.07)
2013–2014	MiNP	Adults	White non-Hispanic	820	525 (64.02%)	0.64 (0.64–0.64)	13.3 (7.3–21.9)	0.85 (0.7–1.06)	8.69 (4.51–18.05)
2013–2014	MiNP	Adults	Black non-Hispanic	442	247 (55.88%)	0.64 (0.64–0.64)	16.1 (7.5–74.3)	0.53 (0.44–0.7)	10.05 (5.02–26.54)
2013–2014	MiNP	Adults	Mexican American	282	185 (65.6%)	0.64 (0.64–0.64)	9.6 (4.6–28.2)	0.78 (0.46–1.31)	8 (3.78–12.94)
2013–2014	MiNP	Adults	Other	496	279 (56.25%)	1.3 (1–1.5)	23.6 (15.5–57.7)	1.2 (0.9–1.49)	17.3 (7.28–41.33)
2013–2014	MiNP	Adults	At or above poverty level	1,405	827 (58.86%)	0.64 (0.64–1.3)	16.6 (11.9–21.9)	0.96 (0.79–1.07)	11.3 (5.03–26.54)
2013–2014	MiNP	Adults	Unkown income	181	122 (67.4%)	0.64 (0.64–0.64)	14.1 (1.5–21.8)	0.67 (0.45–1.08)	5.02 (1.88–13.51)
2013–2014	MiNP	Adults	Below poverty level	454	287 (63.22%)	0.64 (0.64–0.64)	15.5 (4.8–28.2)	0.64 (0.45–0.94)	8.46 (2.95–19.64)
2013–2014	MiNP	Adults	All adults (16+)	2,040	804 (39.41%)	0.64 (0.64–0.64)	16.3 (10.1–21.8)	0.87 (0.76–0.98)	10.2 (5.61–18.05)
2013–2014	MiNP	Adults	Males	964	553 (57.37%)	0.64 (0.64–0.64)	16 (9.6–21.9)	0.85 (0.71–0.97)	10.06 (5.03–18.05)
2013–2014	MiNP	Children	All children (3 to <16 years)	645	364 (56.43%)	0.64 (0.64–0.64)	10.1 (6.4–18)	1.13 (1.02–1.26)	13.18 (8.16–18.33)
2013–2014	MiNP	Children	Children (6 to <11 years)	409	224 (54.77%)	0.64 (0.64–0.64)	6.5 (2.7–28.2)	1.4 (1.16–1.64)	13.18 (7.11–19.78)
2013–2014	MiNP	Children	Adolescents (11 to <16 years)	299	171 (57.19%)	0.64 (0.64–0.64)	15.1 (5.6–25.9)	0.95 (0.74–1.16)	9.03 (5.4–16.61)
2013–2014	MiNP	Children	Females	324	181 (55.86%)	0.64 (0.64–0.64)	10.1 (6.4–18)	1.12 (1–1.33)	15.46 (7.94–27.07)
2013–2014	MiNP	Children	White non-Hispanic	167	91 (54.49%)	0.9 (0.64–1.7)	8.7 (4.1–17.6)	0.85 (0.7–1.06)	8.69 (4.51–18.05)
2013–2014	MiNP	Children	Black non-Hispanic	167	94 (56.29%)	0.64 (0.64–0.64)	5.9 (2.5–38.1)	0.53 (0.44–0.7)	10.05 (5.02–26.54)
2013–2014	MiNP	Children	Mexican American	156	96 (61.54%)	0.64 (0.64–0.64)	25.5 (4.5–40.7)	0.78 (0.46–1.31)	8 (3.78–12.94)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2013–2014	MiNP	Children	Other	155	83 (53.55%)	0.9 (0.64–1.4)	13.4 (2.9–31.6)	1.2 (0.9–1.49)	17.3 (7.28–41.33)
2013–2014	MiNP	Children	Below poverty level	212	136 (64.15%)	0.64 (0.64–0.64)	4.1 (2.1–12.4)	0.64 (0.45–0.94)	8.46 (2.95–19.64)
2013–2014	MiNP	Children	At or above poverty level	384	204 (53.13%)	0.9 (0.64–1.5)	15.1 (8.7–25.9)	0.96 (0.79–1.07)	11.3 (5.03–26.54)
2013–2014	MiNP	Children	Unkown income	49	24 (48.98%)	0.9 (0.64–2.3)	20.1 (2.8–103.8)	0.67 (0.45–1.08)	5.02 (1.88–13.51)
2013–2014	MCOP	WRA	White non-Hispanic	207	207 (100%)	21.4 (15.2–24.7)	256.9 (195.9–378.8)	21.33 (14.76–31.99)	205.46 (150.69–285.28)
2013–2014	MCOP	WRA	Black non-Hispanic	133	133 (100%)	28.8 (19.5–40.7)	386.6 (131.4–504.9)	19.06 (12.89–28.01)	152.12 (106.83–329.24)
2013–2014	MCOP	WRA	Mexican American	90	90 (100%)	11.1 (7.6–20.9)	130.8 (33.5–979.8)	14.12 (8.4–33.75)	121.23 (44.67–1324.05)
2013–2014	MCOP	WRA	Other	169	168 (99.41%)	16.9 (10.2–34.6)	299.4 (70.4–751.9)	14.6 (11.16–21.49)	350.95 (95.44–387.37)
2013–2014	MCOP	WRA	Below poverty level	175	175 (100%)	20.9 (12.6–28.8)	252.7 (114.6–979.8)	16.22 (13.33–31.01)	171.68 (78.49–922.5)
2013–2014	MCOP	WRA	At or above poverty level	379	378 (99.74%)	21.2 (16.9–24.6)	316.7 (204.4–386.6)	18.89 (14.6–26.58)	220.4 (162.83–342.53)
2013–2014	MCOP	WRA	Unkown income	45	45 (100%)	15.8 (6.6–40.7)	112.7 (29.7–447.7)	14.21 (7.77–39.61)	56.84 (31.64–251.39)
2013–2014	MCOP	WRA	WRA (16–49)	599	598 (99.83%)	20.5 (16.1–23.2)	262.2 (232.7–378.8)	17.93 (14.76–21.96)	203.09 (155.83–329.24)
2013–2014	MCOP	Adults	All adults (16+)	2,040	2,037 (99.85%)	23.3 (18.2–28.7)	293.1 (230.2–380.7)	18.72 (15.34–22.15)	204.98 (124.63–275.88)
2013–2014	MCOP	Adults	Males	964	962 (99.79%)	23.3 (17.8–30)	293.1 (224.5–380.7)	24.78 (20.62–34.45)	192.06 (124.63–275.88)
2013–2014	MCOP	Adults	Females	1076	1075 (99.91%)	20.5 (16.1–23.2)	262.2 (232.7–378.8)	17.93 (14.76–21.96)	203.09 (155.83–329.24)
2013–2014	MCOP	Adults	White non-Hispanic	820	819 (99.88%)	25.5 (17.7–41.5)	293.3 (213–484)	21.33 (14.76–31.99)	205.46 (150.69–285.28)
2013–2014	MCOP	Adults	Black non-Hispanic	442	441 (99.77%)	16.4 (13.4–21.8)	283 (144.1–524)	19.06 (12.89–28.01)	152.12 (106.83–329.24)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2013–2014	MCOP	Adults	Mexican American	282	282 (100%)	14.5 (9.3–23.5)	130.8 (71.4–553.8)	14.12 (8.4–33.75)	121.23 (44.67–1324.05)
2013–2014	MCOP	Adults	Other	496	495 (99.8%)	33.9 (22.5–42.9)	380.7 (193–707.2)	14.6 (11.16–21.49)	350.95 (95.44–387.37)
2013–2014	MCOP	Adults	Below poverty level	454	454 (100%)	14.9 (9.5–22.8)	147.7 (114.7–252.7)	16.22 (13.33–31.01)	171.68 (78.49–922.5)
2013–2014	MCOP	Adults	At or above poverty level	1,405	1,403 (99.86%)	25.7 (18.7–40.5)	294.3 (245.4–484)	18.89 (14.6–26.58)	220.4 (162.83–342.53)
2013–2014	MCOP	Adults	Unkown income	181	180 (99.45%)	12.95 (7.4–34)	274.7 (56.5–637.4)	14.21 (7.77–39.61)	56.84 (31.64–251.39)
2013–2014	MCOP	Children	All children (3 to <16 years)	705	705 (100%)	23.9 (19.9–29.1)	163.9 (120.4–208.8)	24.23 (22.06–27.95)	244.97 (173.33–344)
2013–2014	MCOP	Children	Children (6 to <11 years)	346	346 (100%)	24.8 (17.8–35.5)	134.5 (82.1–153.6)	33.75 (23.91–42.96)	254.41 (167.56–333.33)
2013–2014	MCOP	Children	Adolescents (11 to <16 years)	299	299 (100%)	22.6 (18.2–25.5)	172.6 (107.6–762.9)	20.62 (14.33–25.08)	192.5 (108.75–354.84)
2013–2014	MCOP	Children	Females	324	324 (100%)	23.9 (19.9–29.1)	163.9 (120.4–208.8)	17.93 (14.76–21.96)	203.09 (155.83–329.24)
2013–2014	MCOP	Children	White non-Hispanic	167	167 (100%)	24.4 (18.4–40.1)	166.5 (107.6–208.8)	21.33 (14.76–31.99)	205.46 (150.69–285.28)
2013–2014	MCOP	Children	Black non-Hispanic	167	167 (100%)	18.9 (15.3–24)	111.5 (69.4–158.2)	19.06 (12.89–28.01)	152.12 (106.83–329.24)
2013–2014	MCOP	Children	Mexican American	156	156 (100%)	23.6 (17.7–28.2)	352 (69.1–894.2)	14.12 (8.4–33.75)	121.23 (44.67–1324.05)
2013–2014	MCOP	Children	Other	155	155 (100%)	23.9 (17.5–34.7)	176.3 (102.2–207.3)	14.6 (11.16–21.49)	350.95 (95.44–387.37)
2013–2014	MCOP	Children	Below poverty level	212	212 (100%)	18.2 (14.9–23.8)	117.2 (53.9–163.5)	16.22 (13.33–31.01)	171.68 (78.49–922.5)
2013–2014	MCOP	Children	At or above poverty level	384	384 (100%)	26.4 (21.7–36.5)	172.6 (122.6–309.2)	18.89 (14.6–26.58)	220.4 (162.83–342.53)
2013–2014	MCOP	Children	Unkown income	49	49 (100%)	23.8 (6–69.1)	274.7 (66.5–762.9)	14.21 (7.77–39.61)	56.84 (31.64–251.39)
2011–2012	MiNP	WRA	White non-Hispanic	179	81 (45.25%)	0.6 (0.35–1.1)	29.1 (11.9–95.4)	1.32 (0.7–1.77)	33.75 (9.1–56.73)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2011–2012	MiNP	WRA	Black non-Hispanic	135	36 (26.67%)	1.6 (0.8–2.6)	17.8 (9.5–38.8)	0.95 (0.67–1.35)	21.25 (10.73–39.51)
2011–2012	MiNP	WRA	Mexican American	53	16 (30.19%)	1 (0.35–1.9)	7.5 (2.5–83.6)	0.79 (0.67–1.1)	42.63 (3.45–48.29)
2011–2012	MiNP	WRA	Other	169	63 (37.28%)	0.7 (0.35–1.1)	26.9 (19.1–63)	1.01 (0.74–1.25)	13.66 (8.04–23.66)
2011–2012	MiNP	WRA	Below poverty level	150	50 (33.33%)	1.2 (0.5–2.3)	27.3 (12.6–53.5)	1.02 (0.45–1.94)	33.75 (6.5–35.97)
2011–2012	MiNP	WRA	At or above poverty level	344	133 (38.66%)	0.7 (0.35–1)	28.3 (17.9–83.6)	1.18 (0.73–1.56)	23.66 (11.26–56.73)
2011–2012	MiNP	WRA	Unkown income	42	13 (30.95%)	0.35 (0.35–0.35)	4.9 (1.7–68.8)	1.03 (0.67–1.58)	4.85 (2.89–17.45)
2011–2012	MiNP	WRA	WRA (16–49)	536	196 (36.57%)	0.8 (0.35–1.1)	28.3 (17.9–53.5)	1.24 (0.97–1.63)	34.24 (10.29–78.39)
2011–2012	MiNP	Adults	Females	933	424 (45.44%)	0.8 (0.35–1.1)	28.3 (17.9–53.5)	1.24 (0.97–1.63)	34.24 (10.29–78.39)
2011–2012	MiNP	Adults	White non-Hispanic	664	310 (46.69%)	1.3 (0.8–1.8)	79.8 (11.9–124.9)	1.32 (0.7–1.77)	33.75 (9.1–56.73)
2011–2012	MiNP	Adults	Black non-Hispanic	499	178 (35.67%)	1.6 (1–2.6)	39.8 (20.2-67.7)	0.95 (0.67-1.35)	21.25 (10.73-39.51)
2011–2012	MiNP	Adults	Mexican American	186	78 (41.94%)	0.8 (0.35-1.2)	21.7 (4.2-39.6)	0.79 (0.67-1.1)	42.63 (3.45-48.29)
2011–2012	MiNP	Adults	Other	545	235 (43.12%)	1 (0.7-1.4)	22.4 (7.8-45.5)	1.01 (0.74-1.25)	13.66 (8.04-23.66)
2011–2012	MiNP	Adults	At or above poverty level	1,270	529 (41.65%)	1.2 (0.8–2)	34.1 (16.8–107.5)	1.18 (0.73–1.56)	23.66 (11.26–56.73)
2011–2012	MiNP	Adults	Unkown income	183	74 (40.44%)	1 (0.7–1.6)	6.5 (4.2–25)	1.03 (0.67–1.58)	4.85 (2.89–17.45)
2011–2012	MiNP	Adults	Below poverty level	441	198 (44.9%)	0.8 (0.35–3.3)	53.5 (5.4–79.8)	1.02 (0.45–1.94)	33.75 (6.5–35.97)
2011–2012	MiNP	Adults	All adults (16+)	1,894	1,093 (57.71%)	1.2 (0.8–1.5)	35.8 (16.8–95.7)	1.12 (0.73–1.47)	23.37 (9.1–52.48)
2011–2012	MiNP	Adults	Males	961	377 (39.23%)	1.2 (0.8–1.5)	35.8 (14.2–95.7)	1.12 (0.71–1.5)	23.37 (9.1–53.48)
2011–2012	MiNP	Children	All children (3 to <16 years)	595	227 (38.15%)	0.9 (0.6–1.2)	17.7 (4.7–25.3)	1.06 (0.93–1.21)	13.84 (6.13–21.04)
2011–2012	MiNP	Children	Children (6 to <11 years)	396	166 (41.92%)	0.7 (0.35–0.9)	6.2 (3.2–17.7)	1.17 (1.06–1.35)	9.46 (5–18.18)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2011–2012	MiNP	Children	Adolescents (11 to <16 years)	265	92 (34.72%)	0.9 (0.35–2.3)	14.8 (5.6–81.9)	1.06 (0.88–1.24)	14.57 (4.68–33.01)
2011–2012	MiNP	Children	Females	297	110 (37.04%)	0.9 (0.6–1.2)	17.7 (4.7–25.3)	1.24 (0.97–1.63)	34.24 (10.29–78.39)
2011–2012	MiNP	Children	White non-Hispanic	149	64 (42.95%)	0.9 (0.35–2)	23.4 (2.9–24.1)	1.32 (0.7–1.77)	33.75 (9.1–56.73)
2011–2012	MiNP	Children	Black non-Hispanic	166	38 (22.89%)	1 (0.7–1.5)	7.2 (4.1–13.1)	0.95 (0.67–1.35)	21.25 (10.73–39.51)
2011–2012	MiNP	Children	Mexican American	130	66 (50.77%)	0.7 (0.35–1.8)	25.1 (3.3–132.3)	0.79 (0.67–1.1)	42.63 (3.45–48.29)
2011–2012	MiNP	Children	Other	150	59 (39.33%)	0.7 (0.35–1)	14.8 (4.5–45.1)	1.01 (0.74–1.25)	13.66 (8.04–23.66)
2011–2012	MiNP	Children	Below poverty level	195	78 (40%)	0.6 (0.35–1.2)	6.4 (3.5–17)	1.02 (0.45–1.94)	33.75 (6.5–35.97)
2011–2012	MiNP	Children	At or above poverty level	362	135 (37.29%)	0.9 (0.5–1.2)	17.7 (4–27.7)	1.18 (0.73–1.56)	23.66 (11.26–56.73)
2011–2012	MiNP	Children	Unkown income	38	14 (36.84%)	1 (0.35–3.6)	4.1 (1.4–10.7)	1.03 (0.67–1.58)	4.85 (2.89–17.45)
2011–2012	MCOP	WRA	White non-Hispanic	179	179 (100%)	16.1 (8.9–27.6)	192.6 (121–325.3)	21.93 (13.27–31.81)	237.89 (161.25–396.71)
2011–2012	MCOP	WRA	Black non-Hispanic	135	135 (100%)	22.9 (11.6–51.8)	221.1 (129.1–566.3)	14.69 (11.05–30.65)	416.4 (72.27–664.71)
2011–2012	MCOP	WRA	Mexican American	53	53 (100%)	11.7 (9.9–20.3)	73.1 (39.3–211)	13.92 (10.67–23.14)	74.6 (30.94–115.3)
2011–2012	MCOP	WRA	Other	169	169 (100%)	14 (8.5–31.4)	422.7 (77.3–1068)	20.48 (13.33–32.59)	276.27 (73.95–580.43)
2011–2012	MCOP	WRA	Below poverty level	150	150 (100%)	21.1 (14.4–37.3)	315.1 (121–904.7)	23.19 (12.45–48.74)	276.27 (81.56–555.95)
2011–2012	MCOP	WRA	At or above poverty level	344	344 (100%)	14.2 (9.6–23.1)	211 (135.2–410.5)	20.65 (13.27–26.67)	203.05 (156.08–376.76)
2011–2012	MCOP	WRA	Unkown income	42	42 (100%)	9.1 (5.1–25.8)	128.6 (14–213.5)	11.31 (6.95–25.28)	225.61 (18.78–237.89)
2011–2012	MCOP	WRA	WRA (16–49)	536	536 (100%)	15.8 (11.6–23.1)	221.1 (139.4–331.9)	21.14 (15.11–27.14)	225.61 (161.25–376.76)
2011–2012	MCOP	Adults	All adults (16+)	1,894	1,894 (100%)	22.9 (17.8–35.6)	377.5 (222.5–449.4)	21.48 (15.54–27.33)	210.78 (148.04–311.8)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2011–2012	MCOP	Adults	Males	961	961 (100%)	23.1 (18.3–37.5)	379.3 (221.2–449.4)	18.57 (13.98–23.11)	220 (143.98–311.8)
2011–2012	MCOP	Adults	Females	933	933 (100%)	15.8 (11.6–23.1)	221.1 (139.4–331.9)	21.14 (15.11–27.14)	225.61 (161.25–376.76)
2011–2012	MCOP	Adults	White non-Hispanic	664	664 (100%)	33.3 (19–49.5)	412.2 (274.5–490.7)	21.93 (13.27–31.81)	237.89 (161.25–396.71)
2011–2012	MCOP	Adults	Black non-Hispanic	499	499 (100%)	28.2 (19.6–42.4)	305.5 (207.7–421.4)	14.69 (11.05–30.65)	416.4 (72.27–664.71)
2011–2012	MCOP	Adults	Mexican American	186	186 (100%)	15.3 (9.5–27.4)	153.2 (74.4–221.2)	13.92 (10.67–23.14)	74.6 (30.94–115.3)
2011–2012	MCOP	Adults	Other	545	545 (100%)	15 (11.6–25.5)	222.5 (133.6–335.4)	20.48 (13.33–32.59)	276.27 (73.95–580.43)
2011–2012	MCOP	Adults	Below poverty level	441	441 (100%)	19.8 (10.2–52.8)	379.3 (127.6–904.7)	23.19 (12.45–48.74)	276.27 (81.56–555.95)
2011–2012	MCOP	Adults	At or above poverty level	1,270	1,270 (100%)	27.1 (19–41.1)	400.1 (196.1–475)	20.65 (13.27–26.67)	203.05 (156.08–376.76)
2011–2012	MCOP	Adults	Unkown income	183	183 (100%)	13.2 (9–31)	255.3 (60.4–447.3)	11.31 (6.95–25.28)	225.61 (18.78–237.89)
2011–2012	MCOP	Children	All children (3 to <16 years)	649	649 (100%)	19.5 (15.5–25.1)	241 (75.4–289.8)	19.17 (16.96–21.82)	160.83 (110–340)
2011–2012	MCOP	Children	Children (6 to <11 years)	330	330 (100%)	17 (14.6–19.1)	96.2 (67–185.5)	23.11 (18.69–27.72)	164.23 (117.1–340)
2011–2012	MCOP	Children	Adolescents (11 to <16 years)	265	265 (100%)	22.3 (13.7–33.1)	249 (92.7–486.9)	16.46 (12.92–20)	141.72 (90.29–314.17)
2011–2012	MCOP	Children	Females	297	297 (100%)	19.5 (15.5–25.1)	241 (75.4–289.8)	21.14 (15.11–27.14)	225.61 (161.25–376.76)
2011–2012	MCOP	Children	White non-Hispanic	149	149 (100%)	20.7 (14–29.6)	261.3 (37.6–288.8)	21.93 (13.27–31.81)	237.89 (161.25–396.71)
2011–2012	MCOP	Children	Black non-Hispanic	166	166 (100%)	23.5 (18.9–28.8)	85.5 (64.3–164.5)	14.69 (11.05–30.65)	416.4 (72.27–664.71)
2011–2012	MCOP	Children	Mexican American	130	130 (100%)	14.1 (8.4–22.2)	185.5 (51.9–745.7)	13.92 (10.67–23.14)	74.6 (30.94–115.3)
2011–2012	MCOP	Children	Other	150	150 (100%)	16.3 (11.5–25.2)	241 (75.1–503.9)	20.48 (13.33–32.59)	276.27 (73.95–580.43)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2011–2012	MCOP	Children	Below poverty level	195	195 (100%)	17.5 (14.6–27.1)	97.6 (67.2–251.4)	23.19 (12.45–48.74)	276.27 (81.56–555.95)
2011–2012	MCOP	Children	At or above poverty level	362	362 (100%)	20.7 (14.3–25.7)	261.3 (60.9–414.4)	20.65 (13.27–26.67)	203.05 (156.08–376.76)
2011–2012	MCOP	Children	Unkown income	38	38 (100%)	24.9 (3.3–134.4)	134.4 (25.1–486.9)	11.31 (6.95–25.28)	225.61 (18.78–237.89)
2009–2010	MiNP	WRA	White non-Hispanic	277	164 (59.21%)	0.54 (0.54–0.54)	17.89 (5.45–72.58)	1.08 (0.91–1.32)	18.8 (4.23–25.5)
2009–2010	MiNP	WRA	Black non-Hispanic	113	56 (49.56%)	1 (0.54–1.36)	15.82 (4.48–435.82)	0.61 (0.49–0.79)	9.22 (3.33–37.09)
2009–2010	MiNP	WRA	Mexican American	102	63 (61.76%)	0.54 (0.54–0.54)	8.01 (3.54–16.26)	0.66 (0.49–0.9)	14.88 (8.99–41.87)
2009–2010	MiNP	WRA	Other	116	71 (61.21%)	0.54 (0.54–0.54)	9.69 (2.74–16.79)	0.72 (0.61–0.9)	9.15 (4.55–29.13)
2009–2010	MiNP	WRA	Below poverty level	186	114 (61.29%)	0.54 (0.54–0.54)	12.72 (3.68–116.56)	0.87 (0.7–0.93)	9.42 (5.31–28.42)
2009–2010	MiNP	WRA	At or above poverty level	373	214 (57.37%)	0.54 (0.54–0.54)	16.26 (7.02–25.66)	0.93 (0.73–1.07)	14.88 (8.72–24.31)
2009–2010	MiNP	WRA	Unkown income	49	26 (53.06%)	0.54 (0.54–0.54)	14.74 (1.69–105.91)	0.77 (0.54–1.17)	21.6 (3.1–29.13)
2009–2010	MiNP	WRA	WRA (16–49)	608	354 (58.22%)	0.54 (0.54–0.54)	15.63 (8.16–20.56)	0.93 (0.79–1.1)	11.17 (7.17–17)
2009–2010	MiNP	Adults	Females	1,040	669 (64.33%)	0.54 (0.54–0.54)	15.63 (8.16–20.56)	0.93 (0.79–1.1)	11.17 (7.17–17)
2009–2010	MiNP	Adults	Below poverty level	469	287 (61.19%)	0.54 (0.54–0.54)	13.98 (6.45–26.09)	0.87 (0.7–0.93)	9.42 (5.31–28.42)
2009–2010	MiNP	Adults	White non-Hispanic	998	638 (63.93%)	0.54 (0.54–0.54)	28.61 (7.9–38.48)	1.08 (0.91–1.32)	18.8 (4.23–25.5)
2009–2010	MiNP	Adults	Black non-Hispanic	400	219 (54.75%)	1 (0.54–1.28)	17.14 (10.53–41.33)	0.61 (0.49–0.79)	9.22 (3.33–37.09)
2009–2010	MiNP	Adults	Mexican American	393	255 (64.89%)	0.54 (0.54–0.54)	22.53 (7.25–30.25)	0.66 (0.49–0.9)	14.88 (8.99–41.87)
2009–2010	MiNP	Adults	Other	336	210 (62.5%)	0.54 (0.54–0.54)	12.09 (7.62–16.79)	0.72 (0.61–0.9)	9.15 (4.55–29.13)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2009–2010	MiNP	Adults	At or above poverty level	1,455	915 (62.89%)	0.54 (0.54–0.54)	27.63 (7.95–38.48)	0.93 (0.73–1.07)	14.88 (8.72–24.31)
2009–2010	MiNP	Adults	Unkown income	203	120 (59.11%)	0.99 (0.54–1.31)	15.48 (3.82–32.89)	0.77 (0.54–1.17)	21.6 (3.1–29.13)
2009–2010	MiNP	Adults	All adults (16+)	2,127	805 (37.85%)	0.54 (0.54–0.54)	27.61 (10.41–35.73)	0.9 (0.75–1)	13.8 (9.02–21.62)
2009–2010	MiNP	Adults	Males	1,087	653 (60.07%)	0.54 (0.54–0.54)	27.61 (9.26–35.73)	0.9 (0.75–1)	14.16 (8.97–24.31)
2009–2010	MiNP	Children	All children (3 to <16 years)	622	364 (58.52%)	0.54 (0.54–0.54)	14.69 (5.33–23.02)	0.96 (0.83–1.1)	12.21 (7.58–25.71)
2009–2010	MiNP	Children	Children (6 to <11 years)	415	246 (59.28%)	0.54 (0.54–0.54)	20.54 (2.94–52.91)	1.16 (1.06–1.5)	12.21 (7.73–25.71)
2009–2010	MiNP	Children	Adolescents (11 to <16 years)	281	158 (56.23%)	0.54 (0.54–0.54)	8.49 (4.42–176.33)	0.83 (0.72–0.98)	9.73 (4.07–23.38)
2009–2010	MiNP	Children	Females	310	184 (59.35%)	0.54 (0.54–0.54)	14.69 (5.33–23.02)	0.93 (0.79–1.1)	11.17 (7.17–17)
2009–2010	MiNP	Children	White non-Hispanic	208	118 (56.73%)	0.54 (0.54–0.54)	14.69 (4.76–176.33)	1.08 (0.91–1.32)	18.8 (4.23–25.5)
2009–2010	MiNP	Children	Black non-Hispanic	116	62 (53.45%)	0.54 (0.54–0.54)	7.07 (2.99–52.67)	0.61 (0.49–0.79)	9.22 (3.33–37.09)
2009–2010	MiNP	Children	Mexican American	173	104 (60.12%)	0.54 (0.54–0.54)	5.93 (2.65–123.42)	0.66 (0.49–0.9)	14.88 (8.99–41.87)
2009–2010	MiNP	Children	Other	125	80 (64%)	0.54 (0.54–0.54)	17.12 (2.94–42.09)	0.72 (0.61–0.9)	9.15 (4.55–29.13)
2009–2010	MiNP	Children	Below poverty level	186	108 (58.06%)	0.54 (0.54–0.54)	4.99 (2.96–23.02)	0.87 (0.7–0.93)	9.42 (5.31–28.42)
2009–2010	MiNP	Children	At or above poverty level	381	230 (60.37%)	0.54 (0.54–0.54)	16.88 (4.99–52.91)	0.93 (0.73–1.07)	14.88 (8.72–24.31)
2009–2010	MiNP	Children	Unkown income	55	26 (47.27%)	0.77 (0.54–2.57)	2.99 (1.36–105.91)	0.77 (0.54–1.17)	21.6 (3.1–29.13)
2009–2010	MCOP	WRA	White non-Hispanic	277	274 (98.92%)	12.09 (9.65–15.67)	218.11 (68.41–414.02)	13.28 (11.04–17.4)	166.5 (121.05–231.3)
2009–2010	MCOP	WRA	Black non-Hispanic	113	113 (100%)	13.68 (10.14–26.5)	120.16 (49.67–709.8)	7.04 (5.75–13.08)	77.77 (48.55–239.84)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2009–2010	MCOP	WRA	Mexican American	102	102 (100%)	6.27 (4.44–12.71)	59.42 (26.7–113.08)	8.2 (5.35–11.19)	59.28 (21.55–239.73)
2009–2010	MCOP	WRA	Other	116	116 (100%)	8.6 (6.16–24.52)	145.69 (34.57–489.46)	8.36 (4.17–27.21)	75.99 (50.36–165.52)
2009–2010	MCOP	WRA	Below poverty level	186	185 (99.46%)	11.51 (7.16–16.12)	145.69 (50.65–489.46)	9.23 (6.48–13.77)	132.42 (48.55–409.51)
2009–2010	MCOP	WRA	At or above poverty level	373	371 (99.46%)	11.22 (8.71–14.49)	164.46 (66.88–398.59)	10.81 (8.6–13.28)	122.68 (78.83–206)
2009–2010	MCOP	WRA	Unkown income	49	49 (100%)	14.61 (8.19–29.51)	163.59 (45.97–256.15)	14.43 (6.16–32.57)	72.38 (19.75–144.38)
2009–2010	MCOP	WRA	WRA (16–49)	608	605 (99.51%)	11.77 (9.07–14.49)	163.59 (82.39–289.17)	10.81 (8.53–12.99)	126.28 (81.71–206)
2009–2010	MCOP	Adults	All adults (16+)	2,127	2,122 (99.76%)	14.37 (11.44–16.69)	164.46 (109.93–217.18)	11.17 (8.67–14.24)	109.15 (64.81–146.51)
2009–2010	MCOP	Adults	Males	1,087	1,085 (99.82%)	14.43 (11.74–16.69)	167.59 (109.93–217.18)	14.22 (9.59–18.64)	103.82 (63.9–143.92)
2009–2010	MCOP	Adults	Females	1,040	1,037 (99.71%)	11.77 (9.07–14.49)	163.59 (82.39–289.17)	10.81 (8.53–12.99)	126.28 (81.71–206)
2009–2010	MCOP	Adults	White non-Hispanic	998	994 (99.6%)	15.49 (14.15–19.08)	181.27 (87.94–424.78)	13.28 (11.04–17.4)	166.5 (121.05–231.3)
2009–2010	MCOP	Adults	Black non-Hispanic	400	400 (100%)	13.77 (8.51–27.17)	152.9 (65.23–187.94)	7.04 (5.75–13.08)	77.77 (48.55–239.84)
2009–2010	MCOP	Adults	Mexican American	393	392 (99.75%)	8.63 (5.1–15.04)	108.92 (53.06–180.69)	8.2 (5.35–11.19)	59.28 (21.55–239.73)
2009–2010	MCOP	Adults	Other	336	336 (100%)	10.39 (6.64–16.75)	209.47 (71.47–249.06)	8.36 (4.17–27.21)	75.99 (50.36–165.52)
2009–2010	MCOP	Adults	Below poverty level	469	466 (99.36%)	11.51 (8.39–18.57)	126.63 (56.88–445.12)	9.23 (6.48–13.77)	132.42 (48.55–409.51)
2009–2010	MCOP	Adults	At or above poverty level	1,455	1,453 (99.86%)	14.41 (11.84–16.57)	174.37 (107.72–262.91)	10.81 (8.6–13.28)	122.68 (78.83–206)
2009–2010	MCOP	Adults	Unkown income	203	203 (100%)	21.13 (6.7–47.37)	168.93 (75.07–226.95)	14.43 (6.16–32.57)	72.38 (19.75–144.38)
2009–2010	MCOP	Children	All children (3 to <16 years)	675	675 (100%)	13.56 (9.36–18.9)	154.33 (81.31–287.68)	14.29 (10.19–19.77)	121.23 (89.3–181.92)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2009–2010	MCOP	Children	Children (6 to <11 years)	341	341 (100%)	11.84 (6.91–20.82)	110.97 (61.33–340.18)	19.46 (13.05–27.53)	131.74 (76.78–314.49)
2009–2010	MCOP	Children	Adolescents (11 to <16 years)	281	281 (100%)	14.69 (9.36–18.9)	120.93 (66.12–375.25)	10.21 (8.02–14.55)	95.55 (62.52–143.73)
2009–2010	MCOP	Children	Females	310	310 (100%)	13.56 (9.36–18.9)	154.33 (81.31–287.68)	10.81 (8.53–12.99)	126.28 (81.71–206)
2009–2010	MCOP	Children	White non-Hispanic	208	208 (100%)	15.59 (7.82–28.41)	154.33 (75.02–375.25)	13.28 (11.04–17.4)	166.5 (121.05–231.3)
2009–2010	MCOP	Children	Black non-Hispanic	116	116 (100%)	10.67 (7.77–15.42)	86.52 (31.55–323.79)	7.04 (5.75–13.08)	77.77 (48.55–239.84)
2009–2010	MCOP	Children	Mexican American	173	173 (100%)	11.52 (7.78–20.08)	73.31 (32.12–415.86)	8.2 (5.35–11.19)	59.28 (21.55–239.73)
2009–2010	MCOP	Children	Other	125	125 (100%)	13.51 (6.49–23.58)	218.22 (63.33–383.75)	8.36 (4.17–27.21)	75.99 (50.36–165.52)
2009–2010	MCOP	Children	Below poverty level	186	186 (100%)	11.41 (8.9–15.76)	86.68 (51.56–287.68)	9.23 (6.48–13.77)	132.42 (48.55–409.51)
2009–2010	MCOP	Children	At or above poverty level	381	381 (100%)	14.24 (8.66–21.35)	154.33 (75.36–340.18)	10.81 (8.6–13.28)	122.68 (78.83–206)
2009–2010	MCOP	Children	Unkown income	55	55 (100%)	9.26 (4.22–39.78)	74.98 (39.78–256.15)	14.43 (6.16–32.57)	72.38 (19.75–144.38)
2007–2008	MiNP	WRA	White non-Hispanic	222	195 (87.84%)	0.8712 (0.8712–0.8712)	2.464 (1.232–9.24)	0.66 (0.6–0.72)	4.26 (2.54–8.54)
2007–2008	MiNP	WRA	Black non-Hispanic	129	108 (83.72%)	0.8712 (0.8712–0.8712)	3.85 (1.848–5.236)	0.61 (0.54–0.67)	5.72 (2.12–77.46)
2007–2008	MiNP	WRA	Mexican American	125	113 (90.4%)	0.8712 (0.8712–0.8712)	2.926 (0.8712–10.78)	0.7 (0.58–0.81)	3.23 (2.12–5.89)
2007–2008	MiNP	WRA	Other	95	89 (93.68%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–2.002)	0.78 (0.61–0.81)	5.81 (2.18–7.26)
2007–2008	MiNP	WRA	Below poverty level	143	127 (88.81%)	0.8712 (0.8712–0.8712)	3.85 (0.8712–10.78)	0.66 (0.56–0.74)	4.94 (1.98–7.26)
2007–2008	MiNP	WRA	At or above poverty level	382	343 (89.79%)	0.8712 (0.8712–0.8712)	2.002 (1.386–4.158)	0.67 (0.62–0.71)	4.36 (2.95–6.22)
2007–2008	MiNP	WRA	Unkown income	46	35 (76.09%)	0.8712 (0.8712–0.8712)	3.619 (0.8712–54.978)	0.8 (0.52–0.81)	2.33 (0.91–7.26)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2007–2008	MiNP	WRA	WRA (16–49)	571	505 (88.44%)	0.8712 (0.8712–0.8712)	2.464 (1.848–3.85)	0.82 (0.74–0.9)	4.36 (3.1–7.93)
2007–2008	MiNP	Adults	Females	1,030	940 (91.26%)	0.8712 (0.8712–0.8712)	2.464 (1.848–3.85)	0.82 (0.74–0.9)	4.36 (3.1–7.93)
2007–2008	MiNP	Adults	Below poverty level	392	355 (90.56%)	0.8712 (0.8712–0.8712)	3.85 (1.694–11.242)	0.66 (0.56–0.74)	4.94 (1.98–7.26)
2007–2008	MiNP	Adults	All adults (16+)	2,021	197 (9.75%)	0.8712 (0.8712–0.8712)	3.85 (2.464–9.394)	0.68 (0.64–0.7)	4.58 (3.47–6.22)
2007–2008	MiNP	Adults	White non-Hispanic	922	832 (90.24%)	0.8712 (0.8712–0.8712)	3.388 (2.156–10.934)	0.66 (0.6–0.72)	4.26 (2.54–8.54)
2007–2008	MiNP	Adults	Black non-Hispanic	434	385 (88.71%)	0.8712 (0.8712–0.8712)	7.238 (1.694–103.026)	0.61 (0.54–0.67)	5.72 (2.12–77.46)
2007–2008	MiNP	Adults	Mexican American	371	335 (90.3%)	0.8712 (0.8712–0.8712)	3.234 (2.156–11.242)	0.7 (0.58–0.81)	3.23 (2.12–5.89)
2007–2008	MiNP	Adults	Other	294	272 (92.52%)	0.8712 (0.8712–0.8712)	9.394 (1.232–10.626)	0.78 (0.61–0.81)	5.81 (2.18–7.26)
2007–2008	MiNP	Adults	At or above poverty level	1453	1312 (90.3%)	0.8712 (0.8712–0.8712)	4.774 (2.31–10.934)	0.67 (0.62–0.71)	4.36 (2.95–6.22)
2007–2008	MiNP	Adults	Unkown income	176	157 (89.2%)	0.8712 (0.8712–0.8712)	1.232 (0.8712–3.388)	0.8 (0.52–0.81)	2.33 (0.91–7.26)
2007–2008	MiNP	Adults	Males	991	884 (89.2%)	0.8712 (0.8712–0.8712)	4.312 (2.618–10.626)	0.67 (0.63–0.7)	4.36 (3.35–6.39)
2007–2008	MiNP	Children	All children (3 to <16 years)	583	496 (85.08%)	0.8712 (0.8712–0.8712)	4.312 (1.694-6.622)	0.87 (0.8-0.95)	4.15 (3.11-7.26)
2007–2008	MiNP	Children	Children (6 to <11 years)	389	333 (85.6%)	0.8712 (0.8712–0.8712)	2.464 (1.386-11.55)	1.13 (0.96-1.32)	4.36 (2.81-6.96)
2007–2008	MiNP	Children	Adolescents (11 to <16 years)	265	225 (84.91%)	0.8712 (0.8712–0.8712)	3.388 (1.54–14.476)	0.78 (0.72–0.87)	4.84 (2.55–7.51)
2007–2008	MiNP	Children	Females	280	233 (83.21%)	0.8712 (0.8712–0.8712)	4.312 (1.694–6.622)	0.82 (0.74–0.9)	4.36 (3.1–7.93)
2007–2008	MiNP	Children	White non-Hispanic	155	132 (85.16%)	0.8712 (0.8712–0.8712)	3.696 (1.54–5.852)	0.66 (0.6–0.72)	4.26 (2.54–8.54)
2007–2008	MiNP	Children	Black non-Hispanic	163	138 (84.66%)	0.8712 (0.8712–0.8712)	3.388 (1.232–13.09)	0.61 (0.54–0.67)	5.72 (2.12–77.46)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2007–2008	MiNP	Children	Mexican American	160	140 (87.5%)	0.8712 (0.8712–0.8712)	11.55 (0.8712–39.578)	0.7 (0.58–0.81)	3.23 (2.12–5.89)
2007–2008	MiNP	Children	Other	105	86 (81.9%)	0.8712 (0.8712–0.8712)	3.388 (0.8712–21.252)	0.78 (0.61–0.81)	5.81 (2.18–7.26)
2007–2008	MiNP	Children	Below poverty level	186	165 (88.71%)	0.8712 (0.8712–0.8712)	1.54 (0.8712–5.852)	0.66 (0.56–0.74)	4.94 (1.98–7.26)
2007–2008	MiNP	Children	At or above poverty level	358	297 (82.96%)	0.8712 (0.8712–0.8712)	4.312 (1.694–6.622)	0.67 (0.62–0.71)	4.36 (2.95–6.22)
2007–2008	MiNP	Children	Unkown income	39	34 (87.18%)	0.8712 (0.8712–0.8712)	2.156 (0.8712–39.578)	0.8 (0.52–0.81)	2.33 (0.91–7.26)
2007–2008	MCOP	WRA	White non-Hispanic	222	210 (94.59%)	6.8 (5.1–8.8)	66.4 (41.8–102.6)	5.56 (4.42–7.14)	54.43 (33.16–238.35)
2007–2008	MCOP	WRA	Black non-Hispanic	129	127 (98.45%)	10.3 (7.1–12.6)	48.8 (22.9–615)	6.01 (4.11–7.92)	37.24 (16.54–122.39)
2007–2008	MCOP	WRA	Mexican American	125	122 (97.6%)	5.9 (4.5–8.2)	47.2 (17.8–120.2)	4.89 (4.07–5.69)	37.42 (14.97–78.45)
2007–2008	MCOP	WRA	Other	95	89 (93.68%)	7.4 (4.4–15.4)	71.45 (17.8–186.2)	7.58 (4.63–20.51)	70.87 (22.33–169.27)
2007–2008	MCOP	WRA	Below poverty level	143	139 (97.2%)	7.2 (6.2–8.4)	35.8 (19.4–186.2)	5.45 (3.79–7.58)	47.46 (24.21–169.27)
2007–2008	MCOP	WRA	At or above poverty level	382	364 (95.29%)	7.3 (5.9–9.1)	66.25 (43.2–102.6)	5.9 (4.72–7.65)	53.67 (36.07–112.68)
2007–2008	MCOP	WRA	Unkown income	46	45 (97.83%)	7.1 (2.4–19.3)	55.9 (19.3–86.3)	5.23 (2.98–9.09)	34.94 (9.94–78.45)
2007–2008	MCOP	WRA	WRA (16–49)	571	548 (95.97%)	7.1 (6.1–8.2)	64.8 (43.2–102.2)	5.66 (5–6.88)	51.94 (37.24–112.68)
2007–2008	MCOP	Adults	All adults (16+)	2,021	1,934 (95.7%)	6.7 (5.4–7.6)	70.1 (43.2–99.6)	4.62 (4.06–5.3)	43.7 (31.88–75.32)
2007–2008	MCOP	Adults	Males	991	959 (96.77%)	6.6 (5.3–7.8)	63 (42.3–104.2)	8.54 (7.06–9.3)	43.22 (30.61–75.32)
2007–2008	MCOP	Adults	Females	1,030	975 (94.66%)	7.1 (6.1–8.2)	64.8 (43.2–102.2)	5.66 (5–6.88)	51.94 (37.24–112.68)
2007–2008	MCOP	Adults	White non-Hispanic	922	873 (94.69%)	7.1 (6.1–8.9)	70.1 (38.9–147.6)	5.56 (4.42–7.14)	54.43 (33.16–238.35)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2007–2008	MCOP	Adults	Black non-Hispanic	434	421 (97%)	6.7 (4.9–9.5)	95.4 (38.2–161.1)	6.01 (4.11–7.92)	37.24 (16.54–122.39)
2007–2008	MCOP	Adults	Mexican American	371	362 (97.57%)	5.5 (4.8–6.3)	56.7 (31.6–61.2)	4.89 (4.07–5.69)	37.42 (14.97–78.45)
2007–2008	MCOP	Adults	Other	294	278 (94.56%)	4.35 (3.3–5.6)	99.6 (29.1–186.2)	7.58 (4.63–20.51)	70.87 (22.33–169.27)
2007–2008	MCOP	Adults	Below poverty level	392	374 (95.41%)	6.2 (3.7–8.7)	45.4 (24.4–56.7)	5.45 (3.79–7.58)	47.46 (24.21–169.27)
2007–2008	MCOP	Adults	At or above poverty level	1,453	1,390 (95.66%)	7.2 (6.3–8.5)	80.3 (47.2–127.7)	5.9 (4.72–7.65)	53.67 (36.07–112.68)
2007–2008	MCOP	Adults	Unkown income	176	170 (96.59%)	3.2 (1.8–4.2)	29.1 (7.3–61.2)	5.23 (2.98–9.09)	34.94 (9.94–78.45)
2007–2008	MCOP	Children	All children (3 to <16 years)	639	632 (98.9%)	10.8 (7.3–15.1)	76.9 (64.8–156.5)	8.94 (8.08–10.09)	59.34 (52.11–70.53)
2007–2008	MCOP	Children	Children (6 to <11 years)	318	316 (99.37%)	10.7 (8.2–14.7)	64 (29.3–80)	12.81 (10.48–14.61)	64.13 (43.96–141.96)
2007–2008	MCOP	Children	Adolescents (11 to <16 years)	265	260 (98.11%)	12.4 (5.2–16.4)	73.3 (46.1–155.8)	7.92 (5.98–9.25)	48.8 (33.26–97.99)
2007–2008	MCOP	Children	Females	280	274 (97.86%)	10.8 (7.3–15.1)	76.9 (64.8–156.5)	5.66 (5–6.88)	51.94 (37.24–112.68)
2007–2008	MCOP	Children	White non-Hispanic	155	151 (97.42%)	13.1 (6.8–24.5)	79.5 (60.5–253.5)	5.56 (4.42–7.14)	54.43 (33.16–238.35)
2007–2008	MCOP	Children	Black non-Hispanic	163	162 (99.39%)	7.1 (5–10.1)	41.2 (20.8–408.9)	6.01 (4.11–7.92)	37.24 (16.54–122.39)
2007–2008	MCOP	Children	Mexican American	160	160 (100%)	8.3 (5–13)	80 (27.3–304.1)	4.89 (4.07–5.69)	37.42 (14.97–78.45)
2007–2008	MCOP	Children	Other	105	103 (98.1%)	7.3 (3.7–16.4)	75.4 (22.5–105.9)	7.58 (4.63–20.51)	70.87 (22.33–169.27)
2007–2008	MCOP	Children	Below poverty level	186	185 (99.46%)	9.1 (4.6–13)	76.9 (33.6–81.9)	5.45 (3.79–7.58)	47.46 (24.21–169.27)
2007–2008	MCOP	Children	At or above poverty level	358	355 (99.16%)	12.8 (7.5–16.4)	95.3 (64.8–198)	5.9 (4.72–7.65)	53.67 (36.07–112.68)
2007–2008	MCOP	Children	Unkown income	39	36 (92.31%)	8 (0.49–19.6)	19.6 (8.2–304.1)	5.23 (2.98–9.09)	34.94 (9.94–78.45)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2005–2006	MiNP	WRA	White non-Hispanic	234	204 (87.18%)	0.8712 (0.8712–0.8712)	2.31 (0.8712–9.856)	0.65 (0.62–0.73)	5.12 (2.79–9.29)
2005–2006	MiNP	WRA	Black non-Hispanic	162	132 (81.48%)	0.8712 (0.8712–0.8712)	6.16 (1.54–14.322)	0.48 (0.42–0.59)	3.85 (1.62–8.62)
2005–2006	MiNP	WRA	Mexican American	158	128 (81.01%)	0.8712 (0.8712–0.8712)	14.014 (2.002–67.914)	0.67 (0.59–0.72)	3.78 (1.68–13.22)
2005–2006	MiNP	WRA	Other	62	49 (79.03%)	0.8712 (0.8712–0.8712)	3.696 (0.8712–16.016)	0.54 (0.41–0.86)	3.92 (1.06–26.41)
2005–2006	MiNP	WRA	Below poverty level	146	120 (82.19%)	0.8712 (0.8712–0.8712)	3.08 (0.8712–67.914)	0.65 (0.5–0.91)	3.96 (1.36–38.52)
2005–2006	MiNP	WRA	At or above poverty level	442	370 (83.71%)	0.8712 (0.8712–0.8712)	8.47 (2.31–11.088)	0.63 (0.58–0.68)	5.21 (3.11–9.12)
2005–2006	MiNP	WRA	Unkown income	28	23 (82.14%)	0.8712 (0.8712–0.8712)	2.002 (0.8712–21.56)	0.54 (0.33–0.66)	3.63 (0.54–17.42)
2005–2006	MiNP	WRA	WRA (16–49)	616	513 (83.28%)	0.8712 (0.8712–0.8712)	7.546 (2.618–11.088)	0.89 (0.77–0.98)	5.51 (4.59–7.92)
2005–2006	MiNP	Adults	Females	935	812 (86.84%)	0.8712 (0.8712–0.8712)	7.546 (2.618–11.088)	0.89 (0.77–0.98)	5.51 (4.59–7.92)
2005–2006	MiNP	Adults	Below poverty level	340	286 (84.12%)	0.8712 (0.8712–0.8712)	6.16 (0.8712–67.914)	0.65 (0.5–0.91)	3.96 (1.36–38.52)
2005–2006	MiNP	Adults	All adults (16+)	1831	252 (13.76%)	0.8712 (0.8712–0.8712)	6.006 (3.542–7.392)	0.63 (0.59–0.66)	5.18 (3.43–6.32)
2005–2006	MiNP	Adults	White non-Hispanic	846	749 (88.53%)	0.8712 (0.8712–0.8712)	4.466 (2.926–7.392)	0.65 (0.62–0.73)	5.12 (2.79–9.29)
2005–2006	MiNP	Adults	Black non-Hispanic	464	386 (83.19%)	0.8712 (0.8712–0.8712)	5.698 (2.002–14.476)	0.48 (0.42–0.59)	3.85 (1.62–8.62)
2005–2006	MiNP	Adults	Mexican American	390	334 (85.64%)	0.8712 (0.8712–0.8712)	6.93 (1.386–38.962)	0.67 (0.59–0.72)	3.78 (1.68–13.22)
2005–2006	MiNP	Adults	Other	131	110 (83.97%)	0.8712 (0.8712–0.8712)	14.014 (0.8712–47.278)	0.54 (0.41–0.86)	3.92 (1.06–26.41)
2005–2006	MiNP	Adults	At or above poverty level	1,391	1,203 (86.48%)	0.8712 (0.8712–0.8712)	5.236 (3.542–8.624)	0.63 (0.58–0.68)	5.21 (3.11–9.12)
2005–2006	MiNP	Adults	Unkown income	100	90 (90%)	0.8712 (0.8712–0.8712)	1.54 (0.8712–1.694)	0.54 (0.33–0.66)	3.63 (0.54–17.42)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2005–2006	MiNP	Adults	Males	896	767 (85.6%)	0.8712 (0.8712–0.8712)	5.852 (3.542–7.392)	0.61 (0.57–0.66)	4.59 (3.18–6.32)
2005–2006	MiNP	Children	All children (3 to <16 years)	7,173	620 (8.64%)	0.8712 (0.8712–0.8712)	3.388 (1.848–9.24)	0.85 (0.79–0.9)	3.62 (2.98–4.79)
2005–2006	MiNP	Children	Children (6 to <11 years)	356	307 (86.24%)	0.8712 (0.8712–0.8712)	2.156 (0.8712–2.618)	1.01 (0.9–1.08)	2.93 (2.35–5.12)
2005–2006	MiNP	Children	Adolescents (11 to <16 years)	412	356 (86.41%)	0.8712 (0.8712–0.8712)	7.854 (1.386–17.248)	0.75 (0.68–0.85)	3.62 (2.56–7.16)
2005–2006	MiNP	Children	Females	343	300 (87.46%)	0.8712 (0.8712–0.8712)	3.388 (1.848–9.24)	0.89 (0.77–0.98)	5.51 (4.59–7.92)
2005–2006	MiNP	Children	White non-Hispanic	192	165 (85.94%)	0.8712 (0.8712–0.8712)	6.468 (1.54–17.248)	0.65 (0.62–0.73)	5.12 (2.79–9.29)
2005–2006	MiNP	Children	Black non-Hispanic	214	179 (83.64%)	0.8712 (0.8712–0.8712)	5.544 (2.156–14.168)	0.48 (0.42–0.59)	3.85 (1.62–8.62)
2005–2006	MiNP	Children	Mexican American	247	219 (88.66%)	0.8712 (0.8712–0.8712)	1.694 (0.8712–3.234)	0.67 (0.59–0.72)	3.78 (1.68–13.22)
2005–2006	MiNP	Children	Other	64	57 (89.06%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–2.156)	0.54 (0.41–0.86)	3.92 (1.06–26.41)
2005–2006	MiNP	Children	Below poverty level	195	174 (89.23%)	0.8712 (0.8712–0.8712)	2.233 (0.8712–4.312)	0.65 (0.5–0.91)	3.96 (1.36–38.52)
2005–2006	MiNP	Children	At or above poverty level	504	431 (85.52%)	0.8712 (0.8712–0.8712)	4.312 (2.002–10.01)	0.63 (0.58–0.68)	5.21 (3.11–9.12)
2005–2006	MiNP	Children	Unkown income	18	15 (83.33%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–21.56)	0.54 (0.33–0.66)	3.63 (0.54–17.42)
2005–2006	MCOP	WRA	WRA (16–49)	616	582 (94.48%)	4.45 (4–5)	51.95 (21.5–143.9)	4.01 (3.46–5)	39.64 (21.27–81.1)
2005–2006	MCOP	WRA	White non-Hispanic	234	216 (92.31%)	4.3 (3.3–5)	39 (23.6–61.7)	4.1 (3.46–5.86)	31.65 (15.48–50.65)
2005–2006	MCOP	WRA	Black non-Hispanic	162	159 (98.15%)	5.9 (3.9–7.7)	30 (17.8–72.4)	3.33 (2.62–4.79)	27.92 (12.76–79.47)
2005–2006	MCOP	WRA	Mexican American	158	149 (94.3%)	5.3 (3.7–8.3)	154.4 (21.2–370.9)	4.57 (3.67–6.21)	81.1 (12.95–321.67)
2005–2006	MCOP	WRA	Other	62	58 (93.55%)	4.3 (3.4–6.4)	115.35 (15.1–348.1)	3.37 (2.75–5.58)	109.78 (13–224.66)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2005–2006	MCOP	WRA	Below poverty level	146	137 (93.84%)	4.2 (2.1–6.4)	45.3 (14.5–154.4)	3.2 (2.29–4.37)	17.22 (11.54–45.47)
2005–2006	MCOP	WRA	At or above poverty level	442	419 (94.8%)	4.5 (4.1–5.1)	57.1 (22.7–143.9)	4.17 (3.56–5.5)	50.65 (22.63–93.33)
2005–2006	MCOP	WRA	Unkown income	28	26 (92.86%)	5.9 (1.9–14.9)	16.1 (5.2–49.5)	4.89 (2.68–7.25)	17.71 (7.25–27.92)
2005–2006	MCOP	Adults	All adults (16+)	1,831	1,743 (95.19%)	5.6 (4.6–7.1)	77.6 (43.9–133)	3.93 (3.33–4.73)	51.77 (25.14–93.43)
2005–2006	MCOP	Adults	Males	896	864 (96.43%)	5.6 (4.7–7.5)	77.6 (35.7–133)	6.17 (4.86–7.8)	52.16 (25.03–109.32)
2005–2006	MCOP	Adults	Females	935	879 (94.01%)	4.45 (4–5)	51.95 (21.5–143.9)	4.01 (3.46–5)	39.64 (21.27–81.1)
2005–2006	MCOP	Adults	White non-Hispanic	846	796 (94.09%)	5.8 (4.6–8.1)	82.5 (35.7–140.1)	4.1 (3.46–5.86)	31.65 (15.48–50.65)
2005–2006	MCOP	Adults	Black non-Hispanic	464	448 (96.55%)	6.4 (5.4–8.6)	48.2 (24.5–111.5)	3.33 (2.62–4.79)	27.92 (12.76–79.47)
2005–2006	MCOP	Adults	Mexican American	390	375 (96.15%)	4.8 (4.2–5.5)	49.5 (19.8–185)	4.57 (3.67–6.21)	81.1 (12.95–321.67)
2005–2006	MCOP	Adults	Other	131	124 (94.66%)	5.2 (2.5–7.1)	29.8 (8.3–270.5)	3.37 (2.75–5.58)	109.78 (13–224.66)
2005–2006	MCOP	Adults	Below poverty level	340	326 (95.88%)	5.1 (3.8–7.2)	64.6 (15.9–185)	3.2 (2.29–4.37)	17.22 (11.54–45.47)
2005–2006	MCOP	Adults	At or above poverty level	1,391	1,324 (95.18%)	5.8 (4.6–7.8)	78.8 (35.7–133)	4.17 (3.56–5.5)	50.65 (22.63–93.33)
2005–2006	MCOP	Adults	Unkown income	100	93 (93%)	4.7 (1.4–10.9)	15.6 (10.9–24.4)	4.89 (2.68–7.25)	17.71 (7.25–27.92)
2005–2006	MCOP	Children	All children (3 to <16 years)	804	790 (98.26%)	7 (5.9–7.6)	37.7 (23–88.3)	6.24 (5.25–7.43)	40.11 (30.33–53.25)
2005–2006	MCOP	Children	Children (6 to <11 years)	305	301 (98.69%)	7.7 (7–8.8)	35.9 (22.9–51.6)	8.84 (7.81–10.31)	40.11 (30.81–50)
2005–2006	MCOP	Children	Adolescents (11 to <16 years)	412	403 (97.82%)	6 (5.2–7)	40.4 (18.3–268.7)	4.82 (4.36–5.08)	41.83 (19.94–94.88)
2005–2006	MCOP	Children	Females	343	334 (97.38%)	7 (5.9–7.6)	37.7 (23–88.3)	4.01 (3.46–5)	39.64 (21.27–81.1)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2005–2006	MCOP	Children	White non-Hispanic	192	190 (98.96%)	7.1 (5.8–8.2)	51.6 (18.3–193.1)	4.1 (3.46–5.86)	31.65 (15.48–50.65)
2005–2006	MCOP	Children	Black non-Hispanic	214	209 (97.66%)	7.1 (5.8–8.2)	36.5 (28.6–80.5)	3.33 (2.62–4.79)	27.92 (12.76–79.47)
2005–2006	MCOP	Children	Mexican American	247	243 (98.38%)	6.2 (4.8–8.5)	28.1 (15.9–49.5)	4.57 (3.67–6.21)	81.1 (12.95–321.67)
2005–2006	MCOP	Children	Other	64	62 (96.88%)	5.2 (3.7–13.1)	33.3 (11.7–37.3)	3.37 (2.75–5.58)	109.78 (13–224.66)
2005–2006	MCOP	Children	Below poverty level	195	192 (98.46%)	6.1 (5.6–8.4)	28.9 (17.7–66.9)	3.2 (2.29–4.37)	17.22 (11.54–45.47)
2005–2006	MCOP	Children	At or above poverty level	504	494 (98.02%)	7.1 (6.3–7.9)	37.7 (20.9–106.2)	4.17 (3.56–5.5)	50.65 (22.63–93.33)
2005–2006	MCOP	Children	Unkown income	18	18 (100%)	5.3 (1.5–7.9)	20.8 (7.2–49.5)	4.89 (2.68–7.25)	17.71 (7.25–27.92)
2003–2004	MiNP	WRA	WRA (16–49)	606	575 (94.88%)	1.0889 (1.0889–1.0889)	1.0889 (1.0889–1.0889)	0.95 (0.86–1.04)	4.03 (2.87–5.44)
2003–2004	MiNP	WRA	White non-Hispanic	254	243 (95.67%)	1.0889 (1.0889–1.0889)	1.0889 (1.0889–1.0889)	0.78 (0.72–0.84)	3.4 (2.36–4.54)
2003–2004	MiNP	WRA	Black non-Hispanic	157	145 (92.36%)	1.0889 (1.0889–1.0889)	1.0889 (1.0889–1.0889)	0.56 (0.53–0.64)	2.87 (1–6.05)
2003–2004	MiNP	WRA	Mexican American	146	141 (96.58%)	1.0889 (1.0889–1.0889)	1.0889 (1.0889–1.0889)	0.73 (0.63–0.91)	2.27 (1.22–5.44)
2003–2004	MiNP	WRA	Other	49	46 (93.88%)	1.0889 (1.0889–1.0889)	2.156 (1.0889–2.464)	0.9 (0.62–1.24)	3.02 (1.79–4.73)
2003–2004	MiNP	WRA	Below poverty level	169	161 (95.27%)	1.0889 (1.0889–1.0889)	1.0889 (1.0889–1.0889)	0.79 (0.7–0.93)	3.3 (2.22–4.57)
2003–2004	MiNP	WRA	At or above poverty level	399	380 (95.24%)	1.0889 (1.0889–1.0889)	1.0889 (1.0889–1.0889)	0.75 (0.67–0.84)	3.42 (2.66–4.54)
2003–2004	MiNP	WRA	Unkown income	38	34 (89.47%)	1.0889 (1.0889–1.0889)	2.464 (1.0889–4.158)	0.75 (0.61–1.18)	1.51 (1.09–1.79)
2003–2004	MiNP	Adults	Below poverty level	393	373 (94.91%)	1.0889 (1.0889–1.0889)	2.772 (1.0889–4.158)	0.79 (0.7–0.93)	3.3 (2.22–4.57)
2003–2004	MiNP	Adults	All adults (16+)	1,889	82 (4.34%)	1.0889 (1.0889–1.0889)	1.0889 (1.0889–1.0889)	0.75 (0.68–0.83)	3.51 (2.53–4.54)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2003–2004	MiNP	Adults	Females	980	936 (95.51%)	1.0889 (1.0889–1.0889)	1.0889 (1.0889–1.0889)	0.95 (0.86–1.04)	4.03 (2.87–5.44)
2003–2004	MiNP	Adults	White non-Hispanic	901	866 (96.12%)	1.0889 (1.0889–1.0889)	1.0889 (1.0889–1.0889)	0.78 (0.72–0.84)	3.4 (2.36–4.54)
2003–2004	MiNP	Adults	Black non-Hispanic	423	393 (92.91%)	1.0889 (1.0889–1.0889)	2.156 (1.0889–13.244)	0.56 (0.53–0.64)	2.87 (1–6.05)
2003–2004	MiNP	Adults	Mexican American	423	413 (97.64%)	1.0889 (1.0889–1.0889)	1.0889 (1.0889–1.0889)	0.73 (0.63–0.91)	2.27 (1.22–5.44)
2003–2004	MiNP	Adults	Other	142	135 (95.07%)	1.0889 (1.0889–1.0889)	2.926 (1.0889–3.85)	0.9 (0.62–1.24)	3.02 (1.79–4.73)
2003–2004	MiNP	Adults	At or above poverty level	1,378	1,327 (96.3%)	1.0889 (1.0889–1.0889)	1.0889 (1.0889–1.0889)	0.75 (0.67–0.84)	3.42 (2.66–4.54)
2003–2004	MiNP	Adults	Unkown income	118	107 (90.68%)	1.0889 (1.0889–1.0889)	1.694 (1.0889–2.156)	0.75 (0.61–1.18)	1.51 (1.09–1.79)
2003–2004	MiNP	Adults	Males	909	871 (95.82%)	1.0889 (1.0889–1.0889)	1.54 (1.0889–2.618)	0.74 (0.67–0.83)	3.42 (2.37–4.54)
2003–2004	MiNP	Children	All children (3 to <16 years)	716	646 (90.22%)	1.0889 (1.0889–1.0889)	2.31 (1.0889–2.464)	0.92 (0.84–1.06)	4.3 (3.51–5.44)
2003–2004	MiNP	Children	Children (6 to <11 years)	342	295 (86.26%)	1.0889 (1.0889–1.0889)	3.542 (1.0889–5.698)	1.17 (1.06–1.34)	5.44 (4.28–7.26)
2003–2004	MiNP	Children	Adolescents (11 to <16 years)	430	402 (93.49%)	1.0889 (1.0889–1.0889)	1.0889 (1.0889–1.0889)	0.82 (0.77–0.9)	3.65 (2.87–4.36)
2003–2004	MiNP	Children	Females	375	339 (90.4%)	1.0889 (1.0889–1.0889)	2.31 (1.0889–2.464)	0.95 (0.86–1.04)	4.03 (2.87–5.44)
2003–2004	MiNP	Children	White non-Hispanic	177	164 (92.66%)	1.0889 (1.0889–1.0889)	2.31 (1.0889–3.696)	0.78 (0.72–0.84)	3.4 (2.36–4.54)
2003–2004	MiNP	Children	Black non-Hispanic	258	231 (89.53%)	1.0889 (1.0889–1.0889)	2.772 (1.0889–3.85)	0.56 (0.53–0.64)	2.87 (1–6.05)
2003–2004	MiNP	Children	Mexican American	229	204 (89.08%)	1.0889 (1.0889–1.0889)	2.156 (1.0889–3.542)	0.73 (0.63–0.91)	2.27 (1.22–5.44)
2003–2004	MiNP	Children	Other	52	47 (90.38%)	1.0889 (1.0889–1.0889)	1.694 (1.0889–2.464)	0.9 (0.62–1.24)	3.02 (1.79–4.73)
2003–2004	MiNP	Children	Below poverty level	237	215 (90.72%)	1.0889 (1.0889–1.0889)	3.08 (1.0889–3.696)	0.79 (0.7–0.93)	3.3 (2.22–4.57)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2003–2004	MiNP	Children	At or above poverty level	150	403 (268.67%)	1.0889 (1.0889–1.0889)	2.31 (1.0889–3.08)	0.75 (0.67–0.84)	3.42 (2.66–4.54)
2003–2004	MiNP	Children	Unkown income	29	28 (96.55%)	1.0889 (1.0889–1.0889)	3.85 (1.0889–4.928)	0.75 (0.61–1.18)	1.51 (1.09–1.79)
2001–2002	MiNP	WRA	White non-Hispanic	1,588	1,083 (68.2%)	0.8712 (0.8712–0.8712)	1.386 (0.8712–1.848)	0.58 (0.53–0.65)	3.23 (2.12–4.36)
2001–2002	MiNP	WRA	Black non-Hispanic	926	677 (73.11%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.41 (0.38–0.45)	1.7 (1.1–2.23)
2001–2002	MiNP	WRA	Mexican American	1,105	796 (72.04%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.61 (0.5–0.77)	2.2 (1.74–3.48)
2001–2002	MiNP	WRA	Other	368	261 (70.92%)	0.8712 (0.8712–0.8712)	1.694 (0.8712–2.464)	0.56 (0.41–0.68)	2.12 (0.87–5.12)
2001–2002	MiNP	WRA	Below poverty level	853	612 (71.75%)	0.8712 (0.8712–0.8712)	2.31 (0.8712–2.926)	0.55 (0.44–0.74)	2.81 (1.82–5.81)
2001–2002	MiNP	WRA	At or above poverty level	2,868	2,003 (69.84%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–1.848)	0.57 (0.52–0.62)	3 (2.09–4.36)
2001–2002	MiNP	WRA	Unkown income	266	202 (75.94%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.46 (0.38–0.73)	1.47 (0.89–2.03)
2001–2002	MiNP	WRA	WRA (16–49)	3,987	2,817 (70.65%)	0.8712 (0.8712–0.8712)	1.386 (0.8712–2.31)	0.72 (0.65–0.81)	3.38 (2.23–4.15)
2001–2002	MiNP	Adults	All adults (16+)	6,634	4,733 (71.34%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.57 (0.52–0.62)	2.9 (2.12–4.15)
2001–2002	MiNP	Adults	Males	3,181	2,241 (70.45%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.57 (0.51–0.61)	2.9 (2.12–4.36)
2001–2002	MiNP	Adults	Females	3,453	2,492 (72.17%)	0.8712 (0.8712–0.8712)	1.386 (0.8712–2.31)	0.72 (0.65–0.81)	3.38 (2.23–4.15)
2001–2002	MiNP	Adults	White non-Hispanic	3,215	2,776 (86.35%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.58 (0.53–0.65)	3.23 (2.12–4.36)
2001–2002	MiNP	Adults	Black non-Hispanic	1,376	987 (71.73%)	0.8712 (0.8712–0.8712)	1.617 (0.8712–3.234)	0.41 (0.38–0.45)	1.7 (1.1–2.23)
2001–2002	MiNP	Adults	Mexican American	1,504	1,085 (72.14%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–3.08)	0.61 (0.5–0.77)	2.2 (1.74–3.48)
2001–2002	MiNP	Adults	Other	539	385 (71.43%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.56 (0.41–0.68)	2.12 (0.87–5.12)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
2001–2002	MiNP	Adults	Below poverty level	1,188	846 (71.21%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.55 (0.44–0.74)	2.81 (1.82–5.81)
2001–2002	MiNP	Adults	At or above poverty level	4,912	3,473 (70.7%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.57 (0.52–0.62)	3 (2.09–4.36)
2001–2002	MiNP	Adults	Unkown income	534	414 (77.53%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–3.388)	0.46 (0.38–0.73)	1.47 (0.89–2.03)
2001–2002	MiNP	Children	All children (3 to <16 years)	2,835	2,177 (76.79%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.77 (0.7–0.85)	3.08 (2.24–4.36)
2001–2002	MiNP	Children	Children (6 to <11 years)	849	588 (69.26%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	1 (0.93–1.19)	3.11 (3–3.96)
2001–2002	MiNP	Children	Adolescents (11 to <16 years)	1,168	819 (70.12%)	0.8712 (0.8712–0.8712)	2.002 (0.8712–2.464)	0.7 (0.63–0.75)	3.08 (1.61–6.22)
2001–2002	MiNP	Children	Females	1,467	1,136 (77.44%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.72 (0.65–0.81)	3.38 (2.23–4.15)
2001–2002	MiNP	Children	White non-Hispanic	861	669 (77.7%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.58 (0.53–0.65)	3.23 (2.12–4.36)
2001–2002	MiNP	Children	Black non-Hispanic	911	669 (73.44%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.41 (0.38–0.45)	1.7 (1.1–2.23)
2001–2002	MiNP	Children	Mexican American	805	623 (77.39%)	0.8712 (0.8712–0.8712)	1.54 (0.8712–3.542)	0.61 (0.5–0.77)	2.2 (1.74–3.48)
2001–2002	MiNP	Children	Other	258	216 (83.72%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–4.158)	0.56 (0.41–0.68)	2.12 (0.87–5.12)
2001–2002	MiNP	Children	Below poverty level	852	658 (77.23%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.55 (0.44–0.74)	2.81 (1.82–5.81)
2001–2002	MiNP	Children	At or above poverty level	1,815	1,384 (76.25%)	0.8712 (0.8712–0.8712)	1.386 (0.8712–2.156)	0.57 (0.52–0.62)	3 (2.09–4.36)
2001–2002	MiNP	Children	Unkown income	168	135 (80.36%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.46 (0.38–0.73)	1.47 (0.89–2.03)
1999–2000	MiNP	WRA	White non-Hispanic	1,207	847 (70.17%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.64 (0.55–0.74)	7.26 (2.64–13.07)
1999–2000	MiNP	WRA	Black non-Hispanic	780	556 (71.28%)	0.8712 (0.8712–0.8712)	12.32 (0.8712–454.608)	0.46 (0.36–0.54)	3.63 (0.73–7.47)
1999–2000	MiNP	WRA	Mexican American	1,204	856 (71.1%)	0.8712 (0.8712–0.8712)	12.32 (0.8712–60.214)	0.57 (0.52–0.68)	2.12 (1.94–5.12)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
1999–2000	MiNP	WRA	Other	373	259 (69.44%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.53 (0.35–1.15)	2.29 (0.96–13.89)
1999–2000	MiNP	WRA	Below poverty level	811	573 (70.65%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.65 (0.44–1.08)	2.49 (1.45–5.12)
1999–2000	MiNP	WRA	At or above poverty level	2,279	1,597 (70.07%)	0.8712 (0.8712–0.8712)	3.08 (0.8712–13.706)	0.57 (0.53–0.65)	4.82 (2.07–15.66)
1999–2000	MiNP	WRA	Unkown income	474	348 (73.42%)	0.8712 (0.8712–0.8712)	0.8712 (0.8712–0.8712)	0.73 (0.48–1.68)	7.92 (1.21–47.41)
1999–2000	MiNP	WRA	WRA (16–49)	3,564	2,518 (70.65%)	0.8712 (0.8712–0.8712)	1.386 (0.8712–12.628)	0.68 (0.58–0.81)	6.22 (4.15–7.92)
1999–2000	MiNP	Adults	All adults (16+)	6,044	4,359 (72.12%)	0.8712 (0.8712–0.8712)	2.772 (0.8712–18.326)	0.61 (0.55–0.67)	3.63 (2.29–12.43)
1999–2000	MiNP	Adults	Males	2,862	2,070 (72.33%)	0.8712 (0.8712–0.8712)	2.772 (0.8712–18.326)	0.61 (0.54–0.66)	3.79 (2.29–12.67)
1999–2000	MiNP	Adults	Females	3,182	2,289 (71.94%)	0.8712 (0.8712–0.8712)	1.386 (0.8712–12.628)	0.68 (0.58–0.81)	6.22 (4.15–7.92)
1999–2000	MiNP	Adults	White non-Hispanic	2,450	1,779 (72.61%)	0.8712 (0.8712–0.8712)	2.772 (0.8712–24.178)	0.64 (0.55–0.74)	7.26 (2.64–13.07)
1999–2000	MiNP	Adults	Black non-Hispanic	1,204	870 (72.26%)	0.8712 (0.8712–0.8712)	4.158 (0.8712–22.484)	0.46 (0.36–0.54)	3.63 (0.73–7.47)
1999–2000	MiNP	Adults	Mexican American	1,799	1,285 (71.43%)	0.8712 (0.8712–0.8712)	1.386 (0.8712–2.618)	0.57 (0.52–0.68)	2.12 (1.94–5.12)
1999–2000	MiNP	Adults	Other	591	425 (71.91%)	0.8712 (0.8712–0.8712)	4.312 (0.8712–18.326)	0.53 (0.35–1.15)	2.29 (0.96–13.89)
1999–2000	MiNP	Adults	Below poverty level	1,216	867 (71.3%)	0.8712 (0.8712–0.8712)	2.618 (0.8712–18.326)	0.65 (0.44–1.08)	2.49 (1.45–5.12)
1999–2000	MiNP	Adults	At or above poverty level	3,909	2,797 (71.55%)	0.8712 (0.8712–0.8712)	4.312 (0.8712–24.178)	0.57 (0.53–0.65)	4.82 (2.07–15.66)
1999–2000	MiNP	Adults	Unkown income	919	695 (75.63%)	0.8712 (0.8712–0.8712)	2.772 (0.8712–16.17)	0.73 (0.48–1.68)	7.92 (1.21–47.41)
1999–2000	MiNP	Children	All children (3 to <16 years)	2642	2080 (78.73%)	0.8712 (0.8712–0.8712)	3.542 (0.8712–10.472)	0.71 (0.66–0.78)	5.45 (2.35–15.55)
1999–2000	MiNP	Children	Children (6 to <11 years)	741	549 (74.09%)	0.8712 (0.8712–0.8712)	3.542 (0.8712–31.262)	0.85 (0.76–0.97)	8.71 (2.56–21.88)

