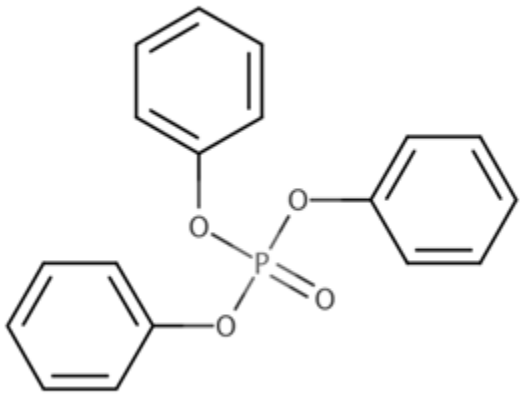
EPA Document# EPA-740-D-20-010
April 2020
Office of Chemical Safety and
Pollution Prevention

United States
Environmental Protection Agency

Draft Scope of the Risk Evaluation for Triphenyl Phosphate

CASRN 115-86-6



April 2020

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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 GDIT (Contract No. HHSN316201200013W), ERG (Contract No. EP-W-12-006), Versar (Contract No. EP-W-17-006), ICF (Contract No.68HERC19D0003), Abt Associates (Contract No. EP-W-16-009) and SRC (Contract No. 68HERH19F0213). 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-2018-0458.

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

ADME	Absorption, Distribution, Metabolism, and Excretion
ATSDR	Agency for Toxic Substances and Disease Registry
BAF	Bioaccumulation Factor
BCF	Bioconcentration Factor
BMF	Biomagnification factor
BOD	Biochemical oxygen demand
CAA	Clean Air Act
CASRN	Chemical Abstracts Service Registry Number
CBI	Confidential Business Information
CCL	Contaminant Candidate List
CDR	Chemical Data Reporting
CFR	Code of Federal Regulations
CWA	Clean Water Act
EC	Engineering control
ECHA	European Chemicals Agency
EPA	Environmental Protection Agency
ESD	Emission Scenario Document
FYI	For Your Information
GS	Generic Scenario
HAP	Hazardous Air Pollutant
HSDB	Hazardous Substances Data Bank
IUR	Inventory Update Rule
K	Thousand
K_{OC}	Organic Carbon: Water Partition Coefficient
K_{OW}	Octanol: Water Partition Coefficient
M	Million
MITI	Ministry of International Trade and Industry
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NIH	National Institutes of Health
NIOSH	National Institute for Occupational Safety and Health
OECD	Organisation for Economic Co-operation and Development
OH	Hydroxyl radical
OSHA	Occupational Safety and Health Administration
P-chem	Physical-chemical
PEL	Permissible Exposure Limit
PESS	Potentially Exposed or Susceptible Subpopulation
PNOR	Particulates Not Otherwise Regulated
PPE	Personal Protective Equipment
RCRA	Resource Conservation and Recovery Act
SDWA	Safe Drinking Water Act
SIDS	Screening Information Data Sets
SMILES	Simplified molecular-input line-entry system
SVOC	Semi-volatile organic compound
STEL	Short-term Exposure Limit
TIAB	Title and abstract
TLV	Threshold Limit Value

TMF	Trophic Magnification Factors
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act
TWA	Time-weighted average
UMCR	Unregulated Contaminants Monitoring Rule
VP	Vapor Pressure
WS	Water solubility

EXECUTIVE SUMMARY

In December 2019, EPA designated Triphenyl Phosphate (TPP; CASRN 115-86-6) 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-2018-0476-0007). 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) (U.S. EPA, 2018a). The draft scope for TPP 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. TPP is a colorless solid that is primarily used as a flame retardant with a total production volume in the United States between 1 million and 10 million pounds.

Reasonably Available Information. EPA leveraged the data and information sources already described in the document supporting the High-Priority Substance designation for TPP 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, 2018b) 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 TPP.

Conditions of Use. EPA plans to evaluate risks from manufacturing, including importing; processing; distribution in commerce; industrial, commercial and consumer uses; and disposal of TPP in the risk evaluation. TPP is processed as a reactant, incorporated into a formulation, mixture, or reaction products, and incorporated into articles. The identified processing activities also include the repackaging of TPP. Several commercial uses were identified, such as paints and coatings and plastic and rubber products. Several consumer uses were reported, including foam seating and bedding products. EPA identified these conditions of use from information reported to EPA through Chemical Data Reporting (CDR), published literature, and consultation with stakeholders for both uses currently in production and uses whose production may have ceased. EPA is aware of information reporting TPP in manufacturing nail polish and flea and tick collars; however, they are not conditions of use as defined in TSCA § 3(4). Section 2.2 provides details about the conditions of use within the scope of the risk evaluation.

Conceptual Model. The conceptual models for TPP 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 proposes to focus the risk evaluation for TPP 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 TPP that EPA plans to consider in risk evaluation. Exposures to TPP are discussed in Section 2.3. EPA identified environmental monitoring data reporting the presence of TPP in surface water, groundwater, biosolids and sediment. Additional information gathered through systematic review searches will also inform expected exposures.

  In Section 2.6.3, EPA presents the conceptual models describing the identified exposures (pathways and routes), receptors and hazards associated with the conditions of use of TPP within the scope of the risk evaluation.

  Preliminarily, EPA plans to include 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 exposures 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, import, processing, use and disposal.
  - *Consumer and bystander exposures associated with consumer conditions of use:* EPA plans to evaluate the inhalation and dermal exposure to TPP when consumers are using foam and upholstery, automobile upholstery, camping tents, cellulose acetate films, thermoplastic products, vulcanization products, hydraulic fluids containing TPP, and children's mouthing or products/articles containing TPP.
  - *General population exposures:* EPA plans to evaluate exposure to TPP via drinking water, groundwater, ambient air, fish ingestion, human breast milk, and soil for the general population.
  - *Human 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 exposures:* EPA plans to evaluate exposure to TPP for aquatic and terrestrial receptors via various pathways and receptors including surface water, sediment, soil.

- *Hazards.* Hazards for TPP 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 TPP 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 plans use systematic review methods to evaluate the epidemiological and toxicological literature for TPP. 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 TPP identified in Section 2.4.2. The broad health effect categories include reproductive and developmental, immunological, nervous system, genotoxicity, carcinogenicity, and irritation effects.

Analysis Plan. The analysis plan for TPP is presented in Section 2.7. The analysis plan outlines the general science approaches that EPA plans to use for the various evidence streams (i.e., chemistry, fate, release and engineering, exposure, hazard) supporting the risk evaluation. The analysis plan is based on EPA's knowledge of TPP to date which includes a partial, but ongoing, review of identified information as described in Section 2.1. EPA plans 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.

EPA plans seek public comments on the systematic review methods supporting the risk evaluation for TPP, 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.

Peer Review. The draft risk evaluation for TPP 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; U.S. EPA, 2018c).

1 INTRODUCTION

This document presents for comment the draft scope of the risk evaluation to be conducted for TPP 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) 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 in conducting 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 potentially exposed or susceptible subpopulations 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 (U.S. EPA, 2018a). In December 2019, EPA published a list of 20 chemical substances that have been designated high priority substances for risk evaluations (84 FR 71924), as required by TSCA § 6(b)(2)(B), which initiated the risk evaluation process for those chemical substances. TPP 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 TPP. 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.

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

[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).

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, 2018b). EPA plans publish supplemental documentation on the systematic review methods supporting the TPP 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 up to date for the general categories of sources and topic areas (or disciplines) using systematic review methods. EPA plans seek public comments on the systematic review methods supporting the risk evaluation for TPP upon publication of the supplemental documentation of those methods.

2.1.1 Search of Gray Literature

EPA surveyed the gray literature[2] and identified 117 search results relevant to EPA's risk assessment needs for TPP. Appendix A lists the gray literature sources that yielded 117 discrete data or information sources relevant to TPP. 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.

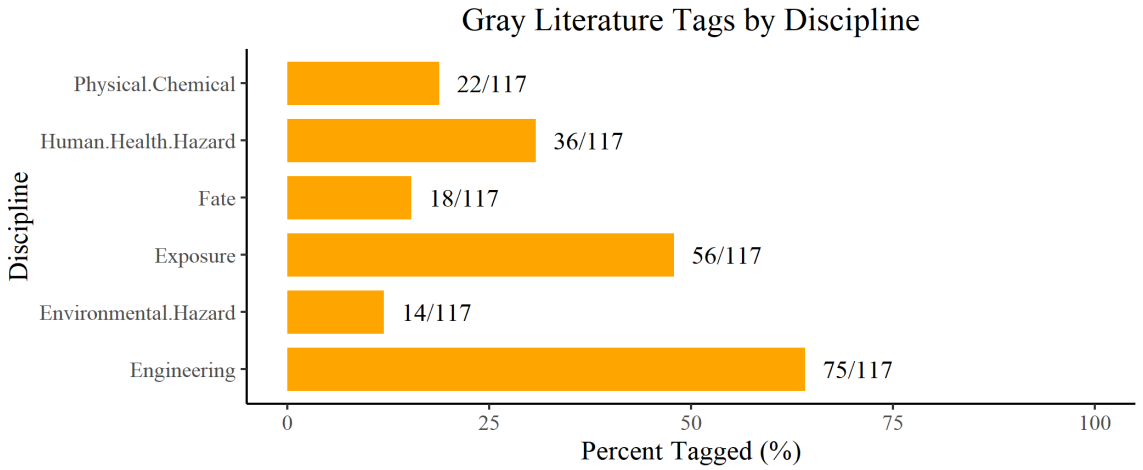

Figure 2-1 Gray Literature Search Results for TPP

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

[2] 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 (p-chem) properties, environmental fate and transport, engineering (environmental release and occupational exposure), exposure (environmental, general population and consumer) and environmental and human health hazards of TPP. Eligibility criteria were applied in the form of population, exposure, comparator, outcome (PECO) or similar statements. Included references met the PECO or similar 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 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.

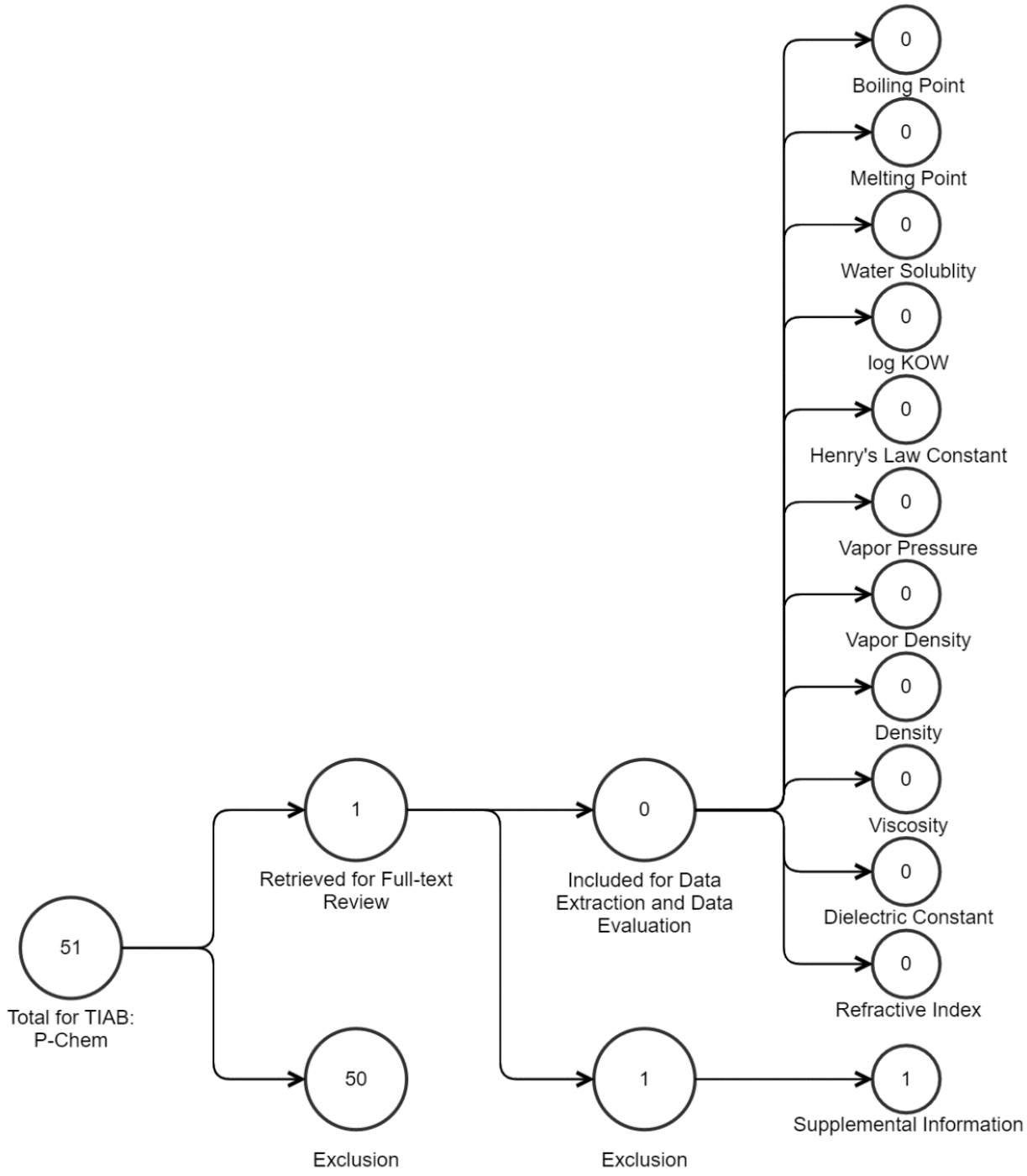

Figure 2-2 Peer-reviewed Literature - Physical-Chemical Properties Search Results for TPP

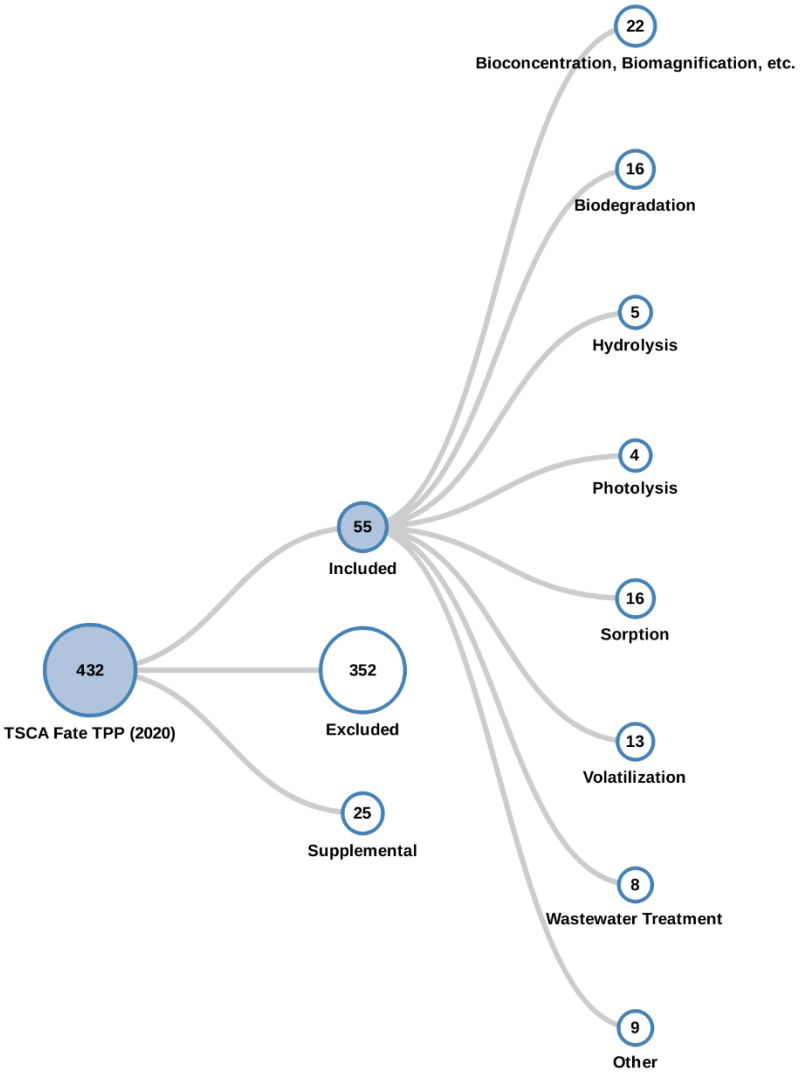

Figure 2-3 Peer-reviewed Literature - Fate and Transport Search Results for TPP
Click here for interactive Health Assessment Workplace Collaborative (HAWC) Diagram.

