United States
Environmental Protection Agency

EPA Document # 740-D-20-002
April 2020
Office of Chemical Safety and
Pollution Prevention

Draft Scope of the Risk Evaluation for *p*-Dichlorobenzene

CASRN 106-46-7

April 2020

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIX TABLES

ACKNOWLEDGEMENTS

This report was developed by the United States Environmental Protection Agency (U.S. EPA), Office of Chemical Safety and Pollution Prevention (OCSPP), Office of Pollution Prevention and Toxics (OPPT).

Acknowledgements

The OPPT Assessment Team gratefully acknowledges participation or input from Intra-agency reviewers that included multiple offices within EPA, Inter-agency reviewers that included multiple Federal agencies, and assistance from EPA contractors Abt Associates (Contract No. EP-W-16-009), GDIT (Contract No. HHSN316201200013W), ERG (Contract No. EP-W-12-006), ICF (Contract No. 68HERC19D0003), SRC (Contract No. 68HERH19D0022), and Versar (Contract No. EP-W-17-006). EPA also acknowledges the contributions of technical experts from EPA's Office of Research and Development.

Docket

Supporting information can be found in public docket: EPA-HQ-OPPT-2018-0462.

Disclaimer

Reference herein to any specific commercial products, process or service by trade name, trademark, manufacturer or otherwise does not constitute or imply its endorsement, recommendation or favoring by the United States Government.

ABBREVIATIONS AND ACRONYMS

µg	Microgram(s)
AAL	Allowable Ambient Levels
AC	Acute concentration
ACGIH	American Conference of Government Industrial Hygienists
ADME	Absorption, Distribution, Metabolism, and Excretion
Apx	Appendix
ATSDR	Agency for Toxic Substances and Disease Registry
AUC	Area Under the Curve
AWQC	Ambient Water Quality Criteria
BAF	Bioaccumulation Factor
BCF	Bioconcentration Factor
BW3/4	Body weight scaling to the 3/4 power
CAA	Clean Air Act
CARB	California Air Resources Board
CASRN	Chemical Abstracts Service Registry Number
CBI	Confidential Business Information
CCD	Chemical Control Division
CCL	Contaminant Candidate List
CDC	Centers for Disease Control
CDR	Chemical Data Reporting
CEHD	Chemical Exposure Health Data
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
ChemSTEER	Chemical Screening Tool for Exposure and Environmental Releases
COC	Concentration of Concern
CoRAP	Community Rolling Action Plan
COU	Conditions of Use
CPCat	Chemical and Product Categories
CPID	Consumer Product Information Database
CSCL	Chemical Substances Control Law
DHHS	Department of Health and Human Services
DMR	Discharge Monitoring Report
DNA	Deoxyribonucleic Acid
EC	Engineering controls
ECOTOX	ECOTOXicology knowledgebase
ED	Exposure duration
E-FAST	Exposure and Fate Assessment Screening Tool
E-FAST2	Exposure and Fate Assessment Screening Tool version 2
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
EPI Suite™	Estimation Program Interface Suite™
EPS	Expanded Polystyrene
ERG	Eastern Research Group, Inc.
ESD	Emission Scenario Document
EU	European Union
FDA	Food and Drug Administration

FF	Far field
FYI	For Your Information
g/L	Gram(s) per Liter
HERO	Health and Environmental Research Online
Hg	Mercury
HHE	Health Hazard Evaluation
HMTA	Hazardous Materials Transportation Act
HPV	High Production Volume
HQ	Headquarters
HSDB	Hazardous Substances Data Bank
HUC	Hydrologic Unit Code
IA	Indoor air
IARC	International Agency for Research on Cancer
IECCU	Indoor Environmental Concentrations in Buildings with Conditioned and Unconditioned Zones
IMIS	Integrated Management Information System
K	Thousand
L	Liter(s)
lb	Pound
LC50	Lethal Concentration of 50% test organisms
LEV	Local exhaust ventilation
LOAEL	Lowest Observed Adverse Effect Level
LOEC	Lowest Observed Effect Concentration
m	Meter(s)
m3	Cubic Meter(s)
MACT	Maximum Achievable Control Technology
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg	Milligram(s)
mg/L	Milligram(s) per Liter
mg/m3	Milligram(s) per cubic meter
mg/mL	Milligram(s) per milliliter
mmHg	Millimeter(s) of Mercury
MOA	Mode of Action
MOE	Margin of exposure
MRL	Minimal Risk Level
n	number
N/A	Not Applicable
NHANES	National Health and Nutrition Examination Survey
NICNAS	National Industrial Chemicals Notification and Assessment Scheme (Australia)
NIH	National Institutes of Health
NIOSH	National Institute for Occupational Safety and Health
NITE	National Institute of Technology and Evaluation
NOAEL	No Observed Adverse Effect Level
NOEC	No Observed Effect Concentration
NPDES	National Pollutant Discharge Elimination System
NPDWR	National Primary Drinking Water Regulations

NPL	National Priorities List
NPRI	National Pollutant Release Inventory
NR	Not Reported
NRC	National Research Council
NSPS	New Source Performance Standards
NTP	National Toxicology Program
NWIS	National Water Information System
OCSPP	Office of Chemical Safety and Pollution Prevention
OECD	Organisation for Economic Co-operation and Development
OEHHA	Office of Environmental Health Hazard Assessment (California)
OEL	Occupational Exposure Limit
OES	Occupational Exposure Scenario
OLEM	Office of Land and Emergency Management
ONU	Occupational Non-User
OPPT	Office of Pollution Prevention and Toxics
ORD	Office of Research and Development
OSHA	Occupational Safety and Health Administration
OST	Office of Science and Technology
OSWER	Office of Solid Waste and Emergency Response
OW	Office of Water
P	Persistence
P-Chem	Physical Chemical Properties
PBPK	Physiologically Based Pharmacokinetic
PBT	Persistent, Bioaccumulative, Toxic
PECO	Population, Exposure, Comparator and Outcome
PEL	Permissible Exposure Limit
PESS	Potentially Exposed or Susceptible Subpopulation
POD	Point of Departure
POTW	Publicly Owned Treatment Works
PPE	Personal Protective Equipment
ppm	Part(s) per million
PS	Point Source
PV	Production Volume
PWS	Public Water System
QA	Quality Assurance
QC	Quality Control
QSAR	Quantitative Structure Activity Relationship
RA	Risk Assessment
RAD	Risk Assessment Division
RCRA	Resource Conservation and Recovery Act
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals (European Union)
REL	Recommended Exposure Limit
RfC	Reference Concentration
RfD	Reference dose
RQ	Risk Quotient
SAB	Science Advisory Board

SAR	Structure-activity relationship
SARA	Superfund Amendments and Reauthorization Act
SD	Standard deviation
SDS	Safety Data Sheet
SDWA	Safe Drinking Water Act
SIC	Standard Industrial Classification
SIDS	Screening Information Dataset
STEL	Short-term Exposure Limit
STORET	STORage and RETrieval (water quality data warehouse)
SVOC	Semivolatile Organic Compounds
SWC	Surface Water Concentration
T	Toxic (used with PBT)
TIAB	Title and Abstract
TLV	Threshold Limit Value
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act
TTO	Total Toxic Organics
TWA	Time-weighted average
U.S.	United States
U.S.C.	United States Code
UCMR	Unregulated Contaminant Monitoring Rule
UIC	Underground Injection Control
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compound
VP	Vapor Pressure
WQP	Water Quality Portal
WQX	Water Quality Exchange
WWT	Wastewater Treatment

EXECUTIVE SUMMARY

In December 2019, EPA designated *p*-dichlorobenzene (CASRN 106-46-7) as a high-priority substance for risk evaluation following the prioritization process required by Section 6(b) of the Toxic Substances Control Act (TSCA) and implementing regulations (40 CFR Part 702) (Docket ID: EPA-HQ-OPPT-2018-0462). The first step of the risk evaluation process is the development of the scope document, and this document fulfills the TSCA regulatory requirement to issue a draft scope document as described in 40 CFR 702.41(c)(7). The draft scope for *p*-dichlorobenzene includes the following information: the conditions of use, potentially exposed or susceptible subpopulations (PESS), hazards, and exposures that EPA plans to consider in this risk evaluation, along with a description of the reasonably available information, conceptual model, analysis plan and science approaches, and plan for peer review for this chemical substance. EPA is providing a 45-day comment period on the draft scope. Comments received on this draft scope document will help inform development of the final scope document and the risk evaluation.

General Information. *p*-Dichlorobenzene is a colorless to white crystalline solid that is poorly soluble in water but miscible in most organic solvents. It has a strong pungent odor. At ambient temperature, it undergoes sublimation, passing directly from a solid directly to a vapor state. *p*-Dichlorobenzene has a total production volume in the United States between 50 to 100 million pounds.

Reasonably Available Information. EPA leveraged the data and information sources already described in the document supporting the High-Priority Substance designation for *p*-dichlorobenzene to inform the development of this draft scope document. To further develop this draft scope document, EPA conducted a comprehensive search to identify and screen multiple evidence streams (i.e., chemistry, fate, release and engineering, exposure, hazard), and the search and screening results to date are provided in Section 2.1. EPA is seeking public comment on this draft scope document and will consider additional information identified following publication of this draft scope document, as appropriate, in developing the final scope document. EPA is using the systematic review process described in the Application of Systematic Review in TSCA Risk Evaluations document (U.S. EPA, 2018a) to guide the process of searching for and screening reasonably available information, including information already in EPA's possession, for use and inclusion in the risk evaluation. EPA is applying these systematic review methods to collect reasonably available information regarding hazards, exposures, PESS, and conditions of use that will help inform the risk evaluation for *p*-dichlorobenzene.

Conditions of Use. EPA plans to evaluate manufacturing, including importing; processing; distribution in commerce; industrial, commercial and consumer uses; and disposal of *p*-dichlorobenzene in the risk evaluation. *p*-Dichlorobenzene is manufactured (including imported) in the United States. The chemical is processed as a reactant, incorporated into formulation, mixture or reaction products and incorporated into articles. The identified processing activities also include recycling of *p*-dichlorobenzene. Several industrial and commercial uses were identified that ranged from use in plastic material and resin manufacturing to use in odor agents and deodorizers. Consumer uses were reported in air care products, automotive care products and building and construction products. EPA identified these conditions of use from information reported to EPA through Chemical Data Reporting (CDR) and Toxics Release Inventory (TRI) reporting, published literature, and consultation with stakeholders both for uses currently in production and uses whose production may have ceased. EPA is aware of information reporting use of *p*-dichlorobenzene in pesticides; however, they are not conditions of use for the chemical substance as defined in TSCA § 3(2) and (4). Section 2.2 provides details about the conditions of use within the scope of the risk evaluation

Conceptual Models. The conceptual models for *p*-dichlorobenzene are presented in Section 2.6. Conceptual models are graphical depictions of the actual or predicted relationships of conditions of use, exposure pathways (e.g., media), exposure routes (e.g., inhalation, dermal, oral), hazards, and receptors throughout the life cycle of the chemical substance. EPA plans to focus the risk evaluation for *p*-dichlorobenzene on the following exposures, hazards, and receptors with the understanding that updates may be made in the final scope document after consideration of public comments and completion of the systematic review data collection phase.

- *Exposures (Pathways and Routes), Receptors and PESS.* EPA plans to analyze both human and environmental exposures and releases to the environment resulting from the conditions of use of *p*-dichlorobenzene that EPA plans to consider in risk evaluation. Exposures for *p*-dichlorobenzene are discussed in Section 2.3. Additional information gathered through systematic review searches will also inform expected exposures.

  EPA's plan as to evaluating environmental exposure pathways consider whether and how other EPA administered statues and regulatory programs address the presence of *p*-dichlorobenzene in media pathways falling under the jurisdiction of those authorities. Section 2.6.3 discusses those pathways that may be addressed pursuant to other Federal laws. In Section 2.6.4, EPA presents the conceptual model describing the identified exposures (pathways and routes), receptors and hazards associated with the conditions of use of <chemical name> within the scope of the risk evaluation.

  EPA plans to evaluate the following human and environmental exposure pathways, routes, receptors and PESS in the scope of the risk evaluation. However, EPA plans to consider comments received on this draft scope and other reasonably available information when finalizing this scope document, and to adjust the exposure pathways, exposure routes and hazards included in the scope document as needed.
    - *Occupational exposure pathways associated with industrial and commercial conditions of use:* EPA plans to evaluate exposures to workers and/or occupational non-users via the inhalation route and exposures to workers via the dermal route associated with the manufacturing, processing, use or disposal of *p*-dichlorobenzene (Section 2.2.1).
    - *Consumer and bystander exposure pathways associated with consumer conditions of use:* EPA plans to evaluate inhalation and dermal exposure to *p*-dichlorobenzene when consumers are handling automotive care products and plastic and rubber products.
    - *Receptors and PESS:* EPA plans to evaluate children, women of reproductive age (including, but not limited to, pregnant women), workers and consumers as receptors and PESS in the risk evaluation.
    - *Environmental exposure pathways:* EPA plans to evaluate exposure to *p*-dichlorobenzene for aquatic and terrestrial receptors (biota).

  Hazards. Hazards for *p*-dichlorobenzene are discussed in Section 2.4. EPA completed preliminary reviews of information from peer-reviewed assessments and databases to identify potential environmental and human health hazards for *p*-dichlorobenzene as part of the prioritization process. Environmental hazard effects were identified for aquatic and terrestrial

organisms. Information collected through systematic review methods and public comments may identify additional environmental hazards that warrant inclusion in the environmental hazard assessment of the risk evaluation.

EPA will use systematic review methods to evaluate the epidemiological and toxicological literature for *p*-dichlorobenzene. Relevant mechanistic evidence will also be considered, if reasonably available, to inform the interpretation of findings related to potential human health effects and the dose-response assessment. EPA plans to evaluate all of the potential human health hazards for *p*-dichlorobenzene identified in Section 2.4.2. The broad health effect categories include reproductive and developmental, immunological, nervous system, irritation effects, genotoxicity, carcinogenicity and ADME (absorption, distribution, metabolism, and excretion).

Analysis Plan. The analysis plan for *p*-dichlorobenzene is presented in Section 2.7. The analysis plan outlines the general science approaches that EPA plans to use for the various information streams (i.e., chemistry, fate, release and engineering, exposure, hazard) supporting the risk evaluation. The analysis plan is based on EPA's knowledge of *p*-dichlorobenzene to date which includes a partial, but ongoing, review of identified information as described in Section 2.1. EPA will consider new information submitted by the public. Should additional data or approaches become reasonably available, EPA may update its analysis plan in the final scope document.

EPA will seek public comments on the systematic review methods supporting the risk evaluation for *p*-dichlorobenzene, including the methods for assessing the quality of data and information and the approach for evidence synthesis and evidence integration supporting the exposure and hazard assessments. The details will be provided in a supplemental document that EPA anticipates releasing for public comment prior to the finalization of the scope document.

The analysis plan is based on EPA's knowledge of *p*-dichlorobenzene to date which includes a partial, but ongoing, review of identified information as described in Section 2.1. EPA plans to continue to consider new information submitted by the public. Should additional data or approaches become reasonably available, EPA may update its analysis plan in the final scope document.

Peer Review. The draft risk evaluation for *p*-dichlorobenzene will be peer reviewed. Peer review will be conducted in accordance with relevant and applicable methods for chemical risk evaluations, including using EPA's Peer Review Handbook and other methods consistent with Section 26 of TSCA (See 40 CFR 702.45).

1 INTRODUCTION

This document presents for comment the scope of the risk evaluation to be conducted for *p*-dichlorobenzene under the Frank R. Lautenberg Chemical Safety for the 21st Century Act. The Frank R. Lautenberg Chemical Safety for the 21st Century Act amended the Toxic Substances Control Act (TSCA), the Nation's primary chemicals management law, on June 22, 2016. The new law includes statutory requirements and deadlines for actions related to conducting risk evaluations of existing chemicals.

Under TSCA § 6(b), the Environmental Protection Agency (EPA) must designate chemical substances as high-priority substances for risk evaluation or low-priority substances for which risk evaluations are not warranted at the time, and upon designating a chemical substance as a high-priority substance, initiate a risk evaluation on the substance. TSCA § 6(b)(4) directs EPA risk evaluations for existing chemicals, to "*determine whether a chemical substance presents an unreasonable risk of injury to health or the environment, without consideration of costs or other non- risk factors, including an unreasonable risk to a potentially exposed or susceptible subpopulation identified as relevant to the risk evaluation by the Administrator under the conditions of use*."

TSCA § 6(b)(4)(D) and implementing regulations require that EPA publish the scope of the risk evaluation to be conducted, including the hazards, exposures, conditions of use and PESS that the Administrator expects to consider, within 6 months after the initiation of a risk evaluation. In addition, a draft scope is to be published pursuant to 40 CFR 702.41. In December 2019, EPA published a list of 20 chemical substances that have been designated high priority substances for risk evaluations (Docket ID: EPA-HQ-OPPT-2018-0446), as required by TSCA § 6(b)(2)(B), which initiated the risk evaluation process for those chemical substances. *p*-Dichlorobenzene is one of the chemicals designated as a high priority substance for risk evaluation.

2 SCOPE OF THE EVALUATION

2.1 Reasonably Available Information

EPA conducted a comprehensive search for reasonably available information[1] to support the development of this draft scope document for *p*-dichlorobenzene. EPA leveraged the data and information sources already identified in the documents supporting the chemical substance's high-priority substance designation. In addition, EPA searched for additional data and information on physical and chemical properties, environmental fate, engineering, exposure, environmental and human health hazards that could be obtained from the following general categories of sources:

1. Databases containing publicly available, peer-reviewed literature;
2. Gray literature, which is defined as the broad category of data/information sources not found in standard, peer-reviewed literature databases.
3. Data and information submitted under TSCA Sections 4, 5, 8(e), and 8(d), as well as "for your information" (FYI) submissions.

[1] *Reasonably available information* means information that EPA possesses or can reasonably generate, obtain, and synthesize for use in risk evaluations, considering the deadlines specified in TSCA Section 6(b)(4)(G) for completing such evaluation. Information that meets the terms of the preceding sentence is reasonably available information whether or not the information is confidential business information, that is protected from public disclosure under TSCA Section 14 (40 CFR 702.33).

Following the comprehensive search, EPA performed a title and abstract screening to identify information potentially relevant for the risk evaluation process. This step also classified the references into useful categories or tags to facilitate the sorting of information through the systematic review process. The search and screening process was conducted based on EPA's general expectations for the planning, execution and assessment activities outlined in the *Application of Systematic Review in TSCA Risk Evaluations* document (U.S. EPA, 2018a). EPA will publish supplemental documentation on the systematic review methods supporting the *p*-dichlorobenzene risk evaluation to explain the literature and screening process presented in this document in the form of literature inventory trees. Please note that EPA focuses on the data collection phase (consisting of data search, data screening, and data extraction) during the preparation of the TSCA scope document, whereas the data evaluation and integration stages will occur during the development of the draft risk evaluation and thus are not part of the scoping activities described in this document.

The subsequent sections summarize the data collection activities completed to date for the general categories of sources and topic areas (or disciplines) using systematic review methods. EPA plans to seek public comments on the systematic review methods supporting the risk evaluation for *p*-dichlorobenzene upon publication of the supplemental documentation of those methods.

2.1.1 Search of Gray Literature

EPA surveyed the gray literature[1] and identified 131 search results relevant to EPA's risk assessment needs for *p*-dichlorobenzene. Appendix A lists the gray literature sources that yielded 131 discrete data or information sources relevant to *p*-dichlorobenzene. EPA further categorized the data and information into the various topic areas (or disciplines) supporting the risk evaluation (e.g., physical chemistry, environmental fate, ecological hazard, human health hazard, exposure, engineering) and the breakdown is shown in Figure 2-1. EPA is currently identifying additional reasonably available information (e.g., public comments), and the reported numbers in Figure 2-1 may change.

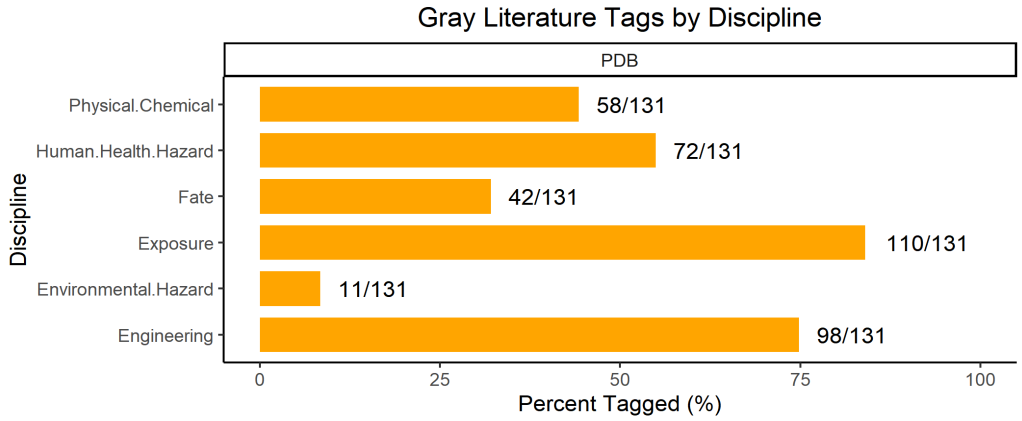

Figure 2-1. Gray Literature Tag Results by Discipline for *p*-Dichlorobenzene

The percentages across disciplines do not add up to 100%, as each source may provide data or information for various topic areas (or disciplines).

[1] Gray literature is defined as the broad category of data/information sources not found in standard, peer-reviewed literature databases (e.g., PubMed and Web of Science). Gray literature includes data/information sources such as white papers, conference proceedings, technical reports, reference books, dissertations, information on various stakeholder websites, and other databases.

2.1.2 Search of Literature from Publicly Available Databases (Peer-Reviewed Literature)

EPA is currently conducting a systematic review of the reasonably available literature. This includes performing a comprehensive search of the reasonably available peer review literature on physical-chemical properties, environmental fate and transport, engineering (environmental release and occupational exposure), exposure (environmental, general population and consumer) and environmental and human health hazards of *p*-dichlorobenzene. Eligibility criteria were applied in the form of PECO (population, exposure, comparator, outcome) statements. Included references met the PECO criteria, whereas excluded references did not meet the criteria (i.e., not relevant), and supplemental material was considered as potentially relevant. EPA plans to analyze the reasonably available information identified for each discipline during the development of the risk evaluation. The literature inventory trees depicting the number of references that were captured and those that were included, excluded, or tagged as supplemental material during the screening process for each discipline area are shown in Figure 2-2 through Figure 2-6. "TIAB" in these figures refer to "title and abstract" screening. Note that in some figures the sum of the numbers for the various sub-categories may be larger than the broader category because some studies may be included under multiple sub-categories. In other cases, the sum of the various sub-categories may be smaller than the main category because some studies may not be depicted in the sub-categories if their relevance to the risk evaluation was unclear.