NHANES Cycle	Metabolite	Age Group	Subset	Sample Size	Detection Frequency	50th Percentile (95% CI) (ng/mL)	95th Percentile (95% CI) (ng/mL)	Creatinine Corrected 50th Percentile (95% CI) (ng/mL)	Creatinine Corrected 95th Percentile (95% CI) (ng/mL)
1999–2000	MiNP	Children	Adolescents (11 to <16 years)	1,158	850 (73.4%)	0.8712 (0.8712–0.8712)	3.542 (0.8712–8.008)	0.61 (0.53–0.73)	4.97 (1.89–15.73)
1999–2000	MiNP	Children	Females	1,308	1,019 (77.91%)	0.8712 (0.8712–0.8712)	3.542 (0.8712–10.472)	0.68 (0.58–0.81)	6.22 (4.15–7.92)
1999–2000	MiNP	Children	White non-Hispanic	596	476 (79.87%)	0.8712 (0.8712–0.8712)	3.542 (0.8712–10.472)	0.64 (0.55–0.74)	7.26 (2.64–13.07)
1999–2000	MiNP	Children	Black non-Hispanic	757	572 (75.56%)	0.8712 (0.8712–0.8712)	46.508 (0.8712–165.55)	0.46 (0.36–0.54)	3.63 (0.73–7.47)
1999–2000	MiNP	Children	Mexican American	1,059	853 (80.55%)	0.8712 (0.8712–0.8712)	2.31 (0.8712–17.864)	0.57 (0.52–0.68)	2.12 (1.94–5.12)
1999–2000	MiNP	Children	Other	230	179 (77.83%)	0.8712 (0.8712–0.8712)	3.08 (0.8712–7.392)	0.53 (0.35–1.15)	2.29 (0.96–13.89)
1999–2000	MiNP	Children	Below poverty level	816	636 (77.94%)	0.8712 (0.8712–0.8712)	10.472 (0.8712–77.616)	0.65 (0.44–1.08)	2.49 (1.45–5.12)
1999–2000	MiNP	Children	At or above poverty level	1,436	1,120 (77.99%)	0.8712 (0.8712–0.8712)	3.08 (0.8712–31.262)	0.57 (0.53–0.65)	4.82 (2.07–15.66)
1999–2000	MiNP	Children	Unkown income	393	324 (82.44%)	0.8712 (0.8712–0.8712)	3.08 (0.8712–14.476)	0.73 (0.48–1.68)	7.92 (1.21–47.41)