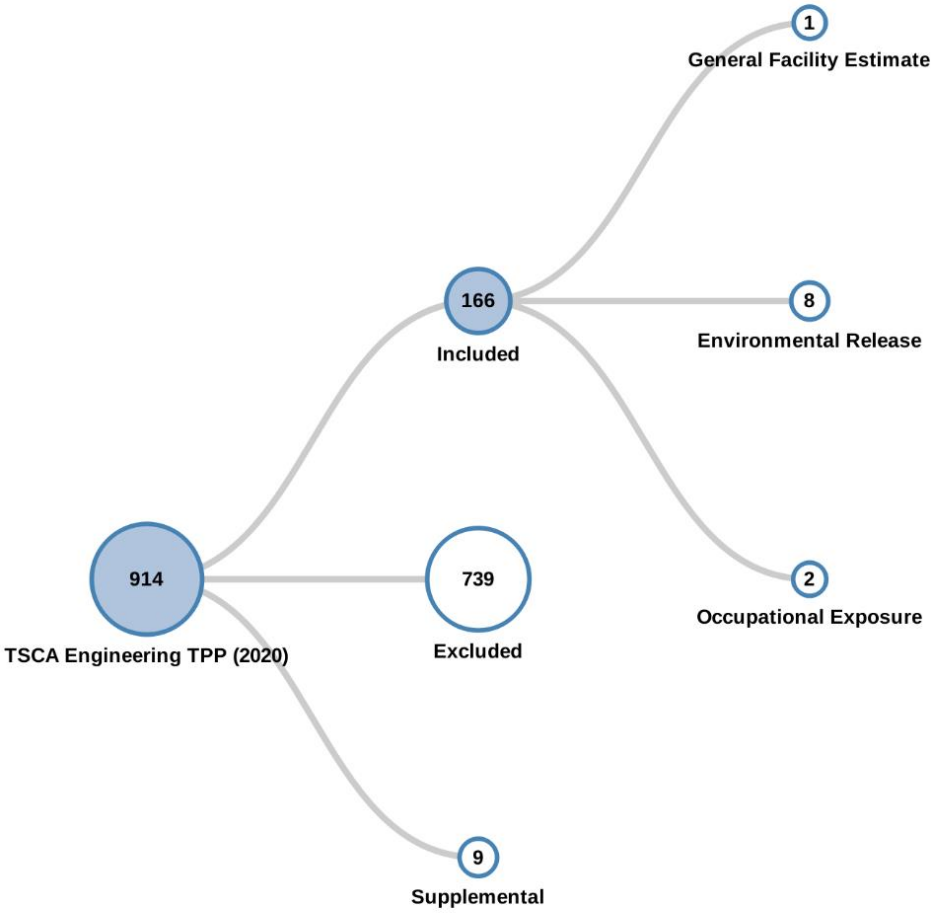

Figure 2-4 Peer-reviewed Literature - Engineering Search Results for TPP
Click here for interactive HAWC Diagram.

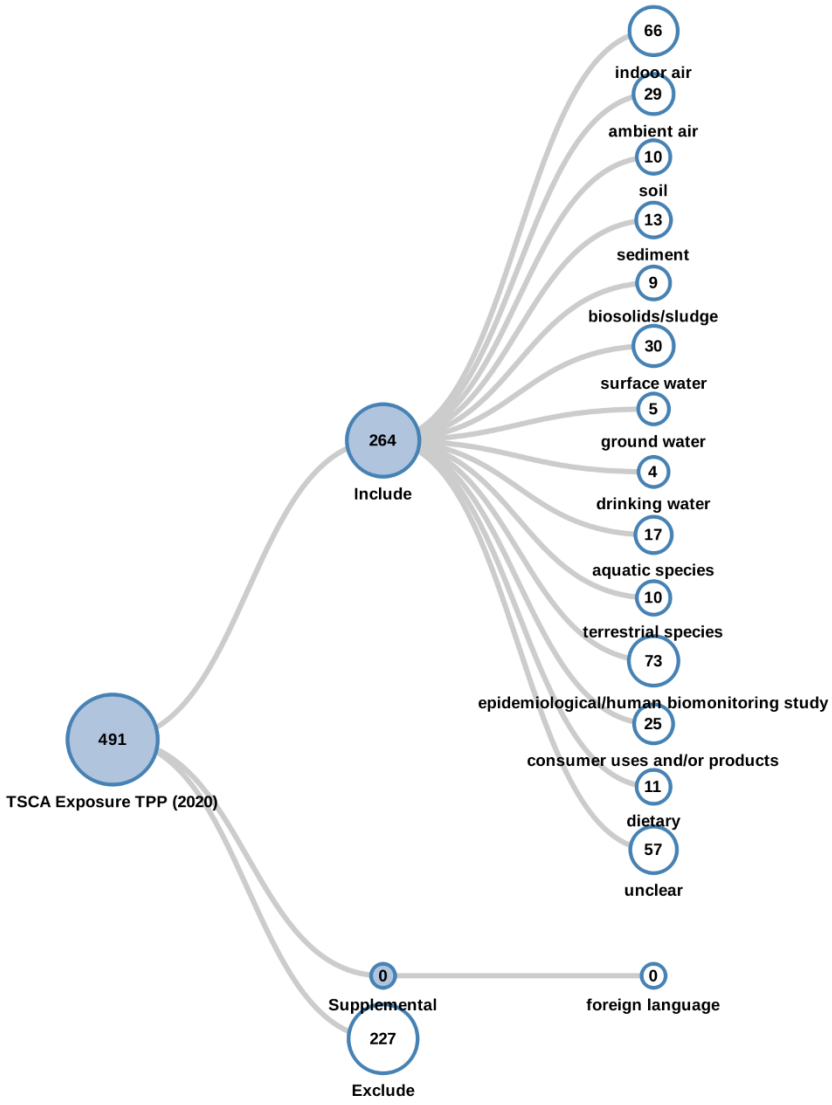

Figure 2-5 Peer-reviewed Literature - Exposure Search Results for TPP
Click here for interactive HAWC Diagram.

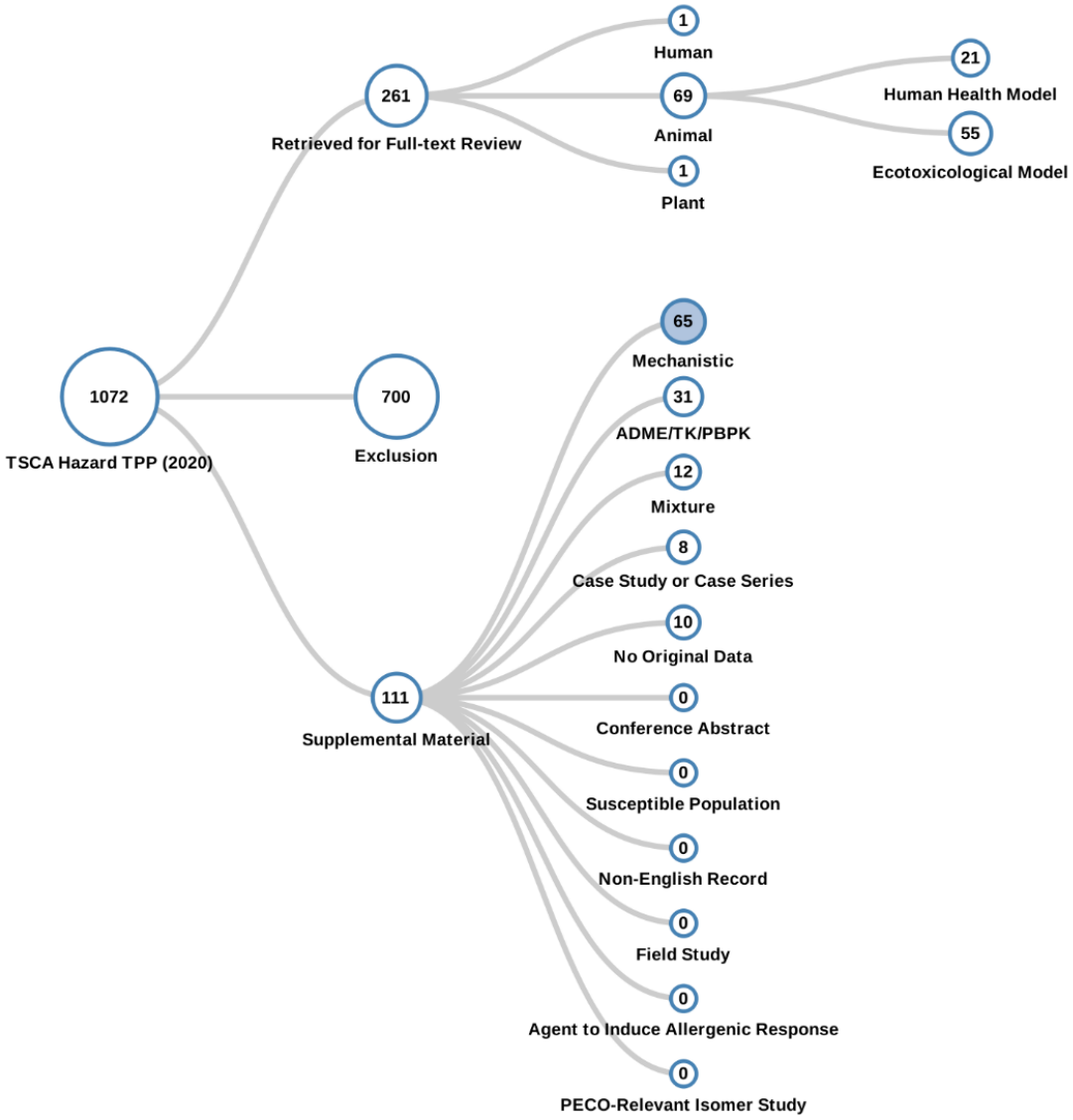

Figure 2-6 Peer-reviewed Literature - Hazard Search Results for TPP
Click here for interactive HAWC Diagram.

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 295 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 153 submissions that met the inclusion criteria in these statements and identified 130 submissions with supplemental data. EPA excluded 12 submissions because the reports were identified as one of the following:

- Summary of other reports
- Draft of a published report that would be identified via peer literature searches
- Submission on a different chemical
- Data not relevant to any discipline
- Letter with no attached report
- Status report
- Notification of study initiation

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 reasonably available.

Table 2-1 Results of Title Screening of Submissions to EPA under Various Sections of TSCA

Discipline	Included [a]	Supplemental [a]
Physicochemical Properties	26	0
Environmental Fate and Transport	70	0
Environmental and General Population Exposure	14	0
Occupational Exposure/Release Information	13	0
Environmental Hazard	58	70
Human Health Hazard	37	74

[a]A given submission may have information on multiple disciplines; therefore, the sum of submissions in each column is greater than the total number of included or supplemental submissions.

2.2 Conditions of Use

As described in the *Proposed Designation of Triphenyl Phosphate (CASRN 115-86-6) 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[3] or significant changes in conditions of use of the chemical substance. EPA also consulted a variety of other sources to identify uses of TPP, including: published literature, company websites, and government and commercial trade databases and publications. To identify formulated products containing TPP, 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. SDSs were cross-checked with company websites to make sure that each product SDS was current. In addition, EPA incorporated communications with companies, industry

[3] *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.

groups, environmental organizations, and public comments to supplement the conditions 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 included in the scope are those reflected in the life cycle diagrams and conceptual models.

After gathering the reasonably available information related to the manufacture, processing, distribution in commerce, use, and disposal of TPP, EPA identified those categories or subcategories of use activities for TPP 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 are included in the scope of the risk evaluation.