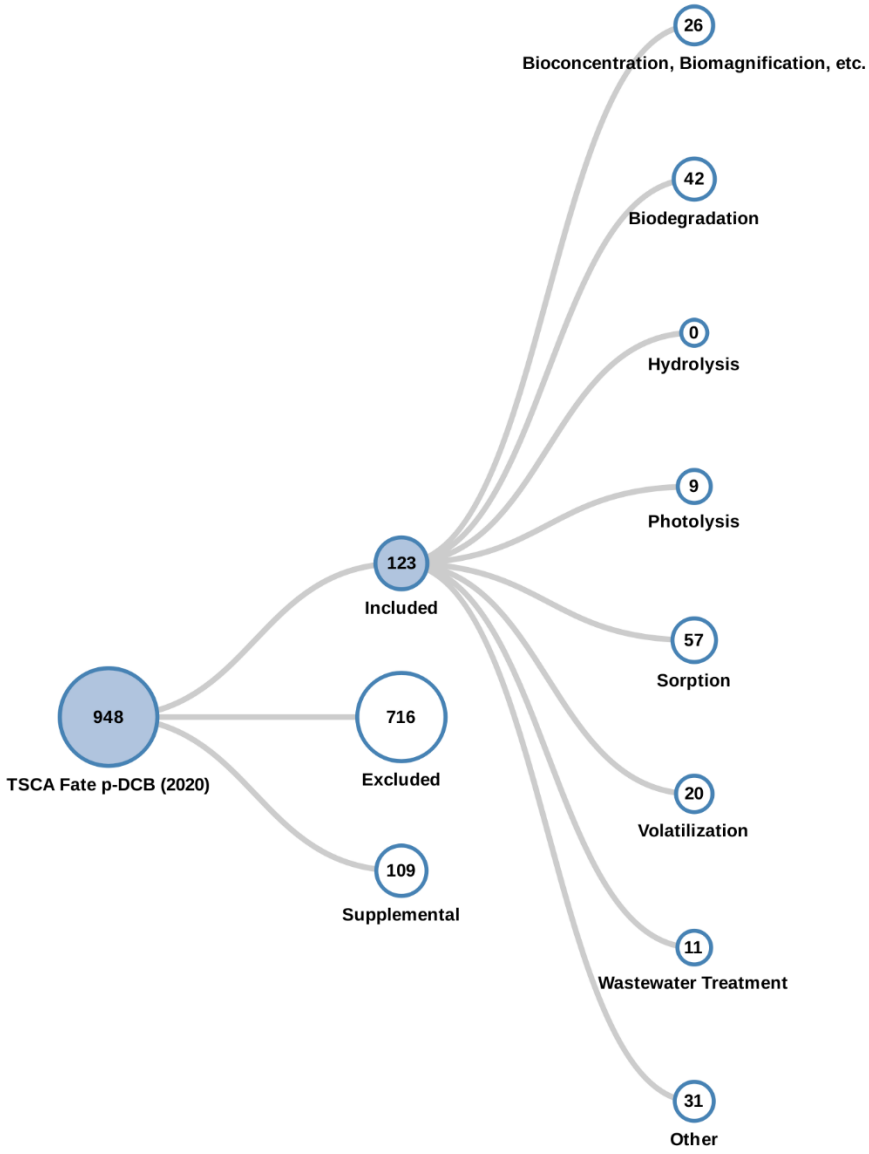

Figure 2-3. Peer-reviewed Literature - Fate and Transport Search Results for *p-Dichlorobenzene*

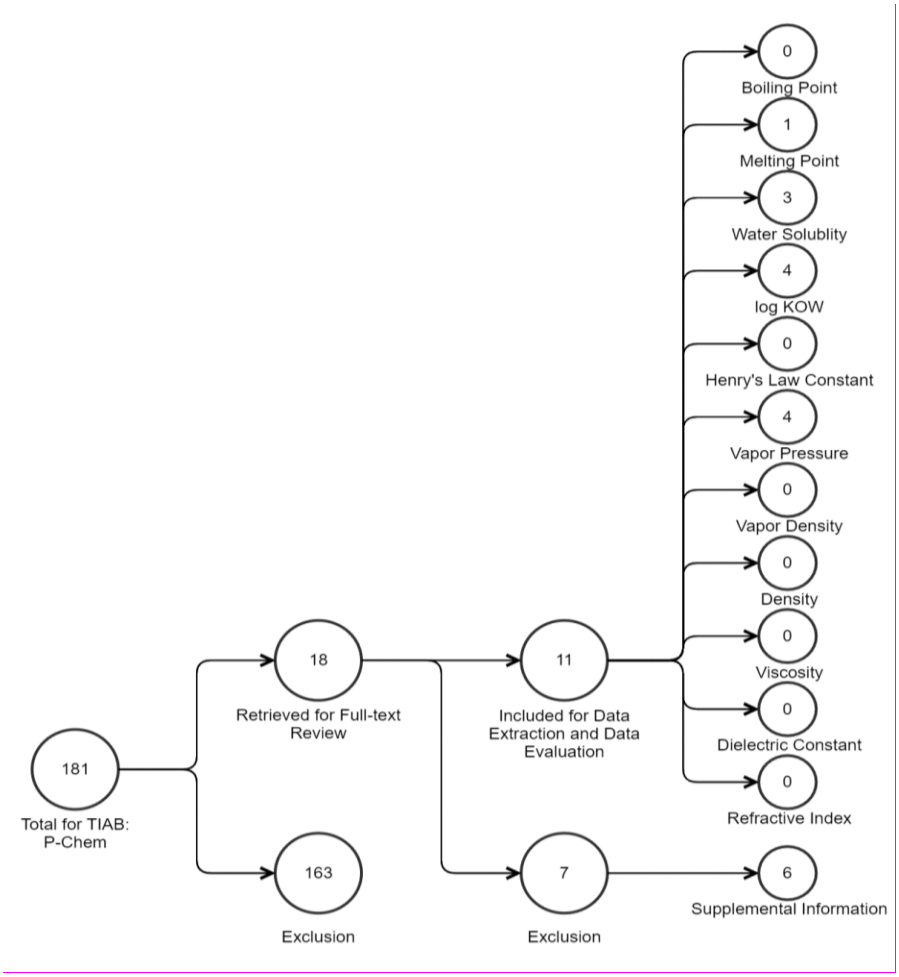

Figure 2-2. Peer-reviewed Literature- Physical-Chemical Properties Search Results for *p*-Dichlorobenzene

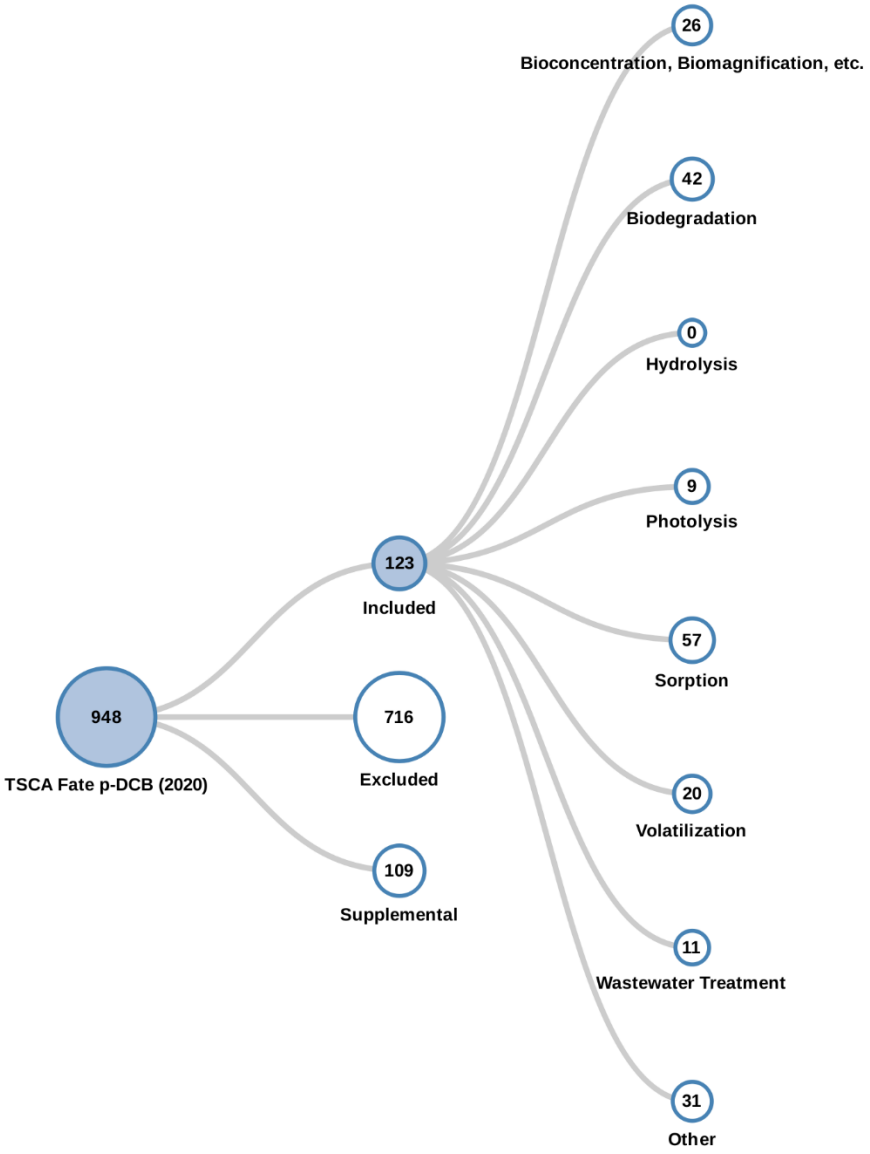

Figure 2-3. Peer-reviewed Literature - Fate and Transport Search Results for *p*-Dichlorobenzene
Click here for interactive Health Assessment Workplace Collaborative (HAWC) Diagram.

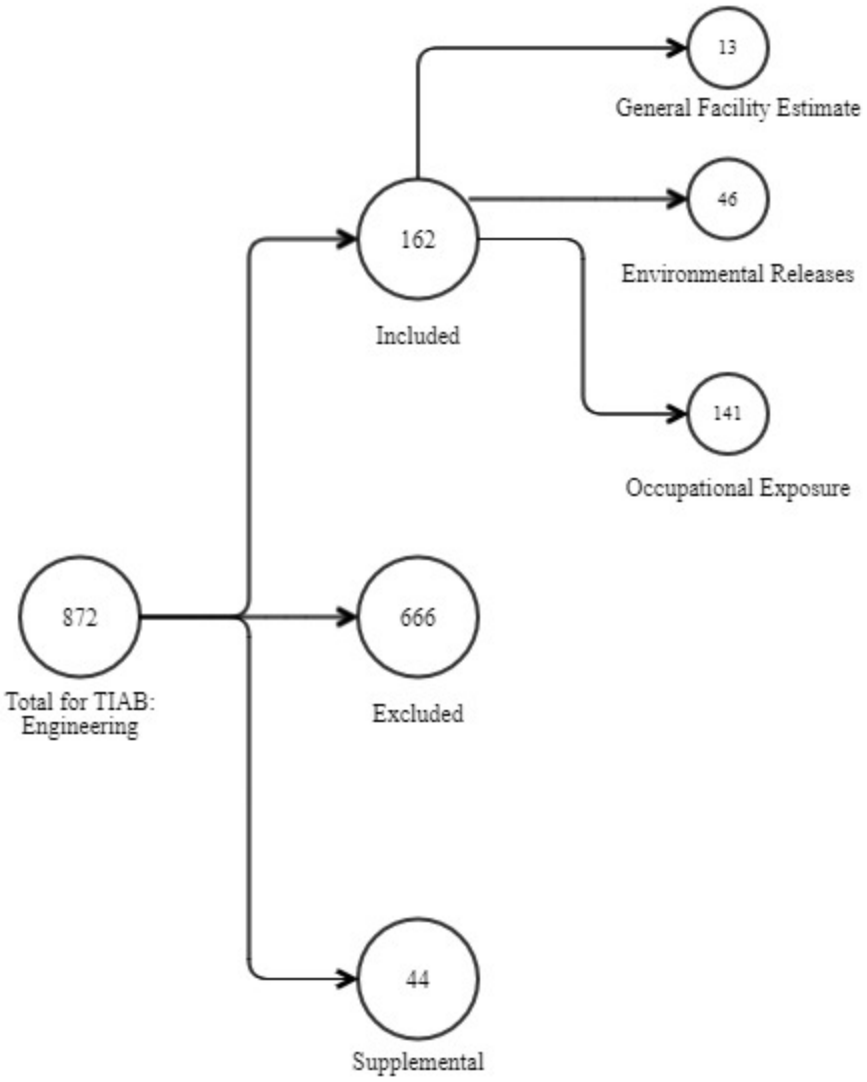

Figure 2-4. Peer-reviewed Literature - Engineering Search Results for *p*-Dichlorobenzene

Figure 2-5. Peer-reviewed Literature Exposure Search Results for *p*-Dichlorobenzene

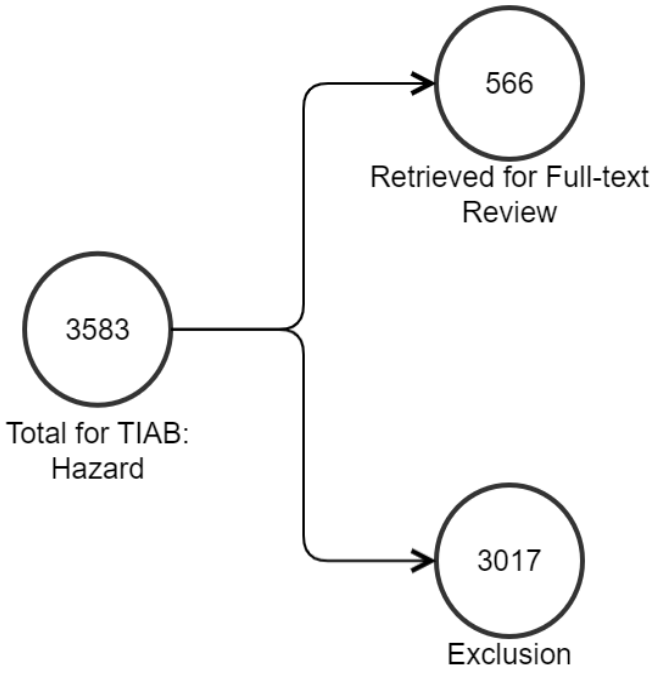

Figure 2-6. Peer-reviewed Literature- Hazard Search Results for *p*-Dichlorobenzene

2.1.3 Search of TSCA Submissions

Table 2-1 presents the results of screening the titles of data sources and reports submitted to EPA under various sections of TSCA. EPA screened a total of 111 submissions using inclusion/exclusion criteria specific to individual disciplines (see Table 2-1 for the list of disciplines). The details about the criteria are not part of this document but will be provided in a supplemental document that EPA anticipates releasing prior to the finalization of the scope document. EPA identified 70 submissions that met the inclusion criteria in these statements and identified 27 submissions with supplemental data. EPA excluded 14 submissions because the reports were identified as one of the following:

- Published report that would be identified via other peer or gray literature searches
- Preliminary report of a final available submitted report
- Duplicate of another report
- Submission on a different chemical
- Data not relevant to any discipline

EPA plans to conduct additional deduplication at later stages of the systematic review process (e.g., full text screening), when more information regarding the reports is available.

Table 2-1. Results of Title Screening of Submissions to EPA under Various Sections of TSCA [a]

Discipline	Included	Supplemental [b]
Physicochemical Properties	1	0
Environmental Fate and Transport	9	0
Environmental and General Population Exposure	42	1
Occupational Exposure/Release Information	5	2
Environmental Hazard	11	2
Human Health Hazard	19	24

[a] Individual submissions may be relevant to multiple disciplines.
[b] Included submissions may contain supplemental data for other disciplines, which will be identified at full-text review.

2.2 Conditions of Use

As described in the *Proposed Designation of p-Dichlorobenzene (CASRN 106-46-7) as a High Priority Substance for Risk Evaluation* (U.S. EPA, 2019a), EPA assembled information from the CDR and TRI programs to determine conditions of use[2] or significant changes in conditions of use of the chemical substance. EPA also consulted a variety of other sources to identify uses of *p*-dichlorobenzene including: published literature, company websites, and government and commercial trade databases and publications. To identify formulated products containing *p*-dichlorobenzene, EPA searched for safety data sheets (SDS) using internet searches, EPA Chemical and Product Categories (CPCat) data, and other resources in which SDSs could be found. In addition, EPA incorporated communications with companies, industry groups, environmental organizations, and public comments to supplement the condition of use information.

EPA identified and described the categories and subcategories of conditions of use that EPA plans to include in the scope of the risk evaluation (Section 2.2.1; Table 2-2). The conditions of use that EPA plans to include in the scope are those reflected in the life cycle diagrams and conceptual models.

After gathering reasonably available information related to the manufacture, processing, distribution in commerce, use, and disposal of *p*-dichlorobenzene, EPA identified those categories or subcategories of use activities for *p*-dichlorobenzene the Agency determined not to be conditions of use or will otherwise be excluded during scoping. These categories and subcategories are described in Section 2.2.2.

2.2.1 Categories and Subcategories of Conditions of Use Included in the Scope of the Risk Evaluation

Table 2-2 lists the conditions of use that EPA plans to include in the scope of the risk evaluation.

[2] *Conditions of use* means the circumstances, as determined by the Administrator, under which a chemical substance is intended, known, or reasonably foreseen to be manufactured, processed, distributed in commerce, used, or disposed of..

Table 2-2. Categories and Subcategories of Conditions of Use Included in the Scope of the Risk Evaluation

Life-Cycle Stage	Category	Subcategory	References
Manufacturing	Import	Import	U.S. EPA, 2019b
Processing	Processing as a reactant	Intermediate in: plastic material and resin manufacturing pharmaceutical manufacturing; all other basic organic chemical manufacturing; dye manufacturing.	U.S. EPA, 2019b;
	Processing – incorporation into formulation, mixture or reaction product	Intermediates in plastic material and resin manufacturing	U.S. EPA, 2019b
		Constituent in oils; Solvents (which become part of product formulation or mixture in plastic material and resin manufacturing)	EPA-HQ-OPPT-2018-0446-0007
		Odor agents (deodorizers)	U.S. EPA, 2019b
	Processing – incorporation into article	Other, including in plastic product manufacturing	U.S. EPA CPCat, EPA-HQ-OPPT-2018-0446-0017
		Intermediates in Pesticides, fertilizer and other agricultural chemical manufacturing (moth repellant)	U.S. EPA, 2019b
		Odor agents in Wholesale and retail trade	U.S. EPA, 2019b
		Pharmaceutical and medicine manufacturing	U.S. EPA, 2019b
	Recycling		U.S. EPA, 2019b
Distribution in commerce	Distribution in commerce	Distribution in commerce	
Commercial use	Air care products	Continuous action air fresheners (including toilet/urinal deodorizers/fresheners), cleaning and furnishing care uses	U.S. EPA, 2019b; EPA-HQ-OPPT-2018-0446-0004; DeLima Associates(2014); 8220 Round Block PARA Cherry Pink (2018),SDS

	Automotive care products	Automotive care products	U.S. EPA, 2019b; Marvel Mystery Oil (2017)
	Lubricants and greases	Lubricants and greases, degreasers	U.S. EPA, 2019b; Marvel Mystery Oil (2017) SDS
	Other use	e.g., Laboratory and analytical uses	U.S. EPA, 2019b; Paulex Powder Embalming (2016) SDS
	Building and construction products	e.g., Plastic foam insulation, foam sealant	Touch n' Foam Mouse Shield Can Foam Sealant and Blocker (2019) SDS
Consumer use	Building and construction products	e.g., Plastic foam insulation, foam sealant	Touch n' Foam Mouse Shield Can Foam Sealant and Blocker (2019) SDS
	Air care products	Continuous action air fresheners (including toilet/urinal deodorizers/fresheners)	U.S. EPA, 2019b; EPA-HQ-OPPT-2018-0446-0004; DeLima Associates (2014);
	Automotive care products	Automotive care products (including automotive fuel additive)	U.S. EPA, 2019b; Marvel Oil Company (2017) SDS
Disposal	Disposal	Disposal	

- Life Cycle Stage Use Definitions (40 CFR § 711.3)
  - "Industrial use" means use at a site at which one or more chemicals or mixtures are manufactured (including imported) or processed.
  - "Commercial use" means the use of a chemical or a mixture containing a chemical (including as part of an article) in a commercial enterprise providing saleable goods or services.
  - "Consumer use" means the use of a chemical or a mixture containing a chemical (including as part of an article, such as furniture or clothing) when sold to or made available to consumers for their use.
- Although EPA has identified both industrial and commercial uses here for purposes of distinguishing scenarios in this document, the Agency interprets the authority over "any manner or method of commercial use" under TSCA section 6(a)(5) to reach both.
- These subcategories reflect more specific uses of *p*-Dichlorobenzene.
- The Agency has included information in this draft scope document sourced from the 2012 and 2016 Chemical Data Reporting (CDR) Rule collections. In instances where particular CDR data elements included in this document were claimed as confidential business information (CBI), the Agency reviewed the claims and secured their declassification.

2.2.2 Activities Excluded from the Scope of the Risk Evaluation

As explained in the final rule, *Procedures for Chemical Risk Evaluation Under the Amended Toxic Substances Control Act*, TSCA Section 6(b)(4)(D) requires EPA to identify the hazards, exposures, conditions of use, and the PESS the Administrator expects to consider in a risk evaluation, suggesting that EPA may exclude certain activities that it determines to be conditions of use on a case-by-case basis (82 FR 33726, 33729; July 20, 2017). TSCA section 3(4) also grants EPA the authority to determine what constitutes a condition of use for a particular chemical substance. EPA does not plan to include in this scope or in the risk evaluation the activities described below that the Agency has concluded do not constitute conditions of use.

EPA identified two uses that are excluded from the definition of "chemical substance" in TSCA § 3(2)(B)(vi) and are therefore not "conditions of use" (defined as circumstances associated with "a chemical substance" in TSCA § 3(4)). *p*-Dichlorobenzene is used as a conventional chemical insecticide with the majority of the pesticidal uses as a moth repellant. Any pesticide (as defined in the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) 7 U.S.C. §136 et seq (1996) when manufactured, processed, or distributed in commerce for use as a pesticide is excluded from the definition of "chemical substance" in TSCA § 3(2)(B)(vi). Activities and releases associated with such pesticidal uses are therefore not "conditions of use," and EPA does not plan to evaluate them during risk evaluation. Public comments submitted to EPA in the docket also emphasized the use of *p*-dichlorobenzene in pesticides (EPA-HQ-OPPT-2018-0446).

p-Dichlorobenzene is authorized for use as a food contact substance in food contact polymers, under the definition of "food additive" in the Federal Food, Drug and Cosmetic Act, 21 U.S.C. § 321. Any food additive, when manufactured, processed, or distributed in commerce for use as a food additive, is excluded from the definition of "chemical substance" under TSCA § 3(2)(B)(vi). Activities associated with such food additive uses are therefore not "conditions of use" (defined as circumstances associated with "a chemical substance[3]," TSCA § 3(4)) and EPA does not plan to evaluate them during risk evaluation.

2.2.3 Production Volume

As reported to EPA during the 2016 CDR reporting period and described here as a range to protect production volumes that were claimed as confidential business information (CBI), total production volume of *p*-dichlorobenzene in 2015was between 50 million and 100 million pounds (U.S. EPA 2017). EPA also uses pre-2015 CDR production volume information, as detailed in the *Proposed Designation of p-Dichlorobenzene (CASRN 106-46-7) as a High Priority Substance for Risk Evaluation* (U.S. EPA, 2019a) and will include future production volume information as it becomes available to support the exposure assessment.

[3] *Chemical substance* means any organic or inorganic substance of a particular molecular identity, including any combination of such substances occurring in whole or in part as a result of a chemical reaction or occurring in nature, and any element or uncombined radical. Chemical substance does not include (1) any mixture; (2) any pesticide (as defined in the Federal Insecticide, Fungicide, and Rodenticide Act) when manufactured, processed, or distributed in commerce for use as a pesticide; (3) tobacco or any tobacco product; (4) any source material, special nuclear material, or byproduct material (as such terms are defined in the Atomic Energy Act of 1954 and regulations issued under such Act); (5) any article the sale of which is subject to the tax imposed by Section 4181 of the Internal Revenue Code of 1954 (determined without regard to any exemptions from such tax provided by Section 4182 or 4221 or any other provision of such Code), and; (6) any food, food additive, drug, cosmetic, or device (as such terms are defined in Section 201 of the Federal Food, Drug, and Cosmetic Act) when manufactured, processed, or distributed in commerce for use as a food, food additive, drug, cosmetic, or device.

2.2.4 Overview of Conditions of Use and Lifecycle Diagram

The life cycle diagram provided in Figure 2-7 depicts the conditions of use that are considered within the scope of risk evaluation for the various life cycle stages. This section provides a brief overview of the industrial, commercial and consumer use categories included in the life cycle diagram. The activities that the EPA determined are out of scope are not included in the life cycle diagram. 2.8Appendix E contains additional descriptions (e.g., process descriptions, worker activities, process flow diagrams) for each manufacture, processing, distribution in commerce, use and disposal category.

The information in the life cycle diagram is grouped according to the CDR processing codes and use categories (including functional use codes for industrial uses and product categories for industrial, commercial and consumer uses).

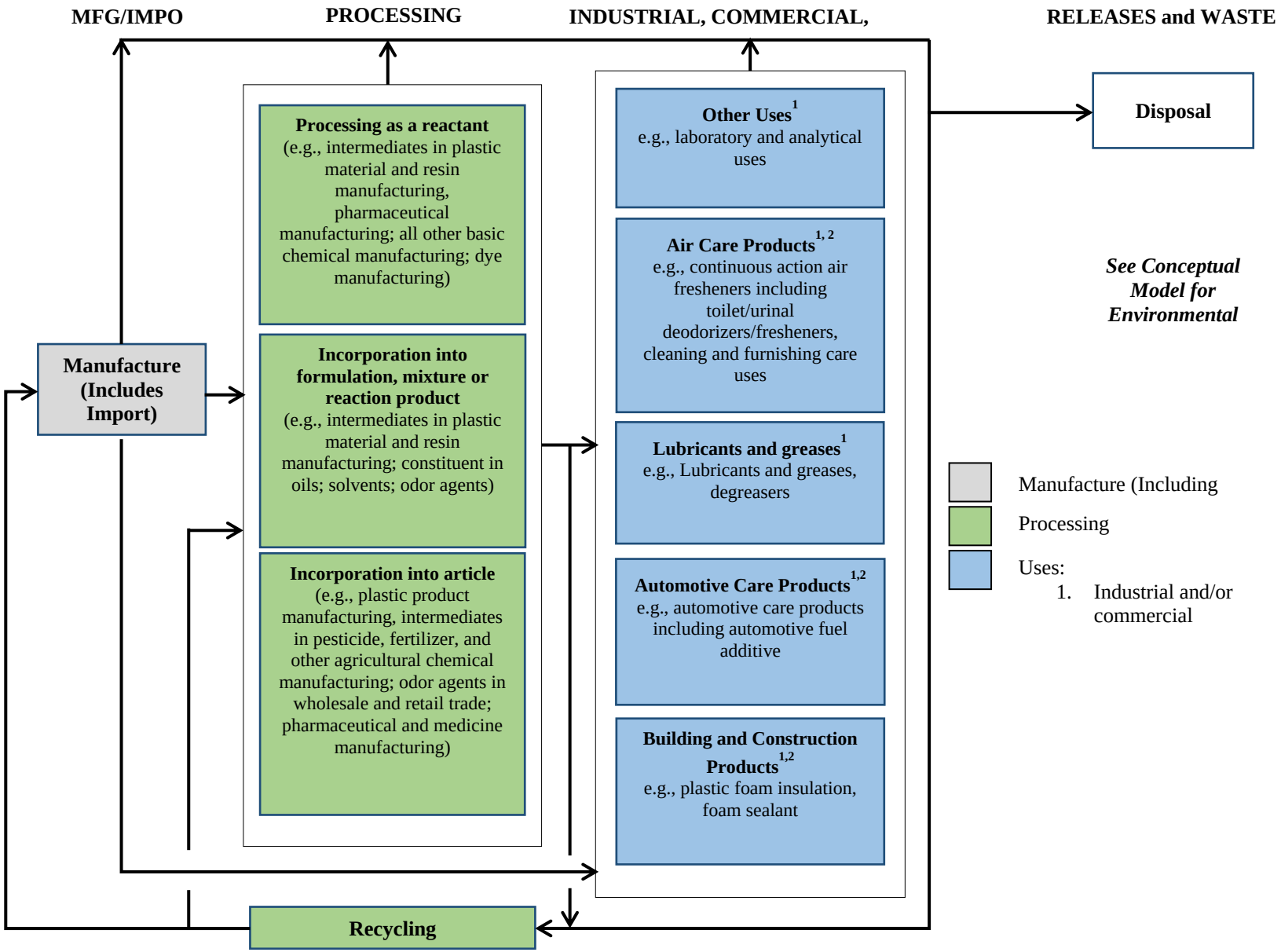

Figure 2-7. *p*-Dichlorobenzene Life Cycle Diagram

Volume is not depicted in the life cycle diagram for processing and industrial, commercial, and consumer uses as specific production volume is claimed confidential business information (CBI) or withheld pursuant to TSCA section § 14.

2.3 Exposures

For TSCA exposure assessments, EPA plans to analyze exposures and releases to the environment resulting from the conditions of use within the scope of the risk evaluation for of *p*-dichlorobenzene. Release pathways and routes will be described to characterize the relationship or connection between the conditions of use of the chemical and the exposure to human receptors, including potentially exposed or susceptible subpopulations, and environmental receptors. EPA plans to consider, where relevant, the duration, intensity (concentration), frequency, and number of exposures in characterizing exposures to *p*-dichlorobenzene.

2.3.1 Physical and Chemical Properties

Physical and chemical properties are essential for a thorough understanding or prediction of environmental fate (i.e., transport and transformation) and the eventual environmental concentrations. They can also inform the hazard assessment. EPA plans to use the physical and chemical properties described in Table 7 of the *Proposed Designation of p-Dichlorobenzene (CASRN 106-46-7) as a High Priority Substance for Risk Evaluation* (U.S. EPA, 2019a) to support the development of the risk evaluation for *p*-dichlorobenzene. The values for the physical and chemical properties (Appendix B) may be updated as EPA collects additional information through systematic review methods.