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, South Dakota, led to central-tendency modeled concentrations and particle deposition, and those from Lake Charles, Lousiana, 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 DINP (Sioux Falls, South Dakota, for central-tendency meteorology; Lake Charles, Lousiana, 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-meter 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 DINP

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[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, EPA does 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 p.m. through hour ending at 4 pm; *i.e.*, 12 to 4 p.m.)
5	Hours 13–17 (hour ending at 1 p.m. through hour ending at 5 pm; *i.e.*, 12 to 5 p.m.)
6	Hours 12–17 (hour ending at 12 p.m. through hour ending at 5 pm; *i.e.*, 11 am to 5 p.m.)
7	Hours 11–17 (hour ending at 11 am through hour ending at 5 pm; *i.e.*, 10 am to 5 p.m.)
9	Hours 9–17 (hour ending at 9 am through hour ending at 5 pm; *i.e.*, 8 am to 5 p.m.)
10	Hours 9–18 (hour ending at 9 am through hour ending at 6 pm; *i.e.*, 8 am to 6 p.m.)
14	Hours 7–20 (hour ending at 7 am through hour ending at 8 pm; *i.e.*, 6 am to 8 p.m.)
15	Hours 6–20 (hour ending at 6 am through hour ending at 8 pm; *i.e.*, 5 am to 8 p.m.)
16	Hours 6–21 (hour ending at 6 am through hour ending at 9 pm; *i.e.*, 5 am to 9 p.m.)
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)

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 Section 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 = 1×10^9 milligrams per cubic meter [m^3])[5], and the suggested value for atmospheric 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 $(K_P \times TSP) / [1 + (K_P \times TSP)]$, where K_P is the particle-air partition coefficient estimated as $f_{om} \times K_{OA}$ / density.[5]

[5] Suggested values for atmospheric particle fraction organic matter and density, and the formula for calculating K_P, are provided in Section 3 of the User Guide for EPA's Consumer Exposure Model.
[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.

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 DINP, 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 DINP 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, that 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 $\mu g/m^3$. That value was divided by the value of TSP concentration discussed above in Section C.1.5 (*i.e.*, 6.15×10^8 kg/m^3 or 61.5 $\mu g/m^3$) 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 $\mu g/m^3$. 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 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

[7] EPA's 2019 Integrated Science Assessment for Particulate Matter.