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

Life Cycle Stage[a]	Category[b]	Subcategory[c]	References
Manufacturing	Domestic Manufacturing	Domestic Manufacturing	CDR US EPA (2019b)
	Import	Import repack	CDR US EPA (2019b)
Processing	Incorporated into formulation, mixture or reaction product	Flame retardant used in all other chemical product and preparation manufacturing	CDR US EPA (2019b)
		Flame retardant used in computer and electronic product manufacturing	CDR US EPA (2019b)
		Flame retardant used in photographic film paper, plate, and chemical manufacturing	CDR US EPA (2019b)
		Flame retardant used in plastic material and resin manufacturing	CDR US EPA (2019b)
		Flame retardant used in plastic product manufacturing	CDR US EPA (2019b)
		Flame retardant used in rubber product manufacturing	CDR US EPA (2019b)
		Flame retardant used in textiles, apparel, and leather manufacturing	CDR US EPA (2019b)
		Flame retardant used in utilities	CDR US EPA (2019b)
		Paint additive and coating additive used in paint and coating manufacturing	CDR US EPA (2019b)
		Solvent (which become part of product formulation or mixture) used	CDR US EPA (2019b)

Life Cycle Stage[a]	Category[b]	Subcategory[c]	References
		in photographic film paper, plate, and chemical manufacturing	
		Plasticizers in all other chemical product and preparation manufacturing	CDR US EPA (2019b)
		Flame retardant used in furniture and related product manufacturing	CDR US EPA (2019b)
		Plasticizer, additive and impurity in adhesives, sealants and lubricants	Public Comment EPA-HQ-OPPT-2018-0458-0003
		Operational fluids, maintenance fluids and semisolids, reactive fluids, and solids used in aerospace industry	Public Comment EPA-HQ-OPPT-2018-0458-0004
		Lubricants, shop materials, and other products used by U.S. Army	U.S. Army submittal to CMRM (2020)
Processing	Incorporated into article	Solvent (which become part of product formulation or mixture) used in photographic film paper, plate, and chemical manufacturing	CDR US EPA (2019b)
		Plasticizer used in plastics product manufacturing	CDR US EPA (2019b)
		Photographic supplies, film, and photo chemicals	CDR US EPA (2019b)
Processing	Recycling	Recycling	
Distribution	Distribution in commerce	Distribution in commerce	
Commercial Use		Paints and coatings	CDR US EPA (2019b)
		Plastic and rubber products not covered elsewhere	CDR US EPA (2019b)
		Photographic supplies, film, and photo chemicals	CDR US EPA (2019b)
		Lubricants and greases	CDR US EPA (2019b)
		Electrical and electronic products	CDR US EPA (2019b)
		Foam seating and bedding products	CDR US EPA (2019b)
		Furniture and Furnishings not covered elsewhere	CDR US EPA (2019b)
Consumer Use		Foam seating and bedding products	CDR US EPA (2019b)
		Plastic and rubber products not covered elsewhere	

Life Cycle Stage[a]	Category[b]	Subcategory[c]	References
			CDR US EPA (2019b)
		Photographic supplies, film, and photo chemicals	CDR US EPA (2019b)
		Lubricants and greases	CDR US EPA (2019b)
		Electrical and electronic products	CDR US EPA (2019b)
Disposal	Disposal	Disposal	

- 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 representations of fact derived from CDR data included in this document were claimed as confidential business information (CBI) in the CDR datasets, the Agency reviewed the claims and secured the necessary declassifications.
- Life Cycle Stage Use Definitions
  - "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.

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 potentially exposed or susceptible subpopulations 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) (U.S. EPA, 2017a). 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 has found information indicating that TPP is used in the manufacture and use of nail polish and in flea and tick collars. EPA has determined that these uses are not TSCA conditions of use and will not be evaluated during the risk evaluation. Nail polish is a cosmetic and is covered by the Federal Food, Drug, and Cosmetic Act, 21 U.S.C. § 321 and flea and tick collars are regulated by the Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. § 136 et seq. Therefore, TPP in nail polish and in flea and tick collars are outside the scope of the definition of chemical substance as regulated by TSCA.

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 TPP in 2015 was between 1 million and 10 million pounds (U.S. EPA, 2017b). EPA also uses pre-2015 CDR production volume information, as detailed in the *Proposed Designation of Triphenyl Phosphate (CASRN 115-86-6) 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.

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 the risk evaluation for the various life cycle stages as presented in Section . The activities that the EPA determined are out of scope are not included in the life cycle diagram. Appendix A contains more detailed 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). The production volume of TPP in 2015 is included in the lifecycle diagram, as reported to EPA during the 2016 CDR reporting period, as a range between 1 million and 10 million pounds (Figure 2-7).

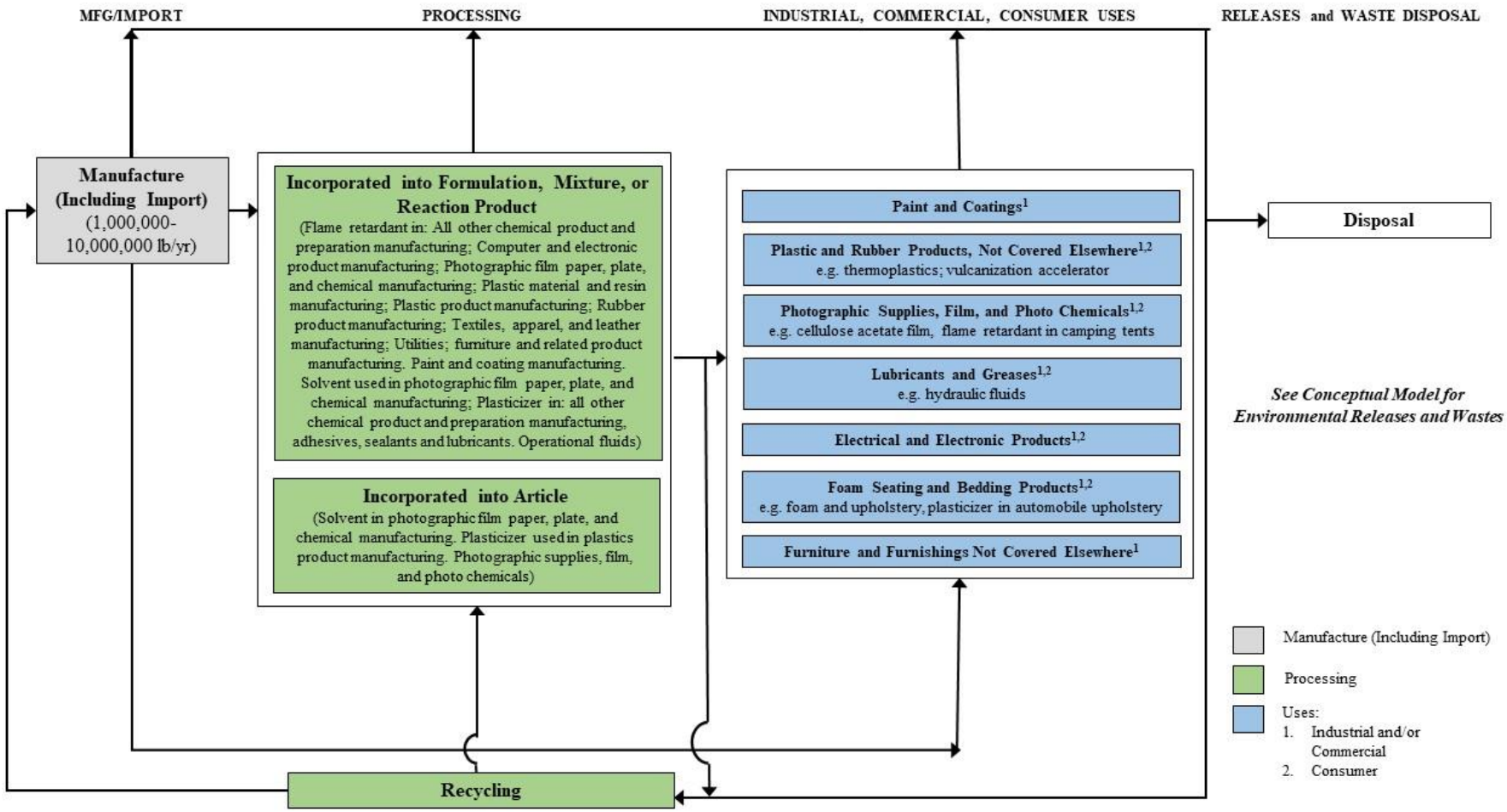

Figure 2-7 TPP Life Cycle Diagram

Note: 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 or unknown.

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 TPP. Release pathways and routes will be described in Section 2.3.3 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 take into account, where relevant, the duration, intensity (concentration), frequency and number of exposures in characterizing exposures to TPP.

2.3.1 Physical and Chemical Properties

Consideration of physical and chemical properties is 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 the *Proposed Designation of Triphenyl Phosphate (CASRN 115-86-6) as a High-Priority Substance for Risk Evaluation* (U.S. EPA, 2019a) to support the development of the risk evaluation for TPP. The values for the physical and chemical properties (Appendix A) 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 TPP. EPA plans to use the environmental fate characteristics described in the *Proposed Designation of Triphenyl Phosphate (CASRN 115-86-6) as a High-Priority Substance for Risk Evaluation* (U.S. EPA, 2019a) to support the development of the risk evaluation for TPP. 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 or assumptions and models.

TPP is not reported to the Toxics Release Inventory (TRI). There may be releases of TPP from industrial sites to wastewater treatment plants (WWTP), surface water, air and landfill. Articles that contain TPP may release TPP to the environment during use or through recycling and disposal. EPA plans to review these data in conducting the exposure assessment component of the risk evaluation for TPP.

2.3.4 Environmental Exposures

The manufacturing, processing, distribution, use and disposal of TPP can result in releases to the environment and exposure to aquatic and terrestrial receptors (biota) via surface water, sediment, soil and ambient air. Environmental exposures to biota are informed by releases into the environment, overall persistence, degradation, bioaccumulation and partitioning across different media. Concentrations of chemical substances in biota provide evidence of exposure. EPA plans to review available environmental exposure data in biota in the risk evaluation. Monitoring data were identified in EPA's search for reasonably available information on environmental exposures in biota to inform development of the environmental exposure assessment for TPP. Relevant and reliable monitoring studies provide information that can be used in an exposure assessment. Monitoring studies that measure environmental concentrations or concentrations of chemical substances in biota provide evidence of exposure.

EPA plans to review available environmental monitoring data for TPP. TPP was detected in wastewater effluent, landfill leachate, sediment, soil, ambient air, as well as in fish (including shellfish) and dolphins (EPA 2015, UK 2009, OECD 2002). According to the USGS Monitoring Data – National Water Quality Monitoring Council, TPP exists in various organisms (USGS, 1991g).

2.3.5 Occupational Exposures

EPA plans to analyze worker activities where there is a potential for exposure under the various conditions of use described in Section 2.2.2. In addition, EPA plans analyze exposure to occupational non-users (ONUs), workers who do not directly handle the chemical but perform work in an area where the chemical is present. EPA also expects to consider the effect(s) that engineering controls (ECs) and/or personal protective equipment (PPE) have on occupational exposure levels as part of the draft risk evaluation.

EPA plans to evaluate potential exposures from the processing of TPP as it is incorporated into formulations and products. TPP is used as an additive flame retardant. In general, EPA plans evaluate the potential for exposure from additive flame retardants due to blooming and release from article components during their manufacture and industrial/commercial use. TPP is also used as a component of liquid products; including, but not limited to paints, coatings, lubricants and greases.

Worker activities associated with the conditions of use within the scope of the risk evaluation for TPP that will be analyzed, include, but are not limited to:

- Unloading and transferring TPP to and from storage containers to process vessels during manufacturing, processing and use;
- Handling, transporting and disposing of waste containing TPP during manufacturing, processing, use and recycling;
- Cleaning and maintaining equipment during manufacturing, processing, use and recycling;
- Sampling chemicals, formulations or products containing TPP for quality control during manufacturing, processing, use and recycling;
- Repackaging chemicals, formulations or products containing TPP during manufacturing, processing, use and recycling; and
- Performing other work activities in or near areas where TPP is used.

TPP is a solid with a vapor pressure of approximately 6.3×10-6 mm Hg at 25 ºC/77 ºF. (U.S. EPA, 2019a) EPA anticipates inhalation of mist, dust, and other respirable particles as an exposure pathway for workers and occupational non-users during the manufacture, processing, and commercial/industrial use of various products containing TPP (e.g., particulate generated during manufacture and handling of foam and plastics and incorporation of foam and plastics into finished products, and mist generated during application to textiles and application of paints and coatings).

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 TPP.

TPP has an Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL). The PEL is 3 milligrams (mg)/cubic meter (m3) over an 8-hour workday, time weighted average (TWA). This chemical also has a National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL) of 3 mg/m^3 TWA. The American Conference of Governmental Industrial Hygienists (ACGIH) set the Threshold Limit Value (TLV) at 3 ppm TWA. Also, the OSHA Permissible Exposure Limit (PEL) for Particulates Not Otherwise Regulated (PNOR) (15 mg/m^3) (29 CFR 1910.1000) may be applicable if particulate matter is generated during industrial operations.

EPA anticipates dermal exposure to workers from contact with solids during packaging and repackaging operations at manufacturing and import sites when TPP is handled as a dry powder. EPA also anticipates dermal exposure to liquid if TPP is formulated with liquid chemical and handled as a liquid. Dermal exposure by ONU is not expected for these conditions of use as they are not expected to directly handle the chemical.

2.3.6 Consumer Exposures

CDR reporting indicate that TPP is used in consumer products used in indoor environments, including foam seating and bedding products, plastic and rubber products, and photographic supplies, film, and photo chemicals (CDR 2016, 2012). The 2012 CDR also reported the use of TPP in electrical and electronic products (CDR 2012). Several of these products have the potential to be mouthed by children. In addition, consumer handling of the disposal on TPP containing materials can lead to consumer and bystander exposures. The main exposure routes for these uses where consumers interact with products and articles containing TPP are dermal, inhalation, and dust ingestion, including children's mouthing of articles (e.g., plastics, textiles, wood products) containing TPP.

2.3.7 General Population Exposures

Releases of TPP from certain conditions of use, such as manufacturing, processing, or disposal activities, may result in general population exposures. TPP was detected in surface water, ground water, soil, ambient air, indoor air, indoor dust, as well as in fish (including shellfish) and dolphins (EPA 2015, UK 2009, OECD 2002, USGS, 1991a,b,c,d,e,f,g). EPA plans to evaluate the available literature for the presence of TPP in drinking water, ground water, ambient air, indoor air, fish, human breast milk, and dust and soil, which may be mouthed or ingested.

2.4 Hazards (Effects)

2.4.1 Environmental Hazards

As described in the *Proposed Designation of Triphenyl Phosphate (CASRN 115-86-6) 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 TPP. EPA considers all the potential environmental hazards for TPP identified during prioritization (U.S. EPA, 2019) 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 TPP. If necessary, EPA plans to update the list of potential hazards in the final scope document of TPP. Based on information identified during prioritization, environmental hazard effects were identified for aquatic and terrestrial organisms.

2.4.2 Human Health Hazards

As described in the *Proposed Designation of Triphenyl Phosphate (CASRN 115-86-6) 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 TPP. EPA plans to consider all of the potential human health hazards for TPP 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 (absorption, distribution, metabolism, and excretion). The broad health effect categories identified in the prioritization document include developmental and irritation effects. Studies were identified reporting information on reproductive toxicity, genotoxicity, dermal sensitivity, immunotoxicity and neurotoxicity. Effects were seen in epidemiological and biomonitoring human studies. 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. If necessary, EPA plans to update the list of potential hazards in the final scope document of the TPP 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 for 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, 2011a).

During the Prioritization process, EPA identified the following potentially exposed or susceptible subpopulations based on CDR information and studies reporting developmental and reproductive effects: children, women of reproductive age (including, but not limited to pregnant women), workers and consumers (U.S. EPA, 2019). EPA plans to evaluate these potentially exposed or susceptible subpopulations in the risk evaluation.