2.3.2 Environmental Fate and Transport

Understanding of environmental fate and transport processes assists in the determination of the specific exposure pathways and potential human and environmental receptors that need to be assessed in the risk evaluation for *p*-dichlorobenzene. EPA plans to use the environmental fate characteristics described in Table 8 of the *Proposed Designation of p-Dichlorobenzene (CASRN 106-46-7) as a High Priority Substance for Risk Evaluation* (U.S. EPA, 2019a) to support the development of the risk evaluation for *p*-dichlorobenzene. The values for the environmental fate properties (Appendix C) may be updated as EPA collects additional information through systematic review methods.

2.3.3 Releases to the Environment

Releases to the environment from conditions of use are a component of potential exposure and may be derived from reported data that are obtained through direct measurement, calculations based on empirical data and/or assumptions and models.

A source of information that EPA plans to consider in evaluating exposure are data reported to the Toxics Release Inventory (TRI) program. EPA's TRI database contains information on chemical waste management activities that are disclosed by industrial and federal facilities, including quantities released into the environment (i.e., to air, water, and disposed to land), treated, burned for energy, recycled, or transferred off-site to other facilities for these purposes.

Under Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) *p*-dichlorobenzene is a TRI-reportable substance, under the name 1,4-dichlorobenzene, effective January 01, 1987 (40 CFR 372.65). For TRI reporting[4], facilities in covered sectors in the United States are required to disclose releases and other waste management activity quantities of *p*-dichlorobenzene under the CASRN 106-46-7 if they manufacture (including import) or process more than 25,000 pounds or otherwise use more than 10,000 pounds of the chemical in a given year by July 1 of the following year.

[4] For TRI reporting criteria see https://www.epa.gov/toxics-release-inventory-tri-program/basics-tri-reporting

Table 2-3 provides production-related waste management data for *p*-dichlorobenzene reported by facilities to the TRI program for reporting year 2018.[5] As shown in the Table 2-3, 16 facilities reported in total nearly 2.7 million pounds of *p*-dichlorobenzene as production-related waste. Of this total, over 1.45 million pounds were recycled and over 1.14 million pounds were treated. Only 1% (approximately 29,000 pounds) of the production-related waste was burned for energy recovery during 2018, and only 2% was released to the environment. The majority of the quantities (92%) of *para*-dichlorobenzene managed as production-related waste were managed as such on site.

Table 2-3. Summary of *p*-Dichlorobenzene TRI Production-Related Waste Managed in 2018

Year	Number of Facilities	Recycled (lbs)	Recovered for Energy (lbs)	Treated (lbs)	Released[a,b,c] (lbs)	Total Production Related Waste (lbs)
2018	16	1,453,833	28,739	1,140,897	55,392	2,678,861

Data source: 2018 TRI Data (U.S. EPA, 2019c)
[a] Terminology used in these columns may not match the more detailed data element names used in the TRI public data and analysis access points.
[b] Does not include releases due to one-time event not associated with production such as remedial actions or earthquakes.
[c] Counts all releases including release quantities transferred and release quantities disposed of by a receiving facility reporting to TRI.

Table 2-3 provides a summary of *p*-dichlorobenzene released to the environment during 2018 as reported to TRI. Quantities of *p*-dichlorobenzene disposed to land and released to air were roughly equal. Comparatively much smaller amounts were discharged to water or designated as "other releases". The quantities of *p*-dichlorobenzene that were disposed of on land were almost exclusively on site to RCRA Subtitle C landfills, and account for approximately 50% of the total amount of *p*-dichlorobenzene released to the environment in 2018. Air releases accounted for 47% of total *p*-dichlorobenzene releases; fugitive air releases comprised the majority of air releases, with only about 1/6 from point sources (i.e., stacks). Of the total *p*-dichlorobenzene disposed of or otherwise released during 2018, only 3% took place off site: nearly all of this quantity was sent off site to waste brokers for disposal, as reported in Table 2-4 under "other releases".

Table 2-4. Summary of Releases of *p*-Dichlorobenzene to the Environment During 2018

Year	Number of Facilities	Air Releases		Water Releases (lbs)	Land Disposal			Other Releases [a] (lbs)	Total Releases [b, c] (lbs)
		Stack Air Releases (lbs)	Fugitive Air Releases (lbs)		Class I Under-ground Injection (lbs)	RCRA Subtitle C Landfills (lbs)	All other Land Disposal [a] (lbs)		
	16	4,396	21,761		38	27,997	0	1,788	55,984

[5] Reporting year 2018 is the most recent TRI data available. Data presented in Table2-3 were queried using TRI Explorer and uses the 2018 National Analysis data set (released to the public in November 2019). This dataset includes revisions for the years 1988 to 2018 processed by EPA.

Year	Number of Facilities	Air Releases		Water Releases (lbs)	Land Disposal			Other Releases [a] (lbs)	Total Releases [b, c] (lbs)
		Stack Air Releases (lbs)	Fugitive Air Releases (lbs)		Class I Under-ground Injection (lbs)	RCRA Subtitle C Landfills (lbs)	All other Land Disposal [a] (lbs)		
2018		26,157		5	28,034				

Data source: 2018 TRI Data (U.S. EPA, 2019c)
[a] Terminology used in these columns may not match the more detailed data element names used in the TRI public data and analysis access points.
[b] These release quantities do include releases due to one-time events not associated with production such as remedial actions or earthquakes.
[c] Counts release quantities once at final disposition, accounting for transfers to other TRI reporting facilities that ultimately dispose of the chemical waste.

While production-related waste managed shown in Table 2-3 excludes any quantities reported as catastrophic or one-time releases (TRI section 8 data), release quantities shown in Table 2-4 include both production-related and non-production-related quantities. For *p*-dichlorobenzene the total release quantities shown in each table are the same, but for other TRI chemicals total release quantities between the two tables may differ slightly and may further reflect differences in TRI calculation methods for reported release range estimates (U.S. EPA, 2019d).

EPA plans to review these data in conducting the exposure assessment component of the risk evaluation for *p*-dichlorobenzene.

2.3.4 Environmental Exposures

The manufacturing, processing, distribution, use and disposal of *p*-dichlorobenzene can result in releases to the environment and exposure to aquatic and terrestrial receptors (biota). Environmental exposures to biota are informed by releases into the environment, overall persistence, degradation, and bioaccumulation, and partitioning across different media. Concentrations of chemical substances in biota provide evidence of exposure. EPA plans to review reasonably available information on environmental exposures in biota to inform development of the environmental exposure assessment for *p*-dichlorobenzene.

2.3.5 Occupational Exposures

EPA plans to analyze worker activities where there is a potential for exposure under the various conditions of use (manufacturing, processing and industrial/commercial uses) described in Section 2.2.1. In addition, EPA plans to analyze exposure to occupational non-users (ONU's), i.e., workers who do not directly handle the chemical but perform work in an area where the chemical is present. EPA also plans to consider the effect(s) that engineering controls (EC) and/or personal protective equipment (PPE) have on occupational exposure levels as part of the draft risk evaluation.

Workers activities associated with the conditions of use within the scope of the risk evaluation for *p*-dichlorobenzene that EPA will analyze include, but are not limited to:

- Unloading and transferring *p*-dichlorobenzene to and from storage containers and process vessels;
- Cleaning and maintaining equipment;
- Sampling chemicals, formulations, or products containing *p*-dichlorobenzene for quality control;
- Repackaging chemicals, formulations, or products containing *p*-dichlorobenzene;

- Applying formulations and products containing *p*-dichlorobenzene onto substrates (e.g., intermediates in plastic material and resin manufacturing, constituent in oils, odor agents [deodorizers] containing *p*-dichlorobenzene);
- Handling, transporting, and disposing waste containing *p*-dichlorobenzene; and Performing other work activities in or near areas where *p*-dichlorobenzene is used.

p-Dichlorobenzene is a solid that sublimes at ambient temperature and has a vapor pressure of 1.74 mmHg. EPA anticipates that workers and ONUs will be exposed via the inhalation route. EPA plans to analyze inhalation exposure to vapor in scenarios where *p*-dichlorobenzene is handled in open systems. EPA also plans to analyze inhalation exposure to dust/particulates where *p*-dichlorobenzene is present as a solid, powder, or contained in an article (e.g., particulate generated during handling of plastic resins, finishing operations associated with the manufacture and finishing of plastics and plastic articles and incorporation of plastics and other article components into finished products), and inhalation exposure to mists in scenarios where products containing *p*-dichlorobenzene may be spray applied (e.g., air care products, automotive care products). The extent of inhalation exposure could vary from facility to facility depending on many factors including but not limited to EC, type of facility, and design.

In addition, EPA plans to analyze worker exposure to solids and liquids via the dermal route, depending on the specific physical form of *p*-dichlorobenzene in each scenario. EPA does not plan to analyze dermal exposure for ONUs because they do not directly handle the chemical.

EPA generally does not evaluate occupational exposures through the oral route. Workers may inadvertently transfer chemicals from their hands to their mouths, ingest inhaled particles that deposit in the upper respiratory tract or consume contaminated food. The frequency and significance of this exposure route are dependent on several factors including the p-chem properties of the substance during expected worker activities, workers' awareness of the chemical hazards, the visibility of the chemicals on the hands while working, workplace practices, and personal hygiene that is difficult to predict (Cherrie et al., 2006). However, EPA will consider oral exposure on a case-by-case basis for certain COUs and worker activities where there is information and data on incidental ingestion of inhaled dust. EPA will consider ingestion of inhaled dust as an inhalation exposure for *p*-dichlorobenzene.

The United States has several regulatory and non-regulatory exposure limits for *p*-dichlorobenzene: the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) (OSHA, 2020) is 75 parts per million (ppm) or 450 milligrams (mg)/cubic meter (m^3) as an 8-hour time weighted average (TWA). This chemical does not have a National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL), although NIOSH does identify *p*-dichlorobenzene as a potential occupational carcinogen (NIOSH, 2019). NIOSH has set an immediately dangerous to life or health (IDLH) concentration of 150 ppm (NIOSH, 2019). The American Conference of Governmental Industrial Hygienists (ACGIH) set the Threshold Limit Value (TLV) at 10 ppm as an 8-hour TWA (Kirk-Othmer, 2001; NIOSH, 1994).

2.3.6 Consumer Exposures

According to reports of the 2016 CDR, air care products, building/construction materials, and automotive care products were identified as consumer products for *p*-dichlorobenzene. Consumers using or disposing of *p*-dichlorobenzene-based air care products, building/construction materials, and automotive care products may be exposed to *p*-dichlorobenzene through direct solid and liquid contact which may lead to dermal and oral exposure, through vapor emissions, which may lead to inhalation exposure, through mist and/or dust generation which may lead to dermal, inhalation, and oral exposure (see 2.8Appendix D). Bystanders present during the consumer use of air care products,

building/construction materials, and automotive care products or disposal of *p*-dichlorobenzene may also be exposed to vapor emissions, mist generation, and dust generation which may lead to inhalation, dermal, and oral exposure. Based on these potential sources and pathways of exposure, EPA plans to analyze dermal, inhalation, and oral routes of exposure to consumers that may result from the conditions of use of *p*-dichlorobenzene.

There were no reports to CDR of any use of *p*-dichlorobenzene in children's products.

2.3.7 General Population Exposures

Releases of *p*-dichlorobenzene from certain conditions of use, such as manufacturing, processing, or disposal activities, may result in general population exposures. *p*-Dichlorobenzene has been identified as the main dichlorobenzene present in drinking water, likely resulting from its release into surface waters after its extensive use in toilet deodorizers (IARC, 1999).

2.4 Hazards (Effects)

2.4.1 Environmental Hazards

As described in the *Proposed Designation of p-Dichlorobenzene (CASRN 106-46-7) as a High Priority Substance for Risk Evaluation* (U.S. EPA, 2019a), EPA considered reasonably available information from peer-reviewed assessments and databases to identify potential environmental hazards for *p*-dichlorobenzene. EPA considers all the potential environmental hazards for *p*-dichlorobenzene identified during prioritization to be relevant for the risk evaluation and thus they remain within the scope of the evaluation. EPA is in the process of identifying additional reasonably available information through systematic review methods and public comments, which may update the list of potential environmental hazards associated with *p*-dichlorobenzene exposure. If necessary, EPA plans to update the list of potential hazards in the final scope document of *p*-dichlorobenzene risk evaluation.

2.4.2 Human Health Hazards

As described in the *Proposed Designation of p-Dichlorobenzene (CASRN 106-46-7) as a High Priority Substance for Risk Evaluation* (U.S. EPA, 2019a), EPA considered reasonably available information from peer-reviewed assessments and databases to identify potential human health hazards for *p*-dichlorobenzene. EPA plans to evaluate all of the potential human health hazards for *p*-dichlorobenzene identified during prioritization. The health effect categories screened for during prioritization included acute toxicity, irritation/corrosion, dermal sensitization, respiratory sensitization, genetic toxicity, repeated dose toxicity, reproductive toxicity, developmental toxicity, immunotoxicity, neurotoxicity, carcinogenicity, epidemiological or biomonitoring studies and ADME. EPA is in the process of identifying additional reasonably available information through systematic review methods and public input, which may update the list of potential human health hazards under the scope of the risk evaluation. EPA plans to update the list of potential hazards in the final scope document of the *p*-dichlorobenzene risk evaluation.

2.5 Potentially Exposed or Susceptible Subpopulations

TSCA § 6(b)(4) requires EPA to determine whether a chemical substance presents an unreasonable risk to "a potentially exposed or susceptible subpopulation identified as relevant to the risk evaluation." TSCA §3(12) states that "the term 'potentially exposed or susceptible subpopulation' means a group of individuals within the general population identified by the Administrator who, due to either greater susceptibility or greater exposure, may be at greater risk than the general population of adverse health effects from exposure to a chemical substance or mixture, such as infants, children, pregnant women,

workers, or the elderly." General population is "the total of individuals inhabiting an area or making up a whole group" and refers here to the U.S. general population (U.S. EPA, 2011).

During the Prioritization process, EPA identified the following PESS based on CDR information and studies reporting developmental and reproductive effects: children, women of reproductive age (e.g., pregnant women per TSCA statute), workers and consumers (U.S. EPA 2019b). EPA plans to evaluate these PESS in the risk evaluation.

In developing exposure scenarios, EPA plans to analyze available data to ascertain whether some human receptor groups may be exposed via exposure pathways that may be distinct to a particular subpopulation or life stage (e.g., children's crawling, mouthing or hand-to-mouth behaviors) and whether some human receptor groups may have higher exposure via identified pathways of exposure due to characteristics (e.g., activities, duration or location of exposure) when compared with the general population (U.S. EPA, 2006). Likewise, EPA plans to evaluate available human health hazard information to ascertain whether some human receptor groups may have greater susceptibility than the general population to the chemical's hazard(s).

2.6 Conceptual Models

In this section, EPA presents the conceptual models describing the identified exposures (pathways and routes), receptors and hazards associated with the conditions of use of *p*-dichlorobenzene. Pathways and routes of exposure associated with workers and occupational non-users are described in Section 2.6.1. Pathways and routes of exposure associated with consumers are described in Section 2.6.2, and routes of exposure associated with environmental releases and wastes, including those pathways that may be addressed pursuant to other Federal laws are discussed and depicted the conceptual model shown in Section 2.6.3. Pathways and routes of exposure associated with environmental releases and wastes, excluding those pathways that may be addressed pursuant to other Federal laws are presented in the conceptual model shown in Section 2.6.4.

2.6.1 Conceptual Model for Industrial and Commercial Activities and Uses: Potential Exposures and Hazards

Figure 2-8 illustrates the conceptual model for the pathways of exposure from industrial and commercial activities and uses of *p*-dichlorobenzene that EPA plans to include in the risk evaluation. There is potential for exposures to workers and/or ONU's via inhalation routes and exposures to workers via dermal routes. It is expected that inhalation exposure to vapors is the most likely exposure route. In addition, workers at waste management facilities may be exposed via inhalation or dermal routes via wastewater treatment, incineration or other disposal methods. EPA plans to evaluate activities resulting in exposures associated with distribution in commerce (e.g., loading, unloading) throughout the various lifecycle stages and conditions of use (e.g., manufacturing, processing, industrial use, commercial use, and disposal) rather than a single distribution scenario. For each condition of use identified in Table 2-2, an initial determination was made whether or not each combination of exposure pathway, route, and receptor will be further assessed in the risk evaluation. The supporting rationale are presented in 2.8Appendix F.

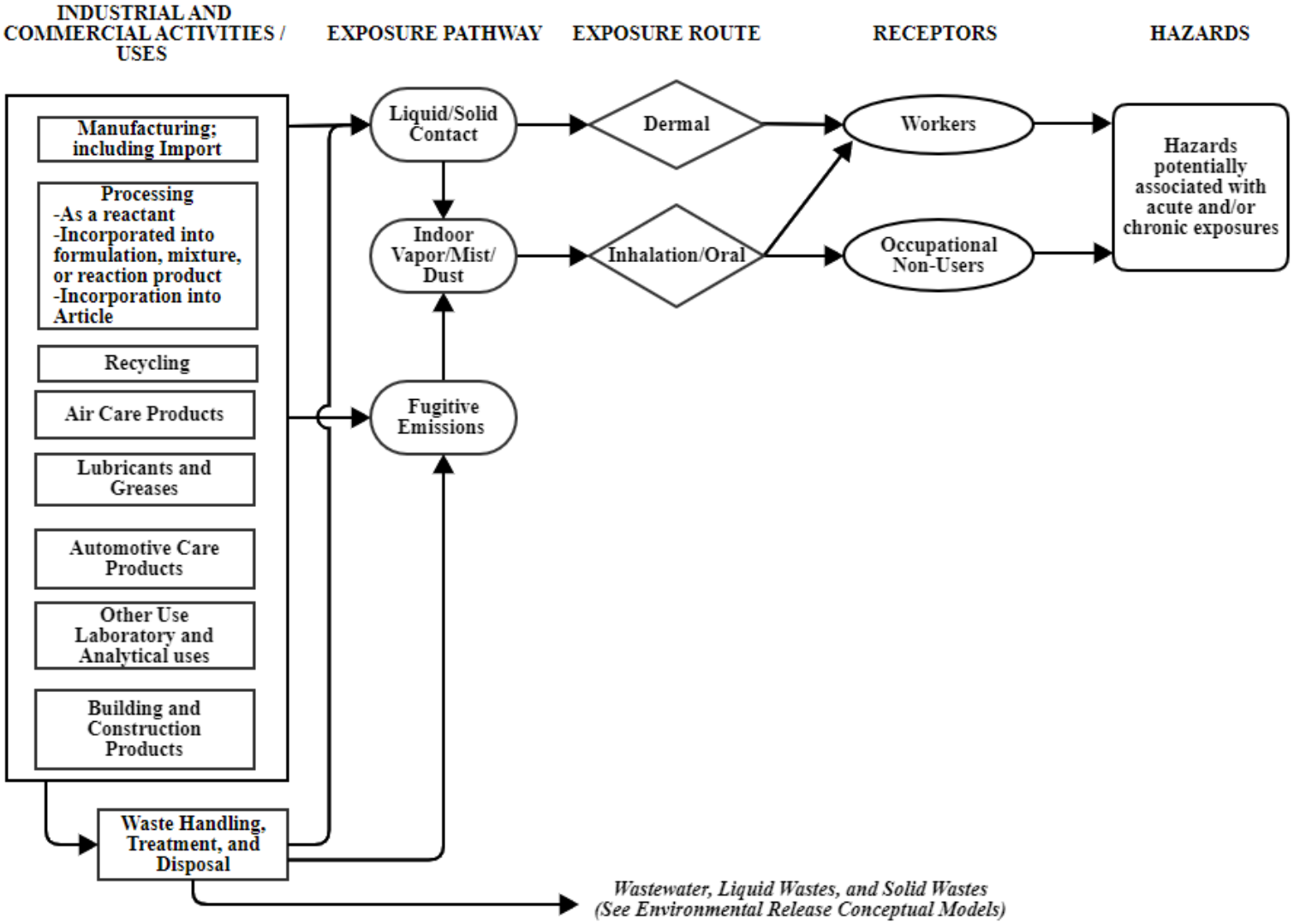

Figure 2-8. *p*-Dichlorobenzene Conceptual Model for Industrial and Commercial Activities and Uses: Worker and Occupational Non-User Exposures and Hazards

The conceptual model presents the exposure pathways, exposure routes, and hazards to human receptors from industrial and commercial activities and uses of *p*-dichlorobenzene.

2.6.2 Conceptual Model for Consumer Activities and Uses: Potential Exposures and Hazards

The conceptual model in Section 2.6.4 presents the exposure pathways, exposure routes and hazards to human receptors from consumer activities and uses of *p*-dichlorobenzene. EPA expects inhalation to be the primary route of exposure and plans to further analyze inhalation exposures to *p*-dichlorobenzene vapor for consumer and bystanders. Oral and dermal exposures to consumers may occur via direct liquid, solid, mist, or dust contact during use. Inhalation exposure may occur via vapor, mist, and dust generation. Bystanders are not expected have direct dermal contact with liquid or solid *p*-dichlorobenzene but may be exposed dermally to mist and dust generation. For each consumer condition of use identified in Table 2-2, EPA made a determination as to whether each combination of exposure pathway, route, and receptor will be further analyzed in the risk evaluation. The results of that analysis along with the supporting rationale are presented in 2.8Appendix G.

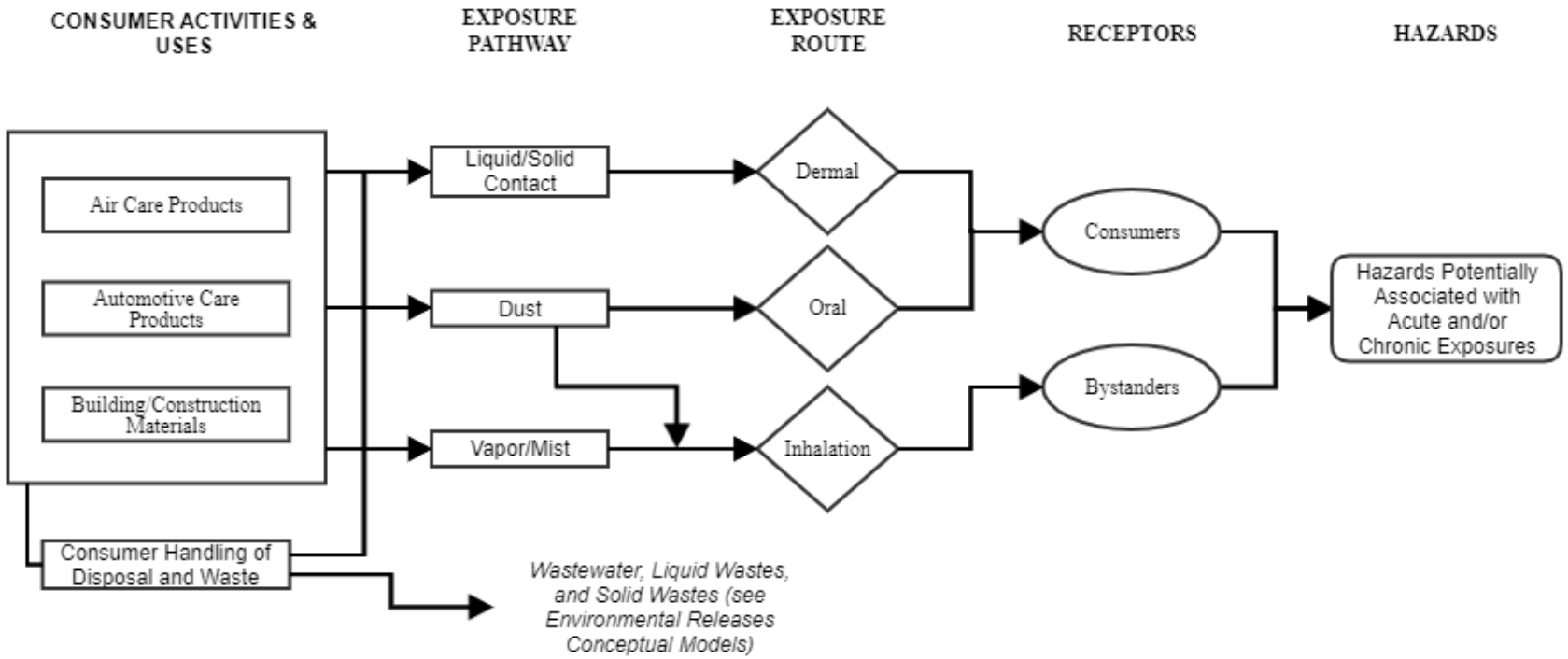

Figure 2-9. *p*-Dichlorobenzene Conceptual Model for Consumer Activities and Uses: Consumer Exposures and Hazards
The conceptual model presents the exposure pathways, exposure routes and hazards to human receptors from consumer activities and uses of *p*-dichlorobenzene.

2.6.3 Conceptual Model for Environmental Releases and Wastes: Potential Exposures and Hazards (Regulatory Overlay)

In this section, EPA presents the conceptual models describing the identified exposures (pathways and routes), receptors and hazards associated with the conditions of use of *p*-dichlorobenzene within the scope of the risk evaluation. It also discusses those pathways that may be addressed pursuant to other Federal laws.

In complying with TSCA, EPA plans to efficiently use Agency resources, avoid duplicating efforts taken pursuant to other Agency programs, maximize scientific and analytical efforts, and meet the statutory deadline for completing risk evaluations. OPPT is working closely with the offices within EPA that administer and implement the Clean Air Act (CAA), the Safe Drinking Water Act (SDWA), the Clean Water Act (CWA) and the Resource Conservation and Recovery Act (RCRA), to identify how those statutes and any associated regulatory programs address the presence of *p*-dichlorobenzene in exposure pathways falling under the jurisdiction of these EPA statutes.

The conceptual model in Section 2.6.4 presents the potential exposure pathways, exposure routes and hazards to human and environmental receptors from releases and waste streams associated with industrial, commercial and consumer uses of *p*-dichlorobenzene. The conceptual model shows the overlays, labeled and shaded to depict the regulatory programs (e.g., CAA, SDWA, CWA-AWQC, RCRA) and associated pathways that EPA considered in developing this conceptual model for the draft scope document. The regulatory programs that cover these environmental release and waste pathways are further described in Section 2.6.3.1 through Section 2.6.3.4.