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-meter 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-meter distance—1,826 values at each receptor. The average statistic 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-meter 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-meter 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 (300K) frequently warmer than ambient air, concentrations resulting from stack emissions frequently will peak farther away (*e.g.*, near the 100-meter 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 DINP, 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 INP COUs/OESs and AERMOD Concentration and Deposition Tables

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

Condition of Use	Occupational Exposure Scenario	Media of Release
Manufacturing – import	Import – repackaging	Fugitive air
Domestic manufacturing	Manufacturing	Fugitive air
Domestic manufacturing	Manufacturing	Stack air
PVC plastic compounding	PVC plastic compounding	Fugitive or stack air
PVC plastic converting	PVC plastic converting	Fugitive or stack air
Non-PVC polymer compounding	Non-PVC polymer compounding	Fugitive or stack air
Non-PVC polymer converting	Non-PVC polymer converting	Fugitive or stack air
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
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

Table_Apx C-4. DINP 95th Percentile Annual Concentrations (μg/m^3) Modeled from High-End Fugitive Release Source

Scenario	Meteorology	Distance									
		Land	**10 m**	**30 m**	**30–60 m**	**60 m**	**100 m**	**100–1,000 m**	**1,000 m**	**2,500 m**	**5,000 m**	**10,000 m**
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	8.9E−08	7.6E−08	6.4E−08	4.4E−08	2.5E−08	5.0E−09	7.8E−10	1.3E−10	3.0E−11	6.7E−12
		Urban	2.2E−07	6.9E−08	5.5E−08	2.6E−08	1.2E−08	1.8E−09	2.3E−10	4.5E−11	1.3E−11	3.6E−12
	High-End	Rural	2.1E−07	1.3E−07	1.0E−07	6.6E−08	3.6E−08	6.5E−09	1.0E−09	1.6E−10	3.9E−11	8.7E−12
		Urban	3.4E−07	1.0E−07	8.3E−08	3.7E−08	1.6E−08	2.1E−09	3.0E−10	5.9E−11	1.7E−11	4.4E−12
Commercial Uses Laboratory Chemicals_ Scenario 1	Central Tendency	Rural	1.6E−08	1.4E−08	1.2E−08	7.9E−09	4.5E−09	8.9E−10	1.4E−10	2.3E−11	5.5E−12	1.2E−12
		Urban	4.0E−08	1.2E−08	9.9E−09	4.7E−09	2.1E−09	3.2E−10	4.1E−11	8.2E−12	2.3E−12	6.4E−13
	High-End	Rural	3.7E−08	2.2E−08	1.8E−08	1.2E−08	6.3E−09	1.2E−09	1.8E−10	2.9E−11	6.9E−12	1.5E−12
		Urban	6.1E−08	1.8E−08	1.5E−08	6.6E−09	2.9E−09	3.7E−10	5.2E−11	1.0E−11	3.0E−12	7.8E−13
Commercial Uses Laboratory Chemicals_ Scenario 3	Central Tendency	Rural	2.0E−11	1.7E−11	1.4E−11	9.9E−12	5.6E−12	1.1E−12	1.8E−13	2.9E−14	6.9E−15	1.5E−15
		Urban	5.0E−11	1.6E−11	1.2E−11	5.9E−12	2.6E−12	4.1E−13	5.1E−14	1.0E−14	2.9E−15	8.0E−16
	High-End	Rural	4.6E−11	2.8E−11	2.2E−11	1.5E−11	7.9E−12	1.5E−12	2.2E−13	3.6E−14	8.6E−15	1.9E−15
		Urban	7.6E−11	2.3E−11	1.8E−11	8.3E−12	3.6E−12	4.6E−13	6.6E−14	1.3E−14	3.7E−15	9.7E−16
Domestic Manufacturing, Manufacturing, Average PV_CAS 1	Central Tendency	Rural	1.7E−05	7.5E−06	5.5E−06	3.1E−06	1.3E−06	1.5E−07	2.2E−08	3.7E−09	1.1E−09	3.5E−10
		Urban	1.9E−05	7.3E−06	5.4E−06	2.7E−06	1.1E−06	1.2E−07	1.2E−08	2.1E−09	6.4E−10	2.1E−10
	High-End	Rural	3.9E−05	1.1E−05	7.0E−06	3.5E−06	1.3E−06	1.1E−07	1.0E−08	1.6E−09	4.7E−10	1.7E−10
		Urban	3.9E−05	1.1E−05	7.0E−06	3.5E−06	1.3E−06	9.8E−08	9.9E−09	1.4E−09	4.2E−10	1.6E−10
Domestic Manufacturing, Manufacturing, Average PV_CAS 2	Central Tendency	Rural	3.1E−05	1.9E−05	1.5E−05	1.0E−05	5.6E−06	1.0E−06	1.8E−07	2.9E−08	7.0E−09	1.7E−09
		Urban	5.6E−05	2.0E−05	1.5E−05	7.4E−06	3.2E−06	4.3E−07	5.2E−08	1.0E−08	3.1E−09	8.8E−10
	High-End	Rural	7.2E−05	3.2E−05	2.3E−05	1.3E−05	6.2E−06	1.0E−06	1.5E−07	2.7E−08	6.9E−09	1.7E−09
		Urban	9.3E−05	2.7E−05	1.9E−05	9.3E−06	3.9E−06	4.5E−07	5.8E−08	1.2E−08	3.4E−09	9.5E−10
Domestic Manufacturing, Manufacturing, PV14: Gehring Montgomery	Central Tendency	Rural	1.6E−05	7.2E−06	5.2E−06	2.9E−06	1.2E−06	1.5E−07	2.1E−08	3.6E−09	1.1E−09	3.3E−10
		Urban	1.8E−05	7.0E−06	5.1E−06	2.6E−06	1.1E−06	1.1E−07	1.2E−08	2.0E−09	6.1E−10	2.0E−10
	High-End	Rural	3.7E−05	1.1E−05	6.7E−06	3.4E−06	1.3E−06	1.0E−07	9.7E−09	1.5E−09	4.5E−10	1.7E−10
		Urban	3.7E−05	1.0E−05	6.7E−06	3.4E−06	1.3E−06	9.4E−08	9.5E−09	1.4E−09	4.0E−10	1.6E−10

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Incorporation into Other Articles Not Covered Elsewhere, Processing – Incorporation into Formulation, Mixture, or Reaction Product	Central Tendency	Rural	1.6E−06	1.4E−06	1.1E−06	7.9E−07	4.4E−07	8.8E−08	1.4E−08	2.2E−09	5.3E−10	1.2E−10
		Urban	3.9E−06	1.2E−06	9.8E−07	4.7E−07	2.1E−07	3.2E−08	4.0E−09	8.0E−10	2.3E−10	6.4E−11
	High-End	Rural	3.8E−06	2.2E−06	1.8E−06	1.2E−06	6.3E−07	1.2E−07	1.8E−08	2.9E−09	7.0E−10	1.6E−10
		Urban	6.1E−06	1.8E−06	1.5E−06	6.6E−07	2.9E−07	3.7E−08	5.3E−09	1.1E−09	3.0E−10	7.8E−11
Manufacturing – Import, Import – Repackaging, Average PV, CAS 1	Central Tendency	Rural	1.6E−06	6.7E−07	4.9E−07	2.5E−07	1.0E−07	1.2E−08	1.4E−09	2.4E−10	6.9E−11	2.1E−11
		Urban	1.7E−06	6.5E−07	4.8E−07	2.4E−07	9.5E−08	9.3E−09	9.1E−10	1.5E−10	4.5E−11	1.6E−11
	High-End	Rural	3.1E−06	8.8E−07	5.6E−07	2.9E−07	1.1E−07	7.8E−09	8.0E−10	1.1E−10	3.2E−11	1.2E−11
		Urban	3.2E−06	8.8E−07	5.6E−07	2.8E−07	1.1E−07	7.3E−09	7.8E−10	1.1E−10	2.9E−11	1.1E−11
Manufacturing – Import, Import – Repackaging, Average PV, CAS 2	Central Tendency	Rural	3.1E−05	2.7E−05	2.3E−05	1.6E−05	8.9E−06	1.8E−06	2.8E−07	4.6E−08	1.1E−08	2.5E−09
		Urban	7.9E−05	2.5E−05	2.0E−05	9.4E−06	4.2E−06	6.5E−07	8.2E−08	1.6E−08	4.7E−09	1.3E−09
	High-End	Rural	7.4E−05	4.4E−05	3.5E−05	2.3E−05	1.3E−05	2.3E−06	3.5E−07	5.7E−08	1.4E−08	3.1E−09
		Urban	1.2E−04	3.6E−05	2.9E−05	1.3E−05	5.7E−06	7.4E−07	1.0E−07	2.1E−08	5.9E−09	1.5E−09
Manufacturing – Import, Import – Repackaging, PV1: Henkel Louisville	Central Tendency	Rural	4.8E−09	2.0E−09	1.5E−09	7.5E−10	3.0E−10	3.1E−11	2.9E−12	4.9E−13	1.5E−13	5.0E−14
		Urban	5.1E−09	2.0E−09	1.5E−09	7.2E−10	2.8E−10	2.4E−11	2.5E−12	3.6E−13	1.1E−13	4.1E−14
	High-End	Rural	9.5E−09	2.6E−09	1.7E−09	8.5E−10	3.2E−10	2.2E−11	2.2E−12	2.9E−13	7.5E−14	3.1E−14
		Urban	9.5E−09	2.6E−09	1.7E−09	8.5E−10	3.1E−10	2.2E−11	2.2E−12	2.8E−13	7.4E−14	3.1E−14
Manufacturing – Import, Import – Repackaging, PV10: Tribute Energy	Central Tendency	Rural	2.9E−07	1.3E−07	9.7E−08	5.0E−08	2.1E−08	2.5E−09	3.0E−10	5.3E−11	1.5E−11	4.4E−12
		Urban	3.2E−07	1.3E−07	9.5E−08	4.7E−08	1.9E−08	1.9E−09	1.9E−10	3.2E−11	9.5E−12	3.2E−12
	High-End	Rural	6.3E−07	1.8E−07	1.1E−07	5.8E−08	2.2E−08	1.6E−09	1.7E−10	2.3E−11	6.4E−12	2.4E−12
		Urban	6.3E−07	1.8E−07	1.1E−07	5.8E−08	2.2E−08	1.5E−09	1.6E−10	2.1E−11	5.8E−12	2.2E−12
Manufacturing – Import, Import – Repackaging, PV11: Geon Performance	Central Tendency	Rural	1.5E−07	6.8E−08	5.0E−08	2.6E−08	1.1E−08	1.3E−09	1.6E−10	2.8E−11	7.7E−12	2.3E−12
		Urban	1.7E−07	6.6E−08	4.9E−08	2.5E−08	9.8E−09	9.9E−10	9.8E−11	1.7E−11	4.9E−12	1.7E−12
	High-End	Rural	3.3E−07	9.3E−08	6.0E−08	3.0E−08	1.1E−08	8.3E−10	8.6E−11	1.2E−11	3.4E−12	1.2E−12
		Urban	3.3E−07	9.3E−08	5.9E−08	3.0E−08	1.1E−08	7.7E−10	8.4E−11	1.1E−11	3.0E−12	1.2E−12
Manufacturing – Import, Import – Repackaging, PV12: Cascade Columbia	Central Tendency	Rural	5.1E−07	2.3E−07	1.7E−07	8.7E−08	3.6E−08	4.3E−09	5.3E−10	9.3E−11	2.6E−11	7.7E−12
		Urban	5.6E−07	2.2E−07	1.7E−07	8.2E−08	3.3E−08	3.4E−09	3.3E−10	5.7E−11	1.7E−11	5.6E−12
	High-End	Rural	1.1E−06	3.1E−07	2.0E−07	1.0E−07	3.8E−08	2.8E−09	2.9E−10	4.0E−11	1.1E−11	4.2E−12
		Urban	1.1E−06	3.1E−07	2.0E−07	1.0E−07	3.8E−08	2.6E−09	2.8E−10	3.8E−11	1.0E−11	3.9E−12

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Manufacturing – Import, Import – Repackaging, PV13: Alac Intl	Central Tendency	Rural	4.6E−06	1.9E−06	1.4E−06	7.5E−07	3.2E−07	4.4E−08	5.8E−09	1.1E−09	3.0E−10	8.9E−11
		Urban	5.1E−06	1.9E−06	1.4E−06	6.8E−07	2.7E−07	2.9E−08	2.8E−09	5.0E−10	1.6E−10	5.5E−11
	High-End	Rural	8.3E−06	2.3E−06	1.5E−06	7.3E−07	2.7E−07	2.3E−08	2.1E−09	3.1E−10	1.0E−10	4.1E−11
		Urban	8.3E−06	2.3E−06	1.5E−06	7.2E−07	2.7E−07	2.1E−08	1.9E−09	2.8E−10	8.5E−11	3.4E−11
Manufacturing – Import, Import – Repackaging, PV2: Formosa Global	Central Tendency	Rural	2.3E−08	9.7E−09	7.2E−09	3.6E−09	1.4E−09	1.5E−10	1.4E−11	2.4E−12	7.1E−13	2.4E−13
		Urban	2.5E−08	9.5E−09	7.0E−09	3.5E−09	1.4E−09	1.2E−10	1.2E−11	1.8E−12	5.2E−13	2.0E−13
	High-End	Rural	4.6E−08	1.3E−08	8.1E−09	4.1E−09	1.5E−09	1.1E−10	1.1E−11	1.4E−12	3.6E−13	1.5E−13
		Urban	4.6E−08	1.3E−08	8.1E−09	4.1E−09	1.5E−09	1.1E−10	1.1E−11	1.4E−12	3.6E−13	1.5E−13
Manufacturing – Import, Import – Repackaging, PV3: ChemSpec	Central Tendency	Rural	4.9E−08	2.0E−08	1.5E−08	7.5E−09	3.0E−09	3.1E−10	2.9E−11	5.0E−12	1.5E−12	5.1E−13
		Urban	5.2E−08	2.0E−08	1.5E−08	7.3E−09	2.9E−09	2.4E−10	2.5E−11	3.7E−12	1.1E−12	4.1E−13
	High-End	Rural	9.6E−08	2.7E−08	1.7E−08	8.6E−09	3.2E−09	2.3E−10	2.3E−11	2.9E−12	7.6E−13	3.2E−13
		Urban	9.6E−08	2.7E−08	1.7E−08	8.6E−09	3.2E−09	2.2E−10	2.2E−11	2.9E−12	7.5E−13	3.2E−13
Manufacturing – Import, Import – Repackaging, PV4: Harwick Standard	Central Tendency	Rural	5.6E−08	2.3E−08	1.7E−08	8.7E−09	3.5E−09	3.6E−10	3.4E−11	5.7E−12	1.7E−12	5.9E−13
		Urban	6.0E−08	2.3E−08	1.7E−08	8.4E−09	3.3E−09	2.8E−10	2.9E−11	4.2E−12	1.3E−12	4.7E−13
	High-End	Rural	1.1E−07	3.1E−08	2.0E−08	9.9E−09	3.7E−09	2.6E−10	2.6E−11	3.3E−12	8.7E−13	3.6E−13
		Urban	1.1E−07	3.1E−08	2.0E−08	9.9E−09	3.7E−09	2.6E−10	2.6E−11	3.3E−12	8.7E−13	3.7E−13
Manufacturing – Import, Import – Repackaging, PV5: Henkel Silver Fern Chem	Central Tendency	Rural	7.3E−08	3.0E−08	2.3E−08	1.1E−08	4.5E−09	4.7E−10	4.4E−11	7.4E−12	2.2E−12	7.6E−13
		Urban	7.7E−08	3.0E−08	2.2E−08	1.1E−08	4.3E−09	3.6E−10	3.7E−11	5.5E−12	1.6E−12	6.2E−13
	High-End	Rural	1.4E−07	4.0E−08	2.6E−08	1.3E−08	4.8E−09	3.4E−10	3.4E−11	4.3E−12	1.1E−12	4.7E−13
		Urban	1.4E−07	4.0E−08	2.5E−08	1.3E−08	4.8E−09	3.4E−10	3.3E−11	4.3E−12	1.1E−12	4.7E−13
Manufacturing – Import, Import – Repackaging, PV6: MAK Chem	Central Tendency	Rural	8.5E−08	3.6E−08	2.6E−08	1.3E−08	5.3E−09	5.5E−10	5.2E−11	8.7E−12	2.6E−12	8.9E−13
		Urban	9.1E−08	3.5E−08	2.6E−08	1.3E−08	5.0E−09	4.3E−10	4.3E−11	6.4E−12	1.9E−12	7.2E−13
	High-End	Rural	1.7E−07	4.7E−08	3.0E−08	1.5E−08	5.6E−09	4.0E−10	3.9E−11	5.0E−12	1.3E−12	5.5E−13
		Urban	1.7E−07	4.7E−08	3.0E−08	1.5E−08	5.6E−09	3.9E−10	3.9E−11	5.0E−12	1.3E−12	5.5E−13
Manufacturing – Import, Import – Repackaging, PV7: Mercedes Benz	Central Tendency	Rural	6.2E−08	2.6E−08	1.9E−08	9.5E−09	3.8E−09	4.0E−10	3.7E−11	6.3E−12	1.9E−12	6.4E−13
		Urban	6.6E−08	2.5E−08	1.9E−08	9.2E−09	3.6E−09	3.1E−10	3.1E−11	4.6E−12	1.4E−12	5.2E−13
	High-End	Rural	1.2E−07	3.4E−08	2.2E−08	1.1E−08	4.0E−09	2.9E−10	2.8E−11	3.6E−12	9.6E−13	4.0E−13
		Urban	1.2E−07	3.4E−08	2.2E−08	1.1E−08	4.0E−09	2.8E−10	2.8E−11	3.6E−12	9.5E−13	4.0E−13

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Manufacturing – Import, Import – Repackaging, PV8: Univar	Central Tendency	Rural	9.8E−08	4.3E−08	3.2E−08	1.7E−08	6.9E−09	8.2E−10	1.0E−10	1.8E−11	4.9E−12	1.5E−12
		Urban	1.1E−07	4.2E−08	3.2E−08	1.6E−08	6.3E−09	6.4E−10	6.3E−11	1.1E−11	3.2E−12	1.1E−12
	High-End	Rural	2.1E−07	6.0E−08	3.8E−08	1.9E−08	7.3E−09	5.3E−10	5.5E−11	7.5E−12	2.2E−12	7.9E−13
		Urban	2.1E−07	5.9E−08	3.8E−08	1.9E−08	7.2E−09	5.0E−10	5.4E−11	7.2E−12	2.0E−12	7.4E−13
Manufacturing – Import, Import – Repackaging, PV9: Belts Concepts	Central Tendency	Rural	2.3E−07	1.0E−07	7.7E−08	4.0E−08	1.6E−08	2.0E−09	2.4E−10	4.2E−11	1.2E−11	3.5E−12
		Urban	2.6E−07	1.0E−07	7.5E−08	3.8E−08	1.5E−08	1.5E−09	1.5E−10	2.6E−11	7.6E−12	2.5E−12
	High-End	Rural	5.0E−07	1.4E−07	9.1E−08	4.6E−08	1.7E−08	1.3E−09	1.3E−10	1.8E−11	5.1E−12	1.9E−12
		Urban	5.0E−07	1.4E−07	9.1E−08	4.6E−08	1.7E−08	1.2E−09	1.3E−10	1.7E−11	4.7E−12	1.8E−12
Non-PVC Plastic Compounding	Central Tendency	Rural	1.0E03	8.3E02	7.1E02	4.9E02	2.8E02	5.7E01	9.1E00	1.5E00	3.4E−01	7.9E−02
		Urban	2.5E03	7.8E02	6.0E02	3.0E02	1.4E02	2.0E01	2.6E00	5.4E−01	1.6E−01	4.4E−02
	High-End	Rural	2.4E03	1.4E03	1.1E03	7.5E02	4.0E02	7.5E01	1.1E01	1.9E00	4.5E−01	1.0E−01
		Urban	3.9E03	1.2E03	9.3E02	4.3E02	1.9E02	2.3E01	3.4E00	6.8E−01	1.9E−01	5.1E−02
Non-PVC Plastic Converting	Central Tendency	Rural	2.4E01	2.1E01	1.7E01	1.2E01	6.7E00	1.3E00	2.1E−01	3.4E−02	8.1E−03	1.8E−03
		Urban	5.9E01	1.8E01	1.5E01	7.0E00	3.1E00	4.8E−01	6.1E−02	1.2E−02	3.4E−03	9.6E−04
	High-End	Rural	5.7E01	3.4E01	2.7E01	1.8E01	9.6E00	1.7E00	2.7E−01	4.4E−02	1.1E−02	2.3E−03
		Urban	9.2E01	2.8E01	2.2E01	1.0E01	4.3E00	5.6E−01	7.9E−02	1.6E−02	4.5E−03	1.2E−03
Paint and Coating Manufacturing, Processing – Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	4.3E−07	3.7E−07	3.1E−07	2.1E−07	1.2E−07	2.4E−08	3.7E−09	6.0E−10	1.4E−10	3.2E−11
		Urban	1.1E−06	3.3E−07	2.6E−07	1.3E−07	5.6E−08	8.5E−09	1.1E−09	2.2E−10	6.1E−11	1.7E−11
	High-End	Rural	1.0E−06	6.0E−07	4.8E−07	3.1E−07	1.7E−07	3.1E−08	4.8E−09	7.8E−10	1.9E−10	4.2E−11
		Urban	1.6E−06	4.9E−07	4.0E−07	1.8E−07	7.7E−08	1.0E−08	1.4E−09	2.8E−10	8.0E−11	2.1E−11
PVC Plastic Compounding	Central Tendency	Rural	6.3E02	5.4E02	4.5E02	3.1E02	1.8E02	3.5E01	5.5E00	8.9E−01	2.1E−01	4.7E−02
		Urban	1.6E03	4.8E02	3.9E02	1.8E02	8.2E01	1.3E01	1.6E00	3.2E−01	9.1E−02	2.5E−02
	High-End	Rural	1.5E03	8.9E02	7.0E02	4.6E02	2.5E02	4.6E01	7.0E00	1.2E00	2.8E−01	6.1E−02
		Urban	2.4E03	7.2E02	5.9E02	2.6E02	1.1E02	1.5E01	2.1E00	4.2E−01	1.2E−01	3.1E−02
PVC Plastic Converting	Central Tendency	Rural	2.9E01	2.5E01	2.1E01	1.4E01	8.1E00	1.6E00	2.5E−01	4.1E−02	9.8E−03	2.2E−03
		Urban	7.1E01	2.2E01	1.8E01	8.5E00	3.8E00	5.7E−01	7.3E−02	1.5E−02	4.2E−03	1.2E−03
	High-End	Rural	6.9E01	4.1E01	3.2E01	2.1E01	1.2E01	2.1E00	3.2E−01	5.3E−02	1.3E−02	2.8E−03
		Urban	1.1E02	3.3E01	2.7E01	1.2E01	5.2E00	6.8E−01	9.6E−02	1.9E−02	5.4E−03	1.4E−03

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Use of Adhesives and Sealants, Use of Adhesives and Sealants	Central Tendency	Rural	6.4E−08	5.3E−08	4.5E−08	3.1E−08	1.7E−08	3.6E−09	5.4E−10	8.6E−11	2.1E−11	5.1E−12
		Urban	1.5E−07	4.8E−08	3.8E−08	1.9E−08	8.5E−09	1.2E−09	1.6E−10	3.4E−11	9.7E−12	2.7E−12
	High-End	Rural	1.5E−07	9.0E−08	7.0E−08	4.7E−08	2.6E−08	4.7E−09	7.1E−10	1.2E−10	2.8E−11	6.4E−12
		Urban	2.5E−07	7.4E−08	6.0E−08	2.7E−08	1.2E−08	1.5E−09	2.2E−10	4.3E−11	1.2E−11	3.2E−12
Use of Paints and Coatings, Use of Paints and Coatings	Central Tendency	Rural	1.4E−07	1.2E−07	9.9E−08	6.8E−08	3.9E−08	7.9E−09	1.3E−09	2.0E−10	4.8E−11	1.1E−11
		Urban	3.5E−07	1.1E−07	8.4E−08	4.2E−08	1.9E−08	2.8E−09	3.7E−10	7.5E−11	2.2E−11	6.2E−12
	High-End	Rural	3.3E−07	2.0E−07	1.6E−07	1.1E−07	5.7E−08	1.0E−08	1.6E−09	2.6E−10	6.3E−11	1.4E−11
		Urban	5.4E−07	1.7E−07	1.3E−07	6.0E−08	2.6E−08	3.3E−09	4.8E−10	9.5E−11	2.7E−11	7.2E−12
Use of Paints and Coatings, Use of Paints and Coatings w/o Engineering Controls	Central Tendency	Rural	1.4E−07	1.2E−07	9.9E−08	6.8E−08	3.9E−08	7.9E−09	1.3E−09	2.0E−10	4.8E−11	1.1E−11
		Urban	3.5E−07	1.1E−07	8.4E−08	4.2E−08	1.9E−08	2.8E−09	3.7E−10	7.5E−11	2.2E−11	6.2E−12
	High-End	Rural	3.3E−07	2.0E−07	1.6E−07	1.1E−07	5.7E−08	1.0E−08	1.6E−09	2.6E−10	6.3E−11	1.4E−11
		Urban	5.4E−07	1.7E−07	1.3E−07	6.0E−08	2.6E−08	3.3E−09	4.8E−10	9.5E−11	2.7E−11	7.2E−12
		Max	**3.9E03**	**1.4E03**	**1.1E03**	**7.5E02**	**4.0E02**	**7.5E01**	**1.1E01**	**1.9E00**	**4.5E−01**	**1.0E−01**
		Mean	**1.4E02**	**5.9E01**	**4.7E01**	**2.7E01**	**1.4E01**	**2.4E00**	**3.7E−01**	**6.3E−02**	**1.6E−02**	**3.8E−03**
		Median	**3.5E−07**	**1.4E−07**	**9.9E−08**	**5.8E−08**	**2.5E−08**	**3.0E−09**	**3.7E−10**	**7.5E−11**	**2.1E−11**	**5.9E−12**
		Min	**2.0E−11**	**1.6E−11**	**1.2E−11**	**5.9E−12**	**2.6E−12**	**4.1E−13**	**5.1E−14**	**1.0E−14**	**2.9E−15**	**8.0E−16**

Table_Apx C-5. DINP 95th Percentile Annual Concentrations (μg/m^3) Modeled from High-End Stack Release Source