In developing exposure scenarios, EPA plans to analyze reasonably 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 unique characteristics (e.g., activities, duration or location of exposure) when compared with the general population (U.S. EPA, 2006). Likewise, EPA plans to evaluate reasonably 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 TPP. Pathways and routes of exposure associated with workers and occupational non-users are described in Section 2.6.1, and pathways and routes of exposure associated with consumers are described in Section 2.6.2. Pathways and routes of exposure associated with environmental releases and wastes are depicted in the conceptual model shown in Section 2.6.3.

2.6.1 Conceptual Model for Industrial and Commercial Activities and Uses

Figure 2-8 illustrates the conceptual model for the pathways of exposure from industrial and commercial activities and uses of TPP that EPA plans to include in the risk evaluation. There is potential for exposure to workers and/or occupational non-users via inhalation routes and exposures to workers via dermal routes. Dermal exposure to TPP in both liquid and solid form is expected, as TPP can be used/transported in solid form or suspended in solution. Inhalation exposure to dust is expected to be a significant exposure pathway. Additionally, potential inhalation exposure to TPP in mist form is expected for certain conditions of use. 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 as to whether or not each combination of exposure pathway, route, and receptor will be assessed in the risk evaluation. The supporting rationale are presented in Appendix F.

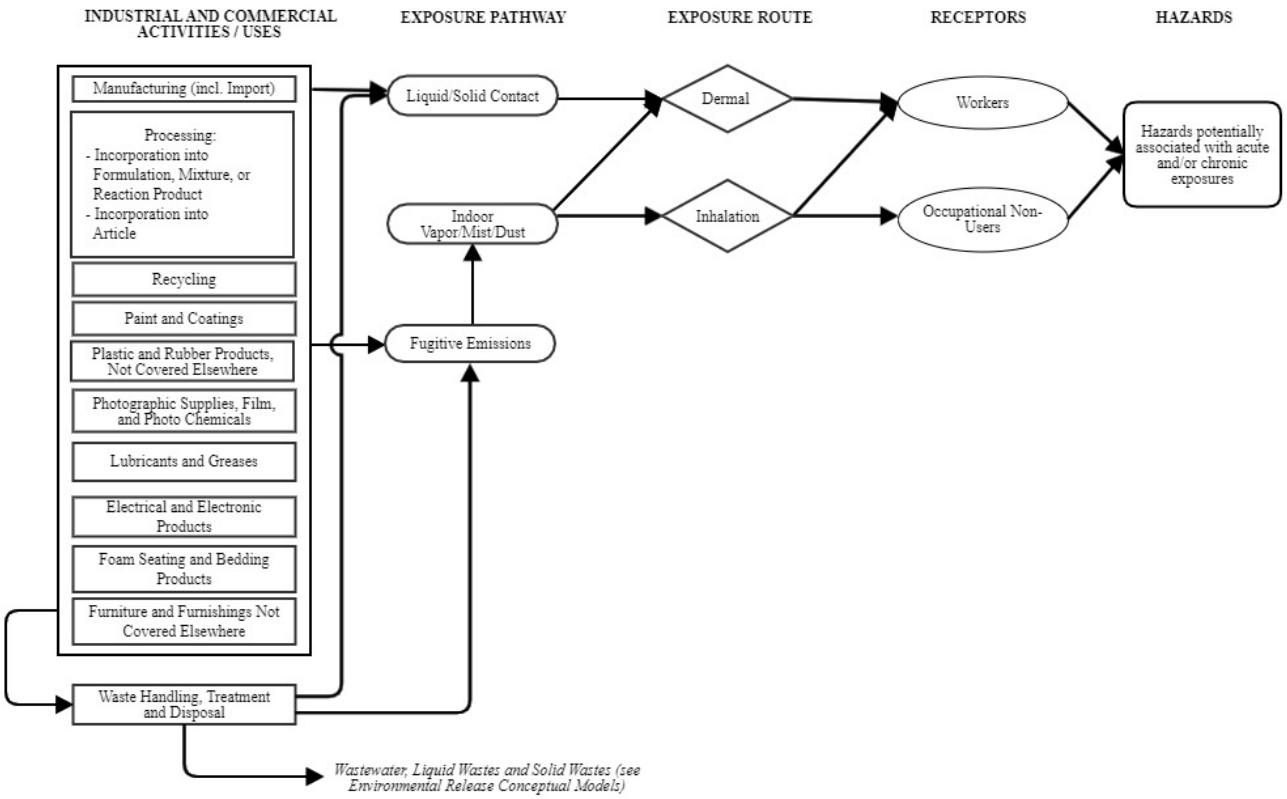

Figure 2-8 TPP Conceptual Model for Industrial and Commercial Activities and Uses: Worker and ONU Exposures and Hazards

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

2.6.2 Conceptual Model for Consumer Activities and Uses

The conceptual model in Figure 2-9 presents the exposure pathways, exposure routes and hazards to human receptors from consumer activities and uses of TPP that EPA plans to include in the risk

evaluation. Inhalation is expected to be a route of exposure for consumers and plans to evaluate inhalation exposures to TPP vapors, mists, and dusts for consumers and bystanders. Consumer oral exposures may also result from direct contact with mists and powders or dust containing TPP during use. Dermal exposures may result from liquids, and mists containing TPP. Bystanders are not expected to have significant direct dermal or oral contact to TPP products. The supporting rationale for consumer pathways considered for TPP are included in Appendix G.

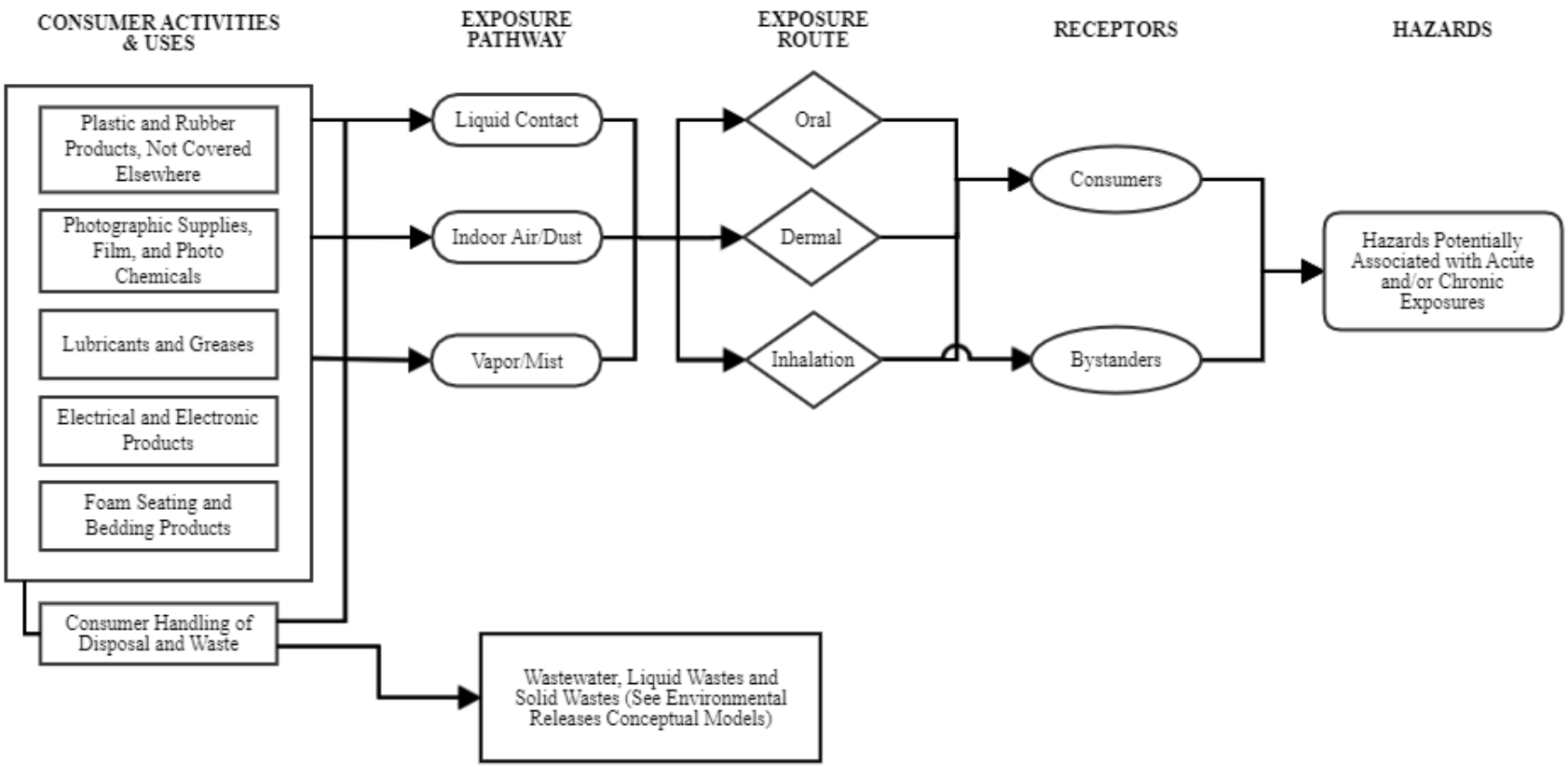

Figure 2-9 TPP Conceptual Model for Consumer Activities and Uses: Consumer Exposures and Hazards
The conceptual model presents the exposure pathways, exposure routes and hazards to human receptors from consumer activities and uses of TPP.

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

Figure 2-10 presents the exposure pathways, exposure routes, and hazards to human and environmental receptors for releases and waste streams associated with environmental releases of TPP. EPA plans to evaluate pathways and routes of exposures to receptors (e.g., general population, aquatic, terrestrial species) that may occur from industrial and/or commercial uses, releases to air, water or land, including biosolids and soil, and other conditions of use. EPA expects humans to be exposed to TPP from air emissions via inhalation as well as from water, liquid, and solid waste releases - orally via drinking water, fish and soil ingestion, and dermally from contact with groundwater and soil. The supporting rationale for general population and environmental pathways considered for TPP are included in Appendix H.

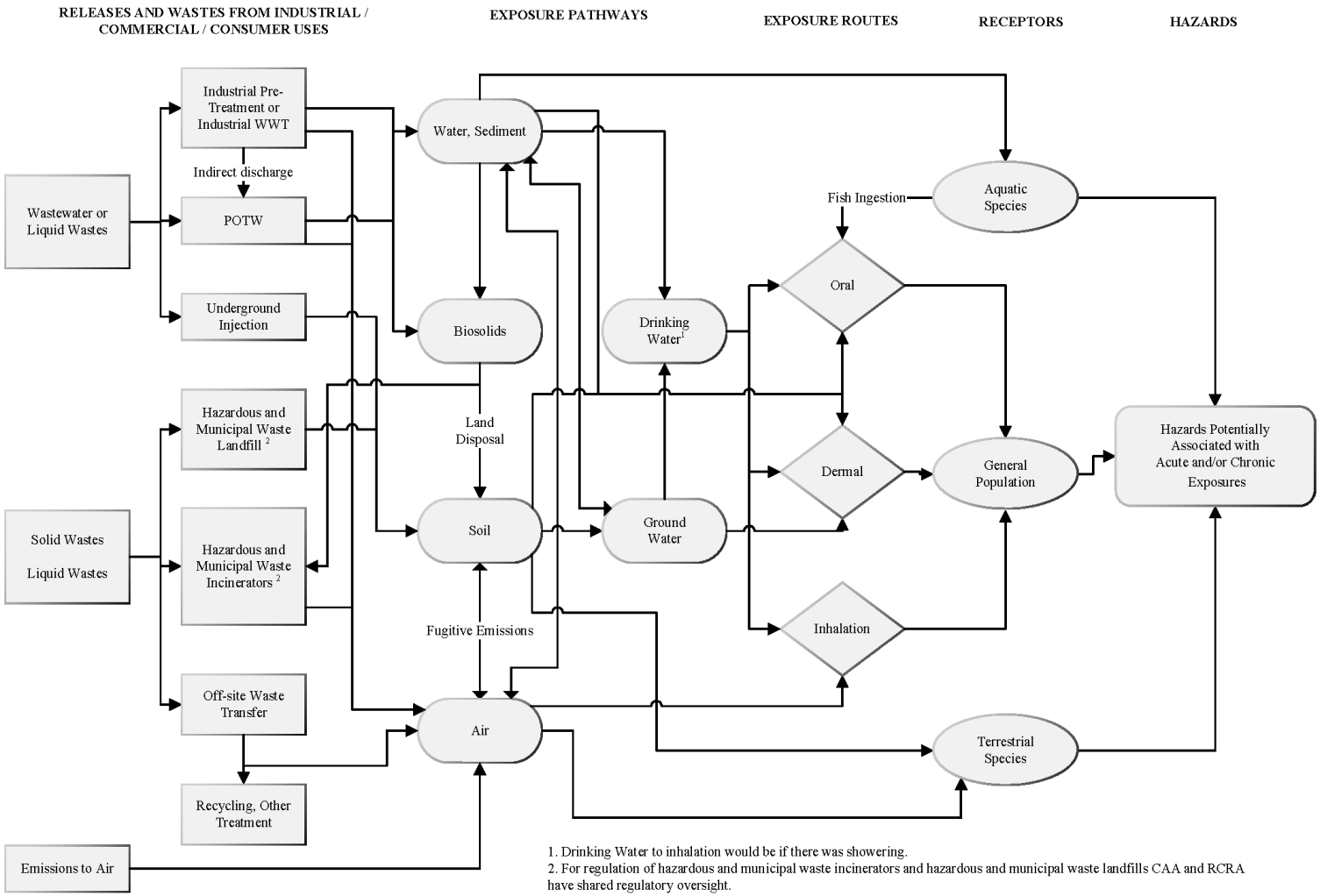

Figure 2-10 TPP Conceptual Model for Environmental Releases and Wastes: Environmental and General Population Exposure and Hazards

Industrial wastewater or liquid wastes may be treated on-site and then released to surface water (direct discharge), or pre-treated and released to 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.
Receptors include potentially exposed or susceptible subpopulations (see Section 2.5).

2.7 Analysis Plan

The analysis plan is based on EPA's knowledge of TPP to date which includes a partial, but not complete review of reasonably available information as described in Section 1. EPA encourages submission of additional data, such as full study reports or workplace monitoring from industry sources, that may be relevant for EPA's evaluation of conditions of use, exposures, hazards and potentially exposed or susceptible subpopulations during risk evaluation. Further, EPA may consider any relevant CBI in a manner that protects the confidentiality of the information from public disclosure. EPA plans 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. As discussed in *Applications of Systematic Review in TSCA Risk Evaluations* (U.S. EPA, 2018b), targeted supplemental searches during the analysis phase may be necessary to identify additional reasonably available information (e.g., commercial mixtures) for the risk evaluation of TPP.