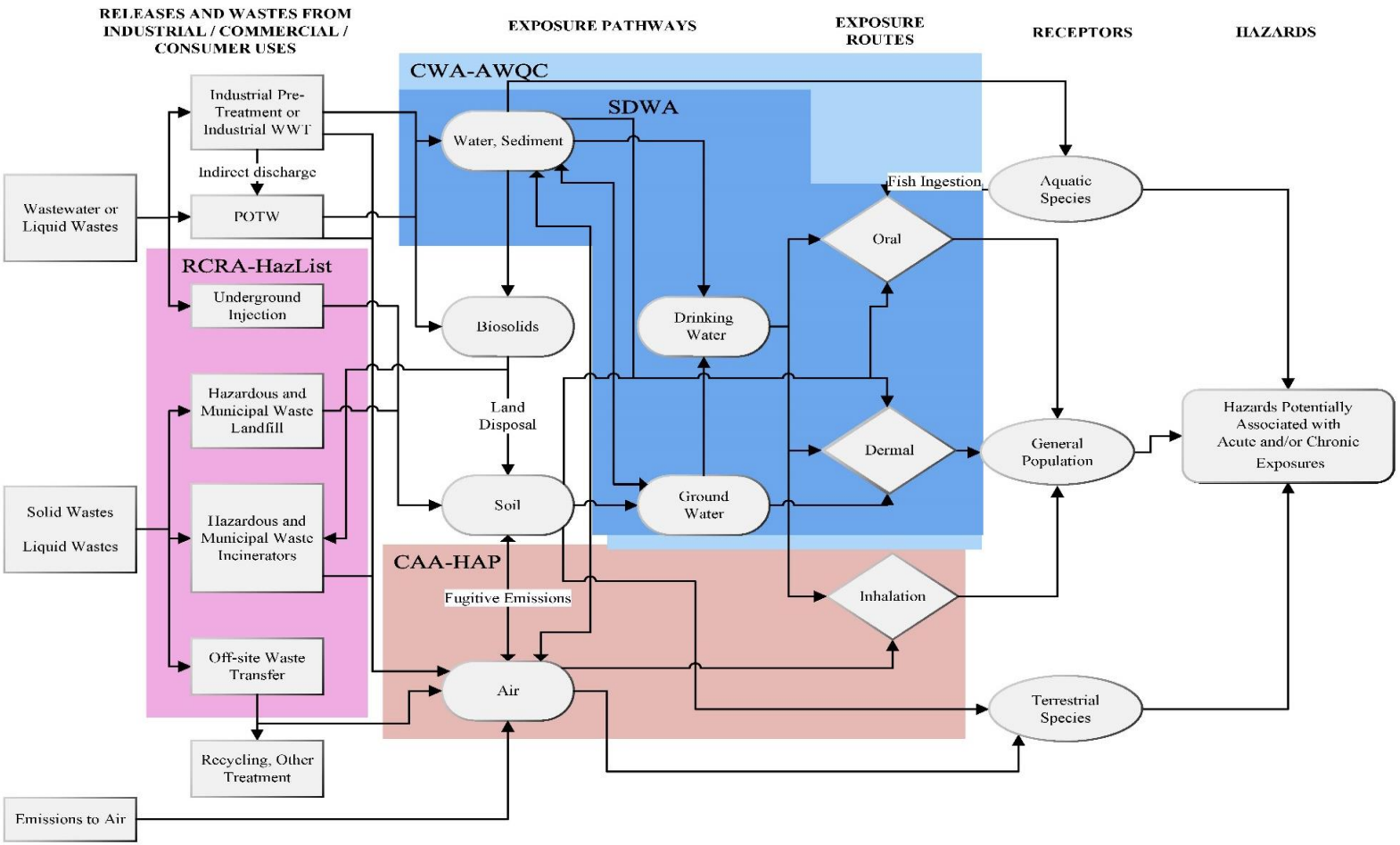

Figure 2-10. ***p*-Dichlorobenzene Conceptual Model for Environmental Releases and Wastes: Environmental and General Population Exposures and Hazards (Regulatory Overlay)**

The conceptual model presents the exposure pathways, exposure routes and hazards to human receptors from releases and wastes from industrial and commercial uses of *p*-dichlorobenzene showing environmental statutes covering those pathways. Notes:

a) Industrial wastewater or liquid wastes may be treated on-site and then released to surface water (direct discharge), or pre-treated and released to a Publicly Owned Treatment Works (POTW) (indirect discharge). For consumer uses, such wastes may be released directly to POTW. Drinking water will undergo further treatment in drinking water treatment plant. Ground water may also be a source of drinking water.

b) Receptors include PESS (see Section 2.5)

c) For regulation of hazardous and municipal waste incinerators and municipal waste landfills CAA and RCRA may have shared regulatory authority.

2.6.3.1 Ambient Air Pathway

The Clean Air Act (CAA) contains a list of hazardous air pollutants (HAP) and provides EPA with the authority to add to that list pollutants that present, or may present, a threat of adverse human health effects or adverse environmental effects. For stationary source categories emitting HAPs, the CAA requires issuance of technology-based standards and, if necessary, additions or revisions to address developments in practices, processes, and control technologies, and to ensure the standards protect public health and the environment. The CAA thereby provides EPA with comprehensive authority to regulate emissions to ambient air of any hazardous air pollutant. *p*-Dichlorobenzene is a HAP. EPA has issued a number of technology-based standards for source categories that emit *p*-dichlorobenzene to ambient air and, as appropriate, has reviewed, or is in the process of reviewing remaining risks.

Emission pathways to ambient air from commercial and industrial stationary sources and associated inhalation exposure of the general population or terrestrial species in this TSCA evaluation from stationary source releases of 1,1,2-trichlorethane to ambient air are covered under the jurisdiction of the CAA. EPA's Office of Air and Radiation and Office of Pollution Prevention and Toxics will continue to work together to provide an understanding and analysis of the CAA regulatory analytical processes and to exchange information related to toxicity and occurrence data on chemicals undergoing risk evaluation under TSCA.

2.6.3.2 Drinking Water Pathway

EPA has promulgated National Primary Drinking Water Regulations (NPDWRs) under the Safe Drinking Water Act for *p*-dichlorobenzene. EPA has set an enforceable Maximum Contaminant Level (MCL) as close as feasible to a health based, non-enforceable Maximum Contaminant Level Goal (MCLG). Feasibility refers to both the ability to treat water to meet the MCL and the ability to monitor water quality at the MCL, SDWA Section 1412(b)(4)(D), and public water systems are required to monitor for the regulated chemical based on a standardized monitoring schedule to ensure compliance with the MCL. The MCL for *p*-dichlorobenzene in water is 0.075 mg/L.

The drinking water exposure pathway for *p*-dichlorobenzene is currently addressed in the SDWA regulatory analytical process for public water systems. EPA's Office of Water and Office of Pollution Prevention and Toxics will continue to work together providing understanding and analysis of the SDWA regulatory analytical processes and to exchange information related to toxicity and occurrence data on chemicals undergoing risk evaluation under TSCA.

2.6.3.3 Ambient Water Pathway

EPA develops recommended water quality criteria under section 304(a) of the CWA for pollutants in surface water that are protective of aquatic life or human health designated uses. EPA has developed recommended water quality criteria for protection of human health for *p*-dichlorobenzene which are available for possible adoption into state water quality standards and are available for possible use by NPDES permitting authorities in deriving effluent limits to meet state narrative criteria. EPA's OW and OPPT will continue to work together providing understanding and analysis of the CWA water quality criteria development process and to exchange information related to toxicity of chemicals undergoing risk evaluation under TSCA. EPA may update its CWA section 304(a) water quality criteria for *p*-dichlorobenzene in the future under the CWA.

EPA has developed CWA section 304(a) recommended human health criteria for 122 chemicals and aquatic life criteria for 47 chemicals. A subset of these chemicals is identified as "priority pollutants" (103 human health and 27 aquatic life), including *p*-dichlorobenzene. The CWA requires that states adopt numeric criteria for priority pollutants for which EPA has published recommended criteria under

section 304(a), the discharge or presence of which in the affected waters could reasonably be expected to interfere with designated uses adopted the state. For pollutants with recommended human health criteria, EPA regulations require that state criteria contain sufficient parameters and constituents to protect designated uses. Once states adopt criteria as water quality standards, the CWA requires that National Pollutant Discharge Elimination System (NPDES) discharge permits include effluent limits as stringent as necessary to meet standards CWA section 301(b)(1)(C). This permit issuance process accounts for risk in accordance with the applicable ambient water exposure pathway (human health or aquatic life as applicable) for the designated water use and, therefore, can the risk from the pathway can be considered assessed and managed.

EPA has not developed CWA section 304(a) recommended water quality criteria for the protection of aquatic life for *p*-dichlorobenzene, so there are no national recommended criteria for this use available for adoption into state water quality standards and available for use in NPDES permits. As a result, this pathway will undergo aquatic life risk evaluation under TSCA (see Section 2.4.1). EPA may publish CWA section 304(a) aquatic life criteria for *p*-dichlorobenzene in the future if it is identified as a priority under the CWA.

2.6.3.4 Disposal and Soil Pathways

p-Dichlorobenzene is included on the list of hazardous wastes pursuant to RCRA 3001 (40 CFR §§ 261.33) as a listed waste on the U072 and D027 lists. The general standard in section RCRA 3004(a) for the technical criteria that govern the management (treatment, storage, and disposal) of hazardous waste are those "necessary to protect human health and the environment," RCRA 3004(a). The regulatory criteria for identifying “characteristic” hazardous wastes and for “listing” a waste as hazardous also relate solely to the potential risks to human health or the environment (40 CFR §§ 261.11, 261.21-261.24). RCRA statutory criteria for identifying hazardous wastes require EPA to “tak[e] into account toxicity, persistence, and degradability in nature, potential for accumulation in tissue, and other related factors such as flammability, corrosiveness, and other hazardous characteristics.” Subtitle C controls cover not only hazardous wastes that are landfilled, but also hazardous wastes that are incinerated (subject to joint control under RCRA Subtitle C and the Clean Air Act (CAA) hazardous waste combustion Maximum Achievable Control Technology (MACT)) or injected into Underground Injection Control (UIC) Class I hazardous waste wells (subject to joint control under Subtitle C and the Safe Drinking Water Act (SDWA)).

TRI reporting in 2018 indicated 38 pounds released to underground injection to Class I hazardous waste wells. Environmental disposal of *p*-dichlorobenzene injected into Class I well types are presumed to be managed and prevented from further environmental release by RCRA and SDWA regulations. Therefore, disposal of *p*-dichlorobenzene via underground injection is not likely to result in environmental and general population exposures.

EPA has identified releases to land that go to RCRA Subtitle C hazardous waste landfills. Based on 2018 reporting, the majority of TRI land disposal includes Subtitle C landfills (27,997 pounds) with a much smaller amount transferred to “other landfills” both on-site and off-site (400 pounds reported in 2015 and 0 pounds in 2018). Design standards for Subtitle C landfills require double liner, double leachate collection and removal systems, leak detection system, run on, runoff, and wind dispersal controls, and a construction quality assurance program. They are also subject to closure and post-closure care requirements including installing and maintaining a final cover, continuing operation of the leachate collection and removal system until leachate is no longer detected, maintaining and monitoring the leak detection and groundwater monitoring system. Bulk liquids may not be disposed in Subtitle C landfills. Subtitle C landfill operators are required to implement an analysis and testing program to ensure

adequate knowledge of waste being managed, and to train personnel on routine and emergency operations at the facility. Hazardous waste being disposed in Subtitle C landfills must also meet RCRA waste treatment standards before disposal. Given these controls, general population exposure in groundwater from Subtitle C landfill leachate is not expected to be a significant pathway.

p-Dichlorobenzene is present in commercial and consumer products that may be disposed of in Municipal Solid Waste (MSW) landfills. On-site releases RCRA Subtitle D municipal solid waste landfills leading to exposures of the general population (including susceptible populations) or terrestrial species from such releases are expected to be minimal based on current TRI releases (i.e., 0 lb in 2018) for 1,1,2- trichloroethane. While permitted and managed by the individual states, municipal solid waste (MSW) landfills are required by federal regulations to implement some of the same requirements as Subtitle C landfills. MSW landfills generally must have a liner system with leachate collection and conduct groundwater monitoring and corrective action when releases are detected. MSW landfills are also subject to closure and post-closure care requirements and must have financial assurance for funding of any needed corrective actions. MSW landfills have also been designed to allow for the small amounts of hazardous waste generated by households and very small quantity waste generators (less than 220 lb per month). Bulk liquids, such as free solvent, may not be disposed of at MSW landfills.

On-site releases to land from industrial non-hazardous and construction/demolition waste landfills may occur for *p*-dichlorobenzene. Industrial non-hazardous and construction/demolition waste landfills are primarily regulated under authorized state regulatory programs. States must also implement limited federal regulatory requirements for siting, groundwater monitoring, and corrective action, and a prohibition on open dumping and disposal of bulk liquids. States may also establish additional requirements such as for liners, post-closure and financial assurance, but are not required to do so.

2.6.4 Conceptual Model for Environmental Releases and Wastes: Potential Exposures and Hazards

As described in Section 2.6.3, some pathways in the conceptual models are covered under the jurisdiction of other environmental statutes administered by EPA. The conceptual model depicted in Figure 2-11 presents the exposure pathways, exposure routes and hazards to human and environmental receptors from releases and wastes from industrial, commercial, and consumer uses of *p*-dichlorobenzene that EPA plans to consider in the risk evaluation. The exposure pathways, exposure routes and hazards presented in this conceptual model are subject to change in the final scope, in light of comments received on this draft scope and other reasonably available information. EPA continues to consider whether and how other EPA-administered statutes and any associated regulatory programs address the presence of *p*-dichlorobenzene in exposure pathways falling under the jurisdiction of these EPA statutes.

The diagram shown in Figure 2-11 includes releases from industrial, commercial and/or consumer uses to water/sediment; biosolids and soil, via direct and indirect discharges to water, that may lead to exposure to aquatic and terrestrial receptors. The supporting basis for environmental pathways considered for *p*-dichlorobenzene are included in Appendix H.
.

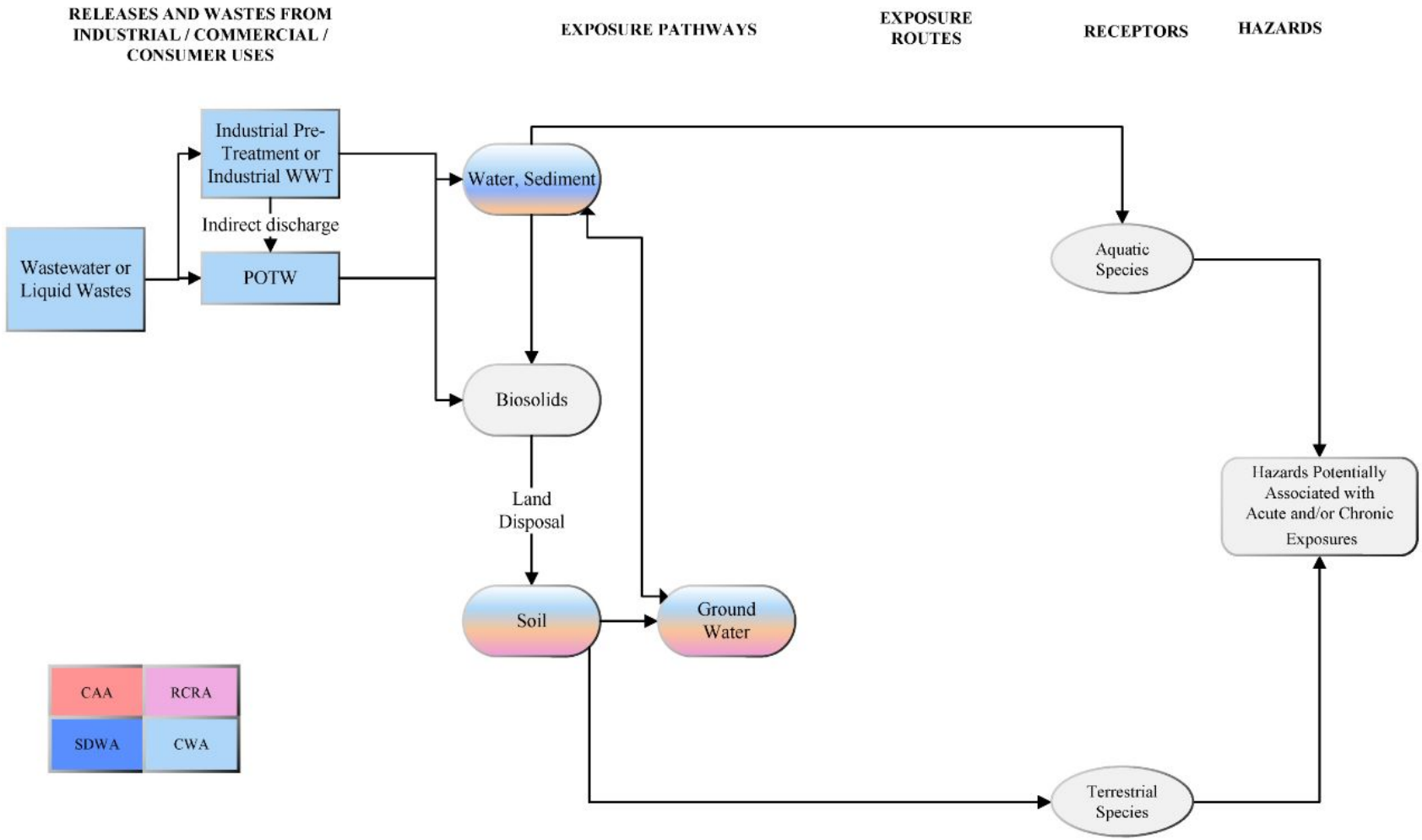

Figure 2-11. *p*-Dichlorobenzene Conceptual Model for Environmental Releases and Wastes: Environmental and General Population Exposures and Hazards

The conceptual model presents the exposure pathways, exposure routes and hazards to human receptors from releases and wastes from industrial and commercial uses of *p*-dichlorobenzene that EPA plans to consider in the risk evaluation. Notes:

a) Industrial wastewater or liquid wastes may be treated on-site and then released to surface water (direct discharge), or pre-treated and released to POTW (indirect discharge). For consumer uses, such wastes may be released directly to POTW. Drinking water will undergo further treatment in drinking water treatment plant. Ground water may also be a source of drinking water.

b) Receptors include PESS (see Section 2.5).

2.7 Analysis Plan

The analysis plan is based on EPA's knowledge of *p*-dichlorobenzene to date which includes a partial, but not complete review of identified information as described in Section 2.1. EPA encourages submission of additional existing data, such as full study reports or workplace monitoring from industry sources, that may be relevant for further evaluating conditions of use, exposures, hazards and PESS during risk evaluation. Further, EPA may consider any relevant CBI in the risk evaluation in a manner that protects the confidentiality of the information from public disclosure. EPA plans to continue to consider new information submitted by the public. Should additional data or approaches become available, EPA may update its analysis plan in the final scope document.

2.7.1 Physical and Chemical Properties and Environmental Fate

EPA plans to analyze the physical and chemical (p-chem) properties and environmental fate and transport of *p*-dichlorobenzene as follows:

1) **Review reasonably available measured or estimated p-chem and environmental fate endpoint data collected using systematic review procedures and, where available, environmental assessments conducted by other regulatory agencies.**
   EPA plans to review data and information collected through the systematic review methods and public comments about the p-chem properties (Appendix B) and fate endpoints (Appendix C) previously summarized in the *Proposed Designation of p-Dichlorobenzene (CASRN 106-46-7) as a High Priority Substance for Risk Evaluation* (U.S. EPA, 2019a). All sources cited in EPA's analysis will be evaluated according to the procedures described in the systematic review documentation that EPA plans to publish prior to finalizing the scope document. Where the systematic review process fails to identify experimentally measured chemical property values of sufficiently high quality, these values will be estimated using chemical parameter estimation models as appropriate. Model-estimated fate properties will be reviewed for applicability and quality.

2) **Using measured data and/or modeling, determine the influence of environmental fate endpoints (e.g., persistence, bioaccumulation, partitioning, transport) on exposure pathways and routes of exposure to human and environmental receptors.**
   Measured data and, where necessary, model predictions of p-chem properties and environmental fate endpoints will be used to characterize the persistence and movement of *p*-dichlorobenzene within and across environmental media. The fate endpoints of interest include volatilization, sorption to organic matter in soil and sediments, water solubility, aqueous and atmospheric photolysis rates, aerobic and anaerobic biodegradation rates, and potential bioconcentration and bioaccumulation. These endpoints will be used in exposure calculations.

3) **Conduct a weight-of-evidence evaluation of environmental fate data, including qualitative and quantitative sources of information.**
   During risk evaluation, EPA plans to evaluate and integrate the p-chem and environmental fate evidence identified in the literature inventory using the methods described in the systematic review documentation that EPA plans to publish prior to finalizing the scope document.

2.7.2 Exposure

EPA plans to analyze exposure levels for indoor dust, indoor air, surface water, ground water, sediment, soil, dietary food sources, aquatic biota, and terrestrial biota associated to exposure to *p*-

dichlorobenzene. EPA has not yet determined the exposure levels in these media or how they may be used in the risk evaluation. Exposure scenarios are combinations of sources (uses), exposure pathways, and exposed receptors. Draft release/exposure scenarios corresponding to various conditions of use for *p*-dichlorobenzene are presented in 2.8Appendix E. EPA plans to analyze scenario-specific exposures.

Based on their physical-chemical properties, expected sources, and transport and transformation within the outdoor and indoor environment, chemical substances are more likely to be present in some media and less likely to be present in others. Exposure level(s) can be characterized through a combination of available monitoring data and modeling approaches.

2.7.2.1 Environmental Releases

EPA plans to analyze releases to environmental media as follows:

1) **Review reasonably available published literature and other reasonably available information on processes and activities associated with the conditions of use to analyze the types of releases and wastes generated.**
   EPA has reviewed some sources containing information on processes and activities resulting in releases, and the information found is described in Appendix E. EPA plans to continue review additional data sources identified. Potential sources of environmental release data are summarized in Table 2-5 below:

   Table 2-5. Categories and Sources of Environmental Release Data

U.S. EPA TRI Data
U.S. EPA Generic Scenarios
OECD Emission Scenario Documents
EU Risk Assessment Reports
Discharge Monitoring Report (DMR) surface water discharge data for *p*-dichlorobenzene from NPDES-permitted facilities

2) **Review reasonably available chemical-specific release data, including measured or estimated release data (e.g., data from risk assessments by other environmental agencies).**
   EPA has reviewed key release data sources including the Toxics Release Inventory (TRI), and the data from this source is summarized in Section 2.3.3. EPA plans to continue to review relevant data sources during risk evaluation. EPA plans to match identified data to applicable conditions of use and identify data gaps where no data are found for particular conditions of use. EPA plans to attempt to address data gaps identified as described in steps 3 and 4 below by considering potential surrogate data and models.

   Additionally, for conditions of use where no measured data on releases are available, the EPA may use a variety of methods including release estimation approaches and assumptions in the Chemical Screening Tool for Occupational Exposures and Releases ChemSTEER (U.S. EPA, 2013).

3) **Review reasonably available measured or estimated release data for surrogate chemicals that have similar uses and physical properties.**
   EPA plans to continue review literature sources identified and if surrogate data are found, these data will be matched to applicable conditions of use for potentially filling data gaps.

4) **Review reasonably available data that may be used in developing, adapting or applying exposure models to the particular risk evaluation.**
This item will be performed after completion of #2 and #3 above. EPA plans to continue to evaluate relevant data to determine whether the data can be used to develop, adapt or apply models for specific conditions of use (and corresponding release scenarios). EPA has identified information from various EPA statutes (including, for example, regulatory limits, reporting thresholds or disposal requirements) that may be relevant to release estimation. EPA plans to further consider relevant regulatory requirements in estimating releases during risk evaluation.

5) **Review and determine applicability of OECD Emission Scenario Documents (ESDs) and EPA Generic Scenarios to estimation of environmental releases.**
EPA has identified potentially relevant OECD Emission Scenario Documents (ESDs) and EPA Generic Scenarios (GS) that correspond to some conditions of use; for example, the July 2009 ESD on Plastics Additives (OECD, 2009) and the September 2011 ESD on Chemical Industry (OECD, 2011) may be useful. EPA plans to critically review these generic scenarios and ESDs to determine their applicability to the conditions of use assessed.

EPA Generic Scenarios are available at the following: https://www.epa.gov/tsca-screening-tools/using-predictive-methods-assess-exposure-and-fate-under-tsca#fate.

OECD Emission Scenario Documents are available at the following: http://www.oecd.org/chemicalsafety/risk-assessment/emissionscenariodocuments.htm

EPA plans to perform additional targeted research to understand those conditions of use which may inform identification of release scenarios. EPA may also need to perform targeted research for applicable models and associated parameters that EPA may use to estimate releases for certain conditions of use. If ESDs and GSs are not available, other methods may be considered. Additionally, for conditions of use where no measured data on releases are available, EPA may use a variety of methods including the application of default assumptions such as standard loss fractions associated with drum cleaning (3%) or single process vessel cleanout (1%).

6) **Map or group each condition of use to a release assessment scenario(s).**
EPA has identified release scenarios and mapped (i.e., grouped) them to relevant conditions of use as shown in Appendix F. EPA was not able to identify release scenarios corresponding to some conditions of use (e.g., automotive care products, and recycling). EPA plans to perform targeted research to understand those uses, which may inform identification of release scenarios. EPA may further refine the mapping of release scenarios based on factors (e.g., process equipment and handling, magnitude of production volume used, and release sources and usage rates of p-dichlorobenzene and polymer products and formulations containing p-dichlorobenzene, or professional judgment) corresponding to conditions of use as additional information is identified during risk evaluation.

7) **Evaluate the weight of the scientific evidence of environmental release data.**
During risk evaluation, the EPA plans to evaluate and integrate the environmental release evidence identified in the literature inventory using the methods described in the systematic

review documentation that EPA plans to publish prior to finalizing the scope document. The data integration strategy will be designed to be fit-for-purpose in which EPA plans to use systematic review methods to assemble the relevant data, evaluate the data for quality and relevance, including strengths and limitations, followed by synthesis and integration of the evidence.

2.7.2.2 Environmental Exposures

EPA plans to analyze the following in developing its environmental exposure assessment of *p*-dichlorobenzene*:*

1) **Review available environmental and biological monitoring data for all media relevant to environmental exposure.**
   For *p*-dichlorobenzene, environmental media which will be analyzed are sediment, soil, ground water, and surface water.

2) **Review reasonably available information on releases to determine how modeled estimates of concentrations near industrial point sources compare with available monitoring data.**
   Available environmental exposure models that meet the TSCA Science Standards and that estimate surface water, sediment, and soil concentrations will be analyzed and considered alongside available surface water, sediment, and soil monitoring data to characterize environmental exposures. Modeling approaches to estimate surface water concentrations, sediment concentrations and soil concentrations generally consider the following inputs: direct release into surface water, sediment, or soil, indirect release into surface water, sediment, or soil (i.e., air deposition), fate and transport (partitioning within media) and characteristics of the environment (e.g., river flow, volume of lake, meteorological data).

3) **Determine applicability of existing additional contextualizing information for any monitored data or modeled estimates during risk evaluation.**
   There have been changes to use patterns of *p*-dichlorobenzene over the last few years. Monitoring data or modeled estimates will be reviewed to determine how representative they are of ongoing use patterns.