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	9.5E−13	7.8E−11	6.5E−10	9.4E−10	1.8E−09	6.1E−10	2.2E−10	6.0E−11	4.0E−11	3.5E−11
		Urban	4.5E−12	1.4E−10	7.9E−10	1.1E−09	1.9E−09	6.4E−10	2.4E−10	7.6E−11	2.6E−11	8.3E−12
	High-End	Rural	4.8E−13	1.0E−10	9.3E−10	1.4E−09	2.3E−09	1.1E−09	5.0E−10	1.6E−10	1.2E−10	4.8E−11
		Urban	3.4E−12	2.2E−10	1.5E−09	2.2E−09	3.6E−09	1.2E−09	4.0E−10	1.1E−10	3.7E−11	1.1E−11
Commercial Uses Laboratory Chemicals_Scenario 2	Central Tendency	Rural	1.0E−08	8.2E−07	6.9E−06	9.9E−06	1.9E−05	6.5E−06	2.3E−06	6.6E−07	4.4E−07	3.8E−07
		Urban	4.7E−08	1.4E−06	8.4E−06	1.1E−05	2.1E−05	6.9E−06	2.6E−06	8.4E−07	2.9E−07	9.1E−08
	High-End	Rural	5.1E−09	1.1E−06	9.9E−06	1.4E−05	2.5E−05	1.2E−05	5.3E−06	1.7E−06	1.2E−06	5.2E−07
		Urban	3.6E−08	2.3E−06	1.5E−05	2.3E−05	3.8E−05	1.3E−05	4.3E−06	1.2E−06	4.0E−07	1.2E−07

Scenario	Meteorology	Distance										
		Land	**10 m**	**30 m**	**30–60 m**	**60 m**	**100 m**	**100–1,000 m**	**1,000 m**	**2,500 m**	**5,000 m**	**10,000 m**
Domestic Manufacturing, Manufacturing, Average PV_CAS 1	Central Tendency	Rural	1.4E−05	1.7E−02	2.1E−01	3.4E−01	6.6E−01	2.1E−01	3.7E−02	7.8E−03	3.0E−03	1.7E−03
		Urban	6.2E−05	2.1E−02	2.3E−01	3.8E−01	7.2E−01	2.2E−01	3.6E−02	7.8E−03	2.4E−03	8.7E−04
	High-End	Rural	3.0E−05	3.3E−02	3.7E−01	6.4E−01	1.2E00	3.1E−01	4.2E−02	6.0E−03	1.9E−03	7.0E−04
		Urban	6.1E−05	3.7E−02	3.8E−01	6.5E−01	1.2E00	3.1E−01	4.1E−02	5.7E−03	1.7E−03	6.3E−04
Domestic Manufacturing, Manufacturing, Average PV_CAS 2	Central Tendency	Rural	8.4E−03	6.4E−01	5.8E00	8.1E00	1.6E01	5.4E00	1.5E00	3.7E−01	2.1E−01	1.9E−01
		Urban	5.3E−02	1.4E00	7.5E00	1.0E01	1.8E01	5.9E00	1.5E00	4.6E−01	1.6E−01	5.2E−02
	High-End	Rural	5.8E−03	9.3E−01	9.3E00	1.4E01	2.5E01	8.7E00	3.0E00	8.8E−01	4.2E−01	1.9E−01
		Urban	4.9E−02	2.1E00	1.4E01	2.1E01	3.4E01	9.7E00	2.5E00	5.8E−01	1.9E−01	5.9E−02
Domestic Manufacturing, Manufacturing, PV14: Gehring Montgomery	Central Tendency	Rural	1.8E−07	2.2E−04	2.7E−03	4.3E−03	8.5E−03	2.8E−03	4.8E−04	1.0E−04	3.8E−05	2.2E−05
		Urban	8.1E−07	2.8E−04	3.0E−03	5.0E−03	9.3E−03	2.9E−03	4.7E−04	1.0E−04	3.1E−05	1.1E−05
	High-End	Rural	3.8E−07	4.3E−04	4.8E−03	8.2E−03	1.6E−02	3.9E−03	5.4E−04	7.8E−05	2.4E−05	9.1E−06
		Urban	7.9E−07	4.7E−04	4.9E−03	8.4E−03	1.6E−02	4.0E−03	5.3E−04	7.3E−05	2.2E−05	8.2E−06
Incorporation into other articles not covered elsewhere, Processing – Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	1.3E−11	1.1E−09	9.2E−09	1.3E−08	2.6E−08	8.5E−09	3.0E−09	8.5E−10	5.6E−10	4.9E−10
		Urban	6.3E−11	1.9E−09	1.1E−08	1.5E−08	2.7E−08	9.0E−09	3.4E−09	1.1E−09	3.7E−10	1.2E−10
	High-End	Rural	6.8E−12	1.4E−09	1.3E−08	1.9E−08	3.3E−08	1.5E−08	7.0E−09	2.2E−09	1.6E−09	6.7E−10
		Urban	4.8E−11	3.1E−09	2.1E−08	3.1E−08	5.1E−08	1.7E−08	5.6E−09	1.6E−09	5.2E−10	1.5E−10
Paint and Coating Manufacturing, Processing – Incorporation into Formulation, Mixture, or Reaction Product	Central Tendency	Rural	7.8E−15	6.4E−13	5.4E−12	7.7E−12	1.5E−11	5.0E−12	1.8E−12	5.0E−13	3.3E−13	2.8E−13
		Urban	3.7E−14	1.1E−12	6.5E−12	8.8E−12	1.6E−11	5.3E−12	2.0E−12	6.3E−13	2.2E−13	6.8E−14
	High-End	Rural	4.0E−15	8.3E−13	7.7E−12	1.1E−11	1.9E−11	8.8E−12	4.1E−12	1.3E−12	9.5E−13	3.9E−13
		Urban	2.8E−14	1.8E−12	1.2E−11	1.8E−11	3.0E−11	9.7E−12	3.3E−12	9.3E−13	3.0E−13	8.9E−14
Use of Paints and Coatings, Use of Paints and Coatings	Central Tendency	Rural	1.3E−04	1.6E−02	1.4E−01	1.9E−01	3.7E−01	1.4E−01	4.6E−02	1.3E−02	8.6E−03	7.2E−03
		Urban	7.9E−04	2.7E−02	1.6E−01	2.2E−01	4.0E−01	1.4E−01	5.1E−02	1.6E−02	5.6E−03	1.8E−03
	High-End	Rural	8.8E−05	1.9E−02	2.1E−01	2.8E−01	4.7E−01	2.2E−01	9.2E−02	2.9E−02	2.3E−02	9.8E−03
		Urban	6.1E−04	4.5E−02	3.1E−01	4.6E−01	7.3E−01	2.4E−01	8.5E−02	2.3E−02	7.7E−03	2.3E−03
		Max	**5.3E−02**	**2.1E00**	**1.4E01**	**2.1E01**	**3.4E01**	**9.7E00**	**3.0E00**	**8.8E−01**	**4.2E−01**	**1.9E−01**
		Mean	**3.7E−03**	**1.6E−01**	**1.2E00**	**1.8E00**	**3.0E00**	**9.8E−01**	**2.8E−01**	**7.5E−02**	**3.3E−02**	**1.6E−02**
		Median	**1.1E−07**	**1.1E−04**	**1.3E−03**	**2.2E−03**	**4.3E−03**	**1.4E−03**	**2.4E−04**	**3.7E−05**	**1.1E−05**	**4.4E−06**
		Min	**4.0E−15**	**6.4E−13**	**5.4E−12**	**7.7E−12**	**1.5E−11**	**5.0E−12**	**1.8E−12**	**5.0E−13**	**2.2E−13**	**6.8E−14**

Table_Apx C-6. DINP 95th Percentile Daily Concentrations (μg/m³) Modeled from High-End Fugitive Release Source

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	3.9E−07	3.1E−07	2.3E−07	1.8E−07	9.9E−08	7.9E−09	3.1E−09	5.3E−10	1.2E−10	2.8E−11
		Urban	8.1E−07	2.9E−07	1.7E−07	1.1E−07	5.0E−08	2.7E−09	1.0E−09	2.1E−10	6.2E−11	1.7E−11
	High-End	Rural	5.9E−07	4.8E−07	3.4E−07	2.4E−07	1.3E−07	1.0E−08	3.8E−09	6.8E−10	1.7E−10	3.6E−11
		Urban	1.2E−06	3.7E−07	2.2E−07	1.4E−07	6.0E−08	3.2E−09	1.2E−09	2.3E−10	6.6E−11	1.8E−11
Commercial Uses Laboratory Chemicals_Scenario 1	Central Tendency	Rural	6.7E−08	5.5E−08	4.1E−08	3.1E−08	1.8E−08	1.4E−09	5.7E−10	9.8E−11	2.3E−11	5.2E−12
		Urban	1.4E−07	5.1E−08	3.0E−08	2.0E−08	8.9E−09	4.9E−10	1.8E−10	3.7E−11	1.1E−11	3.1E−12
	High-End	Rural	1.0E−07	8.4E−08	5.9E−08	4.3E−08	2.3E−08	1.8E−09	6.7E−10	1.2E−10	2.9E−11	6.3E−12
		Urban	2.1E−07	6.5E−08	3.8E−08	2.4E−08	1.1E−08	5.7E−10	2.1E−10	4.1E−11	1.2E−11	3.1E−12
Commercial Uses Laboratory Chemicals_Scenario 3	Central Tendency	Rural	8.3E−11	6.9E−11	5.1E−11	3.9E−11	2.2E−11	1.8E−12	7.1E−13	1.2E−13	2.9E−14	6.5E−15
		Urban	1.8E−10	6.3E−11	3.8E−11	2.5E−11	1.1E−11	6.2E−13	2.3E−13	4.7E−14	1.4E−14	3.9E−15
	High-End	Rural	1.3E−10	1.0E−10	7.3E−11	5.3E−11	2.9E−11	2.3E−12	8.4E−13	1.5E−13	3.7E−14	7.9E−15
		Urban	2.6E−10	8.1E−11	4.7E−11	3.0E−11	1.3E−11	7.2E−13	2.6E−13	5.1E−14	1.5E−14	3.9E−15
Domestic Manufacturing, Manufacturing, Average PV_CAS 1	Central Tendency	Rural	1.0E−04	4.4E−05	2.3E−05	1.5E−05	5.5E−06	9.2E−08	3.3E−08	3.8E−09	8.7E−10	2.1E−10
		Urban	1.1E−04	4.4E−05	2.3E−05	1.5E−05	5.6E−06	9.6E−08	3.4E−08	4.2E−09	1.0E−09	2.8E−10
	High-End	Rural	1.5E−04	4.7E−05	2.4E−05	1.5E−05	5.3E−06	9.8E−08	3.2E−08	3.9E−09	1.1E−09	3.7E−10
		Urban	1.6E−04	4.7E−05	2.4E−05	1.5E−05	5.2E−06	9.9E−08	3.2E−08	4.0E−09	1.1E−09	3.8E−10
Domestic Manufacturing, Manufacturing, Average PV_CAS 2	Central Tendency	Rural	1.8E−04	1.1E−04	7.1E−05	5.0E−05	2.3E−05	9.9E−07	3.3E−07	5.4E−08	1.4E−08	3.6E−09
		Urban	2.7E−04	1.0E−04	5.8E−05	3.8E−05	1.6E−05	6.5E−07	2.6E−07	4.7E−08	1.3E−08	3.6E−09
	High-End	Rural	2.7E−04	1.4E−04	8.9E−05	6.2E−05	3.0E−05	1.4E−06	4.6E−07	6.9E−08	1.7E−08	4.0E−09
		Urban	3.8E−04	1.2E−04	6.5E−05	4.1E−05	1.7E−05	7.1E−07	2.9E−07	5.4E−08	1.4E−08	3.9E−09
Domestic Manufacturing, Manufacturing, PV14: Gehring Montgomery	Central Tendency	Rural	9.8E−05	4.2E−05	2.2E−05	1.4E−05	5.3E−06	8.8E−08	3.1E−08	3.6E−09	8.4E−10	2.0E−10
		Urban	1.1E−04	4.2E−05	2.2E−05	1.4E−05	5.3E−06	9.2E−08	3.3E−08	4.0E−09	9.8E−10	2.7E−10
	High-End	Rural	1.5E−04	4.5E−05	2.3E−05	1.4E−05	5.0E−06	9.4E−08	3.1E−08	3.8E−09	1.0E−09	3.6E−10
		Urban	1.5E−04	4.5E−05	2.3E−05	1.4E−05	5.0E−06	9.5E−08	3.1E−08	3.9E−09	1.0E−09	3.7E−10
Incorporation into other articles not covered elsewhere, Processing – Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	6.9E−06	5.6E−06	4.2E−06	3.1E−06	1.8E−06	1.4E−07	5.5E−08	9.5E−09	2.2E−09	4.9E−10
		Urban	1.5E−05	5.1E−06	3.1E−06	2.0E−06	8.9E−07	4.9E−08	1.8E−08	3.7E−09	1.1E−09	3.1E−10
	High-End	Rural	1.1E−05	8.5E−06	6.0E−06	4.3E−06	2.4E−06	1.8E−07	6.8E−08	1.2E−08	3.0E−09	6.4E−10
		Urban	2.2E−05	6.6E−06	3.9E−06	2.4E−06	1.1E−06	5.8E−08	2.1E−08	4.2E−09	1.2E−09	3.2E−10

Scenario	Meteorology	Distance										
		Land	**10 m**	**30 m**	**30–60 m**	**60 m**	**100 m**	**100–1,000 m**	**1,000 m**	**2,500 m**	**5,000 m**	**10,000 m**
Manufacturing – Import, Import – Repackaging, Average PV, CAS 1	Central Tendency	Rural	7.4E−06	3.2E−06	1.8E−06	1.2E−06	4.4E−07	1.0E−08	3.5E−09	4.8E−10	1.3E−10	4.5E−11
		Urban	8.0E−06	3.1E−06	1.8E−06	1.1E−06	4.3E−07	1.0E−08	3.3E−09	4.8E−10	1.3E−10	4.9E−11
	High-End	Rural	1.0E−05	3.2E−06	1.8E−06	1.1E−06	3.9E−07	9.1E−09	2.8E−09	3.7E−10	1.1E−10	4.2E−11
		Urban	1.0E−05	3.2E−06	1.7E−06	1.0E−06	3.9E−07	9.1E−09	2.7E−09	3.8E−10	1.1E−10	4.3E−11
Manufacturing – Import, Import – Repackaging, Average PV, CAS 2	Central Tendency	Rural	1.3E−04	1.1E−04	8.2E−05	6.2E−05	3.5E−05	2.9E−06	1.1E−06	2.0E−07	4.7E−08	1.0E−08
		Urban	2.8E−04	1.0E−04	6.0E−05	4.0E−05	1.8E−05	9.8E−07	3.6E−07	7.4E−08	2.2E−08	6.2E−09
	High-End	Rural	2.0E−04	1.7E−04	1.2E−04	8.5E−05	4.6E−05	3.6E−06	1.3E−06	2.4E−07	5.9E−08	1.3E−08
		Urban	4.2E−04	1.3E−04	7.5E−05	4.8E−05	2.1E−05	1.1E−06	4.1E−07	8.2E−08	2.3E−08	6.3E−09
Manufacturing – Import, Import – Repackaging, PV1: Henkel Louisville	Central Tendency	Rural	2.4E−08	9.9E−09	5.6E−09	3.6E−09	1.4E−09	2.7E−11	9.3E−12	1.2E−12	3.1E−13	9.8E−14
		Urban	2.5E−08	9.8E−09	5.5E−09	3.5E−09	1.3E−09	2.7E−11	9.1E−12	1.2E−12	3.3E−13	1.1E−13
	High-End	Rural	3.3E−08	1.0E−08	5.5E−09	3.3E−09	1.2E−09	2.6E−11	8.3E−12	1.1E−12	3.1E−13	1.2E−13
		Urban	3.3E−08	1.0E−08	5.5E−09	3.3E−09	1.2E−09	2.6E−11	8.2E−12	1.1E−12	3.2E−13	1.2E−13
Manufacturing – Import, Import – Repackaging, PV10: Tribute Energy	Central Tendency	Rural	1.4E−06	6.2E−07	3.5E−07	2.3E−07	8.9E−08	1.9E−09	6.5E−10	8.6E−11	2.3E−11	7.3E−12
		Urban	1.6E−06	6.1E−07	3.5E−07	2.2E−07	8.7E−08	2.0E−09	6.4E−10	9.0E−11	2.4E−11	8.2E−12
	High-End	Rural	2.0E−06	6.4E−07	3.5E−07	2.1E−07	7.8E−08	1.8E−09	5.6E−10	7.1E−11	2.0E−11	7.6E−12
		Urban	2.0E−06	6.4E−07	3.5E−07	2.1E−07	7.8E−08	1.8E−09	5.5E−10	7.3E−11	2.0E−11	7.8E−12
Manufacturing – Import, Import – Repackaging, PV11: Geon Performance	Central Tendency	Rural	7.5E−07	3.3E−07	1.8E−07	1.2E−07	4.6E−08	1.0E−09	3.4E−10	4.5E−11	1.2E−11	3.8E−12
		Urban	8.1E−07	3.2E−07	1.8E−07	1.2E−07	4.5E−08	1.0E−09	3.3E−10	4.7E−11	1.3E−11	4.3E−12
	High-End	Rural	1.0E−06	3.3E−07	1.8E−07	1.1E−07	4.1E−08	9.3E−10	2.9E−10	3.7E−11	1.0E−11	4.0E−12
		Urban	1.1E−06	3.3E−07	1.8E−07	1.1E−07	4.1E−08	9.4E−10	2.9E−10	3.8E−11	1.1E−11	4.1E−12
Manufacturing – Import, Import – Repackaging, PV12: Cascade Columbia	Central Tendency	Rural	2.5E−06	1.1E−06	6.2E−07	4.0E−07	1.6E−07	3.4E−09	1.1E−09	1.5E−10	4.0E−11	1.3E−11
		Urban	2.7E−06	1.1E−06	6.1E−07	3.9E−07	1.5E−07	3.4E−09	1.1E−09	1.6E−10	4.2E−11	1.4E−11
	High-End	Rural	3.5E−06	1.1E−06	6.1E−07	3.7E−07	1.4E−07	3.1E−09	9.8E−10	1.3E−10	3.5E−11	1.3E−11
		Urban	3.5E−06	1.1E−06	6.1E−07	3.7E−07	1.4E−07	3.2E−09	9.7E−10	1.3E−10	3.6E−11	1.4E−11
Manufacturing – Import, Import – Repackaging, PV13: Alac Intl	Central Tendency	Rural	2.1E−05	9.2E−06	5.4E−06	3.4E−06	1.3E−06	3.6E−08	1.1E−08	1.8E−09	5.4E−10	1.9E−10
		Urban	2.4E−05	8.8E−06	5.0E−06	3.2E−06	1.2E−06	3.3E−08	1.1E−08	1.7E−09	5.6E−10	2.1E−10
	High-End	Rural	2.9E−05	8.8E−06	4.9E−06	2.9E−06	1.1E−06	2.8E−08	8.0E−09	1.2E−09	3.8E−10	1.6E−10
		Urban	2.9E−05	8.6E−06	4.7E−06	2.8E−06	1.0E−06	2.6E−08	7.3E−09	1.2E−09	3.9E−10	1.6E−10

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Manufacturing – Import, Import – Repackaging, PV2: Formosa Global	Central Tendency	Rural	1.2E−07	4.8E−08	2.7E−08	1.7E−08	6.5E−09	1.3E−10	4.5E−11	5.7E−12	1.5E−12	4.7E−13
		Urban	1.2E−07	4.7E−08	2.6E−08	1.7E−08	6.4E−09	1.3E−10	4.4E−11	5.9E−12	1.6E−12	5.2E−13
	High-End	Rural	1.6E−07	5.0E−08	2.7E−08	1.6E−08	5.8E−09	1.3E−10	4.0E−11	5.3E−12	1.5E−12	5.9E−13
		Urban	1.6E−07	4.9E−08	2.6E−08	1.6E−08	5.8E−09	1.2E−10	3.9E−11	5.3E−12	1.5E−12	5.9E−13
Manufacturing – Import, Import – Repackaging, PV3: ChemSpec	Central Tendency	Rural	2.4E−07	1.0E−07	5.6E−08	3.6E−08	1.4E−08	2.8E−10	9.4E−11	1.2E−11	3.1E−12	9.9E−13
		Urban	2.6E−07	9.9E−08	5.5E−08	3.5E−08	1.3E−08	2.7E−10	9.2E−11	1.2E−11	3.4E−12	1.1E−12
	High-End	Rural	3.3E−07	1.0E−07	5.6E−08	3.4E−08	1.2E−08	2.6E−10	8.4E−11	1.1E−11	3.2E−12	1.2E−12
		Urban	3.3E−07	1.0E−07	5.5E−08	3.3E−08	1.2E−08	2.6E−10	8.3E−11	1.1E−11	3.2E−12	1.2E−12
Manufacturing – Import, Import – Repackaging, PV4: Harwick Standard	Central Tendency	Rural	2.8E−07	1.2E−07	6.5E−08	4.2E−08	1.6E−08	3.2E−10	1.1E−10	1.4E−11	3.6E−12	1.1E−12
		Urban	2.9E−07	1.1E−07	6.3E−08	4.1E−08	1.5E−08	3.1E−10	1.1E−10	1.4E−11	3.9E−12	1.3E−12
	High-End	Rural	3.8E−07	1.2E−07	6.4E−08	3.9E−08	1.4E−08	3.0E−10	9.6E−11	1.3E−11	3.6E−12	1.4E−12
		Urban	3.8E−07	1.2E−07	6.4E−08	3.8E−08	1.4E−08	3.0E−10	9.5E−11	1.3E−11	3.7E−12	1.4E−12
Manufacturing – Import, Import – Repackaging, PV5: Henkel Silver Fern Chem	Central Tendency	Rural	3.6E−07	1.5E−07	8.4E−08	5.4E−08	2.0E−08	4.1E−10	1.4E−10	1.8E−11	4.7E−12	1.5E−12
		Urban	3.8E−07	1.5E−07	8.2E−08	5.3E−08	2.0E−08	4.0E−10	1.4E−10	1.9E−11	5.0E−12	1.6E−12
	High-End	Rural	4.9E−07	1.6E−07	8.3E−08	5.0E−08	1.8E−08	3.9E−10	1.3E−10	1.7E−11	4.7E−12	1.8E−12
		Urban	4.9E−07	1.6E−07	8.2E−08	5.0E−08	1.8E−08	3.9E−10	1.2E−10	1.7E−11	4.8E−12	1.8E−12
Manufacturing – Import, Import – Repackaging, PV6: MAK Chem	Central Tendency	Rural	4.2E−07	1.8E−07	9.8E−08	6.3E−08	2.4E−08	4.8E−10	1.6E−10	2.1E−11	5.5E−12	1.7E−12
		Urban	4.5E−07	1.7E−07	9.6E−08	6.2E−08	2.3E−08	4.7E−10	1.6E−10	2.2E−11	5.9E−12	1.9E−12
	High-End	Rural	5.8E−07	1.8E−07	9.7E−08	5.9E−08	2.1E−08	4.6E−10	1.5E−10	2.0E−11	5.5E−12	2.1E−12
		Urban	5.8E−07	1.8E−07	9.6E−08	5.8E−08	2.1E−08	4.5E−10	1.4E−10	2.0E−11	5.6E−12	2.2E−12
Manufacturing – Import, Import – Repackaging, PV7: Mercedes Benz	Central Tendency	Rural	3.1E−07	1.3E−07	7.1E−08	4.6E−08	1.7E−08	3.5E−10	1.2E−10	1.5E−11	3.9E−12	1.3E−12
		Urban	3.2E−07	1.3E−07	7.0E−08	4.5E−08	1.7E−08	3.4E−10	1.2E−10	1.6E−11	4.2E−12	1.4E−12
	High-End	Rural	4.2E−07	1.3E−07	7.0E−08	4.2E−08	1.6E−08	3.3E−10	1.1E−10	1.4E−11	4.0E−12	1.6E−12
		Urban	4.2E−07	1.3E−07	7.0E−08	4.2E−08	1.5E−08	3.3E−10	1.0E−10	1.4E−11	4.0E−12	1.6E−12
Manufacturing – Import, Import – Repackaging, PV8: Univar	Central Tendency	Rural	4.8E−07	2.1E−07	1.2E−07	7.6E−08	3.0E−08	6.5E−10	2.2E−10	2.9E−11	7.5E−12	2.5E−12
		Urban	5.2E−07	2.1E−07	1.2E−07	7.5E−08	2.9E−08	6.5E−10	2.1E−10	3.0E−11	8.0E−12	2.7E−12
	High-End	Rural	6.7E−07	2.1E−07	1.2E−07	7.0E−08	2.6E−08	6.0E−10	1.9E−10	2.4E−11	6.7E−12	2.6E−12
		Urban	6.7E−07	2.1E−07	1.2E−07	7.0E−08	2.6E−08	6.0E−10	1.9E−10	2.4E−11	6.8E−12	2.6E−12