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 TPP 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 review data and information collected through the systematic review methods and public comments about the p-chem properties (Appendix A) and fate endpoints (Appendix C) previously summarized in the *Proposed Designation of Triphenyl Phosphate (CASRN 115-86-6) as a High-Priority Substance for Risk Evaluation* (U.S. EPA, 2019a). All sources cited in EPA's analysis will be reviewed 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 p-chem properties and 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 TPP 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 p-chem and 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 to TPP indoor air, ambient air, surface water, sediment, soil, aquatic biota, and terrestrial biota. 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 TPP are presented in Appendix F. EPA plans to analyze scenario-specific exposures.

Based on their p-chem 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 reasonably 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 key data sources containing information on processes and activities resulting in releases, and the information found is described in Appendix A. EPA plans to continue to review data sources identified in Appendix A during risk evaluation using the evaluation strategy in the systematic review documentation that EPA plans to publish prior to finalizing the scope document. Potential sources of environmental release data are summarized in Table 2-3 below:

Table 2-3 Categories and Sources of Environmental Release Data

U.S. EPA Generic Scenarios
OECD Emission Scenario Documents
UK Environmental Risk Evaluation Report
Discharge Monitoring Report (DMR) surface water discharge data for TPP 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 plans to continue to review relevant data sources as identified in Appendix Aduring the 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, EPA plans to 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 has not yet identified surrogate chemicals and data that can be used to estimate releases from uses of TPP. EPA plans to review release data for surrogate chemicals that have uses and chemical and physical properties similar to TPP as it is identified. EPA may conduct targeted searches for surrogate data.

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 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.**
The 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 2009 ESD on Plastics Additives and the 2011 ESD on the Chemical Industry may be useful. The EPA plans to critically review these generic scenarios and ESDs to determine their applicability to the conditions of use.

EPA Generic Scenarios are available at the following: https://www.epa.gov/tsca-screening-tools/chemsteer-chemical-screening-tool-exposures-and-environmental-releases

Generic Scenarios that contain information that may be related to the potential uses of TPP include, but are not limited to:

- EPA's *Additives in Plastics Processing (Compounding) – Draft Generic Scenario for Estimating Occupational Exposures and Environmental Releases* (May 2004);
- EPA's *Spray Coatings in the Furniture Industry - Generic Scenario for Estimating Occupational Exposures and Environmental Releases* (April 2004);
- EPA's *Leather Dyeing - Generic Scenario for Estimating Occupational Exposures and Environmental Releases* (September 2000);
- EPA's *Fabric Finishing – Draft Generic Scenario for Estimating Occupational Exposures and Environmental Releases (September 1994);*
- EPA's *Application of Spray Polyurethane Foam Insulation – Generic Scenario for Estimating Occupational Exposures and Environmental Releases* (March 2019);
- EPA's *Industry Profile for the Flexible Polyurethane Foam Industry- Generic Scenario for Estimating Occupational Exposures and Environmental Releases* (February 2004); and,
- EPA's *Industry Profile for the Rigid Polyurethane Foam Industry – Draft Generic Scenario for Estimating Occupational Exposures and Environmental Releases* (September 2004).

OECD Emission Scenario Documents are available at the following: https://www.epa.gov/tsca-screening-tools/chemsteer-chemical-screening-tool-exposures-and-environmental-releases

ESDs that contain information that may be related to the potential uses of TPP include, but are not limited to:

- OECD's *Complementing Document to the ESD On Plastic Additives: Plastic Additives During the Use of End Products* (May 2019);
- OECD's *Complementing Document for ESD on Coating Industry: Application of Paint Solvents for Industrial Coating* (December 2015);
- OECD's *ESD on the Chemical Industry* (September 2011);
- OECD's *ESD on Radiation Curable Coating, Inks, and Adhesives* (July 2011);
- OECD's *ESD on Plastic Additives* (July 2009); and
- OECD's *ESD on Coating Industry (Paints, Lacquers and Varnishes)* (July 2009).

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 C. 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 TPP and polymer products and formulations containing TPP, 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, 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. 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 TPP:

1) **Review available environmental and biological monitoring data for all media relevant to environmental exposure.**
For TPP, environmental media which will be analyzed are sediment, biosolids, soil, air and water. The environmental exposure pathways which have been identified in the literature include aquatic and terrestrial.

2) **Review reasonably available information on releases to determine how modeled estimates of concentrations near industrial point sources compare with available monitoring data.**
EPA plans to analyze reasonably available environmental exposure models that meet the TSCA Section 26(h) and (i) Science Standards and that estimate water, sediment, and soil concentrations alongside reasonably available 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 water, sediment, or soil, indirect release into 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) **Review reasonably available biomonitoring data for vegetation, invertebrates, fish, non-fish vertebrates (i.e., amphibians, reptiles, mammals). Plan to consider whether these data could be used to compare with comparable species or taxa-specific toxicological benchmarks.**
EPA plans to analyze predatory bird species that consume fish with elevated levels of TPP. If species-specific biomonitoring data matches toxicity studies, direct comparisons can be made. EPA plans to consider refining data for other species by using body weight of the birds, fish ingestion rate of birds, and typical fish species consumed.

4) **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 TPP over the last few years. Monitoring data or modeled estimates will be reviewed to determine how representative they are of applicable use patterns.

   EPA plans to evaluate any studies which relate levels of TPP in the environment or biota with specific sources or groups of sources.

5) **Group each condition(s) of use to environmental assessment scenario(s).**
EPA plans refine and finalize exposure scenarios for environmental receptors by considering sources (use descriptors), exposure pathways including routes, and populations exposed. For TPP, 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.
   - Modeling inputs such as releases into the media of interest, fate and transport and characteristics of the environment.
   - Reasonably available biomonitoring data, which could be used to compare with species or taxa-specific toxicological benchmarks.
   - Applicability of existing additional contextual 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.

6) **Evaluate the weight of the scientific evidence of environmental occurrence data and modeled estimates.**
During risk evaluation, EPA plans to evaluate and integrate the exposure evidence identified in the literature inventory using systematic review methods.

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 the Occupational Safety and Health Administration (OSHA) and the National

Institute for Occupational Safety and Health (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).

2) **Review reasonably available exposure data for surrogate chemicals that have uses, volatility and chemical and physical properties similar to TPP.**
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 OECD ESDs and EPA Generic Scenarios corresponding to some conditions of use. EPA plans to critically review these generic scenarios and ESDs to determine their applicability to the conditions of use assessed. EPA may conduct industry outreach efforts or perform supplemental, targeted literature searches to better understand the process steps involved in conditions of use. EPA plans to also consider the applicability of exposure models in the Chemical Screening Tool for Occupational Exposure and Releases (ChemSTEER) (U.S. EPA, 2016) tool that are routinely used for assessing new chemicals to assess exposures during various conditions of use. For conditions of use where data are not available, EPA plans to review existing exposure models that may be applicable in estimating exposure levels of TPP. EPA may also perform targeted research to identify other models that EPA could use to estimate exposures for certain conditions of use.

4) **Review reasonably available data that may be used in developing, adapting or applying exposure models to a particular risk evaluation scenario.**
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/OPPT, other government agencies, or 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 occupational non-users.

5) **Consider and incorporate applicable engineering controls (ECs) and/or personal protective equipment (PPE) into exposure scenarios.**
EPA plans to review potentially relevant data sources on ECs 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 ECs, using reasonably available information on available 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 (see Appendix C). As presented in Table_Apx F-1, the EPA has grouped the scenarios into representative release/exposure scenarios, all of which will be evaluated. EPA was not able to identify occupational scenarios corresponding to some conditions of use (e.g. recycling, construction

and demolition). The EPA may further refine the mapping/grouping 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, 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 combinations of sources (ongoing consumer uses), exposure pathways including routes, and exposed populations.

   For TPP, the following are noteworthy considerations in constructing consumer exposure scenarios:
   - Conditions of use and type of consumer product
   - Duration, frequency and magnitude 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 particle inhalation, dust ingestion, and dermal contact as a result of indoor use of TPP consumer products. Indoor exposure pathways expected to be relatively lower include inhalation of vapor and mist and liquid and mist oral ingestion. The data sources associated with these respective pathways have not yet 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 dust concentrations, or indoor dust surface loadings.**
Indoor exposure models that estimate emission and migration of semi-volatile organic compounds (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. These properties vary based on p-chem 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 TPP consumer exposure scenario that is relevant to the OPPT's assessment, EPA plans evaluate those modeled estimates. In addition, if other chemicals similar to TPP 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 TPP in specific media (e.g., indoor air).**
The availability of TPP 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 levels and various indoor sources will be analyzed.

6) **Review reasonably available population- or subpopulation-specific exposure factors and activity patterns to determine if potentially exposed or susceptible subpopulations 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 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 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

EPA plans to analyze general population exposures as follows:

1) **Refine and finalize exposure scenarios for general population by sources and uses, exposure pathways including routes, and exposed populations.**
For TPP, the following are noteworthy considerations in constructing exposure scenarios for the general population: routes of exposure, releases to air, water or land resulting from industrial, commercial, and other conditions of use, in addition to:
   - Review of reasonably available environmental and biological monitoring data for media to which general population exposures are expected.
   - For exposure pathways where data are not available, review existing exposure models that may be applicable in estimating exposure levels.
   - Consider and incorporate applicable media-specific regulations into exposure scenarios or modeling.
   - Review reasonably available data that may be used in developing, adapting or applying exposure models to the particular risk evaluation. For example, existing models developed

for a chemical assessment may be applicable to another chemical assessment if model parameter data are available.
- Review reasonably available information on releases to determine how modeled estimates of concentrations near industrial point sources compare with available monitoring data.
- Review reasonably available population- or subpopulation-specific exposure factors and activity patterns to determine if potentially exposed or susceptible subpopulations need be further defined.
- Evaluate the weight of the scientific evidence of general population exposure data.
- Map or group each condition of use to general population exposure assessment scenario(s).
- Environmental Exposure pathways regulated by non-TSCA EPA laws and regulations will be excluded from analysis

EPA plans to evaluate a variety of data types to determine which types are most appropriate when quantifying exposure scenarios. Environmental monitoring data, biomonitoring data, modeled estimates, experimental data, epidemiological data, and survey-based data can all be used to quantify exposure scenarios. In an effort to associate exposure estimates with sources of exposure and/or conditions of use, EPA plans consider source apportionment across exposure scenarios during risk evaluation. EPA anticipates that there will be a wide range in the relative exposure potential of the exposure scenarios identified in Appendix G. Source apportionment characterizes the relative contribution of any of the following: a use/source toward a total media concentration, a media concentration toward a total exposure route, or an exposure route toward a total external or internal dose. This consideration may be qualitative, semi-quantitative, or quantitative, and is dependent upon reasonably available data and approaches. For example, EPA may consider the co-location of TSCA industrial facilities with reasonably available monitoring data or modeled estimates. EPA may compare modeled estimates for discrete outdoor and indoor sources/uses that apply to unique receptor groups. If available, EPA plans to compare multiple scenario-specific and background exposure doses estimated from media-specific concentrations and exposure factors with available biomonitoring data. The forward-calculated and back-calculated exposures could be compared to characterize the relative contribution from defined exposure scenarios.

After refining and finalizing exposure scenarios, EPA plans quantify concentrations and/or doses for these scenarios. The number of scenarios will depend on how combinations of uses, exposure pathways, and receptors are characterized. The number of scenarios is also dependent upon the reasonably available data and approaches to quantify scenarios. When quantifying exposure scenarios, EPA plans to use a tiered approach. First-tier analysis is based on data that is reasonably available without a significant number of additional inputs or assumptions, and may be qualitative, semi-quantitative, or quantitative. First-tier analyses were conducted during problem formulation and are expected to continue during risk evaluation. The results of first tier analyses inform whether scenarios require more refined analysis. Refined analyses will be iterative and require careful consideration of variability and uncertainty. Should data become available that summarily alters the overall conclusion of a scenario through iterative tiering, EPA can refine its analysis during risk evaluation.

2) **Review reasonably available environmental and biological monitoring data for exposure pathways and media to which general population exposures are expected.**
General population exposure pathways expected to be relatively higher include: ingestion of water and food including fish, root crops, and mother's milk. General population exposure pathways expected to be relatively lower include: dermal contact to TPP via liquids, and inhalation of TPP via

vapors, mists and dusts. 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) **For exposure pathways where empirical data is not available, review exposure models that may be applicable in estimating exposure levels.**
For TPP, EPA plans to consider exposure models for general population exposure, including models that estimate, surface water concentrations, sediment concentrations, soil concentrations, and uptake from aquatic and terrestrial environments into edible aquatic, and terrestrial organisms.

4) **Review reasonably available exposure modeled estimates. For example, existing models developed for a previous TPP chemical assessment may be applicable to EPA's assessment. In addition, another chemical's assessment may also be applicable if model parameter data are available.**
To the extent other organizations have already modeled TPP general population exposure scenario that is relevant to the OPPT's assessment, EPA plans to evaluate those modeled estimates. In addition, if modeled estimates for other chemicals with similar physical chemical properties and similar uses are available, those modeled estimates will also be evaluated. The underlying parameters and assumptions of the models will also be evaluated.

5) **Review reasonably available information on releases to determine how modeled estimates of concentrations near industrial point sources compare with reasonably available monitoring data.**
For TPP, exposure scenarios that involve potentially exposed or susceptible subpopulations will consider age-specific behaviors, activity patterns, and exposure factors unique to those subpopulations. For example, children will have different intake rates for soil than adults.

6) **Review reasonably available information about population- or subpopulation-specific exposure factors and activity patterns to determine if potentially exposed or susceptible subpopulations need to be further defined (e.g., early life and/or puberty as a potential critical window of exposure).**
For TPP, exposure scenarios that involve potentially exposed or susceptible subpopulations will consider age-specific behaviors, activity patterns, and exposure factors unique to those subpopulations. For example, children will have different intake rates for dust, soil, and diet than adults.

7) **Evaluate the weight of the scientific evidence of general population exposure estimates based on different approaches.**
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

2.7.3 Hazards (Effects)

2.7.3.1 Environmental Hazards

EPA plans to conduct an environmental hazard assessment of TPP 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 TPP 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 TPP 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) may be derived and used to further understand the hazard characteristics of TPP to aquatic and/or terrestrial species. Identified environmental hazard thresholds may be used to derive concentrations of concern (COC), based on endpoints that may affect populations of organisms or taxa analyzed.

3) **Evaluate the weight of the 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 reasonably 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 TPP conceptual model. These organisms may be exposed to TPP via a number of environmental pathways (e.g., surface water, sediment, soil, diet).