   Any studies which relate levels of *p*-dichlorobenzene in the environment or biota with specific sources or groups of sources will be evaluated.

4) **Group each condition(s) of use to environmental assessment scenario(s).**
   Refine and finalize exposure scenarios for environmental receptors by considering sources (use descriptors), exposure pathways including routes, and populations exposed. For *p*-dichlorobenzene, the following are noteworthy considerations in constructing exposure scenarios for environmental receptors:
   - Estimates of surface water concentrations, sediment concentrations and soil concentrations near industrial point sources based on available monitoring data.
   - Generally, consider the following modeling inputs: release into the media of interest, fate and transport and characteristics of the environment.
   - Reasonably available biomonitoring data. Monitoring data could be used to compare with species or taxa-specific toxicological benchmarks.
   - Applicability of existing additional contextualizing information for any monitored data or modeled estimates during risk evaluation. Review and characterize the spatial

and temporal variability, to the extent that data are available, and characterize exposed aquatic and terrestrial populations.
- Weight of the scientific evidence of environmental occurrence data and modeled estimates.

5) **Evaluate the weight of the scientific evidence of environmental occurrence data and modeled estimates.**
During risk evaluation, the EPA plans to evaluate and integrate the exposure evidence identified in the literature inventory using the methods described in the systematic review documentation that EPA plans to publish prior to finalizing the scope document.

2.7.2.3 Occupational Exposures

EPA plans to analyze both worker and occupational non-user exposures as follows:

1) **Review reasonably available exposure monitoring data for specific condition(s) of use.**
EPA plans to review exposure data including workplace monitoring data collected by government agencies such as OSHA and NIOSH, and monitoring data found in published literature. These workplace monitoring data include personal exposure monitoring data (direct exposures) and area monitoring data (indirect exposures). EPA has preliminarily reviewed available monitoring data collected by OSHA and NIOSH and will match these data to applicable conditions of use.

   OSHA has established a permissible exposure limit (PEL) for *p*-dichlorobenzene of 75 parts per million (ppm) or 450 milligrams (mg)/cubic meter (m^3) as an 8-hour time weighted average (TWA) (OSHA, 2019). EPA plans to consider the influence of such limits on occupational exposures in the occupational exposure assessment. The following are some data sources identified thus far:

   Table 2-6. Potential Sources of Occupational Exposure Data

2012 ATSDR Toxicological Profile
U.S. OSHA Chemical Exposure Health Data (CEHD) program data
U.S. NIOSH Health Hazard Evaluation (HHE) Program reports

2) **Review reasonably available exposure data for surrogate chemicals that have uses, volatility and chemical and physical properties similar to *p*-dichlorobenzene.**
EPA plans to review literature sources identified and if surrogate data are found, these data will be matched to applicable conditions of use for potentially filling data gaps.

3) **For conditions of use where data are limited or not available, review existing exposure models that may be applicable in estimating exposure levels.**
EPA has identified potentially relevant EPA Generic Scenarios (GS) and will need to critically review these generic scenarios to determine their applicability to the conditions of use assessed. For example, the May 2004 Additives in Plastics Processing (Compounding) GS (EPA, 2004) could be used to estimate occupational exposures. EPA plans to critically review these generic scenarios and ESDs to determine their applicability to the conditions of use. EPA plans to perform additional targeted research to understand those conditions of use, which may inform identification of exposure scenarios. EPA may also need to perform targeted research to identify applicable models that EPA may use to estimate exposures for certain conditions of use.

4) **Review and determine applicability of EPA Generic Scenarios to estimation of occupational exposures.**
This step will be performed after Steps #2 and #3 are completed. Based on information developed from Steps #2 and #3, EPA plans to evaluate relevant data to determine whether the data can be used to develop, adapt, or apply models for specific conditions of use (and corresponding exposure scenarios). EPA may utilize existing, peer-reviewed exposure models developed by EPA or other government agencies, or reasonably available in the scientific literature, or EPA may elect to develop additional models to assess specific condition(s) of use. Inhalation exposure models may be simple box models or two-zone (near-field/far-field) models. In two-zone models, the near-field exposure represents potential inhalation exposures to workers, and the far-field exposure represents potential inhalation exposures to ONU's.

5) **Consider and incorporate applicable EC and/or PPE into exposure scenarios.**
EPA plans to review potentially relevant data sources on EC and PPE to determine their applicability and incorporation into exposure scenarios during risk evaluation. EPA plans to assess worker exposure pre- and post-implementation of EC, using reasonably available information on control technologies and control effectiveness. For example, EPA may assess worker exposure in industrial use scenarios before and after implementation of local exhaust ventilation.

6) **Map or group each condition of use to occupational exposure assessment scenario(s).**
EPA has identified occupational exposure scenarios and mapped them to relevant conditions of use (Appendix F). EPA was not able to identify occupational scenarios corresponding to some conditions of use. EPA plans to perform targeted research to understand those uses which may inform identification of occupational exposure scenarios. EPA may further refine the mapping of occupational exposure scenarios based on factors (e.g., process equipment and handling, magnitude of production volume used, and exposure/release sources) corresponding to conditions of use as additional information is identified during risk evaluation.

7) **Evaluate the weight of the scientific evidence of occupational exposure data, which may include qualitative and quantitative sources of information.**
During risk evaluation, the EPA plans to evaluate and integrate the exposure evidence identified in the literature inventory using the methods described in the systematic review documentation that EPA plans to publish prior to finalizing the scope document. EPA plans to rely on the weight of the scientific evidence when evaluating and integrating occupational data. The data integration strategy will be designed to be fit-for-purpose in which EPA plans to use systematic review methods to assemble the relevant data, evaluate the data for quality and relevance, including strengths and limitations, followed by synthesis and integration of the evidence.

2.7.2.4 Consumer Exposures

EPA plans to analyze both consumers using a consumer product and bystanders associated with the consumer using the product as follows:

1) **Group each condition of use to consumer exposure assessment scenario(s).**
Refine and finalize exposure scenarios for consumers by considering sources (ongoing consumer uses), exposure pathways including routes, and exposed populations.

For *p*-dichlorobenzene, the following are noteworthy considerations in constructing consumer exposure scenarios:

- Conditions of use
- Duration of exposure
- Weight fraction of chemical in products
- Amount of chemical used

2) **Evaluate the relative potential of indoor exposure pathways based on reasonably available data.**
Indoor exposure pathways expected to be relatively higher include inhalation of vapors and mists from indoor air during *p*-dichlorobenzene use and disposal. Indoor exposure pathways expected to be relatively lower include dermal contact and oral ingestion of dust, liquid, or solid products. The data sources associated with these respective pathways have not been comprehensively evaluated, so quantitative comparisons across exposure pathways or in relation to toxicity thresholds are not yet available.

3) **Review existing indoor exposure models that may be applicable in estimating indoor air.**
Indoor exposure models that estimate emission and migration of SVOCs into the indoor environment are available. These models generally consider mass transfer as informed by the gas-phase mass transfer coefficient, the solid-phase diffusion coefficient, and the material-air partition coefficient. In addition, direct transfer to surface dust or physical abrasion may influence emissions over time. These properties vary based on physical-chemical properties and properties of the material. The OPPT's Indoor Environmental Concentrations in Buildings with Conditioned and Unconditioned Zones (IECCU) model and other similar models can be used to estimate indoor air and dust exposures from indoor sources.

4) **Review reasonably available empirical data that may be used in developing, adapting or applying exposure models to a particular risk evaluation scenario. For example, existing models developed for a chemical assessment may be applicable to another chemical assessment if model parameter data are available.**
To the extent other organizations have already modeled a *p*-dichlorobenzene consumer exposure scenario that is relevant to the OPPT's assessment, EPA plans to evaluate those modeled estimates. In addition, if other chemicals similar to *p*-dichlorobenzene have been modeled for similar uses, those modeled estimates will also be evaluated. The underlying parameters and assumptions of the models will also be evaluated.

5) **Review reasonably available consumer product-specific sources to determine how those exposure estimates compare with each other and with indoor monitoring data reporting *p*-dichlorobenzene in specific media (e.g., indoor air).**
The availability of *p*-dichlorobenzene concentration for various ongoing uses will be evaluated. This data provides the source term for any subsequent indoor modeling. Source attribution between overall indoor air and dust levels and various indoor sources will be analyzed.

6) **Review reasonably available population- or subpopulation-specific exposure factors and activity patterns to determine if PESS need to be further refined.**
   During risk evaluation, EPA plans to evaluate and integrate the exposure evidence identified in the literature inventory using the methods described in the systematic review documentation that EPA plans to publish prior to finalizing the scope document.

7) **Evaluate the weight of the scientific evidence of consumer exposure estimates based on different approaches.**
   EPA plans to rely on the weight of the scientific evidence when evaluating and integrating data related to consumer exposure. The weight of the scientific evidence may include qualitative and quantitative sources of information. The data integration strategy will be designed to be fit-for-purpose in which EPA plans to use systematic review methods to assemble the relevant data, evaluate the data for quality and relevance, including strengths and limitations, followed by synthesis and integration of the evidence.

2.7.2.5 General Population

Exposures to the general population may occur from industrial and/or commercial uses, industrial releases to air, water, or land, and other conditions of use. As described in Section 2.6, EPA does not expect to include in the risk evaluation pathways under programs of other environmental statutes, administered by the Agency, which assess and manage exposures and for which long-standing regulatory and analytical processes already exist. The following pathways will not be evaluated: ambient air, drinking water, ambient water, disposal, sediment, and soil.

2.7.3 Hazards (Effects)

2.7.3.1 Environmental Hazards

EPA plans to conduct an environmental hazard assessment of *p*-dichlorobenzene as follows:

1) **Review reasonably available environmental hazard data, including data from alternative test methods (e.g., computational toxicology and bioinformatics; high-throughput screening methods; data on categories and read-across; *in vitro* studies).**
   EPA plans to analyze the hazards of *p*-dichlorobenzene to aquatic and/or terrestrial organisms, including plants, invertebrates (e.g., insects, arachnids, mollusks, crustaceans), and vertebrates (e.g., mammals, birds, amphibians, fish, reptiles) across exposure durations and conditions if potential environmental hazards are identified through systematic review results and public comments. Additional types of environmental hazard information will also be considered (e.g., analogue and read-across data) when characterizing the potential hazards of *p*-dichlorobenzene to aquatic and/or terrestrial organisms.

   Environmental hazard data will be evaluated using the environmental toxicity data quality criteria outlined in the systematic review documentation that EPA plans to publish prior to finalizing the scope document. The study evaluation results will be documented in the risk evaluation phase and data from suitable studies will be extracted and integrated in the risk evaluation process.

   Hazard endpoints (e.g., mortality, growth, immobility, reproduction) will be evaluated, while considering data availability, relevance, and quality.

2) **Derive hazard thresholds for aquatic and/or terrestrial organisms.**
Depending on the robustness of the evaluated data for a particular organism or taxa (e.g., aquatic invertebrates), environmental hazard values (e.g., EC_x/LC_x/NOEC/LOEC, etc.) may be derived and used to further understand the hazard characteristics of *p*-dichlorobenzene to aquatic and/or terrestrial species. Identified environmental hazard thresholds may be used to derived concentrations of concern (COC), based on endpoints that may affect populations of organisms or taxa analyzed.

3) **Evaluate the weight of scientific evidence of environmental hazard data.**
During risk evaluation, EPA plans to evaluate and integrate the environmental hazard evidence identified in the literature inventory using the methods described in the systematic review documentation that EPA plans to publish prior to finalizing the scope document.

4) **Consider the route(s) of exposure, based on available monitoring and modeling data and other available approaches to integrate exposure and hazard assessments.**
EPA plans to consider aquatic (e.g., water and sediment exposures) and terrestrial pathways in the *p*-dichlorobenzene conceptual model. These organisms may be exposed to *p*-dichlorobenzene via a number of environmental pathways (e.g., surface water, sediment, soil, diet).

5) Conduct an environmental risk characterization of *p*-dichlorobenzene.
EPA plans to conduct a risk characterization of *p*-dichlorobenzene to identify if there are risks to the aquatic and/or terrestrial environments from the measured and/or predicted concentrations of *p*-dichlorobenzene in environmental media (i.e., water, sediment, soil). Risk quotients (RQs) may be derived by the application of hazard and exposure benchmarks to characterize environmental risk (U.S. EPA, 1998; Barnthouse et al., 1982).

6) **Consider a Persistent, Bioaccumulative, and Toxic (PBT) Assessment of *p*-dichlorobenzene.**
EPA plans to consider the persistence, bioaccumulation, and toxic (PBT) potential of *p*-dichlorobenzene after reviewing relevant physical-chemical properties and exposure pathways. EPA plans to assess the available studies collected from the systematic review process relating to bioaccumulation and bioconcentration (e.g., BAF, BCF) of *p*-dichlorobenzene. In addition, EPA plans to integrate traditional environmental hazard endpoint values *(*e.g., LC_{50}, LOEC) and exposure concentrations (e.g., surface water concentrations, tissue concentrations) for *p*-dichlorobenzene with the fate parameters (e.g., BAF, BCF, BMF, TMF).

2.7.3.2 Human Health Hazards

EPA plans to analyze human health hazards as follows:

1) **Review reasonably available human health hazard data, including data from alternative test methods (e.g., computational toxicology and bioinformatics; high-throughput screening methods; data on categories and read-across; *in vitro* studies; systems biology).**
Human health studies will be evaluated using the evaluation strategies laid out in the systematic review documentation that EPA plans to publish prior to finalizing the scope document.

Mechanistic data may include analyses of alternative test data such as novel *in vitro* test methods and high throughput screening. The association between acute and chronic exposure scenarios to

the agent and each health outcome will also be integrated. Study results will be extracted and presented in evidence tables or another appropriate format by organ/system

2) **In evaluating reasonably available data, determine whether particular human receptor groups may have greater susceptibility to the chemical's hazard(s) than the general population.**
Reasonably available human health hazard data will be evaluated to ascertain whether some human receptor groups may have greater susceptibility than the general population to *p*-dichlorobenzene hazard(s). Susceptibility of particular human receptor groups to *p*-dichlorobenzene will be determined by evaluating information on factors that influence susceptibility.

   EPA has reviewed some sources containing hazard information associated with susceptible populations and lifestages such as pregnant women and infants. Pregnancy (i.e., gestation) and childhood are potential susceptible lifestages for *p*-dichlorobenzene exposure. EPA plans to review the current state of the literature in order to potentially quantify these differences for risk evaluation purposes.

3) **Conduct hazard identification (the qualitative process of identifying non-cancer and cancer endpoints) and dose-response assessment (the quantitative relationship between hazard and exposure) for identified human health hazard endpoints.**
Human health hazards from acute and chronic exposures will be identified by evaluating the human and animal data that meet the systematic review data quality criteria described in the systematic review documentation that EPA plans to publish prior to finalizing the scope document. Hazards identified by studies meeting data quality criteria will be grouped by routes of exposure relevant to humans (oral, dermal, inhalation) and by cancer and noncancer endpoints.

   Dose-response assessment will be performed in accordance with EPA guidance (U.S. EPA, 2012a, 2011, 1994). Dose-response analyses may be used if the data meet data quality criteria and if additional information on the identified hazard endpoints are not available or would not alter the analysis.

   The cancer mode of action (MOA) determines how cancer risks can be quantitatively evaluated. If cancer hazard is determined to be applicable to *p*-dichlorobenzene, EPA plans to evaluate information on genotoxicity and the mode of action for all cancer endpoints to determine the appropriate approach for quantitative cancer assessment in accordance with the U.S. EPA Guidelines for Carcinogen Risk Assessment (U.S. EPA, 2005).

4) **Derive points of departure (PODs) where appropriate; conduct benchmark dose modeling depending on reasonably available data. Adjust the PODs as appropriate to conform (e.g., adjust for duration of exposure) to the specific exposure scenarios evaluated.**
Hazard data will be evaluated to determine the type of dose-response modeling that is applicable. Where modeling is feasible, a set of dose-response models that are consistent with a variety of potentially underlying biological processes will be applied to empirically model the dose-response relationships in the range of the observed data consistent with EPA's *Benchmark Dose Technical Guidance Document*. Where dose-response modeling is not feasible, NOAELs or

LOAELs will be identified. Non-quantitative data will also be evaluated for contribution to weight of the scientific evidence or for evaluation of qualitative endpoints that are not appropriate for dose-response assessment.

EPA plans to evaluate whether the available PBPK and empirical kinetic models are adequate for route-to-route and interspecies extrapolation of the POD, or for extrapolation of the POD to standard exposure durations (e.g., lifetime continuous exposure). If application of the PBPK model is not possible, oral PODs may be adjusted by $BW^{3/4}$ scaling in accordance with U.S. EPA (2011), and inhalation PODs may be adjusted by exposure duration and chemical properties in accordance with U.S. EPA (1994).

5) **Evaluate the weight of the scientific evidence of human health hazard data.** During risk evaluation, the EPA plans to evaluate and integrate the human health hazard evidence identified in the literature inventory under acute and chronic exposure conditions using the methods described in the systematic review documentation that EPA plans to publish prior to finalizing the scope document.

6) **Consider the route(s) of exposure (oral, inhalation, dermal), available route-to-route extrapolation approaches, available biomonitoring data and available approaches to correlate internal and external exposures to integrate exposure and hazard assessment.** At this stage of review, EPA believes there will be sufficient data to conduct dose-response analysis and/or benchmark dose modeling for the oral route of exposure. EPA also plans to evaluate any potential human health hazards following dermal and inhalation exposure to *p*-dichlorobenzene, which could be important for worker, consumer, and general population risk analysis. Reasonably available data will be assessed to determine whether or not a point of departure can be identified for the dermal and inhalation routes. This may include using route-to-route extrapolation methods where appropriate and depending on the nature of reasonably available data.

   If sufficient toxicity studies are not identified in the literature search to assess risks from dermal and inhalation exposures, then a route-to-route extrapolation from oral toxicity studies would be needed to assess systemic risks from dermal or inhalation exposures. Without an adequate PBPK model, the approaches described in EPA guidance document *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* (U.S. EPA, 2004) could be applied to extrapolate from oral to dermal exposure. These approaches may be able to further inform the relative importance of dermal exposures compared with other routes of exposure. Similar methodology may also be used for assessing inhalation exposures

2.7.4 Summary of Risk Approaches for Characterization

Risk characterization is an integral component of the risk assessment process for both environmental and human health risks. EPA plan to derive the risk characterization in accordance with EPA's *Risk Characterization Handbook* (U.S. EPA, 2000). As defined in EPA's Risk Characterization Policy, "the risk characterization integrates information from the preceding components of the risk evaluation and synthesizes an overall conclusion about risk that is complete, informative and useful for decision makers." Risk characterization is considered to be a conscious and deliberate process to bring all important considerations about risk, not only the likelihood of the risk but also the strengths and

limitations of the assessment, and a description of how others have assessed the risk into an integrated picture.

The level of information contained in each risk characterization varies according to the type of assessment for which the characterization is written. Regardless of the level of complexity or information, the risk characterization for TSCA risk evaluations will be prepared in a manner that is transparent, clear, consistent, and reasonable (U.S. EPA, 2000) and consistent with the requirements of the *Procedures for Chemical Risk Evaluation Under the Amended Toxic Substances Control Act* (82 FR 33726). For instance, in the risk characterization summary, the EPA plans to further carry out the obligations under TSCA Section 26; for example, by identifying and assessing uncertainty and variability in each step of the risk evaluation, discussing considerations of data quality such as the reliability, relevance and whether the methods utilized were reasonable and consistent, explaining any assumptions used, and discussing information generated from independent peer review.

EPA plans to also be guided by EPA's Information Quality Guidelines (U.S EPA, 2002) as it provides guidance for presenting risk information. Consistent with those guidelines, in the risk characterization, EPA plans to also identify: (1) Each population addressed by an estimate of applicable risk effects; (2) the expected risk or central estimate of risk for affected PESS; (3) each appropriate upper-bound or lower bound estimate of risk; (4) each significant uncertainty identified in the process of the assessment of risk effects and the studies that would assist in resolving the uncertainty; and (5) peer reviewed studies known to the Agency that support, are directly relevant to, or fail to support any estimate of risk effects and the methodology used to reconcile inconsistencies in the scientific information.

2.8 Peer Review

Peer review will be conducted in accordance with EPA's regulatory procedures for chemical risk evaluations, including using EPA's Peer Review Handbook and other methods consistent with Section 26 of TSCA (See 40 CFR 702.45). As explained in the Risk Evaluation Rule, the purpose of peer review is for the independent review of the science underlying the risk assessment. Peer review will therefore address aspects of the underlying science as outlined in the charge to the peer review panel such as hazard assessment, assessment of dose-response, exposure assessment, and risk characterization. The draft risk evaluation for HHCB will be peer reviewed.

REFERENCES

ACGIH (American Conference of Governmental Industrial Hygienists). (2007). Documentation of the TLVs and BEIs with other worldwide occupational exposure values [TLV/BEI]. Cincinnati, OH: American Conferences of Governmental Industrial Hygienists. https://www.acgih.org/forms/store/ProductFormPublic/2007-guide-to-occupational-exposure-values. HERO ID: 5185279

Ashworth, RA; Howe, GB; Mullins, ME; Rogers, TN. (1988). Air-water partitioning coefficients of organics in dilute aqueous solutions. Journal of Hazardous Materials. 18: 25-36. http://www.sciencedirect.com/science/article/pii/030438948885057X. HERO ID: 5178812

Atkinson, R. (1989). Kinetics and mechanisms of the gas-phase reactions of the hydroxyl radical with organic compounds. Journal of physical and chemical reference data Monograph No. 1. https://srd.nist.gov/JPCRD/jpcrdM1.pdf. HERO ID: 42876

ATSDR (Agency for Toxic Substances and Disease Registry). (2006). Toxicological profile for dichlorobenzenes. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. https://www.atsdr.cdc.gov/ToxProfiles/tp10.pdf. HERO ID: 5160125

Barnthouse, LW, DeAngelis, DL, Gardner, RH, O'Neill, RV, Suter, GW, Vaughan, DS. 1982. Methodology for Environmental Risk Analysis. Report Number ORNL/TM-8167. Oak Ridge National Laboratory, TN. HERO ID 4417716

Bosma, T; Te Welser, R; Schraa, G; Smeenk, J; Sehnder, A. (1990). Microbial aspects of the behaviour of chlorinated compounds during soil passage. In Org Micropollut Aquat Environ Proc Eur Supp 6th. Dordrecht, The Netherlands: Kluwer. HERO ID: 5178810

CARB. (2005). California Air Resources Board (CARB): Indoor air pollution in California [Database]. https://www.arb.ca.gov/research/apr/reports/l3041.pdf. HERO ID: 4571350

CDC (Centers for Disease Control and Prevention). (2013). National Health and Nutrition Examination Survey Data (NHANES). Atlanta, Georgia: Centers for Disease Control, National Center for Health Statistics. https://www.cdc.gov/nchs/nhanes/index.htm. HERO ID: 6124532

Cherrie, JW., Semple, S. Christopher, Y., Saleem, A., Hughson, G.W., Phillips, A. (2006). How important is inadvertent ingestion of hazardous substances at work? Ann Occup Hyg. 50(7):693-704. HERO ID: 460308

Chiou, CT; Porter, PE; Schmedding, DW. (1983). Partition equilibriums of nonionic organic compounds between soil organic matter and water. Environmental Science & Technology 17: 227-231. https://doi.org/10.1021/es00110a009. HERO ID: 5178813

CIPD. 2020. *p*-Dichlorobenzene. https://www.whatsinproducts.com/chemicals/view/1/1464/000106-46-7. HERO ID: 6329001

Daubert, TE; Danner, RP. (1989). Physical and thermodynamic properties of pure chemicals: Data compilation. Washington, DC: Taylor & Francis. HERO ID: 3827242

DeLima Associates. (2014). Bowl Fresh Toilet Bowl Deodorizer. DeLima Associates. https://www.whatsinproducts.com/types/type_detail/1/15465/standard/Bowl%20Fresh%20Toilet%20Bowl%20Deodorizer-10/20/2014/23-017-013. HERO ID: 6280693

Dean, JA. (1987). Handbook of organic chemistry. New York, NY: McGraw-Hill Book Company. HERO ID: 5349245

Duncan Enterprises. (2014). Duncan OA 901 Essence. https://www.aardvarkclay.com/pdf/duncan_sds/SDS%20Duncan%20OA%20901%20Essence%200113.pdf. HERO ID: 6305229

Duncan Enterprises. (2015). Duncan OG 803 Mother of Pearl. https://tuckerspotteryeshop.com/wp-content/uploads/msds/Duncan_Luster_Products/Duncan%20OG%20803%20Mother%20of%20Pearl-SDS.pdf. HERO ID: 6305231

EC. (2018). Information Platform for Chemical Monitoring Data [Database]. https://ipchem.jrc.ec.europa.eu/RDSIdiscovery/ipchem/index.html. HERO ID: 4571684

ECHA (European Chemicals Agency). (2019). Registration dossier: 1,4-dichlorobenzene (106-46-7) [Website]. Helsinki, Finland. https://echa.europa.eu/registration-dossier/-/registered-dossier/14821/1. HERO ID: 5176675

Environment Canada. (1993). Priority Substances List Assessment Report: 1,4-Dichlorobenzene. Ottawa, Ontario: Government of Canada, Environment Canada, Health Canada. https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/contaminants/psl1-lsp1/1_4_dichlorobenzene/1_4_dichlorobenzene-eng.pdf. HERO ID: 5160029

Environment Canada. (2003). Follow-up report on five PSL1 substances for which there was insufficient information to conclude whether the substances constitute a danger to the environment: 1,2-dichlorobenzene; 1,4-dichlorobenzene; trichlorobenzenes; tetrachlorobenzenes; pentachlorobenzene. Ottawa, Ontario: Government of Canada, Environment Canada, Health Canada. https://www.ec.gc.ca/ese-ees/002284A7-A3AD-4F3B-8DB1-3D74EB83434A/PSL1_chlorobenzenes_followup_EN.pdf

EPA-HQ-OPPT-2018-0444-0004 https://www.regulations.gov/document?D=EPA-HQ-OPPT-2018-0444-0004

EPA-HQ-OPPT-2018-0444-0013 https://www.regulations.gov/document?D=EPA-HQ-OPPT-2018-0444-0013

EPA-HQ-OPPT-2018-0444-0022 https://www.regulations.gov/document?D=EPA-HQ-OPPT-2019-0131-0022

FDA (U.S. Food and Drug Administration). (1991). FDA Total Diet Study [Database]. http://www.fda.gov/Food/FoodScienceResearch/TotalDietStudy/ucm184293.htm. HERO ID: 4571554

Frigid Fluid Co. (2016). Safety data sheet: Paulex Powder. Frigid Fluid Co. https://www.frigidfluid.com/wp-content/uploads/2018/05/PaulexPowderSDS.pdf. HERO ID: 6294076