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Manufacturing – Import, Import – Repackaging, PV9: Belts Concepts	Central Tendency	Rural	1.1E−06	5.0E−07	2.8E−07	1.8E−07	7.1E−08	1.6E−09	5.2E−10	6.8E−11	1.8E−11	5.9E−12
		Urban	1.2E−06	4.9E−07	2.8E−07	1.8E−07	6.9E−08	1.6E−09	5.1E−10	7.2E−11	1.9E−11	6.5E−12
	High-End	Rural	1.6E−06	5.1E−07	2.8E−07	1.7E−07	6.2E−08	1.4E−09	4.4E−10	5.7E−11	1.6E−11	6.1E−12
		Urban	1.6E−06	5.1E−07	2.8E−07	1.7E−07	6.2E−08	1.4E−09	4.4E−10	5.8E−11	1.6E−11	6.3E−12
Non-PVC Plastic Compounding	Central Tendency	Rural	3.9E03	3.2E03	2.4E03	1.9E03	1.1E03	8.9E01	3.5E01	6.1E00	1.5E00	3.3E−01
		Urban	8.4E03	3.0E03	1.8E03	1.2E03	5.4E02	3.1E01	1.1E01	2.3E00	6.7E−01	1.9E−01
	High-End	Rural	6.1E03	5.0E03	3.5E03	2.6E03	1.4E03	1.1E02	4.1E01	7.3E00	1.8E00	3.9E−01
		Urban	1.2E04	3.8E03	2.3E03	1.4E03	6.3E02	3.6E01	1.2E01	2.5E00	7.1E−01	1.9E−01
Non-PVC Plastic Converting	Central Tendency	Rural	1.0E02	8.4E01	6.3E01	4.7E01	2.7E01	2.1E00	8.4E−01	1.4E−01	3.3E−02	7.5E−03
		Urban	2.2E02	7.7E01	4.6E01	3.0E01	1.4E01	7.4E−01	2.7E−01	5.6E−02	1.7E−02	4.6E−03
	High-End	Rural	1.6E02	1.3E02	9.0E01	6.5E01	3.6E01	2.7E00	1.0E00	1.8E−01	4.5E−02	9.7E−03
		Urban	3.3E02	9.9E01	5.8E01	3.7E01	1.6E01	8.7E−01	3.2E−01	6.3E−02	1.8E−02	4.8E−03
Paint and Coating Manufacturing, Processing – Incorporation into Formulation, Mixture, or Reaction Product	Central Tendency	Rural	1.8E−06	1.5E−06	1.1E−06	8.4E−07	4.8E−07	3.8E−08	1.5E−08	2.5E−09	5.9E−10	1.3E−10
		Urban	3.9E−06	1.4E−06	8.3E−07	5.4E−07	2.4E−07	1.3E−08	4.9E−09	1.0E−09	3.0E−10	8.2E−11
	High-End	Rural	2.8E−06	2.3E−06	1.6E−06	1.2E−06	6.3E−07	4.9E−08	1.8E−08	3.2E−09	7.9E−10	1.7E−10
		Urban	5.8E−06	1.8E−06	1.0E−06	6.5E−07	2.9E−07	1.6E−08	5.6E−09	1.1E−09	3.2E−10	8.5E−11
PVC Plastic Compounding	Central Tendency	Rural	2.7E03	2.2E03	1.7E03	1.2E03	7.0E02	5.6E01	2.2E01	3.8E00	8.7E−01	2.0E−01
		Urban	5.7E03	2.0E03	1.2E03	7.9E02	3.5E02	1.9E01	7.2E00	1.5E00	4.4E−01	1.2E−01
	High-End	Rural	4.2E03	3.4E03	2.4E03	1.7E03	9.4E02	7.2E01	2.7E01	4.8E00	1.2E00	2.5E−01
		Urban	8.6E03	2.6E03	1.5E03	9.7E02	4.2E02	2.3E01	8.3E00	1.7E00	4.7E−01	1.3E−01
PVC Plastic Converting	Central Tendency	Rural	1.3E02	1.0E02	7.6E01	5.7E01	3.2E01	2.6E00	1.0E00	1.7E−01	4.0E−02	9.0E−03
		Urban	2.6E02	9.4E01	5.6E01	3.6E01	1.6E01	8.9E−01	3.3E−01	6.8E−02	2.0E−02	5.6E−03
	High-End	Rural	1.9E02	1.6E02	1.1E02	7.9E01	4.3E01	3.3E00	1.2E00	2.2E−01	5.4E−02	1.2E−02
		Urban	4.0E02	1.2E02	7.0E01	4.4E01	2.0E01	1.1E00	3.8E−01	7.6E−02	2.1E−02	5.8E−03
Use of Adhesives and Sealants, Use of Adhesives and Sealants	Central Tendency	Rural	2.4E−07	2.0E−07	1.5E−07	1.1E−07	6.6E−08	5.5E−09	2.1E−09	3.8E−10	9.2E−11	2.1E−11
		Urban	5.1E−07	1.8E−07	1.1E−07	7.1E−08	3.2E−08	1.9E−09	6.6E−10	1.4E−10	4.1E−11	1.1E−11
	High-End	Rural	3.7E−07	3.0E−07	2.2E−07	1.6E−07	8.6E−08	7.1E−09	2.6E−09	4.6E−10	1.2E−10	2.5E−11
		Urban	7.5E−07	2.3E−07	1.4E−07	8.7E−08	3.8E−08	2.2E−09	7.6E−10	1.6E−10	4.4E−11	1.2E−11

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Use of Paints and Coatings, Use of Paints and Coatings	Central Tendency	Rural	5.4E−07	4.5E−07	3.4E−07	2.6E−07	1.5E−07	1.2E−08	4.9E−09	8.5E−10	2.1E−10	4.6E−11
		Urban	1.2E−06	4.2E−07	2.5E−07	1.6E−07	7.5E−08	4.3E−09	1.5E−09	3.1E−10	9.3E−11	2.6E−11
	High-End	Rural	8.5E−07	6.9E−07	4.9E−07	3.6E−07	2.0E−07	1.6E−08	5.7E−09	1.0E−09	2.5E−10	5.4E−11
		Urban	1.7E−06	5.3E−07	3.1E−07	2.0E−07	8.7E−08	5.0E−09	1.7E−09	3.5E−10	9.9E−11	2.7E−11
Use of Paints and Coatings, Use of Paints and Coatings w/o Engineering Controls	Central Tendency	Rural	5.4E−07	4.5E−07	3.4E−07	2.6E−07	1.5E−07	1.2E−08	4.9E−09	8.5E−10	2.1E−10	4.6E−11
		Urban	1.2E−06	4.2E−07	2.5E−07	1.6E−07	7.5E−08	4.3E−09	1.5E−09	3.1E−10	9.3E−11	2.6E−11
	High-End	Rural	8.5E−07	6.9E−07	4.9E−07	3.6E−07	2.0E−07	1.6E−08	5.7E−09	1.0E−09	2.5E−10	5.4E−11
		Urban	1.7E−06	5.3E−07	3.1E−07	2.0E−07	8.7E−08	5.0E−09	1.7E−09	3.5E−10	9.9E−11	2.7E−11
Max			**1.2E04**	**5.0E03**	**3.5E03**	**2.6E03**	**1.4E03**	**1.1E02**	**4.1E01**	**7.3E00**	**1.8E00**	**3.9E−01**
Mean			**4.5E02**	**2.2E02**	**1.4E02**	**1.0E02**	**5.2E01**	**3.8E00**	**1.4E00**	**2.6E−01**	**6.6E−02**	**1.5E−02**
Median			**1.3E−06**	**5.2E−07**	**3.4E−07**	**2.1E−07**	**8.7E−08**	**3.8E−09**	**1.4E−09**	**2.7E−10**	**7.9E−11**	**1.9E−11**
Min			**8.3E−11**	**6.3E−11**	**3.8E−11**	**2.5E−11**	**1.1E−11**	**6.2E−13**	**2.3E−13**	**4.7E−14**	**1.4E−14**	**3.9E−15**

Table_Apx C-7. DINP 95th Percentile Daily Concentrations (µg/m^3) Modeled from High-End Stack Release Source

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	1.3E−12	1.6E−10	1.0E−09	2.1E−09	4.6E−09	1.3E−09	7.1E−10	2.4E−10	1.7E−10	1.1E−10
		Urban	6.2E−12	5.8E−10	1.8E−09	3.1E−09	5.4E−09	1.6E−09	9.7E−10	3.2E−10	1.1E−10	3.6E−11
	High-End	Rural	8.2E−13	2.2E−10	1.5E−09	2.8E−09	6.0E−09	1.9E−09	1.0E−09	5.5E−10	4.1E−10	1.7E−10
		Urban	4.5E−12	7.9E−10	2.8E−09	4.8E−09	8.4E−09	2.6E−09	1.5E−09	4.2E−10	1.4E−10	4.0E−11
Commercial Uses Laboratory Chemicals_Scenario 2	Central Tendency	Rural	1.4E−08	1.7E−06	1.1E−05	2.2E−05	4.9E−05	1.4E−05	7.7E−06	2.7E−06	1.8E−06	1.3E−06
		Urban	6.6E−08	6.1E−06	1.9E−05	3.2E−05	5.7E−05	1.7E−05	1.1E−05	3.4E−06	1.2E−06	3.9E−07
	High-End	Rural	8.8E−09	2.3E−06	1.5E−05	3.0E−05	6.3E−05	2.1E−05	1.1E−05	5.8E−06	4.4E−06	1.9E−06
		Urban	4.8E−08	8.4E−06	3.0E−05	5.1E−05	8.9E−05	2.8E−05	1.6E−05	4.5E−06	1.5E−06	4.3E−07
Domestic Manufacturing, Manufacturing, Average PV_CAS 1	Central Tendency	Rural	1.5E−07	2.7E−02	3.2E−01	9.3E−01	2.2E00	3.1E−01	1.3E−01	1.7E−02	4.3E−03	1.6E−03
		Urban	5.7E−07	5.2E−02	5.1E−01	1.3E00	2.7E00	3.4E−01	1.4E−01	2.0E−02	5.2E−03	1.7E−03
	High-End	Rural	5.1E−06	8.1E−02	7.6E−01	1.6E00	3.6E00	3.9E−01	1.3E−01	1.7E−02	4.4E−03	1.6E−03
		Urban	5.3E−06	9.7E−02	8.1E−01	1.8E00	3.7E00	4.0E−01	1.3E−01	1.7E−02	4.5E−03	1.6E−03

Scenario	Meteorology	Distance: Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Domestic Manufacturing, Manufacturing, Average PV_CAS 2	Central Tendency	Rural	4.8E−03	1.5E00	1.0E01	2.3E01	4.9E01	1.1E01	5.2E00	1.4E00	7.6E−01	2.9E−01
		Urban	2.5E−02	5.8E00	2.1E01	3.7E01	6.1E01	1.3E01	7.2E00	2.2E00	7.3E−01	2.2E−01
	High-End	Rural	3.1E−03	2.8E00	1.9E01	3.8E01	7.7E01	1.5E01	6.5E00	2.3E00	1.0E00	3.3E−01
		Urban	2.7E−02	8.7E00	3.5E01	5.9E01	9.7E01	1.9E01	1.1E01	2.8E00	8.4E−01	2.3E−01
Domestic Manufacturing, Manufacturing, PV14: Gehring Montgomery	Central Tendency	Rural	2.0E−09	3.5E−04	4.2E−03	1.2E−02	2.9E−02	4.0E−03	1.6E−03	2.2E−04	5.6E−05	2.0E−05
		Urban	7.3E−09	6.7E−04	6.5E−03	1.7E−02	3.5E−02	4.4E−03	1.7E−03	2.5E−04	6.7E−05	2.1E−05
	High-End	Rural	6.5E−08	1.0E−03	9.8E−03	2.1E−02	4.7E−02	5.1E−03	1.7E−03	2.2E−04	5.7E−05	2.1E−05
		Urban	6.8E−08	1.3E−03	1.1E−02	2.3E−02	4.8E−02	5.1E−03	1.7E−03	2.2E−04	5.8E−05	2.1E−05
Incorporation into other articles not covered elsewhere, Processing – Incorporation into Formulation, Mixture, or Reaction Product	Central Tendency	Rural	1.9E−11	2.3E−09	1.4E−08	2.9E−08	6.5E−08	1.8E−08	1.0E−08	3.4E−09	2.3E−09	1.6E−09
		Urban	8.7E−11	8.1E−09	2.6E−08	4.3E−08	7.5E−08	2.2E−08	1.4E−08	4.5E−09	1.6E−09	5.1E−10
	High-End	Rural	1.2E−11	3.1E−09	2.1E−08	4.0E−08	8.4E−08	2.7E−08	1.5E−08	7.7E−09	5.8E−09	2.5E−09
		Urban	6.3E−11	1.1E−08	4.0E−08	6.8E−08	1.2E−07	3.6E−08	2.1E−08	5.9E−09	1.9E−09	5.6E−10
Paint and Coating Manufacturing, Processing – Incorporation into Formulation, Mixture, or Reaction Product	Central Tendency	Rural	1.1E−14	1.3E−12	8.3E−12	1.7E−11	3.8E−11	1.1E−11	5.8E−12	2.0E−12	1.4E−12	9.3E−13
		Urban	5.1E−14	4.7E−12	1.5E−11	2.5E−11	4.4E−11	1.3E−11	8.0E−12	2.6E−12	9.4E−13	3.0E−13
	High-End	Rural	6.7E−15	1.8E−12	1.2E−11	2.3E−11	4.9E−11	1.6E−11	8.4E−12	4.5E−12	3.4E−12	1.4E−12
		Urban	3.7E−14	6.5E−12	2.3E−11	4.0E−11	6.9E−11	2.1E−11	1.2E−11	3.5E−12	1.1E−12	3.3E−13
Use of Paints and Coatings, Use of Paints and Coatings	Central Tendency	Rural	3.1E−04	3.4E−02	2.0E−01	4.0E−01	9.2E−01	2.6E−01	1.4E−01	4.9E−02	3.3E−02	2.5E−02
		Urban	1.3E−03	1.1E−01	3.4E−01	5.7E−01	1.0E00	3.0E−01	1.9E−01	6.1E−02	2.2E−02	7.0E−03
	High-End	Rural	1.8E−04	4.4E−02	2.9E−01	5.6E−01	1.2E00	4.0E−01	2.2E−01	1.1E−01	7.9E−02	3.6E−02
		Urban	8.5E−04	1.6E−01	5.7E−01	9.6E−01	1.7E00	5.0E−01	2.9E−01	8.2E−02	2.6E−02	7.7E−03
		Max	**2.7E−02**	**8.7E00**	**3.5E01**	**5.9E01**	**9.7E01**	**1.9E01**	**1.1E01**	**2.8E00**	**1.0E00**	**3.3E−01**
		Mean	**2.0E−03**	**6.1E−01**	**2.8E00**	**5.1E00**	**9.4E00**	**1.9E00**	**9.6E−01**	**2.8E−01**	**1.1E−01**	**3.6E−02**
		Median	**3.1E−08**	**1.8E−04**	**2.1E−03**	**6.0E−03**	**1.5E−02**	**2.0E−03**	**8.2E−04**	**1.1E−04**	**3.0E−05**	**1.1E−05**
		Min	**6.7E−15**	**1.3E−12**	**8.3E−12**	**1.7E−11**	**3.8E−11**	**1.1E−11**	**5.8E−12**	**2.0E−12**	**9.4E−13**	**3.0E−13**

2549 **Table_Apx C-8. DINP 95th Percentile Annual Deposition Rate (g/m^2) Modeled from High-End Fugitive Release Source**

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	2.7E−08	2.8E−08	2.3E−08	1.3E−08	7.2E−09	1.7E−09	2.4E−10	3.8E−11	9.8E−12	2.4E−12
		Urban	5.8E−08	3.8E−08	3.0E−08	1.5E−08	6.0E−09	8.2E−10	9.4E−11	1.9E−11	5.9E−12	1.8E−12
	High-End	Rural	7.1E−08	4.8E−08	3.5E−08	2.1E−08	1.1E−08	2.3E−09	3.1E−10	5.1E−11	1.3E−11	3.2E−12
		Urban	1.1E−07	5.7E−08	4.7E−08	2.0E−08	7.8E−09	9.1E−10	1.2E−10	2.5E−11	7.3E−12	2.1E−12
Commerical Uses Laboratory Chemicals_Scenario 1	Central Tendency	Rural	4.7E−09	4.9E−09	4.0E−09	2.3E−09	1.3E−09	3.1E−10	4.3E−11	7.0E−12	1.8E−12	4.3E−13
		Urban	1.0E−08	6.8E−09	5.4E−09	2.6E−09	1.1E−09	1.5E−10	1.7E−11	3.4E−12	1.0E−12	3.2E−13
	High-End	Rural	1.2E−08	8.4E−09	6.1E−09	3.6E−09	2.0E−09	4.0E−10	5.4E−11	9.0E−12	2.3E−12	5.6E−13
		Urban	2.0E−08	1.0E−08	8.2E−09	3.5E−09	1.4E−09	1.6E−10	2.1E−11	4.3E−12	1.3E−12	3.8E−13
Commerical Uses Laboratory Chemicals_Scenario 3	Central Tendency	Rural	5.8E−12	6.1E−12	5.1E−12	2.9E−12	1.6E−12	3.9E−13	5.3E−14	8.7E−15	2.2E−15	5.4E−16
		Urban	1.3E−11	8.4E−12	6.8E−12	3.2E−12	1.3E−12	1.8E−13	2.1E−14	4.3E−15	1.3E−15	4.1E−16
	High-End	Rural	1.5E−11	1.0E−11	7.7E−12	4.6E−12	2.5E−12	5.1E−13	6.8E−14	1.1E−14	2.9E−15	7.0E−16
		Urban	2.4E−11	1.3E−11	1.0E−11	4.4E−12	1.7E−12	2.0E−13	2.7E−14	5.4E−15	1.6E−15	4.7E−16
Domestic Manufacturing, Manufacturing, Average PV_CAS 1	Central Tendency	Rural	6.3E−06	6.6E−06	5.1E−06	2.5E−06	9.8E−07	1.0E−07	9.5E−09	1.7E−09	5.6E−10	1.9E−10
		Urban	7.2E−06	7.8E−06	5.8E−06	2.9E−06	1.1E−06	1.0E−07	9.0E−09	1.5E−09	4.7E−10	1.8E−10
	High-End	Rural	2.3E−05	1.2E−05	7.5E−06	3.7E−06	1.3E−06	1.1E−07	9.4E−09	1.4E−09	4.6E−10	1.9E−10
		Urban	2.3E−05	1.2E−05	7.7E−06	3.7E−06	1.3E−06	1.1E−07	9.4E−09	1.4E−09	4.4E−10	1.8E−10
Domestic Manufacturing, Manufacturing, Average PV_CAS 2	Central Tendency	Rural	1.2E−05	1.1E−05	8.4E−06	4.6E−06	2.1E−06	4.0E−07	5.6E−08	9.4E−09	2.7E−09	7.7E−10
		Urban	1.9E−05	1.5E−05	1.1E−05	5.4E−06	2.1E−06	2.3E−07	2.6E−08	5.2E−09	1.7E−09	5.8E−10
	High-End	Rural	3.2E−05	1.8E−05	1.3E−05	6.6E−06	2.9E−06	4.1E−07	5.5E−08	9.8E−09	2.9E−09	8.1E−10
		Urban	4.1E−05	2.0E−05	1.6E−05	6.3E−06	2.4E−06	2.5E−07	3.0E−08	5.8E−09	1.9E−09	6.2E−10
Domestic Manufacturing, Manufacturing, PV14: Gehring Montgomery	Central Tendency	Rural	6.0E−06	6.3E−06	4.9E−06	2.4E−06	9.4E−07	9.6E−08	9.1E−09	1.6E−09	5.3E−10	1.9E−10
		Urban	6.8E−06	7.4E−06	5.5E−06	2.7E−06	1.0E−06	9.8E−08	8.6E−09	1.4E−09	4.5E−10	1.7E−10
	High-End	Rural	2.2E−05	1.2E−05	7.2E−06	3.5E−06	1.3E−06	1.0E−07	9.0E−09	1.4E−09	4.4E−10	1.8E−10
		Urban	2.2E−05	1.2E−05	7.4E−06	3.5E−06	1.3E−06	1.0E−07	9.0E−09	1.3E−09	4.2E−10	1.8E−10
Incorporation into other articles not covered elsewhere, Processing – Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	4.8E−07	4.9E−07	4.1E−07	2.3E−07	1.3E−07	3.0E−08	4.2E−09	6.8E−10	1.7E−10	4.3E−11
		Urban	1.0E−06	6.8E−07	5.4E−07	2.6E−07	1.1E−07	1.5E−08	1.7E−09	3.4E−10	1.0E−10	3.2E−11
	High-End	Rural	1.3E−06	8.5E−07	6.3E−07	3.7E−07	2.0E−07	4.1E−08	5.5E−09	9.1E−10	2.3E−10	5.7E−11
		Urban	2.0E−06	1.0E−06	8.3E−07	3.5E−07	1.4E−07	1.6E−08	2.2E−09	4.4E−10	1.3E−10	3.8E−11

Scenario	Meteorology	Distance										
		Land	**10 m**	**30 m**	**30–60 m**	**60 m**	**100 m**	**100–1,000 m**	**1,000 m**	**2,500 m**	**5,000 m**	**10,000 m**
Manufacturing – Import, Import – Repackaging, Average PV, CAS 1	Central Tendency	Rural	5.6E−07	5.9E−07	4.5E−07	2.2E−07	8.2E−08	9.3E−09	8.1E−10	1.4E−10	4.4E−11	1.5E−11
		Urban	6.7E−07	6.8E−07	5.2E−07	2.4E−07	8.9E−08	8.4E−09	7.3E−10	1.3E−10	4.4E−11	1.7E−11
	High-End	Rural	1.9E−06	1.0E−06	6.6E−07	3.1E−07	1.1E−07	8.4E−09	7.6E−10	1.1E−10	3.4E−11	1.3E−11
		Urban	1.9E−06	1.0E−06	6.8E−07	3.1E−07	1.1E−07	8.3E−09	7.6E−10	1.1E−10	3.3E−11	1.3E−11
Manufacturing – Import, Import – Repackaging, Average PV, CAS 2	Central Tendency	Rural	9.2E−06	9.7E−06	8.1E−06	4.6E−06	2.6E−06	6.1E−07	8.5E−08	1.4E−08	3.5E−09	8.6E−10
		Urban	2.0E−05	1.3E−05	1.1E−05	5.2E−06	2.1E−06	2.9E−07	3.4E−08	6.9E−09	2.1E−09	6.6E−10
	High-End	Rural	2.4E−05	1.7E−05	1.2E−05	7.3E−06	4.0E−06	8.1E−07	1.1E−07	1.8E−08	4.6E−09	1.1E−09
		Urban	3.9E−05	2.0E−05	1.6E−05	7.0E−06	2.8E−06	3.2E−07	4.3E−08	8.6E−09	2.6E−09	7.4E−10
Manufacturing – Import, Import – Repackaging, PV1: Henkel Louisville	Central Tendency	Rural	1.8E−09	1.9E−09	1.4E−09	6.8E−10	2.5E−10	2.5E−11	2.0E−12	3.3E−13	1.1E−13	4.3E−14
		Urban	2.1E−09	2.2E−09	1.7E−09	7.7E−10	2.8E−10	2.6E−11	2.2E−12	3.3E−13	1.2E−13	4.7E−14
	High-End	Rural	5.9E−09	3.2E−09	2.1E−09	9.7E−10	3.4E−10	2.7E−11	2.3E−12	3.1E−13	9.9E−14	4.0E−14
		Urban	5.9E−09	3.2E−09	2.2E−09	9.8E−10	3.5E−10	2.7E−11	2.3E−12	3.2E−13	1.0E−13	4.2E−14
Manufacturing – Import, Import – Repackaging, PV10: Tribute Energy	Central Tendency	Rural	1.1E−07	1.1E−07	8.5E−08	4.1E−08	1.6E−08	1.8E−09	1.6E−10	2.8E−11	8.5E−12	2.9E−12
		Urban	1.2E−07	1.3E−07	9.6E−08	4.6E−08	1.7E−08	1.6E−09	1.4E−10	2.5E−11	8.2E−12	3.0E−12
	High-End	Rural	3.6E−07	2.0E−07	1.3E−07	6.0E−08	2.2E−08	1.7E−09	1.5E−10	2.2E−11	6.7E−12	2.5E−12
		Urban	3.6E−07	2.0E−07	1.3E−07	6.1E−08	2.2E−08	1.6E−09	1.5E−10	2.1E−11	6.5E−12	2.5E−12
Manufacturing – Import, Import – Repackaging, PV11: Geon Performance	Central Tendency	Rural	5.5E−08	5.8E−08	4.5E−08	2.1E−08	8.1E−09	9.3E−10	8.4E−11	1.5E−11	4.4E−12	1.5E−12
		Urban	6.4E−08	6.6E−08	5.0E−08	2.4E−08	8.9E−09	8.5E−10	7.5E−11	1.3E−11	4.3E−12	1.6E−12
	High-End	Rural	1.9E−07	1.0E−07	6.5E−08	3.1E−08	1.1E−08	8.7E−10	7.9E−11	1.1E−11	3.5E−12	1.3E−12
		Urban	1.9E−07	1.0E−07	6.7E−08	3.2E−08	1.1E−08	8.5E−10	7.9E−11	1.1E−11	3.4E−12	1.3E−12
Manufacturing – Import, Import – Repackaging, PV12: Cascade Columbia	Central Tendency	Rural	1.8E−07	2.0E−07	1.5E−07	7.2E−08	2.7E−08	3.2E−09	2.8E−10	4.9E−11	1.5E−11	5.0E−12
		Urban	2.2E−07	2.2E−07	1.7E−07	8.0E−08	3.0E−08	2.9E−09	2.5E−10	4.5E−11	1.4E−11	5.3E−12
	High-End	Rural	6.3E−07	3.5E−07	2.2E−07	1.1E−07	3.8E−08	2.9E−09	2.7E−10	3.8E−11	1.2E−11	4.5E−12
		Urban	6.3E−07	3.5E−07	2.3E−07	1.1E−07	3.8E−08	2.9E−09	2.7E−10	3.6E−11	1.1E−11	4.4E−12
Manufacturing – Import, Import – Repackaging, PV13: Alac Intl	Central Tendency	Rural	1.9E−06	1.9E−06	1.3E−06	6.6E−07	2.5E−07	2.7E−08	2.6E−09	4.9E−10	1.6E−10	5.8E−11
		Urban	2.4E−06	2.2E−06	1.5E−06	7.4E−07	2.7E−07	2.6E−08	2.2E−09	4.3E−10	1.5E−10	5.9E−11
	High-End	Rural	5.3E−06	2.7E−06	1.9E−06	7.9E−07	2.8E−07	2.5E−08	2.0E−09	3.6E−10	1.3E−10	5.0E−11
		Urban	5.5E−06	2.8E−06	2.0E−06	8.2E−07	2.9E−07	2.6E−08	2.0E−09	3.4E−10	1.2E−10	5.1E−11