5) **Conduct an environmental risk characterization of TPP.**
   EPA plans to conduct a risk characterization of TPP to identify if there are risks to the aquatic and/or terrestrial environments from the measured and/or predicted concentrations of TPP 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 TPP.**
EPA plans to consider the persistence, bioaccumulation, and toxic (PBT) potential of TPP after reviewing relevant p-chem properties and exposure pathways. EPA plans assess the reasonably available studies collected from the systematic review process relating to bioaccumulation and bioconcentration (e.g., BAF, BCF) of TPP. In addition, EPA plans integrate traditional environmental hazard endpoint values (e.g., LC_{50}, LOEC) and exposure concentrations (e.g., surface water concentrations, fish tissue concentrations) for TPP 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 *Applications of Systematic Review under TSCA 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.**
EPA plans to evaluate reasonably available human health hazard data to ascertain whether some human receptor groups may have greater susceptibility than the general population to TPP hazard(s). Susceptibility of particular human receptor groups to TPP will be determined by evaluating information on factors that influence susceptibility.

   EPA has reviewed some sources containing hazard information associated with potentially exposed or susceptible populations, and lifestages such as pregnant women and infants. Pregnancy (i.e., gestation) and childhood are potential susceptible lifestages for TPP 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.**
EPA plans to identify and evaluate human health hazards from acute and chronic exposures by analyzing 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, 2011b, 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 TPP, EPA plans 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 the available data. Adjust the PODs as appropriate to conform (e.g., adjust for duration of exposure) to the specific exposure scenarios evaluated.**
EPA plans to evaluate hazard data 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 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, 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 reasonably available data to conduct a dose-response analysis and/or benchmark dose modeling for the oral route of exposure. EPA plans also evaluate any potential human health hazards following dermal and inhalation exposure to TPP, which could be important for the worker, consumer, and general population risk analyses. Reasonably available data will be assessed to determine whether or not a POD 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 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 plans 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, EPA plans further carry out the requirements 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 also be guided by EPA's Information Quality Guidelines (U.S, 2002) as it provides guidance for presenting risk information. Consistent with those guidelines, EPA plans identify in the risk characterization the following: (1) Each population addressed by an estimate of applicable risk effects; (2) The expected risk or central estimate of risk for the potentially exposed or susceptible subpopulations affected; (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; U.S. EPA, 2018c). As explained in the preamble to the Risk Evaluation Rule, the purpose of peer review is for the independent review of the science underlying the risk assessment (See 82 Fed. Reg. 33726, 33744 (July 12, 2017). 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 TPP will be peer reviewed.

REFERENCES

Anderson, C; Wischer, D; Schmieder, A; Spiteller, M. (1993). Fate of triphenyl phosphate in soil. Chemosphere 27: 869-879. HERO ID: 5164306

ATSDR (Agency for Toxic Substances and Disease Registry). (2017). Toxicological profile for1-bromopropane. Atlanta, GA: Division of Toxicology and Human Health Sciences, Environmental Toxicology Branch. https://www.atsdr.cdc.gov/ToxProfiles/tp209.pdf. HERO ID: 4442262

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

California Legislative Information. (2018). California flame retardant ban in children's products (Assembly bill no. 2998, chapter 924, Legislative Council, Sess. 2017 2018, C.A. 2018). California Legislative Information. https://leginfo.legislature.ca.gov/faces/billVersionsCompareClient.xhtml?bill_id=201720180AB2998. HERO ID: 6311248

CDIR (California Department of Industrial Relations). (2020). Cal Code Regs. Title 8, § 5155. (California Code of Regulations Title 8 Section § 5155). https://www.dir.ca.gov/title8/5155.html. HERO ID: 6307820

CDTSC (California Department of Toxic Substances Control). (2017). Informational list of candidate chemicals and chemical groups. Available online at https://calsafer.dtsc.ca.gov/chemical/search.aspx HERO ID: 4491939

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

Dobry, A; Keller, R. (1957). Vapor pressures of some phosphate and phosphonate esters. J Phys Chem 61: 1448-1449. https://pubs.acs.org/doi/abs/10.1021/j150556a052. HERO ID: 5186315

ECHA (European Chemicals Agency). (2019). Registration dossier: Triphenyl phosphate. CAS number: 115-86-6. https://echa.europa.eu/registration-dossier/-/registered-dossier/15972/4/4. HERO ID: 5349412

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

Haynes WM. (2014). Triphenyl phosphate. In CRC handbook of chemistry and physics (95 ed.). Boca Raton, FL: CRC Press. Taylor & Francis Group. HERO ID: 5349310

Howard, P; Deo, P. (1979). Degradation of aryl phosphates in aquatic environments. Bull Environ Contam Toxicol 3: 337-344. HERO ID: 5335980

HSDB (Hazardous Substances Data Bank). (2019). Triphenyl phosphate, CASRN: 115-86-6. U.S. Department of Health and Human Services, National Institutes of Health, National Library of Medicine. https://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+2536. HERO ID: 5348007

Kirk-Othmer. (2006). Kirk-Othmer Encyclopedia of Chemical Technology. HERO ID: 6294044

Larranaga, M; Lewis, R; Lewis, R. (2016). Hawley's condensed chemical dictionary (16th ed.). Hoboken, NJ: John Wiley & Sons, Inc. HERO ID: 5333260

Lombardo, P; Egry, IJ. (1979). Identification and gas-liquid chromatographic determination of aryl phosphate residues in environmental samples. J Assoc Offic Anal Chem 62: 47-51. HERO ID: 4620539

Microcell Products Company. (2006). Material Safety Data Sheet: Accustamp Reinking Ink. https://www.arbor-products.com/custom.aspx?id=2. HERO ID: 6301340

Muir, DCG; Yarechewski, AL; Grift, NP. (1983). Environmental dynamics of phosphate esters. III. Comparison of the bioconcentration of four triaryl phosphates by fish. Chemosphere 12: 155-166. http://dx.doi.org/10.1016/0045-6535(83)90159-5. HERO ID: 5176582

NITE (National Institute of Technology and Evaluation). (2019). Chemical Risk Information Platform (CHRIP): CASRN 115-86-6. Japan. http://www.safe.nite.go.jp/english/sougou/view/ComprehensiveInfo Display _en.faces. HERO ID: 5348003

NLM (U.S. National Library of Medicine). (2019). PubChem Database: Triphenyl phosphate. (CID 8289). National Library of Medicine. https://pubchem.ncbi.nlm.nih.gov/compound/Triphenyl-phosphate. HERO ID: 6301324

OECD (Organisation for Economic Co-operation and Development). (2002). SIDS Initial Assessment Report: Triphenyl phosphate (pp. 151). Paris, France. https://hpvchemicals.oecd.org/ui/handler.axd?id=E23395DC-ED57-4822-B9C4-7178045C3C97. HERO ID: 5160033

OECD (Organisation for Economic Co-operation and Development). (2009). Emission scenario documents on coating industry (paints, lacquers and varnishes). (JT03267833). Paris, France. HERO ID: 3827298

OLRC (Office of the Law Revision Counsel). (1996). 7 U.S.C. §136: Federal Insecticide, fungicide, and rodenticide act (FIFA): Insecticides and environmental pesticide control; Environmental pesticide control; Definitions. https://uscode.house.gov/view.xhtml?hl=false&edition=prelim&req=granuleid%3AUSC-prelim-title7-section136&num=0&saved=%7CRmVkZXJhbCBJbnNlY3RpY2lkZSwgRnVuZ2ljaWRlLCBhbmQgUm9kZW50aWNpZGUgQWN0%7CdHJlZXNvcnQ%3D%7CdHJ1ZQ%3D%3D%7C1%7Ctrue%7Cprelim. HERO ID: 6305414

OLRC (Office of the Law Revision Counsel). (2010). Federal Food, Drug, and Cosmetic Act, 21 U.S.C. § 321. https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/6307824C3 -. HERO ID: 6307824

OLRC. (2012). TSCA § 3: Definitions - 15 U.S.C. §2602. https://uscode.house.gov/view.xhtml?hl=false&edition=2016&req=granuleid%3AUSC-2018-title15-chapter53-subchapter1&num=0&saved=%7CZ3JhbnVsZWlkOlVTQy1wcmVsaW0tdGl0bGUxNS1zZWN0aW9uMjYyNQ%3D%3D%7CdHJlZXNvcnQ%3D%7CdHJ1ZQ%3D%3D%7C0%7Cfalse%7Cprelim. HERO ID: 6311094

OLRC. (2012). TSCA § 4: Testing of chemical substances and mixtures - 15 U.S.C. §2603. https://uscode.house.gov/view.xhtml?hl=false&edition=2016&req=granuleid%3AUSC-2018-title15-chapter53-subchapter1&num=0&saved=%7CZ3JhbnVsZWlkOlVTQy1wcmVsaW0tdGl0bGUxNS1zZWN0aW9uMjYyNQ%3D%3D%7CdHJlZXNvcnQ%3D%7CdHJ1ZQ%3D%3D%7C0%7Cfalse%7Cprelim. HERO ID: 6302792

OLRC. (2012). TSCA § 5: Manufacturing and processing notices - 15 U.S.C. §2604. https://uscode.house.gov/view.xhtml?hl=false&edition=2016&req=granuleid%3AUSC-2018-title15-chapter53-subchapter1&num=0&saved=%7CZ3JhbnVsZWlkOlVTQy1wcmVsaW0tdGl0bGUxNS1zZWN0aW9uMjYyNQ%3D%3D%7CdHJlZXNvcnQ%3D%7CdHJ1ZQ%3D%3D%7C0%7Cfalse%7Cprelim. HERO ID: 6302795

OLRC. (2012). TSCA § 6: Prioritization, risk evaluation, and regulation of chemical substances and mixtures - 15 U.S.C. §2605. HERO ID: 6302789

OLRC. (2012). TSCA § 8: Reporting and retention of information - 15 U.S.C. §2607. https://uscode.house.gov/view.xhtml?hl=false&edition=2016&req=granuleid%3AUSC-2018-title15-chapter53-subchapter1&num=0&saved=%7CZ3JhbnVsZWlkOlVTQy1wcmVsaW0tdGl0bGUxNS1zZWN0aW9uMjYyNQ%3D%3D%7CdHJlZXNvcnQ%3D%7CdHJ1ZQ%3D%3D%7C0%7Cfalse%7Cprelim. HERO ID: 6302796

OLRC. (2012). TSCA § 14: Confidential Information - 15 U.S.C. §2613. https://uscode.house.gov/view.xhtml?hl=false&edition=2016&req=granuleid%3AUSC-2018-title15-chapter53-subchapter1&num=0&saved=%7CZ3JhbnVsZWlkOlVTQy1wcmVsaW0tdGl0bGUxNS1zZW N0aW9uMjYyNQ%3D%3D%7CdHJlZXNvcnQ%3D%7CdHJ1ZQ%3D%3D%7C0%7Cfalse%7Cprelim. HERO ID: 6311095

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.). Whitehouse Station, NJ: Merck Research Laboratories Division of Merck & Co., Inc. HERO ID: 3378176

OSHA (Occupational Safety and Health Administration). (2019). 29 CFR § 1910.1000: Air contaminants. (Code of Federal Regulations Title 29 Section 1910.1000). https://www.govinfo.gov/app/details/CFR-2019-title29-vol6/CFR-2019-title29-vol6-sec1910-1000. HERO ID: 6309377

Pennsylvania, So. (1984). P.L. 734, No. 159: Worker and Community Right-To-Know Act. (Phamphlet Law 734 No 159). State of Pennsylvania. https://www.legis.state.pa.us/cfdocs/legis/li/uconsCheck.cfm?yr=1984&sessInd=0&act=159. HERO ID: 6305875

Pennsylvania, So. (1986). 34 Pa. Code § 323: Hazardous substance list. (Pennsylvania Code Title 34 Chapter 323). State of Pennsylvania. HERO ID: 6305876

Relations, HDoLaI. (2019). Haw. Code R. § 12-60-50: Standards. (Hawaii Administrative Rules Section 12-60-50). Hawaii Department of Labor and Industrial Relations. HERO ID: 6305873

Rumble J. R., E. (2018). Triphenyl phosphate. In CRC handbook of chemistry and physics (99 ed.). Boca Raton, FL: CRC Press. Taylor & Francis Group. HERO ID: 5349308

Saeger, VH; Kaley. (1979). Environmental fate of selected phosphate esters. Environ Sci Technol 13: 840-844. HERO ID: 4198341

SGP. (2014). Biomonitoring California Priority Chemicals. Available online at http://www.biomonitoring.ca.gov/chemicals/chemicals-biomonitored-california HERO ID: 3809140

Snyder, R. (1990). Volume II: Nitrogen and Phosphorus Solvents. In Ethel Browning's Toxicity and Metabolism of Industrial Solvents (2nd ed.). Amsterdam-New York-Oxford: Elsevier. HERO ID: 6311104

SPIN (Substances in Preparations in Nordic Countries). (2019). Substance Cas no. 115-86-6. http://www.spin2000.net/spinmyphp/?pid=115866. HERO ID: 6301342

U.S. EPA (U.S. Environmental Protection Agency). (1994). Methods for derivation of inhalation reference concentrations and application of inhalation dosimetry [EPA Report]. (EPA/600/8-90/066F). Research Triangle Park, NC: U.S. Environmental Protection Agency, Office of Research and Development, Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office. https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=71993&CFID=51174829&CFTOKEN=25006317. HERO ID: 6488

U.S. EPA (U.S. Environmental Protection Agency). (1995). Premanufacture Notification; Revisions of Premanufacture Notification Regulations; Final Rule, Federal Registrar: 60 FR 16309. 60: 16309. HERO ID: 6307612

U.S. EPA (U.S. Environmental Protection Agency). (1998). Guidelines for ecological risk assessment [EPA Report]. (EPA/630/R-95/002F). Washington, DC: U.S. Environmental Protection Agency, Risk Assessment Forum. https://hero.epa.gov/hero/index.cfm/reference/details/reference_id/42805. HERO ID: 42805

U.S. EPA (U.S. Environmental Protection Agency). (2000). Science policy council handbook: Risk characterization handbook [EPA Report]. (EPA/100/B-00/002). Washington, D.C.: U.S. Environmental Protection Agency, Science Policy Council. https://www.epa.gov/risk/risk-characterization-handbook. HERO ID: 52149

U.S. EPA (U.S. Environmental Protection Agency). (2002). Guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by the Environmental Protection Agency. (EPA/260/R-02/008). Washington, DC: U.S. Environmental Protection Agency, Office of Environmental Information. https://www.epa.gov/sites/production/files/2017-03/documents/epa-info-quality-guidelines.pdf. HERO ID: 635281