Geiger, DL; Brooke, LT; Call, DJ. (1990). Acute toxicities of organic chemicals to fathead minnows (Pimephales promelas): Volume V. Superior, WI: University of Wisconsin-Superior, Center for Lake Superior Environmental Studies. HERO ID:5177139

Haider, K; Jagnow, G; Kohnen, R; Lim, SU. (1974). Degradation of chlorinated benzenes, phenols and cyclohexane derivatives by benzene and phenol utilizing soil bacteria under aerobic conditions. Archives of microbiology 96: 183-200. http://dx.doi.org/10.1007/BF00590175. HERO ID: 2720884

Hansch, C; Leo, A; Hoekman, D. (1995). Exploring QSAR: Hydrophobic, electronic, and steric constants. Washington, DC: American Chemical Society. HERO ID: 51424

HOSPECO (2018). SDS for: 8220 Round Block PARA Cherry Pink. Cleveland, OH : HOSPECO; https://www.hospeco.com/Documents/SDS/08220%20Round%20Block%20PARA%20Cherry%20Pink_(US).pdf

HSDB (Hazardous Substances Data Bank). (2014). 1,2-Dichlorobenzene (CASRN: 95-50-1). U.S. National Library of Medicine. https://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+521. HERO ID: 5348445

Kirk-Othmer. (1993). Kirk-Othmer Encyclopedia of Chemical Technology (4th ed.). New York, NY: John Wiley and Sons. HERO ID: 5348450

Kirk-Othmer Encyclopedia of Chemical Technology. 2001. Chlorinated Benzenes. https://onlinelibrary.wiley.com/doi/abs/10.1002/0471238961.0308121502182501.a01.pub2 HERO ID: 5177139

Krishnamurti, R. (2001). Chlorinated benzenes. In Kirk-Othmer Encyclopedia of Chemical Technology. [online]: John Wiley & Sons. https://onlinelibrary.wiley.com/doi/10.1002/0471238961.0308121502182501.a01.pub2. HERO ID: 5177139

Kurt, Z; Spain, JC. (2013). Biodegradation of chlorobenzene, 1,2-dichlorobenzene, and 1,4-dichlorobenzene in the vadose zone. Environmental Science and Technology. 47: 6846-6854. http://dx.doi.org/10.1021/es3049465. HERO ID: 1752483

Lewis, RJ, Sr. (2012). Sax's dangerous properties of industrial materials (12th ed.). Hoboken, NJ: John Wiley & Sons. http://dx.doi.org/10.1002/0471701343. HERO ID: 3840105

Ma, Y-J; Wang, X-L; Yu, W-J; Zhang, L-J; Sun, H-Z. (1997). Toxicity of chlorinated benzenes to marine algae. 15: 308-313. http://dx.doi.org/10.1007/bf02850564. HERO ID: 5243980

Marvel Oil Company. (2017). SDS for: Marvel Mystery Oil-01/26/2017. Addison, IL: Marvel Oil Company; I. https://www.whatsinproducts.com/brands/show_msds/1/21614. HERO ID: 6280737

NICNAS (National Industrial Chemicals Notification and Assessment Scheme). (2001). Priority existing chemical assessment report no. 14: Ortho-dichlorobenzene. Sydney, Australia: Australian Department of Health, National Industrial Chemicals Notification and Assessment Scheme. https://www.nicnas.gov.au/__data/assets/word_doc/0018/34821/PEC14-ortho-dichlorobenzene.docx#cas-A_95-50-1;%20Benzene,%201,2-dichloro-. HERO ID: 5155563

NIOSH (National Institute for Occupational Safety and Health). (1994). NIOSH Publications & Products. https://www.cdc.gov/niosh/idlh/106467.html. HERO ID: 6305405

NIOSH (National Institute for Occupational Safety and Health). (2019). NIOSH pocket guide to chemical hazards. https://www.cdc.gov/niosh/npg/npgd0190.html. HERO ID: 6305402

NTP (National Toxicology Program). (1985). NTP technical report on the toxicology and carcinogenesis studies of 1,2-dichlorobenzene (o-dichlorobenzene) (CAS no. 95-50-1) in F344/N rats and B6C3F1 mice (gavage studies). (publication No. 86-2511). Research Triangle Park, NC: U.S. Department of Health and Human Services, National Institutes of Health, National Toxicology Program. https://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr255.pdf. HERO ID: 5160109

OECD (Organisation for Economic Co-operation and Development). (2001). SIDS Dossier: CAS No. 95-50-1: o-Dichlorobenzene. Organisation for Economic Cooperation and Development/Screening Information Data Set. http://www.inchem.org/documents/sids/sids/95501.pdf. HERO ID: 5185286

OECD (Organisation for Economic Co-operation and Development). (2001). SIDS initial assessment report for 13th SIAM: 1,2-Dichloroethane. (RISKLINE/1996100028). Nairobi, Kenya: United Nations Environment Programme. http://www.oecd.org/chemicalsafety/risk-ssessment/publishedassessments.htm. HERO ID: 5185293

OECD (Organisation for Economic Co-operation and Development). (2001). SIDS Initial Assessment Report: 1,2-Dichlorobenzene (pp. 203). Paris, France. https://hpvchemicals.oecd.org/ui/handler.axd?id=40127CF8-F9A5-4437-BC08-0E1199DF65C7. HERO ID: 5160045

OECD (Organisation for Economic Co-operation and Development). (2004). Emission scenario document on lubricants and lubricant additives. In OECD Series On Emission Scenario Documents. (JT00174617). Paris, France. http://www.olis.oecd.org/olis/2004doc.nsf/LinkTo/env-jm-mono(2004)21. HERO ID: 3827416

OECD (Organisation for Economic Co-operation and Development). (2018). OECD Monitoring Database [Database]. HERO ID: 4571754

OEHHA. (2020). Cal Code Regs. Title 27, § 27001: Chemicals known to the state to cause cancer or reproductive toxicity. (California Code of Regulations Title 27 Section 27001). https://govt.westlaw.com/calregs/Document/I54B9D2B0D45011DEA95CA4428EC25FA0?contextData=%28sc.Default%29&transitionType=Default. HERO ID: 6305878

Oliver, BG; Niimi, AJ. (1983). Bioconcentration of chlorobenzenes from water by rainbow trout: correlations with partition coefficients and environmental residues. Environ Sci Technol 17: 287-291. HERO ID: 4159607

Oliver, BG; Niimi, AJ. (1985). Bioconcentration factors of some halogenated organics for rainbow trout: limitations in their use for prediction of environmental residues. 19: 842-849. http://dx.doi.org/10.1021/es00139a013. HERO ID: 1443873

O'Neil, MJ; Heckelman, PE; Dobbelaar, PH; Roman, KJ; Kenney, CM; Karaffa, LS. (2013). The Merck index: An encyclopedia of chemicals, drugs, and biologicals (15th ed.). Cambridge, UK: The Royal Society of Chemistry. HERO ID: 3378176

OSHA (Occupational Safety and Health Administration). (2019). Permissible exposure limits (PELs). https://www.osha.gov/dsg/annotated-pels/tablez-1.html. HERO ID: 5353123

OSHA (Occupational Safety and Health Administration). (2020). TABLE Z-1 Limits for Air Contaminants. https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1000TABLEZ1. HERO ID: 6305400

Environmental Contamination and Toxicology 12: 679-684. http://dx.doi.org/10.1007/BF01060751. HERO ID: 3634174

RIVM (National Institute for Public Health and the Environment (Netherlands)). (2001). Re-evaluation of human-toxicological maximum permissible risk levels (pp. 297). (711701025). Bilthoven, Netherlands: National Institute for Public Health and the Environment (RIVM). https://www.rivm.nl/bibliotheek/rapporten/711701025.pdf. HERO ID: 5159898

Shiu, W-Y; Mackay, D. (1997). Henry's law constants of selected aromatic hydrocarbons, alcohols, and ketones. Journal of Chemical & Engineering Data. 42: 27-30. https://doi.org/10.1021/je960218u HERO ID: 5184510

Solvay. (2020). Ryton®PPS Regulatory Statements. https://www.solvay.com/en/brands/ryton-pps/regulatory-statements. HERO ID: 6305403

Staudinger, J; Roberts, PV. (1996). A critical review of henry's law constants for environmental applications. Crit Rev Environ Sci Tech 26: 205-297. http://dx.doi.org/10.1080/10643389609388492. HERO ID: 1441644

Syracuse Research Corp. (1978). Results of continuous exposure of fathead minnow embryo to 21 priority pollutants (pp. 46 p. (NTIS/OTS0511060)(Publ in Part as 0515175, 0515184, 0515590, 0519607, 0519953, 0510366, 0510427, 0120941)). (OTS#0511060). Springfield, VA. HERO ID: 3808969

Touch n Foam. (2019). DAP® Mouse Shield® Foam Sealant 2019. http://www.touch-n-foam.com/cmss_files/attachmentlibrary/TDS/TDS-TNF-MouseShield-FINAL.pdf. HERO ID: 6305404

U.S. EPA (U.S. Environmental Protection Agency). (1981). An exposure and risk assessment for dichlorobenzenes. (EPA-440/4-81-019). HERO ID: 1482344

U.S. EPA (U.S. Environmental Protection Agency). (1990). EPA Ambient Monitoring Technology Information Center (AMTIC): Air toxics data. https://www3.epa.gov/ttnamti1/toxdat.html. HERO ID: 6126519

U.S. EPA (U.S. Environmental Protection Agency) (1993). Generic Scenario: Application of Agricultural Pesticides. HERO ID: 5097880

U.S. EPA (U.S. Environmental Protection Agency). (1996). EPA Unregulated Contaminant Monitoring Rule (UCMR). https://www.epa.gov/dwucmr. HERO ID: 6126665

U.S. EPA (U.S. Environmental Protection Agency). (1998). Guidelines for ecological risk assessment. U.S. Report Number EPA/630/R-95/002F. Environmental Protection Agency, Risk Assessment Forum. Washington, DC. https://www.epa.gov/risk/guidelines-ecological-risk-assessment. HERO ID 42805

U.S. EPA (U.S. Environmental Protection Agency). (2006). Targeted National Sewage Sludge Survey (TNSSS) [Database]. https://www.epa.gov/biosolids/sewage-sludge-surveys. HERO ID: 4571702

U.S. EPA (U.S. Environmental Protection Agency). (2007). EPA Discharge Monitoring Report Data [Database]. https://cfpub.epa.gov/dmr/. HERO ID: 4571528

U.S. EPA (U.S. Environmental Protection Agency). (2009). Initial risk-based prioritization of high production volume (HPV) chemicals: Chlorobenzenes category: Sponsored chemicals: Monochlorobenzene (CASRN 108-90-7) (CA Index Name: Benzene, chloro-); 1,2-Dichlorobenzene (CASRN 95-50-1) (CA Index Name: Benzene, 1,2-dichloro-); 1,3-Dichlorobenzene (CASRN 541-73-1) (CA Index Name: Benzene, 1,3-dichloro-); 1,2,3-Trichlorobenzene (CASRN 87-61-6) (CA Index Name: Benzene, 1,2,3-trichloro-). Washington, DC: U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics. https://chemview.epa.gov/chemview/proxy?filename=HC95501.pdf. HERO ID: 5113349

U.S. EPA (U.S. Environmental Protection Agency) (2011). Final rule. TSCA inventory update modifications: Chemical data reporting. Fed Reg 76: 50815-50879. HERO ID: 3808939

U.S. EPA (U.S. Environmental Protection Agency). (2012). PhysProp database. Estimation Programs Interface Suite™ for Microsoft® Windows, v 4.11: CASRN 106-47-6 [Fact Sheet]. Washington, DC: U.S. Environmental Protection Agency. https://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface. HERO ID: 5178554

U.S. EPA (U.S. Environmental Protection Agency). (2013). 1986-2002 inventory update reporting rule data (non-confidential production volume in pounds). Washington, DC: Washington, DC. U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics. HERO ID: 6114854

U.S. EPA (United States Environmental Protection Agency). (2015). Form R Reports. https://enviro.epa.gov/enviro/tri_formr_partone_v2.get_thisone?rpt_year=2015&dcn_num=1315213902543&ban_flag=Y. HERO ID: 6305399

U.S. EPA (U.S. Environmental Protection Agency) (2017). Procedures for chemical risk evaluation under the amended Toxic Substances Control Act. Final Rule Federal Registrar 82: 33726-33753. Fed Reg 82. HERO ID: 6128248

U.S. EPA (U.S. Environmental Protection Agency). (2017). Chemical data reporting (2012 and 2016 Public CDR database) [Database]. Washington, DC: U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics. Retrieved from ChemView: June 2019. https://chemview.epa.gov/chemview HERO ID: 6275311 .HERO ID: 6275311

U.S. EPA (U.S. Environmental Protection Agency) (2018). 40 CFR 702.3: Procedures for prioritization of chemical substances for risk evaluation: Definitions. Washington, DC. HERO ID: 5165395

U.S. EPA (U.S. Environmental Protection Agency) (2018). 40 CFR 702.41: Procedures for Chemical Substance Risk Evaluations: Evaluation requirements. Washington, DC. HERO ID: 6302779

U.S. EPA (U.S. Environmental Protection Agency) (2018). 40 CFR 702.45: Procedures for Chemical Substance Risk Evaluations: Peer review. Washington, DC. HERO ID: 6302780

U.S. EPA (U.S. Environmental Protection Agency) (2018a). Application of systematic review in TSCA risk evaluations. (740-P1-8001). Washington, DC: U.S. Environmental Protection Agency, Office of

Chemical Safety and Pollution Prevention. https://www.epa.gov/sites/production/files/2018-06/documents/final_application_of_sr_in_tsca_05-31-18.pdf. HERO ID: 4532281

U.S. EPA (U.S. Environmental Protection Agency). (2018b). para-Dichlorobenzene: Human health risk assessment in support of registration review. (EPA-HQ-OPP-2016-0117). Washington, DC: U.S. Environmental Protection Agency, Office of Pesticide Programs. https://www.regulations.gov/docket?D=EPA-HQ-OPP-2016-0117. HERO ID: 6323358

U.S. EPA (U.S. Environmental Protection Agency) (2019a). Proposed Designation of *p*-Dichlorobenzene (CASRN 106-46-7) as a High Priority Substance for Risk Evaluation. Office of Chemical Safety and Pollution Prevention. https://www.epa.gov/sites/production/files/2019-08/documents/pdb_106-46-7_high-priority_proposeddesignation_082319.pdf HERO ID: 6311315

U.S. EPA (U.S. Environmental Protection Agency) (2019b). Chemical Data Reporting (2012 and 2016 CBI CDR database). Washington, DC. U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics. Retrieved: April 25, 2019. HERO ID: 6301193

U.S. EPA (U.S. Environmental Protection Agency). (2019c). TRI Explorer (2018 dataset released November 2019). Washington, DC. Retrieved from https://enviro.epa.gov/triexplorer/. HERO ID: 6323208

U.S. EPA (U.S. Environmental Protection Agency). (2019d). Envirofacts Toxics Release Inventory 2017 Updated Dataset (released April 2019) [Website]. https://www.epa.gov/enviro/tri- customized-search. HERO ID: 6127841

Van Der Meer, JR; Bosma, TN; De Bruin, WP; Harms, H; Holliger, C; Rijnaarts, HH; Tros, ME; Schraa, G; Zehnder, AJ. (1992). Versatility of soil column experiments to study biodegradation of halogenated compounds under environmental conditions. Biodegradation. 3: 265-284. http://dx.doi.org/10.1007/BF00129088. HERO ID: 647132

Wasik, SP; Miller, MM; Tewari, YB; May, WE; Sonnefeld, WJ; De Voe, H; Zoller, WH. (1983). Determination of the vapor pressure, aqueous solubility, and octanol/water partition coefficient of hydrophobic substances by coupled generator column/liquid chromatographic methods. In Residue Reviews. New York, NY: Springer. HERO ID: 5184511

Yalkowsky, SH; He, Y; Jain, P. (2010). Handbook of aqueous solubility data (2nd ed.). Boca Raton, FL: CRC Press. http://dx.doi.org/10.1201/EBK1439802458. HERO ID: 2990992

APPENDICES

Appendix A LIST OF GRAY LITERATURE SOURCES

Table_Apx A-1. Gray Literature Sources that yielded results for *p*-Dichlorobenzene

Source/Agency	Source Name	Source Type	Source Category
ATSDR	ATSDR Tox Profile Updates and Addendums	Other US Agency Resources	Assessment or Related Document
ATSDR	ATSDR Toxicological Profiles (original publication)	Other US Agency Resources	Assessment or Related Document
Australian Government Department of Health.	NICNAS Assessments (human health, Tier I, II or III)	International Resources	Assessment or Related Document
CAL EPA	Technical Support Documents for regulations: Cancer Potency Information	Other US Agency Resources	Assessment or Related Document
CAL EPA	Technical Support Documents for regulations: Reference Exposure Levels (RELs)	Other US Agency Resources	Assessment or Related Document
CAL EPA	Technical Support Documents for regulations: Proposition 65, Cancer	Other US Agency Resources	Assessment or Related Document
CAL EPA	Technical Support Documents for regulations: Drinking Water Public Health Goals	Other US Agency Resources	Assessment or Related Document
CDC	CDC Biomonitoring Tables	Other US Agency Resources	Database
ECHA	European Union Risk Assessment Report	International Resources	Assessment or Related Document

Source/Agency	Source Name	Source Type	Source Category
ECHA	Annex XV Restriction Report	International Resources	Assessment or Related Document
Env Canada	Priority Substances List Assessment Report; State of Science Report, Environment Canada Assessment	International Resources	Assessment or Related Document
Env Canada	Chemicals at a Glance (fact sheets)	International Resources	Assessment or Related Document
Env Canada	Guidelines, Risk Management, Regulations	International Resources	Assessment or Related Document
EPA	Office of Water: STORET and WQX	US EPA Resources	Database
EPA	EPA Office of Water: Ambient Water Quality Criteria documents	US EPA Resources	Assessment or Related Document
EPA	Office of Air: TRI	US EPA Resources	Database
EPA	EPA Pesticide Chemical Search (docket)	US EPA Resources	Assessment or Related Document
EPA	Office of Air: AQS, Annual	US EPA Resources	Database
EPA	TSCA Hazard Characterizations	US EPA Resources	Assessment or Related Document
EPA	Office of Air: National Emissions Inventory (NEI) - National Emissions Inventory (NEI) Data (2014, 2011, 2008)	US EPA Resources	Database
EPA	Other EPA: Misc sources	US EPA Resources	General Search
EPA	EPA: AP-42	US EPA Resources	Regulatory Document or List

Source/Agency	Source Name	Source Type	Source Category
EPA	TRI: Envirofacts Toxics Release Inventory 2017 Updated Dataset	US EPA Resources	Database
EPA	Chemical Data Reporting (2012 and 2016 non-CBI CDR database)	US EPA Resources	Database
EPA	Chemical Data Reporting (2012 and 2016 CBI CDR database)	US EPA Resources	Database
EPA	EPA: Generic Scenario	US EPA Resources	Assessment or Related Document
EPA	EPA Discharge Monitoring Report Data	US EPA Resources	Database
EPA	Office of Water: Drinking Water Standards Health Effects Support Documents	US EPA Resources	Regulatory Document or List
EPA	Office of Air: CFRs and Dockets	US EPA Resources	Regulatory Document or List
FDA	FDA Market Baskets	Other US Agency Resources	Assessment or Related Document
IARC	IARC Monograph	International Resources	Assessment or Related Document
Japan	Japanese Ministry of the Environment Assessments - Environmental Risk Assessments (Class I Designated Chemical Substances Summary Table)	International Resources	Regulatory Document or List
KOECT	Kirk-Othmer Encyclopedia of	Other Resource	Encyclopedia

Source/Agency	Source Name	Source Type	Source Category
	Chemical Technology Journal Article		
NIOSH	CDC NIOSH - Occupational Health Guideline Documents	Other US Agency Resources	Assessment or Related Document
NIOSH	CDC NIOSH - Pocket Guides	Other US Agency Resources	Database
NIOSH	CDC NIOSH - Health Hazard Evaluations (HHEs)	Other US Agency Resources	Assessment or Related Document
NLM	National Library of Medicine's Hazardous Substance Databank	Other US Agency Resources	Database
NLM	National Library of Medicine's HazMap	Other US Agency Resources	Database
NTP	Technical Reports	Other US Agency Resources	Assessment or Related Document
OECD	OECD Emission Scenario Documents	International Resources	Assessment or Related Document
OECD	OECD: General Site	International Resources	General Search
OSHA	OSHA Chemical Exposure Health Data	Other US Agency Resources	Database
OSHA	U.S. OSHA Chemical Exposure Health Data (CEHD) program data [ERG]	Other US Agency Resources	Database
RIVM	Integrated Critera Documents	International Resources	Assessment or Related Document
RIVM	RIVM Reports: Risk Assessments	International Resources	Assessment or Related Document
TERA	Toxicology Excellence for Risk Assessment	Other Resources	Assessment or Related Document

Appendix B Physical and Chemical Properties of *p*-Dichlorobenzene

This appendix provides p-chem information and data found in preliminary data gathering for *p*-dichlorobenzene. Table_Apx B-1 summarizes the p-chem property values preliminarily selected for use in the risk evaluation from among the range of reported values collected as of March 2020. This table differs from that presented in the *Proposed Designation of p-Dichlorobenzene (CASRN 106-46-7) as a High Priority Substance for Risk Evaluation* (U.S. EPA, 2019a) and may be updated as EPA collects additional information through systematic review methods. All p-chem property values that were extracted and evaluated as of March 2020 are presented in the supplemental file *Data Extraction and Data Evaluation Tables for Physical Chemical Property Studies* (EPA-HQ-OPPT-2018-0462).

Table_Apx B-1. Physical and Chemical Properties of *p*-Dichlorobenzene

Property or Endpoint	Value[a]	Reference	Data Quality Rating
Molecular formula	$C_6H_4Cl_2$	NA	NA
Molecular weight	147.00 g/mol	NA	NA
Physical state	Solid monoclinic prisms, leaves	Rumble, 2018	High
Physical properties	Distinctive aromatic odor, becomes very strong at concentrations between 30 and 60 ppm	NLM, 2018	High
Melting point	53.1°C	Rumble, 2018	High
Boiling point	174°C	U.S. EPA, 2018	High
Density	1.46 g/cm^3 at 20°C	O'Neil, 2013	High
Vapor pressure	1.3 mm Hg	RSC, 2019	High
Vapor density	5.08 (air = 1)	NLM, 2018	High
Water solubility	81.4 mg/L at 25°C	Shiu, 1997	High
Log Octanol/water partition coefficient (Log Kow)	3.52 at 22±0.2°C (Calculated from experimental retention times)	Verbruggen, 1999	High
Henry's Law constant	0.00241 atm·m^3/mol at 25°C	Rumble, 2018	High

Property or Endpoint	Value[a]	Reference	Data Quality Rating
Flash point	65.56°C (closed cup)	O'Neil, 2013	High
Auto flammability	Not available		
Viscosity	0.839 cP at 55°C	NLM, 2018	High
Refractive index	1.5285	O'Neil, 2013	High
Dielectric constant	2.3943 at 55°C	NLM, 2018	High

[a] Measured unless otherwise noted.
NA = Not applicable

Appendix C ENVIRONMENTAL FATE AND TRANSPORT PROPERTIES

Table_Apx C-1 provides the environmental fate characteristics that EPA identified and considered in developing the scope for *p*-dichlorobenzene.

Table_Apx C-1. Environmental Fate Characteristics of *p*-Dichlorobenzene

Property or Endpoint	Value	Reference
Direct Photodegradation	Does not contain chromophores that absorb at wavelengths >290 nm; not expected to undergo direct photolysis by sunlight	HSDB (2018)
Indirect Photodegradation	$t_{1/2}$ = 33 days (based on 12-hour day with 1.5×10^6 ·OH/cm^3 and ·OH rate constant 3.2×10^{-13} cm^3/mol·second at 25 ºC)	PhysProp Database (U.S. EPA, 2012b) citing Atkinson (1989)
Hydrolysis	Stable; *p*-dichlorobenzene is not expected to undergo hydrolysis based on its chemical structure, which lacks functional groups known to undergo hydrolysis under environmental conditions	HSDB (2018)
Biodegradation (Aerobic)	Water: 0%/28 days based on theoretical BOD and HPLC using an activated sludge inoculum (Japanese MITI test; improved for a volatile substance; initial test substance concentration of 100 mg/L)	HSDB (2018) citing NITE (2010)
	Water: 80%/ 28 days mineralization and 30%/28 days with initial test substance concentrations of 8 and 40 mg/L, respectively (test comparable to MITI [I] test) 1.4%/8 days, 49.5%/15 days, and 67%/28 days based on test substance analysis and initial test substance concentration of 1.9 mg/L (OECD 301D, closed bottle test); *p*-dichlorobenzene meets the 10-day window and is readily biodegradable at lower concentrations but toxic effect at higher concentrations is likely	ECHA (2004)
	Soil: 6.3%/10 weeks based on theoretical CO_2 evolution in an alkaline soil sample reported for dichlorobenzene isomers	HSDB (2018) citing Haider et al. (1974)

Property or Endpoint	Value	Reference
	Sediment: 25 and 90%/300 days incubation in soil column experiments with sediment from the Rhine River	HSDB (2018) citing van der Meer et al. (1992)
Biodegradation (Anaerobic)	Sediment: no biotransformation/12 months in anaerobic Rhine River sediment column	HSDB (2018) citing Bosma et al. (1990)
	Groundwater: 7.4 mg/m^3/day biodegradation rate in vadose zone in New Jersey measured above polluted groundwater at DuPont Chambers Works	HSDB (2018) citing Kurt et al. (2013)
Wastewater Treatment	76% total removal (46% by biodegradation, 7.1% by sludge, and 23% by volatilization to air; estimated)[b]	U.S. EPA (2012a)
Bioconcentration Factor	370–720 (rainbow trout) 78 (mosquito fish)	HSDB (2018) citing Chaisukant (1997) and Oliver and Niimi (1983)
	33–190 (*Cyprinus carpio*; OECD 305)	NITE (2010)
	Ranged from 60 (*Lepomis macrochirus*; whole-body wet weight) to 1,800 (*Poecilia reticulata*; total lipid content and BCF of 270 based on whole-body dry weight)	ECHA (2019) (range from eight study summaries)
Bioaccumulation Factor	281 (estimated)[b]	U.S. EPA (2012a)
Soil Organic Carbon:Water Partition Coefficient (Log K_{OC})	2.44 (K_{OC} = 273; batch equilibrium method equivalent to OECD 106)	ATSDR (2006) citing Chiou et al. (1983); ECHA (2019)

[a]Measured unless otherwise noted
[b]EPI Suite™ physical property inputs: Log K_{OW} = 3.44, BP = 174 ºC, MP = 52.09 ºC, VP = 1.74 mm Hg, WS = 81.3 mg/L, HLC = 0.00241 atm-m^3/mol, STP Exp. biodeg values of BIOP = 40, BioA = 10 and BioS = 10, SMILES c(ccc(c1)Cl)(c1)Cl
□OH = hydroxyl radical; HPLC = high performance liquid chromatography; BOD = biological oxygen demand; OECD = Organisation for Economic Cooperation and Development; MITI = Ministry of International Trade and Industry

Appendix D REGULATORY HISTORY

The chemical substance, *p*-dichlorobenzene, is subject to federal and state laws and regulations in the United States Table_Apx D-1 and **Table_Apx D-2**. Regulatory actions by other governments, tribes and international agreements applicable to *p*-dichlorobenzene are listed in Table_Apx D-3.