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Manufacturing – Import, Import – Repackaging, PV2: Formosa Global	Central Tendency	Rural	8.6E−09	9.0E−09	7.0E−09	3.3E−09	1.2E−09	1.2E−10	9.7E−12	1.6E−12	5.3E−13	2.1E−13
		Urban	1.0E−08	1.0E−08	7.9E−09	3.7E−09	1.4E−09	1.3E−10	1.1E−11	1.6E−12	5.5E−13	2.3E−13
	High-End	Rural	2.8E−08	1.5E−08	1.0E−08	4.7E−09	1.7E−09	1.3E−10	1.1E−11	1.5E−12	4.7E−13	1.9E−13
		Urban	2.9E−08	1.6E−08	1.0E−08	4.7E−09	1.7E−09	1.3E−10	1.1E−11	1.5E−12	5.0E−13	2.0E−13
Manufacturing – Import, Import – Repackaging, PV3: ChemSpec	Central Tendency	Rural	1.8E−08	1.9E−08	1.5E−08	6.9E−09	2.5E−09	2.5E−10	2.0E−11	3.4E−12	1.1E−12	4.4E−13
		Urban	2.1E−08	2.2E−08	1.7E−08	7.7E−09	2.9E−09	2.6E−10	2.2E−11	3.4E−12	1.2E−12	4.8E−13
	High-End	Rural	5.9E−08	3.2E−08	2.1E−08	9.8E−09	3.5E−09	2.8E−10	2.3E−11	3.1E−12	1.0E−12	4.0E−13
		Urban	6.0E−08	3.3E−08	2.2E−08	9.9E−09	3.5E−09	2.8E−10	2.4E−11	3.2E−12	1.0E−12	4.3E−13
Manufacturing – Import, Import – Repackaging, PV4: Harwick Standard	Central Tendency	Rural	2.1E−08	2.2E−08	1.7E−08	7.9E−09	2.9E−09	2.9E−10	2.3E−11	3.9E−12	1.3E−12	5.0E−13
		Urban	2.5E−08	2.5E−08	1.9E−08	8.9E−09	3.3E−09	3.0E−10	2.6E−11	3.9E−12	1.3E−12	5.5E−13
	High-End	Rural	6.8E−08	3.7E−08	2.4E−08	1.1E−08	4.0E−09	3.2E−10	2.7E−11	3.6E−12	1.2E−12	4.7E−13
		Urban	6.9E−08	3.8E−08	2.5E−08	1.1E−08	4.0E−09	3.2E−10	2.7E−11	3.7E−12	1.2E−12	4.9E−13
Manufacturing – Import, Import – Repackaging, PV5: Henkel Silver Fern Chem	Central Tendency	Rural	2.7E−08	2.8E−08	2.2E−08	1.0E−08	3.8E−09	3.7E−10	3.0E−11	5.0E−12	1.7E−12	6.6E−13
		Urban	3.2E−08	3.3E−08	2.5E−08	1.2E−08	4.3E−09	3.9E−10	3.3E−11	5.0E−12	1.7E−12	7.1E−13
	High-End	Rural	8.9E−08	4.8E−08	3.2E−08	1.5E−08	5.2E−09	4.1E−10	3.5E−11	4.7E−12	1.5E−12	6.0E−13
		Urban	9.0E−08	4.9E−08	3.3E−08	1.5E−08	5.2E−09	4.1E−10	3.5E−11	4.8E−12	1.6E−12	6.4E−13
Manufacturing – Import, Import – Repackaging, PV6: MAK Chem	Central Tendency	Rural	3.2E−08	3.3E−08	2.6E−08	1.2E−08	4.4E−09	4.4E−10	3.6E−11	5.9E−12	2.0E−12	7.7E−13
		Urban	3.7E−08	3.8E−08	2.9E−08	1.4E−08	5.0E−09	4.6E−10	3.9E−11	5.9E−12	2.0E−12	8.4E−13
	High-End	Rural	1.0E−07	5.6E−08	3.7E−08	1.7E−08	6.1E−09	4.8E−10	4.1E−11	5.5E−12	1.7E−12	7.1E−13
		Urban	1.1E−07	5.7E−08	3.8E−08	1.7E−08	6.1E−09	4.8E−10	4.1E−11	5.6E−12	1.8E−12	7.4E−13
Manufacturing – Import, Import – Repackaging, PV7: Mercedes Benz	Central Tendency	Rural	2.3E−08	2.4E−08	1.8E−08	8.7E−09	3.2E−09	3.2E−10	2.6E−11	4.2E−12	1.4E−12	5.5E−13
		Urban	2.7E−08	2.8E−08	2.1E−08	9.8E−09	3.6E−09	3.3E−10	2.8E−11	4.2E−12	1.5E−12	6.0E−13
	High-End	Rural	7.5E−08	4.1E−08	2.7E−08	1.2E−08	4.4E−09	3.5E−10	3.0E−11	4.0E−12	1.3E−12	5.1E−13
		Urban	7.6E−08	4.1E−08	2.7E−08	1.3E−08	4.4E−09	3.5E−10	3.0E−11	4.0E−12	1.3E−12	5.4E−13
Manufacturing – Import, Import – Repackaging, PV8: Univar	Central Tendency	Rural	3.5E−08	3.7E−08	2.9E−08	1.4E−08	5.2E−09	6.0E−10	5.4E−11	9.3E−12	2.8E−12	9.6E−13
		Urban	4.1E−08	4.2E−08	3.2E−08	1.5E−08	5.7E−09	5.4E−10	4.8E−11	8.5E−12	2.8E−12	1.0E−12
	High-End	Rural	1.2E−07	6.6E−08	4.2E−08	2.0E−08	7.2E−09	5.5E−10	5.1E−11	7.3E−12	2.2E−12	8.5E−13
		Urban	1.2E−07	6.6E−08	4.3E−08	2.0E−08	7.3E−09	5.5E−10	5.1E−11	6.9E−12	2.2E−12	8.3E−13

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Manufacturing – Import, Import – Repackaging, PV9: Belts Concepts	Central Tendency	Rural	8.4E−08	8.9E−08	6.8E−08	3.3E−08	1.2E−08	1.4E−09	1.3E−10	2.2E−11	6.8E−12	2.3E−12
		Urban	9.8E−08	1.0E−07	7.7E−08	3.6E−08	1.4E−08	1.3E−09	1.2E−10	2.0E−11	6.6E−12	2.4E−12
	High-End	Rural	2.9E−07	1.6E−07	1.0E−07	4.8E−08	1.7E−08	1.3E−09	1.2E−10	1.7E−11	5.4E−12	2.0E−12
		Urban	2.9E−07	1.6E−07	1.0E−07	4.9E−08	1.7E−08	1.3E−09	1.2E−10	1.6E−11	5.2E−12	2.0E−12
Non-PVC Plastic Compounding	Central Tendency	Rural	2.9E02	3.1E02	2.4E02	1.5E02	8.0E01	2.0E01	2.8E00	4.4E−01	1.1E−01	3.0E−02
		Urban	6.3E02	4.5E02	3.5E02	1.7E02	7.1E01	9.0E00	1.1E00	2.3E−01	7.3E−02	2.2E−02
	High-End	Rural	7.8E02	5.3E02	4.0E02	2.4E02	1.3E02	2.6E01	3.5E00	5.9E−01	1.5E−01	3.8E−02
		Urban	1.2E03	6.7E02	5.3E02	2.3E02	9.1E01	1.0E01	1.4E00	2.9E−01	8.6E−02	2.5E−02
Non-PVC Plastic Converting	Central Tendency	Rural	7.2E00	7.5E00	6.2E00	3.5E00	1.9E00	4.5E−01	6.3E−02	1.0E−02	2.6E−03	6.5E−04
		Urban	1.5E01	1.0E01	8.1E00	3.9E00	1.6E00	2.2E−01	2.5E−02	5.1E−03	1.6E−03	4.8E−04
	High-End	Rural	1.9E01	1.3E01	9.4E00	5.5E00	3.1E00	6.1E−01	8.2E−02	1.4E−02	3.5E−03	8.6E−04
		Urban	3.0E01	1.5E01	1.3E01	5.3E00	2.1E00	2.4E−01	3.2E−02	6.6E−03	2.0E−03	5.7E−04
Paint and Coating Manufacturing, Processing – Incorporation into formulation, mixture, or reaction product	Central Tendency	Rural	1.3E−07	1.3E−07	1.1E−07	6.3E−08	3.4E−08	8.1E−09	1.1E−09	1.8E−10	4.7E−11	1.2E−11
		Urban	2.8E−07	1.8E−07	1.4E−07	7.0E−08	2.9E−08	3.9E−09	4.5E−10	9.1E−11	2.8E−11	8.6E−12
	High-End	Rural	3.4E−07	2.3E−07	1.7E−07	9.9E−08	5.4E−08	1.1E−08	1.5E−09	2.4E−10	6.3E−11	1.5E−11
		Urban	5.4E−07	2.7E−07	2.2E−07	9.4E−08	3.7E−08	4.3E−09	5.8E−10	1.2E−10	3.5E−11	1.0E−11
PVC Plastic Compounding	Central Tendency	Rural	1.9E02	2.0E02	1.6E02	9.2E01	5.1E01	1.2E01	1.7E00	2.7E−01	6.9E−02	1.7E−02
		Urban	4.1E02	2.7E02	2.1E02	1.0E02	4.2E01	5.8E00	6.6E−01	1.3E−01	4.1E−02	1.3E−02
	High-End	Rural	5.0E02	3.4E02	2.5E02	1.5E02	8.0E01	1.6E01	2.2E00	3.6E−01	9.3E−02	2.3E−02
		Urban	7.9E02	4.0E02	3.3E02	1.4E02	5.5E01	6.4E00	8.5E−01	1.7E−01	5.2E−02	1.5E−02
PVC Plastic Converting	Central Tendency	Rural	8.7E00	9.0E00	7.5E00	4.2E00	2.3E00	5.5E−01	7.6E−02	1.2E−02	3.2E−03	7.8E−04
		Urban	1.9E01	1.2E01	9.8E00	4.7E00	1.9E00	2.7E−01	3.0E−02	6.2E−03	1.9E−03	5.9E−04
	High-End	Rural	2.3E01	1.6E01	1.1E01	6.7E00	3.7E00	7.4E−01	1.0E−01	1.7E−02	4.3E−03	1.0E−03
		Urban	3.6E01	1.9E01	1.5E01	6.4E00	2.5E00	2.9E−01	3.9E−02	8.0E−03	2.4E−03	6.9E−04
Use of Adhesives and Sealants, Use of Adhesives and Sealants	Central Tendency	Rural	1.9E−08	2.0E−08	1.6E−08	9.5E−09	5.0E−09	1.2E−09	1.6E−10	2.7E−11	7.3E−12	1.9E−12
		Urban	3.9E−08	2.8E−08	2.2E−08	1.1E−08	4.5E−09	5.7E−10	7.0E−11	1.4E−11	4.5E−12	1.4E−12
	High-End	Rural	5.0E−08	3.4E−08	2.5E−08	1.5E−08	8.2E−09	1.6E−09	2.2E−10	3.7E−11	9.5E−12	2.3E−12
		Urban	7.9E−08	4.1E−08	3.4E−08	1.4E−08	5.6E−09	6.6E−10	8.8E−11	1.8E−11	5.3E−12	1.6E−12

Scenario	Meteorology	Distance										
		Land	**10 m**	**30 m**	**30–60 m**	**60 m**	**100 m**	**100–1,000 m**	**1,000 m**	**2,500 m**	**5,000 m**	**10,000 m**
Use of Paints and Coatings, Use of Paints and Coatings	Central Tendency	Rural	4.0E−08	4.3E−08	3.4E−08	2.1E−08	1.1E−08	2.8E−09	3.8E−10	6.1E−11	1.6E−11	4.2E−12
		Urban	8.8E−08	6.2E−08	4.9E−08	2.4E−08	9.9E−09	1.3E−09	1.6E−10	3.2E−11	1.0E−11	3.1E−12
	High-End	Rural	1.1E−07	7.4E−08	5.6E−08	3.3E−08	1.9E−08	3.6E−09	4.9E−10	8.2E−11	2.1E−11	5.3E−12
		Urban	1.7E−07	9.4E−08	7.3E−08	3.2E−08	1.3E−08	1.5E−09	2.0E−10	4.0E−11	1.2E−11	3.5E−12
Use of Paints and Coatings, Use of Paints and Coatings w/o Engineering Controls	Central Tendency	Rural	4.0E−08	4.3E−08	3.4E−08	2.1E−08	1.1E−08	2.8E−09	3.8E−10	6.1E−11	1.6E−11	4.2E−12
		Urban	8.8E−08	6.2E−08	4.9E−08	2.4E−08	9.9E−09	1.3E−09	1.6E−10	3.2E−11	1.0E−11	3.1E−12
	High-End	Rural	1.1E−07	7.4E−08	5.6E−08	3.3E−08	1.9E−08	3.6E−09	4.9E−10	8.2E−11	2.1E−11	5.3E−12
		Urban	1.7E−07	9.4E−08	7.3E−08	3.2E−08	1.3E−08	1.5E−09	2.0E−10	4.0E−11	1.2E−11	3.5E−12
		Max	**1.2E03**	**6.7E02**	**5.3E02**	**2.4E02**	**1.3E02**	**2.6E01**	**3.5E00**	**5.9E−01**	**1.5E−01**	**3.8E−02**
		Mean	**4.1E01**	**2.7E01**	**2.1E01**	**1.1E01**	**5.2E00**	**9.0E−01**	**1.2E−01**	**2.1E−02**	**5.9E−03**	**1.6E−03**
		Median	**1.3E−07**	**1.0E−07**	**7.3E−08**	**3.3E−08**	**1.5E−08**	**1.7E−09**	**2.0E−10**	**3.7E−11**	**1.0E−11**	**3.1E−12**
		Min	**5.8E−12**	**6.1E−12**	**5.1E−12**	**2.9E−12**	**1.3E−12**	**1.8E−13**	**2.1E−14**	**4.3E−15**	**1.3E−15**	**4.1E−16**

Table_Apx C-9. DINP 95th Percentile Annual Deposition Rate (g/m^2) Modeled from High-End Stack Release Source

Scenario	Meteorology	Distance										
		Land	**10 m**	**30 m**	**30–60 m**	**60 m**	**100 m**	**100–1,000 m**	**1,000 m**	**2,500 m**	**5,000 m**	**10,000 m**
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	4.5E−09	1.5E−09	1.2E−09	1.1E−09	1.5E−09	5.9E−10	1.2E−10	2.9E−11	1.5E−11	1.1E−11
		Urban	4.1E−09	1.6E−09	1.4E−09	1.4E−09	1.9E−09	6.8E−10	1.3E−10	3.7E−11	1.3E−11	4.2E−12
	High-End	Rural	4.9E−09	1.5E−09	1.6E−09	1.7E−09	2.4E−09	7.8E−10	1.9E−10	5.4E−11	3.7E−11	1.5E−11
		Urban	4.6E−09	1.8E−09	2.0E−09	2.2E−09	3.1E−09	9.2E−10	1.9E−10	4.9E−11	1.6E−11	5.0E−12
Commerical Uses Laboratory Chemicals_Scenario 2	Central Tendency	Rural	4.9E−05	1.7E−05	1.3E−05	1.2E−05	1.6E−05	6.3E−06	1.3E−06	3.2E−07	1.7E−07	1.2E−07
		Urban	4.5E−05	1.7E−05	1.5E−05	1.5E−05	2.0E−05	7.3E−06	1.4E−06	4.1E−07	1.4E−07	4.6E−08
	High-End	Rural	5.2E−05	1.6E−05	1.7E−05	1.8E−05	2.6E−05	8.4E−06	2.0E−06	5.8E−07	4.0E−07	1.6E−07
		Urban	5.0E−05	1.9E−05	2.1E−05	2.4E−05	3.3E−05	9.9E−06	2.1E−06	5.3E−07	1.8E−07	5.4E−08
Domestic Manufacturing, Manufacturing, Average PV_CAS 1	Central Tendency	Rural	3.1E−01	1.2E−01	2.1E−01	3.0E−01	6.4E−01	2.4E−01	2.8E−02	5.3E−03	1.8E−03	8.2E−04
		Urban	2.7E−01	1.1E−01	2.4E−01	3.6E−01	7.4E−01	2.7E−01	3.1E−02	5.9E−03	1.9E−03	7.1E−04
	High-End	Rural	5.3E−01	2.3E−01	4.7E−01	7.3E−01	1.4E00	3.7E−01	4.0E−02	5.8E−03	1.9E−03	7.7E−04
		Urban	5.0E−01	1.9E−01	4.8E−01	7.6E−01	1.4E00	3.7E−01	4.0E−02	5.8E−03	1.8E−03	7.3E−04

Scenario	Meteorology	Distance										
		Land	**10 m**	**30 m**	**30–60 m**	**60 m**	**100 m**	**100–1,000 m**	**1,000 m**	**2,500 m**	**5,000 m**	**10,000 m**
Domestic Manufacturing, Manufacturing, Average PV_CAS 2	Central Tendency	Rural	1.6E01	6.2E00	6.4E00	8.1E00	1.4E01	5.1E00	8.5E−01	2.3E−01	1.0E−01	6.5E−02
		Urban	1.5E01	7.9E00	9.9E00	1.2E01	1.8E01	6.2E00	9.7E−01	2.6E−01	9.3E−02	3.3E−02
	High-End	Rural	4.5E01	1.5E01	1.6E01	1.7E01	2.6E01	7.8E00	1.5E00	3.6E−01	1.7E−01	7.2E−02
		Urban	4.3E01	1.8E01	2.0E01	2.3E01	3.2E01	9.1E00	1.4E00	3.2E−01	1.0E−01	3.6E−02
Domestic Manufacturing, Manufacturing, PV14: Gehring Montgomery	Central Tendency	Rural	4.0E−03	1.5E−03	2.7E−03	3.9E−03	8.2E−03	3.1E−03	3.7E−04	6.9E−05	2.4E−05	1.1E−05
		Urban	3.5E−03	1.4E−03	3.1E−03	4.7E−03	9.6E−03	3.5E−03	4.0E−04	7.6E−05	2.4E−05	9.2E−06
	High-End	Rural	6.8E−03	2.9E−03	6.1E−03	9.5E−03	1.7E−02	4.8E−03	5.2E−04	7.5E−05	2.4E−05	9.9E−06
		Urban	6.5E−03	2.4E−03	6.2E−03	9.8E−03	1.8E−02	4.8E−03	5.2E−04	7.5E−05	2.3E−05	9.5E−06
Incorporation into other articles not covered elsewhere, Processing – Incorporation Into Formulation, Mixture, or Reaction Product	Central Tendency	Rural	6.3E−08	2.1E−08	1.7E−08	1.6E−08	2.1E−08	8.3E−09	1.6E−09	4.1E−10	2.1E−10	1.5E−10
		Urban	5.8E−08	2.2E−08	2.0E−08	1.9E−08	2.6E−08	9.5E−09	1.8E−09	5.2E−10	1.8E−10	5.9E−11
	High-End	Rural	6.8E−08	2.1E−08	2.2E−08	2.4E−08	3.4E−08	1.1E−08	2.7E−09	7.7E−10	5.2E−10	2.1E−10
		Urban	6.5E−08	2.6E−08	2.8E−08	3.2E−08	4.3E−08	1.3E−08	2.7E−09	6.9E−10	2.3E−10	7.0E−11
Paint and Coating Manufacturing, Processing – Incorporation into Formulation, Mixture, or Reaction Product	Central Tendency	Rural	3.7E−11	1.3E−11	1.0E−11	9.1E−12	1.3E−11	4.9E−12	9.5E−13	2.4E−13	1.2E−13	8.9E−14
		Urban	3.4E−11	1.3E−11	1.2E−11	1.1E−11	1.5E−11	5.6E−12	1.1E−12	3.0E−13	1.0E−13	3.4E−14
	High-End	Rural	4.0E−11	1.2E−11	1.3E−11	1.4E−11	2.0E−11	6.5E−12	1.6E−12	4.5E−13	3.1E−13	1.2E−13
		Urban	3.8E−11	1.5E−11	1.6E−11	1.8E−11	2.5E−11	7.6E−12	1.6E−12	4.0E−13	1.3E−13	4.1E−14
Use of Paints and Coatings, Use of Paints and Coatings	Central Tendency	Rural	8.5E−01	3.0E−01	2.3E−01	2.1E−01	3.1E−01	1.2E−01	2.4E−02	6.2E−03	3.3E−03	2.3E−03
		Urban	7.8E−01	3.1E−01	2.6E−01	2.7E−01	3.8E−01	1.3E−01	2.7E−02	7.8E−03	2.8E−03	9.0E−04
	High-End	Rural	1.1E00	3.3E−01	3.3E−01	3.3E−01	4.8E−01	1.6E−01	3.8E−02	1.1E−02	7.7E−03	3.1E−03
		Urban	1.0E00	3.9E−01	3.9E−01	4.4E−01	6.1E−01	1.9E−01	4.1E−02	1.0E−02	3.5E−03	1.1E−03
		Max	**4.5E01**	**1.8E01**	**2.0E01**	**2.3E01**	**3.2E01**	**9.1E00**	**1.5E00**	**3.6E−01**	**1.7E−01**	**7.2E−02**
		Mean	**3.9E00**	**1.5E00**	**1.7E00**	**2.0E00**	**3.0E00**	**9.4E−01**	**1.5E−01**	**3.8E−02**	**1.5E−02**	**6.7E−03**
		Median	**1.8E−03**	**7.1E−04**	**1.4E−03**	**2.0E−03**	**4.1E−03**	**1.5E−03**	**1.8E−04**	**3.5E−05**	**1.2E−05**	**4.7E−06**
		Min	**3.4E−11**	**1.2E−11**	**1.0E−11**	**9.1E−12**	**1.3E−11**	**4.9E−12**	**9.5E−13**	**2.4E−13**	**1.0E−13**	**3.4E−14**

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

Scenario	Meteorology	Distance										
		Land	**10 m**	**30 m**	**30–60 m**	**60 m**	**100 m**	**100–1,000 m**	**1,000 m**	**2,500 m**	**5,000 m**	**10,000 m**
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	7.8E−11	7.3E−11	4.6E−11	3.3E−11	1.7E−11	1.5E−12	5.4E−13	9.8E−14	2.6E−14	6.3E−15
		Urban	1.4E−10	9.4E−11	5.5E−11	3.5E−11	1.4E−11	6.6E−13	2.2E−13	4.7E−14	1.5E−14	4.5E−15
	High-End	Rural	1.6E−10	9.8E−11	6.3E−11	4.4E−11	2.4E−11	1.8E−12	6.4E−13	1.2E−13	3.0E−14	7.0E−15
		Urban	2.5E−10	1.2E−10	6.7E−11	4.0E−11	1.6E−11	7.6E−13	2.5E−13	5.2E−14	1.5E−14	4.6E−15
Commercial Uses Laboratory Chemicals_Scenario 1	Central Tendency	Rural	1.3E−11	1.3E−11	8.0E−12	5.7E−12	3.0E−12	2.6E−13	9.6E−14	1.8E−14	4.7E−15	1.2E−15
		Urban	2.4E−11	1.6E−11	9.6E−12	6.1E−12	2.5E−12	1.2E−13	4.0E−14	8.3E−15	2.6E−15	7.9E−16
	High-End	Rural	2.7E−11	1.7E−11	1.1E−11	7.6E−12	4.1E−12	3.2E−13	1.1E−13	2.0E−14	5.3E−15	1.3E−15
		Urban	4.3E−11	2.0E−11	1.2E−11	6.9E−12	2.8E−12	1.4E−13	4.5E−14	9.0E−15	2.7E−15	8.0E−16
Commercial Uses Laboratory Chemicals_Scenario 3	Central Tendency	Rural	1.7E−14	1.6E−14	1.0E−14	7.0E−15	3.7E−15	3.3E−16	1.2E−16	2.2E−17	5.9E−18	1.5E−18
		Urban	3.0E−14	2.0E−14	1.2E−14	7.6E−15	3.1E−15	1.5E−16	5.0E−17	1.0E−17	3.3E−18	9.9E−19
	High-End	Rural	3.4E−14	2.1E−14	1.4E−14	9.5E−15	5.2E−15	4.1E−16	1.4E−16	2.5E−17	6.6E−18	1.6E−18
		Urban	5.3E−14	2.5E−14	1.5E−14	8.6E−15	3.4E−15	1.7E−16	5.6E−17	1.1E−17	3.4E−18	1.0E−18
Domestic Manufacturing, Manufacturing, Average PV_CAS 1	Central Tendency	Rural	1.5E−08	2.1E−08	1.2E−08	8.1E−09	3.0E−09	5.1E−11	1.9E−11	2.4E−12	5.2E−13	1.2E−13
		Urban	1.9E−08	2.5E−08	1.4E−08	8.9E−09	3.3E−09	5.7E−11	2.1E−11	2.8E−12	6.6E−13	1.6E−13
	High-End	Rural	4.9E−08	3.1E−08	1.6E−08	9.8E−09	3.4E−09	6.3E−11	2.2E−11	2.9E−12	8.1E−13	2.7E−13
		Urban	5.0E−08	3.2E−08	1.6E−08	9.9E−09	3.4E−09	6.4E−11	2.3E−11	3.0E−12	8.3E−13	2.8E−13
Domestic Manufacturing, Manufacturing, Average PV_CAS 2	Central Tendency	Rural	3.2E−08	3.4E−08	2.0E−08	1.3E−08	6.1E−09	2.7E−10	8.6E−11	1.5E−11	4.4E−12	1.3E−12
		Urban	5.5E−08	4.3E−08	2.4E−08	1.5E−08	5.8E−09	1.9E−10	7.0E−11	1.4E−11	4.4E−12	1.5E−12
	High-End	Rural	8.3E−08	4.8E−08	2.7E−08	1.7E−08	7.4E−09	3.3E−10	1.1E−10	1.8E−11	5.2E−12	1.6E−12
		Urban	1.1E−07	5.4E−08	2.8E−08	1.7E−08	6.2E−09	2.0E−10	7.4E−11	1.5E−11	4.8E−12	1.6E−12
Domestic Manufacturing, Manufacturing, PV14: Gehring Montgomery	Central Tendency	Rural	1.4E−08	2.1E−08	1.2E−08	7.8E−09	2.9E−09	4.9E−11	1.8E−11	2.3E−12	5.0E−13	1.1E−13
		Urban	1.8E−08	2.4E−08	1.3E−08	8.5E−09	3.1E−09	5.4E−11	2.1E−11	2.7E−12	6.3E−13	1.6E−13
	High-End	Rural	4.7E−08	3.0E−08	1.6E−08	9.3E−09	3.3E−09	6.0E−11	2.1E−11	2.8E−12	7.7E−13	2.6E−13
		Urban	4.8E−08	3.1E−08	1.6E−08	9.4E−09	3.3E−09	6.1E−11	2.2E−11	2.9E−12	7.9E−13	2.7E−13
Incorporation into other articles not covered elsewhere, Processing – Incorporation into formulation, mixture, or	Central Tendency	Rural	1.4E−09	1.3E−09	8.2E−10	5.8E−10	3.0E−10	2.6E−11	9.6E−12	1.7E−12	4.5E−13	1.1E−13
		Urban	2.5E−09	1.7E−09	9.8E−10	6.2E−10	2.5E−10	1.2E−11	4.0E−12	8.3E−13	2.6E−13	7.9E−14
	High-End	Rural	2.8E−09	1.7E−09	1.1E−09	7.8E−10	4.2E−10	3.2E−11	1.1E−11	2.1E−12	5.3E−13	1.3E−13
		Urban	4.4E−09	2.1E−09	1.2E−09	7.0E−10	2.8E−10	1.4E−11	4.5E−12	9.2E−13	2.7E−13	8.1E−14