U.S. EPA (U.S. Environmental Protection Agency). (2004). Risk Assessment Guidance for Superfund (RAGS), volume I: Human health evaluation manual, (part E: Supplemental guidance for dermal risk assessment): Final. (EPA/540/R/99/005). Washington, DC. http://www.epa.gov/oswer/riskassessment /ragse/index.htm. HERO ID: 664634

U.S. EPA (U.S. Environmental Protection Agency). (2005). Guidelines for carcinogen risk assessment [EPA Report]. (EPA/630/P-03/001F). Washington, DC: U.S. Environmental Protection Agency, Risk Assessment Forum. https://www.epa.gov/sites/production/files/2013-09/documents/cancer_guidelines_final_3-25-05.pdf. HERO ID: 86237

U.S. EPA (U.S. Environmental Protection Agency). (2006). A framework for assessing health risk of environmental exposures to children (pp. 1-145). (EPA/600/R-05/093F). Washington, DC: U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment. http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=158363. HERO ID: 194567

UK Environment Agency. (2009). Environmental risk evaluation report: Triphenyl phosphate (CAS no. 115-86-6). Bristol, UK: The Environment Agency. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/290862/scho0809bquk-e-e.pdf. HERO ID: 5155567

U.S. EPA (U.S. Environmental Protection Agency). (2011a). Exposure factors handbook: 2011 edition [EPA Report]. (EPA/600/R-090/052F). Washington, DC. http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=236252. HERO ID: 786546

U.S. EPA (U.S. Environmental Protection Agency). (2011b). 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). (2012a). Benchmark dose technical guidance. (EPA/100/R-12/001). Washington, DC: U.S. Environmental Protection Agency, Risk Assessment Forum. https://www.epa.gov/risk/benchmark-dose-technical-guidance. HERO ID: 1239433

U.S. EPA (U.S. Environmental Protection Agency). (2012b). Estimation Programs Interface Suite for Microsoft Windows, v 4.11 [Computer Program]. Washington, DC. https://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface. HERO ID: 2347246

U.S. EPA (U.S. Environmental Protection Agency). (2012c). PhysProp database. Estimation Programs Interface Suite for Microsoft Windows, v 4.11: Triphenyl phosphate (CASRN: 115-86-6) [Fact Sheet]. Washington, DC. https://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface. HERO ID: 5336057

U.S. EPA (U.S. Environmental Protection Agency). (2013). ChemSTEER user guide - Chemical screening tool for exposures and environmental releases. Washington, D.C. https://www.epa.gov/sites/production/files/2015-05/documents/user_guide.pdf. HERO ID: 3809033

U.S. EPA (U.S. Environmental Protection Agency). (2014a). Use of Additives in the Thermoplastic Converting Industry - Generic Scenario for Estimating Occupational Exposures and Environmental Releases (Draft). HERO ID: 6305894

U.S. EPA (U.S. Environmental Protection Agency). (2014b). Flame retardant alternatives for hexabromocyclododecane (HBCD) [EPA Report]. (EPA/740/R-14/001). Washington, D.C.

http://www2.epa.gov/saferchoice/partnership-evaluate-flame-retardant-alternatives-hbcd-publications. HERO ID: 2533762

U.S. EPA (U.S. Environmental Protection Agency). (2015). Science policy council peer review handbook [EPA Report] (4th ed.). (EPA/100/B-15/001). Washington, DC: U.S. Environmental Protection Agency, Science Policy Council. HERO ID: 3350604

U.S. EPA (U.S. Environmental Protection Agency). (2016). Chemical Screening Tool for Exposure and Environmental Releases (ChemSTEER) v. 3.2. https://www.epa.gov/tsca-screening-tools/chemsteer-chemical-screening-tool-exposures-and-environmental-releases. HERO ID: 6306744

U.S. EPA (U.S. Environmental Protection Agency). (2017a). 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). (2017b). Non-Confidential 2016 Chemical Data Reporting (CDR). https://chemview.epa.gov/chemview. HERO ID: 6172406

U.S. EPA (U.S. Environmental Protection Agency). (2018a). 40 CFR 702.41: Procedures for Chemical Substance Risk Evaluations: Evaluation requirements. Washington, DC. https://www.govinfo.gov/content/pkg/CFR-2018-title40-vol33/xml/CFR-2018-title40-vol33-part702.xml#seqnum702.41. HERO ID: 6302779

U.S. EPA (U.S. Environmental Protection Agency). (2018b). 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). (2018c). 40 CFR § 702.45: Procedures for Chemical Substance Risk Evaluations: Peer review. (Code of Federal Regulations Title 40 Section 702.45). Washington, DC. https://www.govinfo.gov/content/pkg/CFR-2018-title40-vol33/xml/CFR-2018-title40-vol33-part702.xml#seqnum702.45. HERO ID: 6302780

U.S. EPA (U.S. Environmental Protection Agency). (2018d). Problem formulation of the risk evaluation for 1-bromopropane. (EPA-740-R1-7019). Washington, DC: Office of Chemical Safety and Pollution Prevention, United States Environmental Protection Agency. https://www.epa.gov/sites/production/files/2018-06/documents/1bp_problem_formulation_05-31-18.pdf. HERO ID: 5085557

U.S. EPA (U.S. Environmental Protection Agency). (2018e). Problem formulation of the risk evaluation for cyclic aliphatic bromides cluster (HBCD). (EPA-740-R1-7012). Washington, DC: Office of Chemical Safety and Pollution Prevention, United States Environmental Protection Agency. https://www.epa.gov/sites/production/files/2018-06/documents/hbcd_problem_formulation_05-31-18.pdf. HERO ID: 5085560

U.S. EPA (U.S. Environmental Protection Agency). (2018f). Problem formulation of the risk evaluation for methylene chloride (dichloromethane, DCM). (EPA-740-R1-7016). Washington, DC: Office of Chemical Safety and Pollution Prevention, United States Environmental Protection Agency.

https://www.epa.gov/sites/production/files/2018-06/documents/mecl_problem_formulation_05-31-18.pdf. HERO ID: 5085603

U.S. EPA (U.S. Environmental Protection Agency). (2019a). Proposed Designation of Triphenyl Phosphate (CASRN 115-86-6) as a High-Priority Substance for Risk Evaluation. Washington, DC: Office of Pollution Prevention and Toxics. https://www.epa.gov/sites/production/files/2019-08/documents/tris2-chloroethylphosphate_115-96-8_high-priority_proposeddesignation_082319.pdf.

U.S. EPA (U.S. Environmental Protection Agency). (2019b). Chemical data reporting (2012 and 2016 non-CBI CDR database). Washington, DC.: Office of Pollution Prevention and Toxics. HERO ID: 6296234

USGS (U.S. Geological Survey). (1991a). USGS Monitoring Data: National Water Quality Monitoring Council [Database]. http://www.waterqualitydata.us/portal/. HERO ID: 4571753

USGS (U.S. Geological Survey). (1991b). USGS Monitoring Data: National Water Quality Monitoring Council - Air. https://www.waterqualitydata.us/portal/#siteType=Aggregate%20groundwater%20use&sampleMedia=Water&mimeType=csv&dataProfile=activityAll. HERO ID: 6120444

USGS (U.S. Geological Survey). (1991c). USGS Monitoring Data: National Water Quality Monitoring Council - Groundwater. https://www.waterqualitydata.us/portal/#siteType=Aggregate%20ground water%20use&sample Media=Water&mimeType=csv&dataProfile=activityAll. HERO ID: 6120028

USGS (U.S. Geological Survey). (1991d). USGS Monitoring Data: National Water Quality Monitoring Council - Sediment. https://www.waterqualitydata.us/portal/#sampleMedia=Sediment&mimeType=csv. HERO ID: 6120597

USGS (U.S. Geological Survey). (1991e). USGS Monitoring Data: National Water Quality Monitoring Council - Soil. https://www.waterqualitydata.us/portal/#sampleMedia=Soil&mimeType=csv. HERO ID: 6120844

USGS (U.S. Geological Survey). (1991f). USGS Monitoring Data: National Water Quality Monitoring Council - Surface Water. https://www.waterqualitydata.us/portal/#siteType=Aggregate%20surface-water-use&sampleMedia=Water&mimeType=csv. HERO ID: 6120448

USGS (U.S. Geological Survey). (1991g). USGS Monitoring Data: National Water Quality Monitoring Council - Tissue. https://www.waterqualitydata.us/portal/#sampleMedia=Tissue&mimeType=csv. HERO ID: 6120843

APPENDICES

Appendix A LIST OF GRAY LITERATURE SOURCES

Table_Apx A-1 List of Gray Literature Sources for TPP

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, eco, Tier I, II or III)	International 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
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: Cancer Potency Information	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: Proposition 65, Cancer, Notice	Other US Agency Resources	Assessment or Related Document
CAL EPA	Technical Support Documents for regulations: Proposition 65, Reproductive Toxicity	Other US Agency Resources	Assessment or Related Document

Source/Agency	Source Name	Source Type	Source Category
CAL EPA	Technical Support Documents for regulations: Soil Screening	Other US Agency Resources	Assessment or Related Document
Canada Gov	Government of Canada - Factsheet: Prohibition of Certain Toxic Substances Regulations	International Resources	Factsheet
Canada Gov	Government of Canada - Substances Search	International Resources	General Search
CARB	Report to the California Legislature Indoor Air Pollution in California.	Other US Agency Resources	Technical Report
CDC	CDC Biomonitoring Tables	Other US Agency Resources	Data
CDC	NHANES data	Other US Agency Resources	Data
CPSC	Chronic Hazard Advisory Panel Reports	Other US Agency Resources	Assessment or Related Document
CPSC	Technical Reports: Exposure/Risk Assessment	Other US Agency Resources	Assessment or Related Document
CPSC	Technical Reports: Toxicity Review	Other US Agency Resources	Assessment or Related Document
EC	European Commission	International Resources	Assessment or Related Document
EC	IPCHEM: Information Platform for Chemical Monitoring Data	International Resources	Database
ECHA	Annex XIV Restriction Report	International Resources	Assessment or Related Document
ECHA	Annex XV Restriction Report	International Resources	Assessment or Related Document
ECHA	Annex XVII Restriction Reports	International Resources	Assessment or Related Document
ECHA	Annex XVII To REACH - Conditions of Use	International Resources	Assessment or Related Document

Source/Agency	Source Name	Source Type	Source Category
ECHA	AnnexXV Transitional Report	International Resources	Assessment or Related Document
ECHA	ECHA Documents	International Resources	Assessment or Related Document
ECHA	European Union Risk Assessment Report	International Resources	Assessment or Related Document
EFSA	EFSA reports	International Resources	Assessment or Related Document
Env Canada	CEPA Environmental Registry - Draft assessments currently available	International Resources	Assessment or Related Document
Env Canada	CEPA Environmental Registry - Final Assessments	International Resources	Assessment or Related Document
Env Canada	Canada Substance Grouping Pages	International Resources	Assessment or Related Document
Env Canada	Screening Assessment Report	International Resources	Assessment or Related Document
Env Canada	Guidelines, Risk Management, Regulations	International Resources	Assessment or Related Document
Env Canada	Chemicals at a Glance (fact sheets)	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	Screening Assessment for the Challenge	International Resources	Assessment or Related Document
Env Canada	Government of Canada - Toxic substances list: schedule 1	International Resources	Assessment or Related Document
Env UK	Environmental risk evaluation report	International Resources	Assessment or Related Document
EPA	Design for the Environment (DfE)	US EPA Resources	Assessment or Related Document

Source/Agency	Source Name	Source Type	Source Category
	Alternatives Assessments		
EPA	EPA Office of Water: Ambient Water Quality Criteria documents	US EPA Resources	Assessment or Related Document
EPA	EPA Pesticide Chemical Search (docket)	US EPA Resources	Assessment or Related Document
EPA	EPA Pesticide Chemical Search (assessment)	US EPA Resources	Assessment or Related Document
EPA	Included in 2011 NATA	US EPA Resources	Assessment or Related Document
EPA	IRIS Summary	US EPA Resources	Assessment or Related Document
EPA	IRIS Tox Review	US EPA Resources	Assessment or Related Document
EPA	PPRTV Derivation Support Document	US EPA Resources	Assessment or Related Document
EPA	Support document for AEGLS	US EPA Resources	Assessment or Related Document
EPA	TSCA Assessments	US EPA Resources	Assessment or Related Document
EPA	TSCA Data Needs Assessments or Problem Formulation	US EPA Resources	Assessment or Related Document
EPA	TSCA Hazard Characterizations	US EPA Resources	Assessment or Related Document
EPA	Office of Air: Air Emission Factors	US EPA Resources	Data
EPA	Office of Air: AQS, Annual	US EPA Resources	Data
EPA	Office of Air: NATA 2011	US EPA Resources	Data
EPA	Office of Air: National Emissions Inventory (NEI) - National Emissions Inventory (NEI) Data (2014a, 2011, 2008)	US EPA Resources	Data

Source/Agency	Source Name	Source Type	Source Category
EPA	Office of Air: National Emissions Inventory (NEI) - Additional Documents	US EPA Resources	Data
EPA	Office of Air: TRI	US EPA Resources	Data
EPA	Office of Water: STORET and WQX	US EPA Resources	Data
EPA	Chemical Data Reporting (2012 and 2016 non-CBI CDR database)	US EPA Resources	Database
EPA	Chemical Data Reporting (2012 and 2016 non-CBI CDR database)	US EPA Resources	Database
EPA	EPA - ECOTOX Database	US EPA Resources	Database
EPA	CPDAT	US EPA Resources	Database
EPA	EPA Ambient Monitoring Technology Information Center – Air Toxics Data	US EPA Resources	Database
EPA	EPA Discharge Monitoring Report Data	US EPA Resources	Database
EPA	enam	US EPA Resources	Database
EPA	EPA: ICIS	US EPA Resources	Database
EPA	Great Lakes Environmental Database	US EPA Resources	Database
EPA	TRI: Envirofacts Toxics Release Inventory 2017 Updated Dataset	US EPA Resources	Database
EPA	TSCATS	US EPA Resources	Database
EPA	Other EPA: Misc sources	US EPA Resources	General Search
EPA	Office of Air: CFRs and Dockets	US EPA Resources	Regulatory Document or List
EPA	EPA: AP-42	US EPA Resources	Regulatory Document or List