D.1 Federal Laws and Regulations

Table_Apx D-1. Federal Laws and Regulations

Statutes/Regulations	Description of Authority/Regulation	Description of Regulation
EPA Regulations		
Toxic Substances Control Act (TSCA) – Section 6(b)	EPA is directed to identify high-priority chemical substances for risk evaluation; and conduct risk evaluations on at least 20 high priority substances no later than three and one-half years after the date of enactment of the Frank R. Lautenberg Chemical Safety for the 21st Century Act.	*p*-Dichlorobenzene is one of the 20 chemicals EPA designated as a High-Priority Substance for risk evaluation under TSCA (84 FR 71924, December 30, 2019). Designation of *p*-dichlorobenzene as high-priority substance constitutes the initiation of the risk evaluation on the chemical.
Toxic Substances Control Act (TSCA) – Section 8(a)	The TSCA Section 8(a) CDR Rule requires manufacturers (including importers) to give EPA basic exposure-related information on the types, quantities and uses of chemical substances produced domestically and imported into the United States	*p*-Dichlorobenzene manufacturing (including importing), processing and use information is reported under the CDR rule (76 FR 50816, August 16, 2011).
Toxic Substances Control Act (TSCA) – Section 8(b)	EPA must compile, keep current and publish a list (the TSCA Inventory) of each chemical substance manufactured (including imported) or processed in the United States.	*p*-Dichlorobenzene was on the initial TSCA Inventory and therefore was not subject to EPA's new chemicals review process under TSCA Section 5 (60 FR 16309, March 29, 1995).

Statutes/Regulations	Description of Authority/Regulation	Description of Regulation
Toxic Substances Control Act (TSCA) – Section 8(e)	Manufacturers (including importers), processors, and distributors must immediately notify EPA if they obtain information that supports the conclusion that a chemical substance or mixture presents a substantial risk of injury to health or the environment.	There are three risk reports for *p*-dichlorobenzene received between 1998-2002 (U.S. EPA, ChemView Accessed 4/5/2019)
Toxic Substances Control Act (TSCA) – Section 4	Provides EPA with authority to issue rules and orders requiring manufacturers (including importers) and processors to test chemical substances and mixtures.	2 notifications of chemical data submissions from test rules received for *p*-dichlorobenzene: Two chemical data submissions from test rules received for *p*-dichlorobenzene (One was a 2005 Metabolism and Pharmacokinetics study (In Vitro Dermal Absorption Rate Testing). The other was a 1989 Reproductive toxicity study (Two Generation Reproduction Study)). (U.S. EPA, ChemView. Accessed March 28, 2019).
Emergency Planning and Community Right-To-Know Act (EPCRA) – Section 313	Requires annual reporting from facilities in specific industry sectors that employ 10 or more full-time equivalent employees and that manufacture, process or otherwise use a TRI-listed chemical in quantities above threshold levels. A facility that meets reporting requirements must submit a reporting form for each chemical for which it triggered reporting, providing data across a variety of categories, including activities and uses of the chemical, releases and other waste management (e.g., quantities recycled, treated, combusted) and pollution prevention activities (under Section 6607 of the Pollution Prevention Act). These data include on- and off-site data as well as multimedia data (i.e., air, land and water).	*p*-Dichlorobenzene (1,4-Dichlorobenzene) is a listed substance subject to reporting requirements under 40 CFR 372.65 effective as of January 1, 1987.

Statutes/Regulations	Description of Authority/Regulation	Description of Regulation
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) - Sections 3 and 6	FIFRA governs the sale, distribution and use of pesticides. Section 3 of FIFRA generally requires that pesticide products be registered by EPA prior to distribution or sale. Pesticides may only be registered if, among other things, they do not cause "unreasonable adverse effects on the environment." Section 6 of FIFRA provides EPA with the authority to cancel pesticide registrations if either (1) the pesticide, labeling, or other material does not comply with FIFRA; or (2) when used in accordance with widespread and commonly recognized practice, the pesticide generally causes unreasonable adverse effects on the environment.	*p*-Dichlorobenzene was first registered as an antimicrobial and conventional chemical insecticide on June 15,1948. EPA issued the revised reregistration Eligibility Decision (RED) for *p*-dichlorobenzene (*p*-dichlorobenzene) on December 29, 2008. All antimicrobial uses of *p*-dichlorobenzene were cancelled at the time of the RED in 2008. As of 2020, of the Section 3 registrations for *p*-dichlorobenzene the majority of the pesticidal uses are as a moth repellant to protect garments from insect damage. There are no outdoor uses registered for *p*-dichlorobenzene. In November 2018, OPP completed a Human Health Assessment of *p*-dichlorobenzene in support of its Registration Review, under the 15-year cycle (U.S. EPA, 2018b). OPP is planning to issue a Proposed Interim Decision on pesticidal uses of *p*-dichlorobenzene in FY 2020.
Clean Air Act (CAA) – Section 111(b)	Requires EPA to establish new source performance standards (NSPS) for any category of new or modified stationary sources that EPA determines causes, or contributes significantly to, air pollution,	*p*-Dichlorobenzene is subject to the NSPS for equipment leaks of volatile organic compounds (VOCs) in the

Statutes/Regulations	Description of Authority/Regulation	Description of Regulation
	which may reasonably be anticipated to endanger public health or welfare. The standards are based on the degree of emission limitation achievable through the application of the best system of emission reduction (BSER) which (taking into account the cost of achieving reductions and environmental impacts and energy requirements) EPA determines has been adequately demonstrated.	synthetic organic chemicals manufacturing industry for which construction, reconstruction or modification began after January 5, 1981
Clean Air Act (CAA) – Section 112(b)	Defines the original list of 189 hazardous air pollutants (HAPs). Under 112(c) of the CAA, EPA must identify and list source categories that emit HAP and then set emission standards for those listed source categories under CAA Section 112(d). CAA Section 112(b)(3)(A) specifies that any person may petition the Administrator to modify the list of HAP by adding or deleting a substance. Since 1990, EPA has removed two pollutants from the original list leaving 187 at present.	*p*-Dichlorobenzene is listed as a HAP (63 FR 71381, December 28, 1998)
Clean Air Act (CAA) – Section 112(d)	Directs EPA to establish, by rule, NESHAPs for each category or subcategory of listed major sources and area sources of HAPs (listed pursuant to Section 112(c)). For major sources, the standards must require the maximum degree of emission reduction that EPA determines is achievable by each particular source category. This is generally referred to as maximum achievable control technology (MACT). For areas sources, the standards must require generally achievable control technology (GACT) though may require MACT.).	EPA has established NESHAPs for a number of source categories that emit *p*-dichlorobenzene to air. (See https://www.epa.gov/stationary-sources-air-pollution/national-emission-standards-hazardous-air-pollutants-neshap-9)
Clean Air Act (CAA) – Section 183(e)	Section 183(e) requires EPA to list the categories of consumer and commercial products that account for at least 80 percent of all VOC emissions in areas that violate the National Ambient Air Quality Standards (NAAQS) for ozone and to issue standards for these categories that require "best available controls." In lieu of regulations, EPA may issue control techniques guidelines if the	*p*-Dichlorobenzene is listed under the National Volatile Organic Compound Emission Standards for Aerosol Coatings (40 CFR part 59, subpart E). *p*-dichlorobenzene has a

Statutes/Regulations	Description of Authority/Regulation	Description of Regulation
	guidelines are determined to be substantially as effective as regulations.	reactivity factor of .20 g O3/g VOC.
Clean Water Act (CWA) - Section 304(a)(1)	Requires EPA to develop and publish ambient water quality criteria (AWQC) reflecting the latest scientific knowledge on the effects on human health that may be expected from the presence of pollutants in any body of water.	In 2015, EPA published updated AWQC for *p*-dichlorobenzene, including a recommendation of 300 (µg/L) for "Human Health for the consumption of Water + Organism" and 900 (µg/L) for "Human Health for the consumption of Organism Only" for states and authorized tribes to consider when adopting criteria into their water quality standards.
Clean Water Act (CWA) – Section 301(b), 304(b), 306, 207(a) and 307(b)	Clean Water Act Section 307(a) establishes a list of toxic pollutants or combination of pollutants under the CWA. The statue specifies a list of families of toxic pollutants also listed in the Code of Federal Regulations at 40 CFR Part 401.15. The "priority pollutants" specified by those families are listed in 40 CFR Part 423 Appendix A. These are pollutants for which best available technology effluent limitations must be established on either a national basis through rules (Sections 301(b), 304(b), 307(b), 306) or on a case-by-case best professional judgement basis in NPDES permits, see Section 402(a)(1)(B). EPA identifies the best available technology that is economically achievable for that industry after considering statutorily prescribed factors and sets regulatory requirements based on the performance of that technology.	*p*-Dichlorobenzene is designated as a toxic pollutant and a priority pollutant under Section 307(a)(1) of the CWA and as such is subject to effluent limitations. Under CWA Section 304, *p*-dichlorobenzene is included in the list of total toxic organics (TTO) (40 CFR 413.02(i)).
Clean Water Act (CWA) – Section 311(b)(2)(A) and 501(a) of the Federal	Requires EPA to develop, promulgate, and revise as may be appropriate, regulations designating as hazardous substances, other than oil, which, when discharged present an	*p*-Dichlorobenzene is a designated hazardous substance in accordance with Section 311(b)(2)(A)

Statutes/Regulations	Description of Authority/Regulation	Description of Regulation
Water Pollution Control Act.	imminent and substantial danger to the public health or welfare, including, but not limited to, fish, shellfish, wildlife, shorelines, and beaches.	of the Federal Water Pollution Control Act. (40 FR 116.4, March 13, 1978).
Safe Drinking Water Act (SDWA) – Section 1412	Requires EPA to publish non-enforceable maximum contaminant level goals (MCLGs) for contaminants which 1. may have an adverse effect on the health of persons; 2. are known to occur or there is a substantial likelihood that the contaminant will occur in public water systems with a frequency and at levels of public health concern; and 3. in the sole judgement of the Administrator, regulation of the contaminant presents a meaningful opportunity for health risk reductions for persons served by public water systems. When EPA publishes an MCLG, EPA must also promulgate a National Primary Drinking Water Regulation (NPDWR) which includes either an enforceable maximum contaminant level (MCL), or a required treatment technique. Public water systems are required to comply with NPDWRs.	*p*-Dichlorobenzene is subject to NPDWR under the SDWA with a MCLG of 0.075 $(mg/L)^2$ and an enforceable MCL of 0.075 $(mg/L)^2$ (Section 1412) (52 FR 25690, January 30, 1991).
Resource Conservation and Recovery Act (RCRA) – Section 3001	Directs EPA to develop and promulgate criteria for identifying the characteristics of hazardous waste, and for listing hazardous waste, taking into account toxicity, persistence, and degradability in nature, potential for accumulation in tissue and other related factors such as flammability, corrosiveness, and other hazardous characteristics.	*p*-Dichlorobenzene is included on the list of hazardous wastes pursuant to RCRA 3001. RCRA Hazardous Waste Codes: D027 and U072 (40 CFR 261.24 and 261.33).
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) – Sections 102(a) and 103	Authorizes EPA to promulgate regulations designating as hazardous substances those substances which, when released into the environment, may present substantial danger to the public health or welfare or the environment. EPA must also promulgate regulations establishing the quantity of any hazardous	*p*-Dichlorobenzene is a hazardous substance under CERCLA. Releases of *p*-dichlorobenzene in excess of 100 pounds must be reported (40 CFR 302.4).

Statutes/Regulations	Description of Authority/Regulation	Description of Regulation
	substance the release of which must be reported under Section 103. Section 103 requires persons in charge of vessels or facilities to report to the National Response Center if they have knowledge of a release of a hazardous substance above the reportable quantity threshold.	
Superfund Amendments and Reauthorization Act (SARA) –	Requires the Agency to revise the hazardous ranking system and update the National Priorities List of hazardous waste sites, increases state and citizen involvement in the superfund program and provides new enforcement authorities and settlement tools.	*p*-Dichlorobenzene is listed on SARA, an amendment to CERCLA and the CERCLA Priority List of Hazardous Substances. This list includes substances most commonly found at facilities on the CERCLA National Priorities List (NPL) that have been deemed to pose the greatest threat to public health.
Other Federal Regulations		
Occupational Safety and Health Act (OSHA)	Requires employers to provide their workers with a place of employment free from recognized hazards to safety and health, such as exposure to toxic chemicals, excessive noise levels, mechanical dangers, heat or cold stress or unsanitary conditions (29 U.S.C Section 651 et seq.). Under the Act, OSHA can issue occupational safety and health standards including such provisions as Permissible Exposure Limits (PELs), exposure monitoring, engineering and administrative control measures, and respiratory protection.	OSHA issued occupational safety and health standards for *p*-dichlorobenzene including a PEL of 75 ppm TWA, exposure monitoring, control measures and respiratory protection (29 CFR 1910.1000).
Federal Hazardous Materials Transportation Act (HMTA)	Section 5103 of the Act directs the Secretary of Transportation to: • Designate material (including an explosive, radioactive material, infectious substance, flammable or combustible liquid, solid or gas, toxic, oxidizing or corrosive material, and compressed gas)	*p*-Dichlorobenzene is listed as a hazardous material with regard to transportation and is subject to regulations prescribing requirements applicable to the shipment

Statutes/Regulations	Description of Authority/Regulation	Description of Regulation
	as hazardous when the Secretary determines that transporting the material in commerce may pose an unreasonable risk to health and safety or property. • Issue regulations for the safe transportation, including security, of hazardous material in intrastate, interstate and foreign commerce.	and transportation of listed hazardous materials (49 CFR 172.101) (70 FR 34381, June 14 2005).
Federal Food, Drug and Cosmetic Act (FFDCA)	Provides the FDA with authority to oversee the safety of food, drugs and cosmetics. As a food contact substance FDA does not use "indirect food additive" as a regulatory term anymore. Since about 2000, the regulatory term for things previously categorized as "indirect food additives" is "food contact substance" "FDA established a maximum residual level of 0.8 ppm of *p*-dichlorobenzene as an indirect food additive in food contact polymers (21 CFR 177.2490).""	*p*-Dichlorobenzene is listed as a food contact substance in food contact polymers, specifically in polyphenylene sulfide resins in coatings or components of coatings of articles intended for repeated use in contact with food. FDA established a maximum residual level of 0.8 ppm of *p*-dichlorobenzene as a food contact substance in food contact polymers (21 CFR 177.2490).

D.2 State Laws and Regulations

Table_Apx D-2. State Laws and Regulations

State Actions	Description of Action
State Air Regulations	Allowable Ambient Levels [New Hampshire has an 800 24-hour AAL mg/m^3 (Env-A 1400: Regulated Toxic Air Pollutants). Rhode Island has set a 1hour AAL of 12,000 mg/m^3 and a 24-hour AAL of 800 mg/m^3 and an annual AAL of .09 mg/m^3 (Rhode Island Air Pollution Regulation No. 22)]
State Drinking Water Standards and Guidelines	Arizona set an MCL of .075 mg/L and an MCLG of 0.075 mg/L (14 Ariz. Admin. Register 2978, August 1, 2008), California set an MCL of .0005 mg/L, a DLR of .0005 and a PHG of .006 mg/l in 1997 (Cal Code Regs. Title 26, § 22-64444), Delaware set an MCL of 0.075 mg/L and MCLG of 75 mg/L (Del. Admin. Code Title 16, § 4462),

State Actions	Description of Action
	Connecticut set an MCL of 0.075 mg/L (Conn. Agencies Regs. § 19-13-B102), Florida set an MCL of 75 mg/L (Fla. Admin. Code R. Chap. 62-550), Maine set an MCL of 0.075 mg/L (10 144 Me. Code R. Chap. 231), Massachusetts set an MCL of 0.005 mg/L (310 Code Mass. Regs. § 22.00), Michigan set drinking water criteria of 75 mg/L (Mich. Admin. Code r.299.44 and r.299.49, 2017), Minnesota set an MCL of 10 mg/L (Minn R. Chap. 4720), New Jersey adopted Federal MCL of 75 mg/L (7:10 N.J Admin. Code § 5.2), Pennsylvania set an MCL of 0.075 mg/L (25 Pa. Code § 109.202), Rhode Island set an MCL of 75 mg/L (Rules and Regulations Pertaining to Public Drinking Water R46-13-DWQ).
State PELs	California PEL of 10 ppm and a STEL of 110 ppm) (Cal Code Regs. Title 8, § 5155) Hawaii PEL of 75 ppm and 450 mg/m^{3d} and a STEL of 110 ppm and 675 mg/m^{3d} (Hawaii Administrative Rules Section 12-60-50).
State Right-to-Know Acts	*p*-Dichlorobenzene is on the MA Toxic Use Reduction Act (TURA) list of 2019 (301 CMR 41.00 (105 Code Massachusetts. Regs. § 670.000 Appendix A), *p*-Dichlorobenzene is a hazardous substance identified under New Jersey's Worker and Community RTK Act which includes over 2000 hazardous substances. New Jersey (N.J.A.C. 7:1G) and Pennsylvania (P.L. 734, No. 159 and 34 Pa. Code § 323).
Chemicals of High Concern to Children	Several states have adopted reporting laws for chemicals in children's products containing *p*-dichlorobenzene Maine designated *p*-dichlorobenzene as a chemical of concern (38 MRSA Chapter 16-D), and Minnesota lists *p*-dichlorobenzene as a Chemical of High Concern (Toxic Free Kids Act Minn. Stat. 116.9401 to 116.9407).
Volatile Organic Compound (VOC) Regulations for Consumer Products	Many states regulate *p*-dichlorobenzene as a VOC. These regulations may set VOC limits for consumer products and/or ban the sale of certain consumer products as an ingredient and/or impurity. Regulated products vary from state to state and could include toilet and urinal care products and air fresheners including in toilet bowls, urinals and animal holding facilities. California prohibited *p*-dichlorobenzene in solid air freshener and in toilet/urinal care products effective 12/31/2005 with a sell through date of 12/31/2006. (Title 17, California Code of Regulations, Division 3, Chapter 1, Subchapter 8.5, Articles 1, 2, 3 and 4), Connecticut prohibits the sale, supply or manufacture of any solid air freshener or toilet/urinal care product that contains *p*-dichlorobenzene

State Actions	Description of Action
	(R.C.S.A Sections 22a-174-40, 22a-174-41, and 22a-174-44), Delaware (Adm. Code Title 7, 1141), District of Columbia prohibits the sale, supply, manufacturer or use of solid air fresheners or toilet/urinal care products that contain *p*-dichlorobenzene (Rule 729) Illinois prohibits air fresheners containing *p*-dichlorobenzene (35 Adm Code 223), Indiana adopted restrictions on *p*-dichlorobenzene in VOC-containing products (Article 8 Volatile Organic Compound Rule 326 IAC 8-15), Maine adopted a ban effective January 1, 2010 on the sale, supply, and manufacture of any solid air fresheners or Toilet/Urinal Care products that contain *p*-dichlorobenzene. (Chapter 152 of the Maine Department of Environmental Protection Regulations), Maryland prohibits insecticides, solid air fresheners and toilet or urinal care products containing *p*-dichlorobenzene (COMAR 26.11.32.00 to 26.11.32.26), New Hampshire prohibits fragrances containing *p*-dichlorobenzene (Env-A 4100), New Jersey prohibits solid air fresheners containing 98% by weight *p*-dichlorobenzene (Title 7, Chapter 27, Subchapter 24), New York prohibits solid air fresheners and toilet/urinal care products containing *p*-dichlorobenzene (6 CRR-NY III A 235), Ohio prohibits *p*-dichlorobenzene in toilet care products. (Chapter 3725-112), Pennsylvania prohibits *p*-dichlorobenzene in toilet care products (Chapter 130, Subchapter B, Sections 130.201 through 130.471), Rhode Island prohibits solid air fresheners and toilet/urinal care products containing *p*-dichlorobenzene (Air Pollution Control Regulation No. 31), Utah limits toilet care and solid air fresheners to 3% by weight VOC (R 307-357) Virginia (9VAC5 CHAPTER 45) has VOC regulations or limits for consumer products.
Other	California listed *p*-dichlorobenzene on Proposition 65 in 1989 due to carcinogenicity. (Cal Code Regs. Title 27, § 27001). *p*-Dichlorobenzene is listed as a Candidate Chemical under California's Safer Consumer Products Program (Health and Safety Code § 25252 and 25253). California lists *p*-dichlorobenzene as a designated chemical for biomonitoring (California SB 1379).

State Actions	Description of Action
	California Department of Industrial Relations lists *p*-dichlorobenzene as a Hazardous Substance. *p*-Dichlorobenzene is on the MA Toxic Use Reduction Act (TURA) list of 2019 (301 CMR 41.00)

D.3 International Laws and Regulations

Table_Apx D-3. Regulatory Actions by Other Governments, Tribes, and International Agreements

Country/ Organization	Requirements and Restrictions
Canada	*p*-Dichlorobenzene is on the Domestic Substances List (Government of Canada. Managing substances in the environment. Substances Search. Database accessed April 17, 2019). Other regulations include: • Canada's National Pollutant Release Inventory (NPRI)
European Union	In 2014, a restriction on the sale of *p*-dichlorobenzene as a substance or as a constituent of mixtures in concentration equal to or greater than 1% by weight, where the substance or the mixture is placed on the market for use or used as an air freshener or deodorizer in toilets, homes, offices or other indoor public areas. (Accessed 4/16/2019)
Australia	*p*-Dichlorobenzene is subject to secondary notifications when importing or manufacturing the chemical in Australia. In 2000, *p*-dichlorobenzene was assessed (*para*-Dichlorobenzene. Priority Existing Chemical No. 13. Full Public Report (2000)).
Japan	*p*-Dichlorobenzene is regulated in Japan under the following legislation: • Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc. (Chemical Substances Control Law; CSCL) • Act on Confirmation, etc. of Release Amounts of Specific Chemical Substances in the Environment and Promotion of Improvements to the Management Thereof • Industrial Safety and Health Act (ISHA) • Air Pollution Control Law • Water Pollution Control Law (National Institute of Technology and Evaluation [NITE] Chemical Risk Information Platform [CHIRP]. Accessed April 12, 2019

Country/ Organization	Requirements and Restrictions
Australia, Austria, Belgium, Canada-Ontario, Canada-Quebec, Denmark, European Union, Finland, France, Germany, Hungary Ireland, Italy, Japan, Latvia New Zealand, People's Republic of China, Poland, Romania, Singapore, South Korea, Spain, Sweden, Switzerland, The Netherlands, Turkey, USA, United Kingdom	Occupational exposure limits for *p*-dichlorobenzene (GESTIS International limit values for chemical agents (Occupational exposure limits, OELs) database. Accessed April 15, 2019

Appendix E PROCESS, RELEASE AND OCCUPATIONAL EXPOSURE INFORMATION

This appendix provides information and data found in preliminary data gathering for *p*-dichlorobenzene

E.1 Process Information

Process-related information potentially relevant to the risk evaluation may include process diagrams, descriptions and equipment. Such information may inform potential release sources and worker exposure activities.

E.1.1 Manufacture (Including Import)

The 2016 CDR reports five facilities that submitted activity data for 2015. Four of these facilities stated that they imported *p*-dichlorobenzene in 2015. (U.S. EPA, 2016 [2016 CDR]). However, the fifth site reported in their TRI Form R for reporting year 2015 that they import *p*-dichlorobenzene for on-site use as a reactant and they do not manufacture *p*-dichlorobenzene (U.S. EPA, 2015). Therefore, the information EPA has identified to date indicates that *p*-dichlorobenzene is not domestically manufactured and is only imported into the United States.

E.1.1.1 Import

In general, chemicals may be imported into the United States in bulk via water, air, land, and intermodal shipments (Tomer and Kane, 2015). These shipments take the form of oceangoing chemical tankers, railcars, tank trucks, and intermodal tank containers. *p*-Dichlorobenzene is shipped either in molten form in heated, insulated steel tank cars or in flake or granular solid form in sealed containers such as paper bags, fiber packs, or drums (Kirk-Othmer, 2001). EPA has identified two importers of record that import *p*-dichlorobenzene directly to their sites for on-site processing or use and three importers of record that import *p*-dichlorobenzene directly to other sites for processing or use (the importing sites of record do not directly handle or store the imported *p*-dichlorobenzene) (U.S. EPA, 2016 [2016 CDR]).

E.1.2 Processing and Distribution

E.1.2.1 Processing as a Reactant or Intermediate

Processing as a reactant or intermediate is the use of *p*-dichlorobenzene as a feedstock in the production of another chemical product via a chemical reaction in which *p*-dichlorobenzene is consumed to form the product. *p*-Dichlorobenzene is used as a feedstock in the manufacture of poly (phenylene sulfide) resins, 1,2,4-trichlorobenzene, dyes, and insecticide intermediates (Kirk-Othmer, 2001).

Exact operations for the use of *p*-dichlorobenzene as a reactant to produce plastic materials and resins and other chemicals are not known at this time. For using a chemical as a reactant, operations would typically involve unloading the chemical from transport containers and feeding the chemical into a reaction vessel(s), where the chemical would react either fully or to a lesser extent. Following completion of the reaction, the produced substance may be purified further, thus removing unreacted *p*-dichlorobenzene (if any exists). One poly (phenylene sulfide) manufacturer has indicated their poly (phenylene sulfide) product may contain up to 100 ppm of unreacted *p*-dichlorobenzene (Solvay, 2020).

E.1.2.2 Incorporated into a Formulation, Mixture or Reaction Product

Incorporation into a formulation, mixture or reaction product refers to the process of mixing or blending of several raw materials to obtain a single product or preparation. EPA has identified the following product formulations in which *p*-dichlorobenzene is a component:

- Plastic material and resin manufacturing: *p*-dichlorobenzene is used as a feedstock in the manufacture of poly (phenylene sulfide) resins, 1,2,4-trichlorobenzene, dyes, and insecticide intermediates (Kirk-Othmer, 2001).
- Air care products: *p*-dichlorobenzene is an odor agent in air care products (U.S. EPA, 2016 [2016 CDR]; Kirk-Othmer, 2001).

The exact processes used to formulate products containing *p*-dichlorobenzene are not known at this time.