Scenario	Meteorology	Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
reaction product												
Manufacturing – Import, Import – Repackaging, Average PV, CAS 1	Central Tendency	Rural	1.5E−09	1.7E−09	9.9E−10	6.2E−10	2.3E−10	5.1E−12	1.8E−12	2.6E−13	7.6E−14	2.7E−14
		Urban	1.8E−09	2.0E−09	1.1E−09	6.9E−10	2.5E−10	5.4E−12	1.9E−12	2.9E−13	8.8E−14	3.1E−14
	High-End	Rural	3.8E−09	2.3E−09	1.2E−09	7.1E−10	2.5E−10	5.6E−12	1.8E−12	2.6E−13	7.8E−14	3.2E−14
		Urban	3.9E−09	2.3E−09	1.2E−09	7.2E−10	2.5E−10	5.7E−12	1.8E−12	2.6E−13	8.0E−14	3.3E−14
Manufacturing – Import, Import – Repackaging, Average PV, CAS 2	Central Tendency	Rural	2.7E−08	2.5E−08	1.6E−08	1.1E−08	5.9E−09	5.2E−10	1.9E−10	3.5E−11	9.3E−12	2.3E−12
		Urban	4.8E−08	3.2E−08	1.9E−08	1.2E−08	4.9E−09	2.3E−10	7.9E−11	1.7E−11	5.2E−12	1.6E−12
	High-End	Rural	5.3E−08	3.4E−08	2.2E−08	1.5E−08	8.2E−09	6.4E−10	2.2E−10	4.0E−11	1.1E−11	2.5E−12
		Urban	8.4E−08	4.0E−08	2.3E−08	1.4E−08	5.5E−09	2.7E−10	8.9E−11	1.8E−11	5.4E−12	1.6E−12
Manufacturing – Import, Import – Repackaging, PV1: Henkel Louisville	Central Tendency	Rural	4.5E−12	5.6E−12	3.2E−12	2.0E−12	7.5E−13	1.5E−14	5.3E−15	7.5E−16	2.0E−16	5.9E−17
		Urban	5.6E−12	6.5E−12	3.7E−12	2.3E−12	8.2E−13	1.6E−14	5.8E−15	8.3E−16	2.2E−16	7.0E−17
	High-End	Rural	1.2E−11	7.5E−12	4.0E−12	2.3E−12	8.3E−13	1.7E−14	5.9E−15	8.1E−16	2.3E−16	9.0E−17
		Urban	1.2E−11	7.7E−12	4.1E−12	2.4E−12	8.4E−13	1.8E−14	6.0E−15	8.2E−16	2.4E−16	9.2E−17
Manufacturing – Import, Import – Repackaging, PV10: Tribute Energy	Central Tendency	Rural	2.7E−10	3.2E−10	1.9E−10	1.2E−10	4.5E−11	9.6E−13	3.5E−13	5.0E−14	1.3E−14	4.5E−15
		Urban	3.3E−10	3.7E−10	2.1E−10	1.3E−10	4.9E−11	1.0E−12	3.7E−13	5.4E−14	1.5E−14	5.1E−15
	High-End	Rural	6.9E−10	4.3E−10	2.3E−10	1.4E−10	4.9E−11	1.1E−12	3.5E−13	4.9E−14	1.4E−14	5.5E−15
		Urban	7.0E−10	4.4E−10	2.4E−10	1.4E−10	4.9E−11	1.1E−12	3.6E−13	5.0E−14	1.5E−14	5.7E−15
Manufacturing – Import, Import – Repackaging, PV11: Geon Performance	Central Tendency	Rural	1.4E−10	1.7E−10	9.9E−11	6.3E−11	2.4E−11	5.0E−13	1.8E−13	2.6E−14	6.9E−15	2.3E−15
		Urban	1.7E−10	1.9E−10	1.1E−10	6.9E−11	2.5E−11	5.4E−13	1.9E−13	2.8E−14	7.8E−15	2.7E−15
	High-End	Rural	3.6E−10	2.2E−10	1.2E−10	7.0E−11	2.5E−11	5.6E−13	1.8E−13	2.6E−14	7.5E−15	2.9E−15
		Urban	3.7E−10	2.3E−10	1.2E−10	7.1E−11	2.6E−11	5.7E−13	1.9E−13	2.6E−14	7.7E−15	3.0E−15
Manufacturing – Import, Import – Repackaging, PV12: Cascade Columbia	Central Tendency	Rural	4.8E−10	5.7E−10	3.3E−10	2.1E−10	8.0E−11	1.7E−12	6.1E−13	8.7E−14	2.3E−14	7.9E−15
		Urban	5.7E−10	6.5E−10	3.7E−10	2.3E−10	8.5E−11	1.8E−12	6.5E−13	9.5E−14	2.6E−14	9.0E−15
	High-End	Rural	1.2E−09	7.6E−10	4.1E−10	2.4E−10	8.5E−11	1.9E−12	6.2E−13	8.7E−14	2.5E−14	9.7E−15
		Urban	1.2E−09	7.7E−10	4.1E−10	2.4E−10	8.6E−11	1.9E−12	6.3E−13	8.8E−14	2.6E−14	1.0E−14
Manufacturing – Import, Import – Repackaging, PV13: Alac Intl	Central Tendency	Rural	5.4E−09	5.0E−09	2.8E−09	1.8E−09	6.6E−10	1.7E−11	5.7E−12	9.4E−13	3.0E−13	1.2E−13
		Urban	7.1E−09	5.8E−09	3.2E−09	2.0E−09	7.1E−10	1.7E−11	5.8E−12	1.0E−12	3.5E−13	1.4E−13
	High-End	Rural	1.2E−08	6.4E−09	3.4E−09	1.9E−09	6.8E−10	1.7E−11	5.0E−12	8.1E−13	2.7E−13	1.2E−13
		Urban	1.2E−08	6.6E−09	3.5E−09	2.0E−09	7.0E−10	1.7E−11	5.1E−12	8.7E−13	3.0E−13	1.3E−13

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Manufacturing – Import, Import – Repackaging, PV2: Formosa Global	Central Tendency	Rural	2.2E−11	2.7E−11	1.6E−11	9.8E−12	3.6E−12	7.1E−14	2.6E−14	3.6E−15	9.4E−16	2.8E−16
		Urban	2.7E−11	3.1E−11	1.8E−11	1.1E−11	3.9E−12	7.8E−14	2.8E−14	4.0E−15	1.1E−15	3.4E−16
	High-End	Rural	5.8E−11	3.6E−11	1.9E−11	1.1E−11	4.0E−12	8.4E−14	2.8E−14	3.9E−15	1.1E−15	4.3E−16
		Urban	5.9E−11	3.7E−11	2.0E−11	1.1E−11	4.0E−12	8.5E−14	2.9E−14	3.9E−15	1.1E−15	4.4E−16
Manufacturing – Import, Import – Repackaging, PV3: ChemSpec	Central Tendency	Rural	4.6E−11	5.7E−11	3.2E−11	2.1E−11	7.6E−12	1.5E−13	5.4E−14	7.6E−15	2.0E−15	5.9E−16
		Urban	5.7E−11	6.6E−11	3.7E−11	2.3E−11	8.3E−12	1.6E−13	5.9E−14	8.4E−15	2.3E−15	7.0E−16
	High-End	Rural	1.2E−10	7.6E−11	4.1E−11	2.4E−11	8.4E−12	1.8E−13	6.0E−14	8.1E−15	2.4E−15	9.1E−16
		Urban	1.3E−10	7.7E−11	4.1E−11	2.4E−11	8.5E−12	1.8E−13	6.0E−14	8.3E−15	2.4E−15	9.3E−16
Manufacturing – Import, Import – Repackaging, PV4: Harwick Standard	Central Tendency	Rural	5.3E−11	6.6E−11	3.7E−11	2.4E−11	8.7E−12	1.7E−13	6.2E−14	8.7E−15	2.3E−15	6.8E−16
		Urban	6.5E−11	7.6E−11	4.3E−11	2.6E−11	9.5E−12	1.9E−13	6.8E−14	9.7E−15	2.6E−15	8.1E−16
	High-End	Rural	1.4E−10	8.7E−11	4.7E−11	2.7E−11	9.6E−12	2.0E−13	6.9E−14	9.4E−15	2.7E−15	1.0E−15
		Urban	1.4E−10	8.9E−11	4.8E−11	2.8E−11	9.7E−12	2.1E−13	6.9E−14	9.5E−15	2.8E−15	1.1E−15
Manufacturing – Import, Import – Repackaging, PV5: Henkel Silver Fern Chem	Central Tendency	Rural	6.8E−11	8.5E−11	4.9E−11	3.1E−11	1.1E−11	2.2E−13	8.1E−14	1.1E−14	2.9E−15	8.9E−16
		Urban	8.5E−11	9.8E−11	5.6E−11	3.4E−11	1.2E−11	2.4E−13	8.8E−14	1.3E−14	3.4E−15	1.1E−15
	High-End	Rural	1.8E−10	1.1E−10	6.1E−11	3.5E−11	1.3E−11	2.6E−13	8.9E−14	1.2E−14	3.5E−15	1.4E−15
		Urban	1.9E−10	1.2E−10	6.2E−11	3.6E−11	1.3E−11	2.7E−13	9.0E−14	1.2E−14	3.6E−15	1.4E−15
Manufacturing – Import, Import – Repackaging, PV6: MAK Chem	Central Tendency	Rural	8.0E−11	1.0E−10	5.7E−11	3.6E−11	1.3E−11	2.6E−13	9.4E−14	1.3E−14	3.4E−15	1.0E−15
		Urban	9.9E−11	1.2E−10	6.5E−11	4.0E−11	1.4E−11	2.9E−13	1.0E−13	1.5E−14	3.9E−15	1.2E−15
	High-End	Rural	2.1E−10	1.3E−10	7.1E−11	4.1E−11	1.5E−11	3.1E−13	1.0E−13	1.4E−14	4.1E−15	1.6E−15
		Urban	2.2E−10	1.4E−10	7.2E−11	4.2E−11	1.5E−11	3.1E−13	1.1E−13	1.4E−14	4.2E−15	1.6E−15
Manufacturing – Import, Import – Repackaging, PV7: Mercedes Benz	Central Tendency	Rural	5.8E−11	7.2E−11	4.1E−11	2.6E−11	9.5E−12	1.9E−13	6.8E−14	9.6E−15	2.5E−15	7.5E−16
		Urban	7.1E−11	8.3E−11	4.7E−11	2.9E−11	1.0E−11	2.1E−13	7.5E−14	1.1E−14	2.9E−15	8.9E−16
	High-End	Rural	1.5E−10	9.6E−11	5.1E−11	3.0E−11	1.1E−11	2.2E−13	7.5E−14	1.0E−14	3.0E−15	1.1E−15
		Urban	1.6E−10	9.8E−11	5.2E−11	3.0E−11	1.1E−11	2.3E−13	7.6E−14	1.0E−14	3.0E−15	1.2E−15
Manufacturing – Import, Import – Repackaging, PV8: Univar	Central Tendency	Rural	9.1E−11	1.1E−10	6.3E−11	4.0E−11	1.5E−11	3.2E−13	1.2E−13	1.7E−14	4.4E−15	1.5E−15
		Urban	1.1E−10	1.2E−10	7.1E−11	4.4E−11	1.6E−11	3.5E−13	1.2E−13	1.8E−14	5.0E−15	1.7E−15
	High-End	Rural	2.3E−10	1.4E−10	7.7E−11	4.5E−11	1.6E−11	3.6E−13	1.2E−13	1.6E−14	4.8E−15	1.9E−15
		Urban	2.3E−10	1.5E−10	7.8E−11	4.6E−11	1.6E−11	3.6E−13	1.2E−13	1.7E−14	4.9E−15	1.9E−15

Scenario	Meteorology	Distance										
		Land	10 m	30 m	30–60 m	60 m	100 m	100–1,000 m	1,000 m	2,500 m	5,000 m	10,000 m
Manufacturing – Import, Import – Repackaging, PV9: Belts Concepts	Central Tendency	Rural	2.2E−10	2.6E−10	1.5E−10	9.6E−11	3.6E−11	7.7E−13	2.8E−13	4.0E−14	1.1E−14	3.6E−15
		Urban	2.6E−10	3.0E−10	1.7E−10	1.1E−10	3.9E−11	8.3E−13	2.9E−13	4.3E−14	1.2E−14	4.1E−15
	High-End	Rural	5.5E−10	3.4E−10	1.9E−10	1.1E−10	3.9E−11	8.6E−13	2.8E−13	3.9E−14	1.2E−14	4.4E−15
		Urban	5.6E−10	3.5E−10	1.9E−10	1.1E−10	3.9E−11	8.7E−13	2.9E−13	4.0E−14	1.2E−14	4.5E−15
Non-PVC Plastic Compounding	Central Tendency	Rural	8.2E−01	7.5E−01	4.8E−01	3.4E−01	1.8E−01	1.6E−02	5.9E−03	1.1E−03	2.9E−04	7.4E−05
		Urban	1.5E00	9.6E−01	5.7E−01	3.6E−01	1.5E−01	7.3E−03	2.4E−03	5.1E−04	1.6E−04	4.8E−05
	High-End	Rural	1.6E00	1.0E00	6.5E−01	4.5E−01	2.5E−01	2.0E−02	6.8E−03	1.2E−03	3.2E−04	7.8E−05
		Urban	2.5E00	1.2E00	6.9E−01	4.1E−01	1.6E−01	8.4E−03	2.7E−03	5.5E−04	1.7E−04	4.9E−05
Non-PVC Plastic Converting	Central Tendency	Rural	2.1E−02	2.0E−02	1.2E−02	8.7E−03	4.6E−03	3.9E−04	1.4E−04	2.6E−05	6.8E−06	1.7E−06
		Urban	3.7E−02	2.5E−02	1.5E−02	9.3E−03	3.8E−03	1.8E−04	6.0E−05	1.3E−05	3.9E−06	1.2E−06
	High-End	Rural	4.2E−02	2.6E−02	1.7E−02	1.2E−02	6.4E−03	4.9E−04	1.7E−04	3.1E−05	8.1E−06	1.9E−06
		Urban	6.6E−02	3.1E−02	1.8E−02	1.1E−02	4.2E−03	2.0E−04	6.8E−05	1.4E−05	4.1E−06	1.2E−06
Paint and Coating Manufacturing, Processing – Incorporation into Formulation, Mixture, or Reaction Product	Central Tendency	Rural	3.7E−10	3.5E−10	2.2E−10	1.6E−10	8.2E−11	6.9E−12	2.6E−12	4.7E−13	1.2E−13	3.0E−14
		Urban	6.6E−10	4.5E−10	2.6E−10	1.7E−10	6.7E−11	3.1E−12	1.1E−12	2.2E−13	7.0E−14	2.1E−14
	High-End	Rural	7.5E−10	4.7E−10	3.0E−10	2.1E−10	1.1E−10	8.7E−12	3.0E−12	5.5E−13	1.4E−13	3.4E−14
		Urban	1.2E−09	5.6E−10	3.2E−10	1.9E−10	7.6E−11	3.6E−12	1.2E−12	2.5E−13	7.3E−14	2.2E−14
PVC Plastic Compounding	Central Tendency	Rural	5.5E−01	5.2E−01	3.3E−01	2.3E−01	1.2E−01	1.0E−02	3.8E−03	6.9E−04	1.8E−04	4.5E−05
		Urban	9.8E−01	6.6E−01	3.9E−01	2.4E−01	9.9E−02	4.6E−03	1.6E−03	3.3E−04	1.0E−04	3.1E−05
	High-End	Rural	1.1E00	6.9E−01	4.4E−01	3.1E−01	1.7E−01	1.3E−02	4.5E−03	8.1E−04	2.1E−04	5.0E−05
		Urban	1.7E00	8.2E−01	4.7E−01	2.8E−01	1.1E−01	5.4E−03	1.8E−03	3.6E−04	1.1E−04	3.2E−05
PVC Plastic Converting	Central Tendency	Rural	2.5E−02	2.4E−02	1.5E−02	1.1E−02	5.6E−03	4.7E−04	1.8E−04	3.2E−05	8.3E−06	2.1E−06
		Urban	4.5E−02	3.0E−02	1.8E−02	1.1E−02	4.5E−03	2.1E−04	7.2E−05	1.5E−05	4.8E−06	1.4E−06
	High-End	Rural	5.1E−02	3.2E−02	2.0E−02	1.4E−02	7.7E−03	5.9E−04	2.1E−04	3.8E−05	9.7E−06	2.3E−06
		Urban	8.0E−02	3.8E−02	2.2E−02	1.3E−02	5.1E−03	2.5E−04	8.2E−05	1.7E−05	4.9E−06	1.5E−06
Use of Adhesives and Sealants, Use of Adhesives and Sealants	Central Tendency	Rural	5.3E−11	4.7E−11	3.0E−11	2.1E−11	1.1E−11	1.0E−12	3.6E−13	6.7E−14	1.8E−14	4.6E−15
		Urban	9.2E−11	5.9E−11	3.5E−11	2.2E−11	8.9E−12	4.6E−13	1.5E−13	3.2E−14	9.9E−15	3.0E−15
	High-End	Rural	1.0E−10	6.2E−11	4.0E−11	2.7E−11	1.5E−11	1.3E−12	4.3E−13	7.6E−14	2.0E−14	4.9E−15
		Urban	1.5E−10	7.3E−11	4.2E−11	2.5E−11	1.0E−11	5.3E−13	1.7E−13	3.4E−14	1.0E−14	3.1E−15
Use of Paints and Coatings,	Central	Rural	1.1E−10	1.0E−10	6.6E−11	4.7E−11	2.5E−11	2.3E−12	8.3E−13	1.5E−13	4.1E−14	1.0E−14

Scenario	Meteorology	Distance										
		Land	**10 m**	**30 m**	**30–60 m**	**60 m**	**100 m**	**100–1,000 m**	**1,000 m**	**2,500 m**	**5,000 m**	**10,000 m**
Use of Paints and Coatings	Tendency	Urban	2.0E−10	1.3E−10	7.9E−11	5.0E−11	2.0E−11	1.0E−12	3.4E−13	7.1E−14	2.2E−14	6.7E−15
	High-End	Rural	2.3E−10	1.4E−10	9.0E−11	6.3E−11	3.5E−11	2.8E−12	9.5E−13	1.7E−13	4.4E−14	1.1E−14
		Urban	3.5E−10	1.7E−10	9.6E−11	5.7E−11	2.3E−11	1.2E−12	3.8E−13	7.7E−14	2.3E−14	6.9E−15
Use of Paints and Coatings, Use of Paints and Coatings w/o Engineering Controls	Central Tendency	Rural	1.1E−10	1.0E−10	6.6E−11	4.7E−11	2.5E−11	2.3E−12	8.3E−13	1.5E−13	4.1E−14	1.0E−14
		Urban	2.0E−10	1.3E−10	7.9E−11	5.0E−11	2.0E−11	1.0E−12	3.4E−13	7.1E−14	2.2E−14	6.7E−15
	High-End	Rural	2.3E−10	1.4E−10	9.0E−11	6.3E−11	3.5E−11	2.8E−12	9.5E−13	1.7E−13	4.4E−14	1.1E−14
		Urban	3.5E−10	1.7E−10	9.6E−11	5.7E−11	2.3E−11	1.2E−12	3.8E−13	7.7E−14	2.3E−14	6.9E−15
		Max	**2.5E00**	**1.2E00**	**6.9E−01**	**4.5E−01**	**2.5E−01**	**2.0E−02**	**6.8E−03**	**1.2E−03**	**3.2E−04**	**7.8E−05**
		Mean	**9.3E−02**	**5.7E−02**	**3.5E−02**	**2.2E−02**	**1.1E−02**	**7.3E−04**	**2.5E−04**	**4.8E−05**	**1.3E−05**	**3.5E−06**
		Median	**3.4E−10**	**2.4E−10**	**1.4E−10**	**8.4E−11**	**3.5E−11**	**1.2E−12**	**3.8E−13**	**7.7E−14**	**2.3E−14**	**6.7E−15**
		Min	**1.7E−14**	**1.6E−14**	**1.0E−14**	**7.0E−15**	**3.1E−15**	**1.5E−16**	**5.0E−17**	**1.0E−17**	**3.3E−18**	**9.9E−19**

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

Scenario	Meteorology	Distance										
		Land	**10 m**	**30 m**	**30–60 m**	**60 m**	**100 m**	**100–1,000 m**	**1,000 m**	**2,500 m**	**5,000 m**	**10,000 m**
Adhesive Sealant Manufacturing Processing	Central Tendency	Rural	4.4E−13	4.4E−13	1.1E−12	1.8E−12	3.2E−12	5.0E−13	2.3E−13	6.6E−14	3.8E−14	2.3E−14
		Urban	1.0E−12	1.6E−12	2.3E−12	2.9E−12	4.1E−12	5.8E−13	2.7E−13	7.6E−14	2.7E−14	9.1E−15
	High-End	Rural	1.1E−12	5.3E−13	1.6E−12	2.6E−12	4.2E−12	7.6E−13	3.0E−13	1.2E−13	7.5E−14	3.0E−14
		Urban	1.9E−12	1.7E−12	3.0E−12	4.0E−12	5.3E−12	8.4E−13	3.7E−13	9.6E−14	3.1E−14	9.7E−15
Commerical Uses Laboratory Chemicals_Scenario 2	Central Tendency	Rural	5.6E−09	4.8E−09	1.2E−08	1.9E−08	3.4E−08	5.3E−09	2.4E−09	7.2E−10	4.1E−10	2.6E−10
		Urban	1.2E−08	1.7E−08	2.4E−08	3.1E−08	4.3E−08	6.2E−09	2.9E−09	8.3E−10	3.0E−10	1.0E−10
	High-End	Rural	1.2E−08	5.7E−09	1.7E−08	2.8E−08	4.4E−08	8.2E−09	3.3E−09	1.3E−09	8.0E−10	3.3E−10
		Urban	2.2E−08	1.8E−08	3.2E−08	4.2E−08	5.6E−08	9.0E−09	3.9E−09	1.0E−09	3.4E−10	1.1E−10
Domestic Manufacturing, Manufacturing, Average PV_CAS 1	Central Tendency	Rural	1.4E−07	2.1E−05	2.0E−04	6.1E−04	1.7E−03	1.8E−04	7.2E−05	1.1E−05	2.9E−06	1.0E−06
		Urban	2.5E−07	3.9E−05	3.3E−04	8.9E−04	2.2E−03	2.1E−04	8.1E−05	1.2E−05	3.5E−06	1.2E−06
	High-End	Rural	2.3E−05	1.1E−04	6.8E−04	1.5E−03	2.9E−03	2.6E−04	8.8E−05	1.2E−05	3.4E−06	1.3E−06
		Urban	2.5E−05	1.1E−04	7.4E−04	1.5E−03	3.0E−03	2.6E−04	8.9E−05	1.2E−05	3.5E−06	1.3E−06

Scenario	Meteorology	Distance										
		Land	**10 m**	**30 m**	**30–60 m**	**60 m**	**100 m**	**100–1,000 m**	**1,000 m**	**2,500 m**	**5,000 m**	**10,000 m**
Domestic Manufacturing, Manufacturing, Average PV_CAS 2	Central Tendency	Rural	7.4E−04	2.2E−03	8.5E−03	1.8E−02	3.6E−02	4.7E−03	2.1E−03	5.2E−04	2.3E−04	9.3E−05
		Urban	2.3E−03	9.2E−03	2.3E−02	3.3E−02	5.0E−02	5.5E−03	2.5E−03	6.3E−04	2.3E−04	8.0E−05
	High-End	Rural	2.9E−03	4.2E−03	1.9E−02	3.5E−02	5.8E−02	7.1E−03	2.7E−03	7.0E−04	3.1E−04	1.1E−04
		Urban	4.6E−03	1.3E−02	3.5E−02	5.2E−02	7.1E−02	7.6E−03	3.1E−03	7.3E−04	2.5E−04	8.6E−05
Domestic Manufacturing, Manufacturing, PV14: Gehring Montgomery	Central Tendency	Rural	1.9E−09	2.7E−07	2.6E−06	7.9E−06	2.2E−05	2.4E−06	9.3E−07	1.4E−07	3.7E−08	1.3E−08
		Urban	3.2E−09	5.0E−07	4.3E−06	1.1E−05	2.8E−05	2.6E−06	1.1E−06	1.6E−07	4.5E−08	1.5E−08
	High-End	Rural	3.0E−07	1.4E−06	8.8E−06	1.9E−05	3.8E−05	3.3E−06	1.1E−06	1.6E−07	4.4E−08	1.7E−08
		Urban	3.3E−07	1.5E−06	9.5E−06	2.0E−05	3.9E−05	3.4E−06	1.2E−06	1.6E−07	4.5E−08	1.7E−08
Incorporation into other articles not covered elsewhere, Processing – Incorporation into Formulation, Mixture, or Reaction Product	Central Tendency	Rural	6.3E−12	6.2E−12	1.5E−11	2.5E−11	4.6E−11	7.0E−12	3.2E−12	9.3E−13	5.3E−13	3.2E−13
		Urban	1.4E−11	2.2E−11	3.2E−11	4.1E−11	5.7E−11	8.1E−12	3.8E−12	1.1E−12	3.9E−13	1.3E−13
	High-End	Rural	1.5E−11	7.4E−12	2.3E−11	3.7E−11	5.9E−11	1.1E−11	4.3E−12	1.7E−12	1.1E−12	4.2E−13
		Urban	2.7E−11	2.3E−11	4.2E−11	5.6E−11	7.4E−11	1.2E−11	5.2E−12	1.4E−12	4.4E−13	1.4E−13
Paint and Coating Manufacturing, Processing – Incorporation into Formulation, Mixture, or Reaction Product	Central Tendency	Rural	3.7E−15	3.6E−15	8.8E−15	1.5E−14	2.7E−14	4.1E−15	1.9E−15	5.4E−16	3.1E−16	1.9E−16
		Urban	8.3E−15	1.3E−14	1.9E−14	2.4E−14	3.3E−14	4.7E−15	2.2E−15	6.2E−16	2.3E−16	7.5E−17
	High-End	Rural	8.8E−15	4.3E−15	1.3E−14	2.1E−14	3.5E−14	6.2E−15	2.5E−15	9.7E−16	6.1E−16	2.5E−16
		Urban	1.6E−14	1.4E−14	2.4E−14	3.3E−14	4.4E−14	6.9E−15	3.0E−15	7.9E−16	2.6E−16	8.0E−17
Use of Paints and Coatings, Use of Paints and Coatings	Central Tendency	Rural	1.6E−04	9.6E−05	2.2E−04	3.4E−04	6.1E−04	9.9E−05	4.4E−05	1.3E−05	7.3E−06	4.9E−06
		Urban	2.9E−04	3.4E−04	4.4E−04	5.5E−04	7.6E−04	1.2E−04	5.2E−05	1.5E−05	5.4E−06	1.8E−06
	High-End	Rural	2.9E−04	1.2E−04	3.3E−04	5.2E−04	8.0E−04	1.5E−04	6.4E−05	2.3E−05	1.4E−05	6.0E−06
		Urban	4.8E−04	3.5E−04	5.8E−04	7.6E−04	1.0E−03	1.6E−04	7.1E−05	1.9E−05	6.1E−06	1.9E−06
		Max	**4.6E−03**	**1.3E−02**	**3.5E−02**	**5.2E−02**	**7.1E−02**	**7.6E−03**	**3.1E−03**	**7.3E−04**	**3.1E−04**	**1.1E−04**
		Mean	**3.7E−04**	**9.4E−04**	**2.8E−03**	**4.5E−03**	**7.1E−03**	**8.2E−04**	**3.4E−04**	**8.4E−05**	**3.3E−05**	**1.2E−05**
		Median	**1.2E−08**	**1.5E−07**	**1.3E−06**	**4.0E−06**	**1.1E−05**	**1.2E−06**	**4.7E−07**	**6.8E−08**	**1.9E−08**	**6.7E−09**
		Min	**3.7E−15**	**3.6E−15**	**8.8E−15**	**1.5E−14**	**2.7E−14**	**4.1E−15**	**1.9E−15**	**5.4E−16**	**2.3E−16**	**7.5E−17**

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. As noted in Section 4, the standard EPA waterbody applied for the modeling has a surface of 5 m by 40 m, resulting in a surface area of 200 m². 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 Section 4.

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

	Distance									
	10 m	**30 m**	**30–60 m**	**60 m**	**100 m**	**100–1,000 m**	**1,000 m**	**2,500 m**	**5,000 m**	**10,000 m**
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 less than 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.