E.1.2.3 Incorporated into an Article

Incorporation into an article typically refers to a process in which a chemical becomes an integral component of an article (as defined at 40 CFR 704.3) for distribution in commerce. EPA has identified the following articles in which *p*-dichlorobenzene is incorporated:

- Pesticide, fertilizer, and other agricultural chemical products: *p*-dichlorobenzene is an active pesticidal ingredient in pesticide products used for moth control (U.S. EPA, 2016 [2016 CDR]; CPID, 2020; Kirk-Othmer, 2001).
- Air care products: *p*-dichlorobenzene is an odor agent in air care products (U.S. EPA, 2016 [2016 CDR]; Kirk-Othmer, 2001), such as toilet bowl deodorizers (CPID, 2020).
- Plastic products: *p*-dichlorobenzene is used in the manufacture of polyphenyl sulfide (PPS), in high heat thermoplastics. Thermoplastics are used in a variety of consumer and industrial/commercial products including food contact materials (FDA), automotive brake systems, air valves, fuel rails, transmission accumulator pistons and water pump impellers (Solvay 2020; U.S. EPA CPCat, EPA-HQ-OPPT-2018-0446-0017)
- Pharmaceuticals and medicines: U.S. EPA's Chemical Use Report for *p*-dichlorobenzene (November 2019) identifies use of *p*-dichlorobenzene as a chemical intermediate in the manufacture of pharmaceutical products.

Exact process operations involved in the incorporation of *p*-dichlorobenzene into these products are not known at this time. Since *p*-dichlorobenzene is a solid in these articles, incorporation activities may include unloading *p*-dichlorobenzene from shipping containers, melting *p*-dichlorobenzene into liquid form, forming *p*-dichlorobenzene into the desired shape, and cooling and solidifying the article at its desired shape.

E.1.3 Uses

E.1.3.1 Building/Construction Materials

EPA has identified a single building and construction material product that contains *p*-dichlorobenzene: Touch n' Foam Mouse Shield. This building sealant is sold in a 12-ounce can and is used to spray a foam sealant to seal gaps and cracks in buildings. The *p*-dichlorobenzene provides a pest repellant function in the product (DAP® Mouse Shield® Foam Sealant, 2019).

E.1.3.2 Lubricants and Greases

EPA has identified a single lubricant and grease product that contains *p*-dichlorobenzene: Marvel Mystery Oil, which is also identified under automotive care product category. A fuel additive from Marvel Oil Company (2017) was found to contain <0.1 wt% *p*-dichlorobenzene, as per its safety data sheet (SDS) (Marvel Mystery Oil, 2017). Additional details are available in Section E.1.3.4.

E.1.3.3 Air Care Products

The 2016 and 2012 CDRs report use of *p*-dichlorobenzene in air care products at concentrations of at least 90 percent by weight. Synapse Information Resources (2009) identifies use of this chemical in air purifiers. Ullmann's (2003) indicates that the chemical provides deodorant properties due to its inherently strong odor and high vapor pressure. GoodGuide's (2011) Pollution Scorecard identifies use of this chemical in non-personal, non-aerosol deodorants and air fresheners. The ECHA (2019) registration dossier identified use of *p*-dichlorobenzene in air care products. The Government of Canada (2003) identifies use of the chemical as an air freshener and deodorizer. The Finnish Environment Institute (2019) also identifies the use of *p*-dichlorobenzene in air deodorizers. Australia's Dept. of Health (2000) identifies use of *p*-dichlorobenzene as a room freshener in homes. An air freshener tablet from Grainger Global Sourcing (2014) was found to contain *p*-dichlorobenzene.

EPA identified additional domestic use of this chemical in antimicrobial products and bathroom cleaners. EPA identified urinal and toilet deodorants and deodorizing wall blocks that contain *p*-dichlorobenzene. Synapse Information Resources identified use of *p*-dichlorobenzene in mildew control agents (U.S. EPA 2019).

EPA has identified the following articles in which *p*-dichlorobenzene is incorporated:

- Pesticide, fertilizer, and other agricultural chemical products: *p*-dichlorobenzene is an active pesticidal ingredient in pesticide products used for moth control (U.S. EPA, 2016 [2016 CDR]; CPID, 2020; Kirk-Othmer, 2001).
- Air care products: *p*-dichlorobenzene is an odor agent in air care products (U.S. EPA, 2016 [2016 CDR]; Kirk-Othmer, 2001), such as toilet bowl deodorizers (CPID, 2020). CPID and the SDS for Toilet Bowl Deodorizer (2014) identify use of *p*-dichlorobenzene in a toilet bowl deodorizer also in concentrations between 99 - 100% by weight (CPID, 2020; Home Depot, 2019). The toilet bowl deodorizer is designed to be attached with a hanger to the interior of the toilet bowl, where it continuously deodorizes (Home Depot, 2019).

E.1.3.4 Automotive Care Products

CDR reports use of *p*-dichlorobenzene in consumer and commercial automotive care products. The Consumer Product Information Database (CPID, 2020) identifies one fuel additive product that contains this chemical. A fuel additive from Marvel Oil Company (2017) was found to contain <0.1 wt% *p*-dichlorobenzene, as per its safety data sheet (SDS) (Marvel Mystery Oil, 2017).

Marvel Mystery Oil is sold in small containers and can be added directly to the fuel tank or the crankcase of engines for automobiles, trucks, agricultural and earth moving equipment, marine vehicles, recreational vehicles, small powered landscaping equipment (such as chainsaws, lawn mowers, and snow blowers), and gasoline-powered generators. Marvel Mystery Oil improves oil lubrication and sludge control, improves fuel combustion, and aids engine cleaning (Marvel Mystery Oil. 2017).

The Organisation for Economic Co-operation and Development (OECD) *Emission Scenario Document on Lubricants and Lubricant Additives* (OECD, 2004) provides general process descriptions for the formulation of lubricants, which may be similar to the formulation of lubricating fuel additives such as the Marvel Mystery Oil. Lubricant formulation typically involves the blending of two or more components, including liquid and solid additives, together in a blending vessel (OECD, 2004).

E.1.3.5 Other Uses

EPA has identified additional uses of *p*-dichlorobenzene in various other TSCA-covered conditions of use, including aerosol coatings, closet storage and organizers, dyes and pigments, laboratory chemicals, plastics, solvents, and textile colorants. One company identifies the use of *p*-dichlorobenzene in polymer preparations and compounds, though this may be a non-domestic use. SPIN reports non-domestic use of *p*-dichlorobenzene in adhesives, binding materials, and stabilizers (U.S. EPA 2019).

E.1.4 Disposal

Each of the conditions of use of *p*-dichlorobenzene may generate waste streams of the chemical that are collected and transported to third-party sites for disposal, treatment, or recycling. Industrial sites that treat or dispose onsite wastes that they themselves generate are assessed in each condition of use assessment. Similarly, point source discharges of *p*-dichlorobenzene to surface water are assessed in each condition of use assessment (point source discharges are exempt as solid wastes under RCRA). Wastes of *p*-dichlorobenzene that are generated during a condition of use and sent to a third-party site for treatment, disposal, or recycling may include the following:

- Wastewater: *p*-dichlorobenzene may be contained in wastewater discharged to POTW or other, non-public treatment works for treatment. Industrial wastewater containing *p*-dichlorobenzene discharged to a POTW may be subject to EPA or authorized NPDES state pretreatment programs. The assessment of wastewater discharges to POTWs and non-public treatment works of *p*-dichlorobenzene is included in each of the condition of use assessments.

- Solid Wastes: Solid wastes are defined under RCRA as any material that is discarded by being: abandoned; inherently waste-like; a discarded military munition; or recycled in certain ways (certain instances of the generation and legitimate reclamation of secondary materials are exempted as solid wastes under RCRA). Solid wastes may subsequently meet RCRA's definition of hazardous waste by either being listed as a waste at 40 CFR §§ 261.30 to 261.35 or by meeting waste-like characteristics as defined at 40 CFR §§ 261.20 to 261.24. Solid wastes that are hazardous wastes are regulated under the more stringent requirements of Subtitle C of RCRA, whereas non-hazardous solid wastes are regulated under the less stringent requirements of Subtitle D of RCRA. *p*-dichlorobenzene is both a listed and a characteristic hazardous waste. *p*-dichlorobenzene is a U-listed hazardous waste under code U072 under RCRA; therefore, discarded, unused pure and commercial grades of *p*-dichlorobenzene are regulated as a hazardous waste under RCRA (40 CFR § 261.33(f)). *p*-dichlorobenzene is a toxic contaminant under RCRA with waste number D027. A solid waste can be a hazardous waste due to its toxicity characteristic if its extract following the Toxicity Characteristic Leaching Procedure (TCLP) (or the liquid waste itself if it contains less than 0.5% filterable solids) contains at least 7.5 mg/L of *p*-dichlorobenzene [40 CFR § 261.24].

- Wastes Exempted as Solid Wastes under RCRA: Certain conditions of use of *p*-dichlorobenzene may generate wastes of *p*-dichlorobenzene that are exempted as solid wastes under 40 CFR § 261.4(a). For example, the generation and legitimate reclamation of hazardous secondary materials of *p*-dichlorobenzene may be exempt as a solid waste.

For the 2018 reporting year of the TRI program, 16 facilities reported in total nearly 2.7 million pounds of *p*-dichlorobenzene as production-related waste. Of this total, over 1.45 million pounds were recycled and over 1.14 million pounds were treated. Only 1% (approximately 29,000 pounds) of the production-related waste was burned for energy recovery during 2018, and only 2% was released to the environment. The

majority of the quantities (92%) of *p*-dichlorobenzene managed as production-related waste were managed as such on site.

E.2 Preliminary Occupational Exposure Data

EPA presents below an example of occupational exposure-related information obtained from preliminary data gathering. EPA plans to consider this information and data in combination with other data and methods for use in the risk evaluation.

Table Apx_E-1 summarizes the OSHA inspection monitoring data identified in the CEHD from 2010 to 2019 by North American Industry Classification System (NAICS) code.

Table_Apx E-1. Summary of Industry Sectors with *p*-Dichlorobenzene Monitoring Samples Available from OSHA Inspections Conducted Between 2010 and 2019

NAICS	NAICS Description	Number of Data Points
325130	Synthetic Dye and Pigment Manufacturing	26
326199	All Other Plastics Product Manufacturing	7
926150	Regulation, Licensing, and Inspection of Miscellaneous Commercial Sectors	4

Table Apx_E-2 summarizes NIOSH Health Hazard Evaluations identified during EPA's preliminary data gathering.

Table_Apx E-2. Summary of NIOSH HHEs with Monitoring for *p*-Dichlorobenzene [a]

Year of Publication	Report Number	Facility Description
2009	HETA 2005-0076	Environmental tobacco smoke at casinos (Bally's, Paris, and Caesars Palace in Las Vegas, NV)
1981	HETA 81-065-938	Vehicle maintenance facility (METRO Bus Maintenance Shop, Washington, D.C.)
1980	80-082-773	Manufacturer of chlorinated benzene derivatives
1980	HHE 77-99-726	Chemical manufacturer (DuPont Chambers Works, Deepwater, New Jersey)
1976	74-107-279	Silicone manufacturer (General Electric Company, Silicone Products Department, Waterford, New York)

[a] Table includes HHEs identified to date.

Appendix F SUPPORTING INFORMATION - CONCEPTUAL MODEL FOR INDUSTRIAL AND COMMERCIAL ACTIVITIES

Table_Apx F-1. Worker and Occupational Non-User Exposure Conceptual Model Supporting Table

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
Manufacture	Domestic	CBI	Manufacture of p-DCB	Liquid/Solid Contact	Dermal	Workers	Yes	The potential for exposure to workers exists during manufacturing, as p-DCB can be manufactured as a liquid or solid.
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.
				Dust	Inhalation/Oral	Workers, ONU	Yes	p-DCB can be manufactured as a solid; therefore, there is a potential for dust generation.
				Mist	Inhalation	Workers, ONU	No	Mist generation is not expected during manufacturing.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical
	Import	Import	Repackaging of Import Containers	Liquid/Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during import, but exposure will only occur in the event the imported material is repackaged. p-DCB is typically imported as a solid, but may also be shipped in a molten form.

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.
				Dust	Inhalation/Oral	Workers, ONU	Yes	If p-DCB is imported and repackaged as a solid, then there is a potential for dust generation.
				Mist	Inhalation	Workers, ONU	No	Mist generation is not expected during import or repackaging.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical
Processing	As a Reactant	Intermediates in plastic material and resin manufacturing; pharmaceutical manufacturing; all other basic chemical manufacturing; dye manufacturing	Reactants in plastic material and resin manufacturing, pharmaceutical manufacturing, dye manufacturing, chemical manufacturing	Liquid/Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during manufacturing of other chemicals, as p-DCB can be processed in liquid/solid form.
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.
				Dust	Inhalation/Oral	Workers, ONU	Yes	If p-DCB is transported to industrial users as a solid, then there is a potential for dust generation.
				Mist	Inhalation	Workers, ONU	No	Mist generation is not expected during manufacturing of other chemicals.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
								expected for this condition of use as they are not expected to directly handle the chemical.
	Incorporated into formulation, mixture, or reaction product	Intermediates in plastic material and resin manufacturing	Intermediates in plastic material and resin manufacturing	Liquid/Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during processing (incorporation into formulation, mixture, or reaction product), as p-DCB can be processed in liquid/solid form.
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.
				Dust	Inhalation/Oral	Workers, ONU	Yes	If p-DCB is transported to industrial users as a solid, then there is a potential for dust generation.
				Mist	Inhalation	Workers, ONU	No	Mist generation is not expected during processing.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
		Constituent in oils; Solvents (which become part of product formulation or mixture in plastic material and resin manufacturing)	Incorporated as constituents in oil, solvents	Liquid/Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during processing (incorporation into formulation, mixture, or reaction product), as p-DCB can exist as liquid/solid.
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
				Dust	Inhalation/Oral	Workers, ONU	Yes	If p-DCB is transported to industrial users as a solid, then there is a potential for dust generation.
				Mist	Inhalation	Workers, ONU	No	Mist generation is not expected during processing.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
		Odor agents (deodorizers)	Incorporated in odor agents (e.g. deodorizers)	Liquid/Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during processing (incorporation into formulation, mixture, or reaction product), as p-DCB can exist as liquid/solid.
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.
				Dust	Inhalation/Oral	Workers, ONU	Yes	Dust generation is possible during processing when p-DCB exists as dry powder.
				Mist	Inhalation	Workers, ONU	Yes	Mist generation is possible during processing.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. ONUs are not expected to come in direct contact with the chemicals.
	Incorporated into article	Intermediates in Pesticide, fertilizer, and other agricultural	Intermediates in pesticide, fertilizer, and	Liquid/Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during processing (incorporation into

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
		chemical manufacturing (moth repellant)	other agricultural chemical manufacturing					article), as p-DCB can be processed as liquid/solid.
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.
				Dust	Inhalation/Oral	Workers, ONU	Yes	If p-DCB is transported to industrial users as a solid, then there is a potential for dust generation.
				Mist	Inhalation	Workers, ONU	No	Mist generation is not expected during processing.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
		In plastic product manufacturing	Incorporated in plastic products (p-DCB is used in the manufacture of PPS (polyphenyl sulfide) – e.g., high heat thermoplastics	Liquid/Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during processing (incorporation into article), as p-DCB can be processed as liquid/solid.
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.
				Dust	Inhalation/Oral	Workers, ONU	Yes	Dust generation is possible during processing when p-DCB exists as dry powder.
				Mist	Inhalation	Workers, ONU	No	Mist generation is not expected during processing.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
								expected for this condition of use as they are not expected to directly handle the chemical.
		Odor agents in wholesale and retail trade	Incorporated in odor agents	Liquid/Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during processing (incorporation into article), as p-DCB can be processed as liquid/solid.
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.
				Dust	Inhalation/Oral	Workers, ONU	Yes	Dust generation is possible during processing when p-DCB exists as dry powder.
				Mist	Inhalation	Workers, ONU	Yes	Mist generation is possible during processing.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
		Pharmaceutical and medicine manufacturing	Incorporated in pharmaceutical and medicine manufacturing	Liquid/Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during processing (incorporation into article), as p-DCB can be processed as liquid/solid.
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.
				Dust	Inhalation/Oral	Workers, ONU	Yes	Dust generation is possible during processing when p-DCB exists as dry powder.
				Mist	Inhalation	Workers, ONU	Yes	Mist generation is possible during processing.

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
Commercial Uses	Air care products	Continuous action air fresheners (including toilet/urinal deodorizers/fresheners), cleaning and furnishing care uses	Used in air care products. Cleaning and furnishing care products	Liquid/Solid Contact	Dermal	Workers	Yes	Air care products can be in solid or liquid form; therefore, exposures to workers exists for p-DCB used in air care products.
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.
				Dust	Inhalation/Oral	Workers, ONU	Yes	Dust generation is possible during use of air care products.
				Mist	Inhalation	Workers, ONU	Yes	Mist generation is possible during use of air care products.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
	Automotive care products	Automotive care products	Used in automotive care products	Liquid/Solid Contact	Dermal	Workers	Yes	Automotive care products can be in solid or liquid form; therefore, exposures to workers exists for p-DCB used in air care products.
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
				Dust	Inhalation/Oral	Workers, ONU	Yes	Dust generation is possible during use of automotive care products.
				Mist	Inhalation	Workers, ONU	Yes	Mist generation is possible during use of automotive care products.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
	Lubricants and greases	Lubricants and greases, degreasers	Used in lubricants and greases, and degreasers	Liquid/Solid Contact	Dermal	Workers	Yes	Lubricants and greases, and degreasers can be in solid or liquid forms.
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.
				Mist	Inhalation	Workers, ONU	No	Mist generation is not expected during its use in lubricants and grease, and degreaser.
				Dust	Inhalation/Oral	Workers, ONU	No	Dust generation is not expected during its use in lubricants and grease, and degreaser.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
	Building and construction products	Building and construction products	Used in plastic foam insulation, foam sealant	Liquid Contact	Dermal	Workers	No	Plastic foam insulation, foam sealant, and other building and construction products will typically in solid form; therefore, exposures to workers

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
								is minimal when p-DCB is in liquid form.
				Solid Contact	Dermal	Workers	Yes	Plastic foam insulation, foam sealant, and other building and construction products will typically in solid form; therefore, exposures to workers exist when p-DCB is in solid form.
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.
				Mist	Inhalation	Workers, ONU	No	Mist generation is not expected during its use as a plastic foam insulation, foam sealant, and other building and construction products.
				Dust	Inhalation/Oral	Workers, ONU	Yes	Dust generation is possible during its use as a plastic foam insulation, foam sealant, and other building and construction products.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
	Other Use	Laboratory and analytical use	Used as laboratory chemicals	Liquid/Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers is possible during use of p-DCB as a laboratory chemical, as p-DCB can be used in liquid/solid form.
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
								temperature and there is potential for vapor generation.
				Mist	Inhalation	Workers, ONU	No	Mist generation is not expected during its use as a laboratory chemical.
				Dust	Inhalation/Oral	Workers, ONU	Yes	Dust generation is possible during its use as a laboratory chemical.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
Disposal	Disposal	Emissions to air, in wastewater, liquid wastes, and solid wastes	Worker handling wastes	Liquid/Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during this use as liquid/solid formulations may be disposed
				Vapor	Inhalation	Workers, ONU	Yes	p-DCB is semi-volatile (VP = 1.74 mmHg) at room temperature and there is potential for vapor generation.
				Dust	Inhalation/Oral	Workers, ONU	Yes	Dust generation is possible during disposal of solid wastes.
				Mist	Inhalation	Workers, ONU	No	Mist generation is not expected during disposal of liquid wastes.
				Liquid/Solid Contact	Dermal	ONU	No	Exposure is expected to be primarily restricted to workers who are directly involved in working with the chemical. Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.

Appendix G SUPPORTING INFORMATION - CONCEPTUAL MODEL FOR CONSUMER ACTIVITIES/USES

Table_Apx G-1. Consumer Exposure Conceptual Model Supporting Table

Life Cycle Stage	Category	Subcategory	Release from source	Exposure Pathway	Route	Receptor	Plans to Evaluate	Rationale
Consumer Use	Air care products	Continuous action air fresheners (including toilet/urinal deodorizers/fresheners)	Direct contact through application or use of products	Liquid/ Solid Contact	Dermal	Consumers	Yes	Exposure is expected to be primarily restricted to consumers who are directly involved in the application or use of the chemical. Bystanders are not expected to come in direct contact with the chemical.
			Long-term emission/mass-transfer through application or use of products	Vapor	Inhalation	Consumers and Bystanders	Yes	p-DCB is volatile at room temperature; the inhalation pathway should be further analyzed.
			Direct contact through application or use of products	Mist	Inhalation and Dermal	Consumers and Bystanders	No	The product is not expected to be spray applied; therefore, mist generation is not expected.
			Long-term emission/mass-transfer, Abrasion, Direct Transfer to Dust	Dust	Dermal, Inhalation, and Oral	Consumers and Bystanders	Yes	Dust generation is possible during use of this particular air care product.
Consumer Use	Building/ construction materials not covered elsewhere	Plastic foam insulation, foam sealant	Direct contact through application or use of products	Liquid/ Solid Contact	Dermal	Consumers	Yes	Exposure is expected to be primarily restricted to consumers who are directly involved in using the chemical. Bystanders are not expected to come in direct contact with the chemical.
			Long-term emission/mass-transfer through application or use of products	Vapor	Inhalation	Consumers and Bystanders	Yes	p-DCB is volatile at room temperature; the inhalation pathway should be further analyzed.
			Direct contact through application or use of products	Mist	Inhalation and Dermal	Consumers and Bystanders	Yes	The product is expected to be spray applied; therefore, mist generation is expected.
			Long-term emission/mass-transfer, Abrasion,	Dust	Dermal, Inhalation, and Oral	Consumers and Bystanders	Yes	Dust generation is possible during use of building/construction materials. In addition, product can be sanded after application; therefore, dust generation is expected.

Life Cycle Stage	Category	Subcategory	Release from source	Exposure Pathway	Route	Receptor	Plans to Evaluate	Rationale
			Direct Transfer to Dust					
Consumer Use	Automotive care products	Automotive care products (including automotive fuel additive)	Direct contact through application or use of products	Liquid/ Solid Contact	Dermal	Consumers	Yes	Exposure is expected to be primarily restricted to consumers who are directly involved in using the chemical. Bystanders are not expected to come in direct contact with the chemical.
			Long-term emission/mass-transfer through application or use of products	Vapor	Inhalation	Consumers and Bystanders	Yes	p-DCB is volatile at room temperature; the inhalation pathway should be further analyzed.
			Direct contact through application or use of products	Mist	Inhalation and Dermal	Consumers and Bystanders	No	The product is not expected to be spray applied; therefore, mist generation is not expected.
			Long-term emission/mass-transfer, Abrasion, Direct Transfer to Dust	Dust	Dermal, Inhalation, and Oral	Consumers and Bystanders	No	Dust generation is unlikely during use of this particular automotive care products.
Consumer Handling of Disposal and Waste	Wastewater, Liquid wastes and solid wastes	Wastewater, Liquid wastes and solid wastes	Direct contact through handling or disposal of products	Liquid/ Solid Contact	Dermal	Consumers	Yes	Exposure is expected to be primarily restricted to consumers who are directly involved in handling or disposing the chemical. Bystanders are not expected to come in direct contact with the chemical.
			Long-term emission/mass-transfer through handling or disposal of products	Vapor	Inhalation	Consumers and Bystanders	Yes	p-DCB is volatile at room temperature; inhalation pathway should be further analyzed.
			Direct contact through handling or disposal of products	Mist	Inhalation and Dermal	Consumers and Bystanders	No	Mist generation is not expected during handling or disposal.
			Long-term emission/mass-transfer, Abrasion, Direct Transfer to Dust	Dust	Dermal, Inhalation, and Oral	Consumers and Bystanders	Yes	Dust generation is possible during disposal of solid wastes.

Appendix H SUPPORTING INFORMATION – CONCEPTUAL MODEL FOR ENVIRONMENTAL RELEASES AND WASTES

Table_Apx H-1. General Population and Environmental Exposure Conceptual Model Supporting Table

Life Cycle Stage	Category	Release	Exposure Pathway / Media	Exposure Routes	Receptor / Population	Plans to Evaluate[6]	Rationale
All	Emissions to Air	Emissions to Air	Near facility ambient air concentrations	Inhalation	General Population	No	p-Dichlorobenzene is a HAP. Stationary source releases of p-dichlorobenzene to ambient air are under the jurisdiction of the CAA.
			Indirect deposition to nearby bodies of water and soil catchments	Oral Dermal	General Population	No	
				TBD	Aquatic and Terrestrial Receptors	No	
	Wastewater or Liquid Wastes	Industrial pre-treatment and wastewater treatment, or POTW	Direct release into surface water and indirect partitioning to sediment	TBD	Aquatic and Terrestrial Receptors	Yes	EPA has developed Ambient Water Quality Criteria for protection of human health for *p*-dichlorobenzene.
				Oral Dermal	General Population	No	
			Drinking Water via Surface or Ground Water	Oral Dermal and Inhalation (e.g., showering)	General Population	No	The drinking water exposure pathway for *p*-dichlorobenzene is currently addressed in the SDWA regulatory analytical process for public water systems.
			Biosolids: application to soil and/or migration to groundwater and/or surface water	Oral (e.g., ingestion of soil) Inhalation	General Population	No	Since it has been found in biosolids (Biosolids Biennial Review - https://www.epa.gov/sites/production/files/2019-06/documents/2016-2017-biosolids-biennial-review.pdf), this pathway will be evaluated for exposures to aquatic and terrestrial species
				TBD	Aquatic and Terrestrial receptors	Yes	

[6]The exposure pathways, exposure routes and hazards EPA plans to consider are subject to change in the final scope, in light of comments received on this draft scope and other reasonably available information. EPA continues to consider whether and how other EPA-administered statutes and any associated regulatory programs address the presence of 1,1,2-trichloroethane in exposure pathways falling under the jurisdiction of these EPA statutes.

Life Cycle Stage	Category	Release	Exposure Pathway / Media	Exposure Routes	Receptor / Population	Plans to Evaluate[6]	Rationale
		Underground injection	Migration to groundwater, potential surface/drinking water	Oral Dermal Inhalation	General Population	No	*p*-dichlorobenzene is released to Class I Underground Injection Wells which are covered by SDWA and RCRA.
					Aquatic and Terrestrial Species		
				TBD			
Disposal	Solid and Liquid Wastes	Hazardous, Municipal landfill and other land disposal	Leachate to soil, ground water and/or mitigation to surface water	Oral Dermal	General Population	No	*p*-dichlorobenzene is included on the list of hazardous wastes pursuant to RCRA 3001 (40 CFR §§ 261.33).
				TBD	Aquatic and Terrestrial Receptors		