Source/Agency	Source Name	Source Type	Source Category
EPA	EPA Office of Air NESHAP list	US EPA Resources	Regulatory Document or List
EPA	Clean Air Act Hazardous Air Pollutants (HAPs)	US EPA Resources	Regulatory Document or List
EPA	Office of Water: CFRs	US EPA Resources	Regulatory Document or List
EPA	Office of Water: Drinking Water Standards Health Effects Support Documents	US EPA Resources	Regulatory Document or List
EPA	Office of Water: Drinking water Chemical contaminant lists	US EPA Resources	Regulatory Document or List
EPA	EPA: Generic Scenario	US EPA Resources	Technical Report
EPA	EPA OECA Sector Notebooks	US EPA Resources	Technical Report
FDA	FDA technical support documents for regulations	Other US Agency Resources	Assessment or Related Document
FDA	FDA Cumulative Estimated Daily Intake	Other US Agency Resources	Data
FDA	FDA Total Diet Study	Other US Agency Resources	Database
FDA	FDA Market Baskets	Other US Agency Resources	Technical Report
IARC	IARC Monograph	International Resources	Assessment or Related Document
Japan	Japanese Ministry of the Environment Assessments - Environmental Risk Assessments	International Resources	Assessment or Related Document
Japan	Japanese Ministry of the Environment Assessments - Environmental Risk Assessments (Class I Designated Chemical	International Resources	Assessment or Related Document

Source/Agency	Source Name	Source Type	Source Category
	Substances Summary Table)		
KOECT	Kirk-Othmer Encyclopedia of Chemical Technology	Encyclopedia	Encyclopedia
MDI	Comparative Toxicogenomics Database	Other Resource	Database
Misc	Consumer Products Information Database (CPID)	Other Resources	Data
NIOSH	CDC NIOSH - Occupational Health Guideline Documents	Other US Agency Resources	Assessment or Related Document
NIOSH	CDC NIOSH - Pocket Guide	Other US Agency Resources	Database
NIOSH	CDC NIOSH - Health Hazard Evaluations (HHEs)	Other US Agency Resources	Technical Report
NIOSH	CDC NIOSH - Workplace Survey Reports	Other US Agency Resources	Technical Report
NIOSH	CDC NIOSH - Publications and Products	Other US Agency Resources	Technical Report
NLM	NIEHS Tox Review	Other US Agency Resources	Database
NLM	National Library of Medicine’s HazMap	Other US Agency Resources	Database
NLM	National Library of Medicine’s PubChem	Other US Agency Resources	Database
NLM	National Library of Medicine’s Hazardous Substance Databank	Other US Agency Resources	Database
NTP	Additional NTP Reports	Other US Agency Resources	Assessment or Related Document

Source/Agency	Source Name	Source Type	Source Category
NTP	OHAT Monographs	Other US Agency Resources	Assessment or Related Document
NTP	RoC Monographs	Other US Agency Resources	Assessment or Related Document
NTP	Technical Reports	Other US Agency Resources	Assessment or Related Document
OECD	OECD Emission Scenario Documents	International Resources	Assessment or Related Document
OECD	OECD Substitution and Alternatives Assessment	International Resources	Assessment or Related Document
OECD	OECD SIDS	International Resources	Assessment or Related Document
OECD	OECD: eChem Portal	International Resources	Database
OECD	OECD: General Site	International Resources	General Search
OSHA	OSHA Chemical Exposure Health Data	Other US Agency Resources	Data
OSHA	OSHA [data from ERG]	Other US Agency Resources	Data
RIVM	Integrated Criteria Documents	International Resources	Assessment or Related Document
RIVM	Probit Function Technical Support Document	International Resources	Assessment or Related Document
RIVM	RIVM Reports: Risk Assessments	International Resources	Assessment or Related Document
RIVM	RIVM Reports: Dietary Intake	International Resources	Assessment or Related Document
SRI	SRI data (proprietary)	Other Resource	Database
State of North Carolina	NC Division of Environmental Assistance and Customer Service	Other US Agency Resources	General Search
TERA	Toxicology Excellence for Risk Assessment	Other Resources	Assessment or Related Document
U.S. Census Bureau	North American Industry Classification System (NAICS)	Other US Agency Resources	Database

Source/Agency	Source Name	Source Type	Source Category
UNEP	Risk Profile / Stockholm Convention	International Resources	Assessment or Related Document
US BLS	Bureau of Labor Statistics	Other US Agency Resources	Database
USGS	USGS Monitoring Data –National Water Quality Monitoring Council	Other US Agency Resources	Database

Appendix B PHYSICAL AND CHEMICAL PROPERTIES

This appendix provides p-chem information and data found in preliminary data gathering for triphenyl phosphate. 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 Triphenyl Phosphate (CASRN 115-86-6) 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-2018-0451).

Table_Apx B-1 Physical and Chemical Properties of TPP

Property or Endpoint	Value[a]	Reference	Data Quality Rating
Molecular formula	$C_{18}H_{15}O_4P_1$	NA	NA
Molecular weight	326.29 g/mol	NA	NA
Physical state	Solid crystals or prisms	Rumble, 2018	High
Physical properties	Colorless, crystalline powder; odorless	NLM, 2018	High
Melting point	49.39°C	Rumble, 2018	High
Boiling point	413°C	U.S. EPA, 2019a	High
Density	1.2055 g/cm^3 at 50°C	Rumble, 2018	High
Vapor pressure	6.28×10^{-6} mm Hg	U.S. EPA, 2019a	High
Vapor density	1.19 (air = 1)	NLM, 2018	High
Water solubility	1.9 mg/L at 25°C	NLM, 2018	High
Log Octanol/water partition coefficient (Log Kow)	4.59	NLM, 2018	High
Henry's Law constant	1.42×10^{-6} atm·m^3/mole (Calculated from VP/WS)	U.S. EPA, 2012c	High
Flash point	220°C	RSC, 2019	High

Property or Endpoint	Value[a]	Reference	Data Quality Rating
Auto flammability	Not available		
Viscosity	Not available		
Refractive index	1.550	NLM, 2018	High
Dielectric constant	Not available		

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

Appendix C ENVIRONMENTAL FATE AND TRANSPORT PROPERTIES

Table_Apx C-1 Environmental Fate and Transport Properties of TPP

Property or Endpoint	Value[a]	Reference
Direct Photodegradation	Not expected to be susceptible to direct photolysis by sunlight because the chemical does not absorb light at wavelengths >290 nm	HSDB (2019)
Indirect Photodegradation	$t_{1/2}$ = 12 hours (based on □OH reaction rate constant of 1.11 × 10^{-11} cm^3/mol·second at 25 ºC and 5 × 10^5 □OH radicals/cm^3; estimated)[b]	HSDB (2019) citing EPI Suite (2012b)
Hydrolysis	$t_{1/2}$ = 19 days (pH 7 at 25 ºC) $t_{1/2}$ = 3 days (pH 9 at 25 ºC)	HSDB (2019) citing Mayer (1981)
	$t_{1/2}$ = 7.5 days (pH 8.2 at 21 ºC) $t_{1/2}$ = 1.3 days (pH 9.5 at 21 ºC)	HSDB (2019) citing Howard (1979)
Biodegradation (Aerobic)	$t_{1/2}$ = 2–4 days in river die-away tests (Mississippi River)	HSDB (2019) citing Saeger (1979)
	48% mineralization/32 days; $t_{1/2}$ = 37 days (loamy sand)	HSDB (2019) citing Anderson (1993)
	100%/7–8 days (freshwater)	HSDB (2019) citing Howard (1979)
	83–94%/4 weeks based on BOD (Japanese MITI test)	HSDB (2019) citing NITE (2019)
Biodegradation (Anaerobic)	$t_{1/2}$ = 32 days (loamy sand)	HSDB (2019) citing Anderson (1993)
Wastewater Treatment	61% total removal (0.56% by biodegradation, 60% by sludge and 0.07% by volatilization to air; estimated)[b]	EPI Suite (2012b)
Bioconcentration Factor	180–280 (*Salmo gairdneri*) for Pydraul 50E, a hydraulic fluid containing 35% TPP	HSDB (2019) citing Lombardo (1979)
	132–364 (*Oncorhynchus mykiss)*	HSDB (2019) citing Mayer (1981)
	573 (*Oncorhynchus mykiss)*; 561 (*Pimephales promelas*)	HSDB (2019) citing Muir (1983)
Bioaccumulation Factor	73 (estimated)[b]	EPI Suite (2012b)
Soil Organic Carbon:Water Partition Coefficient (Log K_{OC})	3.40, 3.55, and 3.44 (silty clay, loamy sand, and silt loam, respectively)	HSDB (2019) citing Anderson (1993)

[a]Measured unless otherwise noted

[b]EPI SuiteTM physical property inputs: Log Kow = 4.59, MP = 50.5 ºC, VP = 6.4 × 10-6 mm Hg, WS = 1900 mg/L. SMILES:O=P(Oc(cccc1)c1)(Oc(cccc2)c2)Oc(cccc3)c3

□OH = hydroxyl radical; BOD = biological oxygen demand; MITI = Ministry of International Trade and Industry

Appendix D REGULATORY HISTORY

The chemical substance, TPP, is subject to federal and state laws and regulations in the United States (Table_Apx D-1 Federal Laws and Regulations and Table_Apx D-2 State Laws and Regulations). Regulatory actions by other governments, tribes and international agreements applicable to TPP 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.	TPP 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 TPP as a 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.	TPP 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.	TPP 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).
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.	EPA received one Substantial Risk Report for TPP (1992).

Statutes/Regulations	Description of Authority/Regulation	Description of Regulation
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.	Test rule for TPP. EPA received 67 studies including ecotox, environmental fate, human health, and p-chem properties. (U.S. EPA, ChemView. Accessed January 24, 2020)
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.	In 1970, OSHA issued occupational safety and health standards for TPP that included a PEL of TWA of 3 mg/$m^{3.}$ and respirator recommendations. (29 CFR 1910.1000).

D.2 State Laws and Regulations

Table_Apx D-2 State Laws and Regulations

State Actions	Description of Action
State Prohibitions	California adopted a prohibition on the selling and distribution in commerce of new, not previously owned juvenile products, mattresses, or upholstered furniture that contains, or a constituent component of which contains, covered flame retardant chemicals at levels above 1,000 parts per million (A.B. 2998, Legislative Council, Sess. 2017-2018, C.A. 2018)
State PELs	California (PEL of 3 mg/m^3) (Cal Code Regs. Title 8, § 5155) Hawaii (PEL- TWA of 3 mg/$m^{3)}$ and STEL (6 mg/$m^{3)}$ (Hawaii Administrative Rules section 12-60-50). Minnesota (PEL of 3mg/m^3) (MNOSHA Permissible Exposure Limits- Limits for Air Contaminants)
State Right-to-Know Acts	Massachusetts (105 Code Mass. Regs. § 670.000 Appendix A), New Jersey (N.J.A.C. 7:1C) and Pennsylvania (P.L. 734, No. 159 and 34 Pa. Code § 323).
Chemicals of High Concern to Children	One state has adopted a reporting law for chemicals in children's products containing TPP: Washington State (Wash. Admin. Code 173-334-130).
Other	TPP is listed as a Candidate Chemical under California's Safer Consumer Products Program established under Health and Safety Code § 25252 and 25253 (California, Candidate Chemicals List. Accessed April 18, 2019). California lists TPP as a designated priority chemical for biomonitoring under criteria established by California SB 1379 (Biomonitoring California, Priority Chemicals, February 2019).

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	TPP is on the Domestic Substances List (Government of Canada. Managing substances in the environment. Substances search. Database accessed April 8, 2019)
European Union	TPP is registered for use in the EU. (European Chemicals Agency (ECHA) database accessed April 9, 2019.) TPP was evaluated under the 2017 Community Rolling Action Plan (CoRAP) under regulation (European Commission [EC]) No1907/2006 - REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals). Additional information was requested and is due August 2020. (ECHA database accessed April 17, 2019).
Australia	TPP was assessed under Human Health Tier II of the Inventory Multi-Tiered Assessment and Prioritisation (IMAP). Uses reported include: in plastic products, in construction materials, in cellulose acetate films, in lubricants and transmission oils, as an industrial sealant, as a plasticiser, as a flame retardant, in nail polishes and enamels; in manicuring preparations, in indoor and outdoor adhesives and sealants, in coatings, lacquers, and varnishes; in paints and inks, in roofing paper, in polyurethane foam, in plastics and rubber, in electronic products, in textiles, and in hydraulic fluids and lubricants. The chemical is reported to be present in foam-based furniture and baby products (Stapleton et al., 2009; Stapleton et al., 2011) (NICNAS, 2016, Human Health Tier II assessment for Phosphoric acid, triphenyl ester) (Accessed April 11, 2019).
Japan	TPP 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) (National Institute of Technology and Evaluation • Act of 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) National Institute of Technology and Evaluation [NITE] Chemical Risk Information Platform [CRIP] (Accessed April 11, 2019)
Basel Convention	Organic phosphorus compounds are listed as a category of waste under the Basel Convention. Although the United States is not currently a party to the Basel Convention, this treaty still affects U.S. importers and exporters.

Country/ Organization	Requirements and Restrictions
	https://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.33/2012/mtg1/Basel_convention_Article_1_and_Annexes.pdf (Accessed April 19, 2019)
OECD Control of Transboundary Movements of Wastes Destined for Recovery Operations	Organic phosphorus compounds are listed as a category of constituents of waste subject to The Amber Control Procedure under Council Decision C (2001) 107/Final. https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0266
Australia, Austria, Belgium, Canada, Denmark, France, Finland, Ireland, New Zealand, Romania, Singapore, South Korea, Spain, Switzerland, United Kingdom	Occupational exposure limits for TPP ((GESTIS International limit values for chemical agents (Occupational exposure limits, OELs) database. Accessed January 13, 2019)).

Appendix E PROCESS, RELEASE AND OCCUPATIONAL EXPOSURE INFORMATION

This appendix provides information and data found in preliminary data gathering for TPP.

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 Manufacturing (Including Import)

E.1.1.1 Domestic Manufacture

TPP is prepared by reacting phosphorus pentoxide and phenol and by reaction of triethyl phosphate and chloramine-T. On a larger scale phosphorus oxychloride and phenol are reacted in an esterification tank with heating. The hydrogen chloride formed is trapped and condensed, while the crude triphenyl phosphate runs into a large tank where it is purified (Snyder, 1990).

E.1.1.2 Import

EPA plans that imported chemicals are often stored in warehouses prior to distribution for further processing and use. In some cases, the chemicals may be repackaged into differently sized containers, depending on customer demand, and QC samples may be taken for analyses (U.S. EPA, 2018d).

E.1.2 Processing and Distribution

E.1.2.1 Incorporation 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. TPP may undergo several processing steps and the processing is dependent on its downstream incorporation into articles, which is discussed in the next subsection (U.S. EPA, 2018e).

E.1.2.2 Incorporation 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. Exact process operations involved in the incorporation of TPP-containing formulations or reaction products are dependent on the article (U.S. EPA, 2018e). For example, TPP may be incorporated into solvents for chemical manufacturing, plastics products as a plasticizer, or photographic supplies, film, and photo chemicals (U.S. EPA, 2019b). EPA plans to further investigate the use of TPP being incorporated into articles during risk evaluation.

E.1.2.3 Recycling

EPA did not identify TPP-specific information for recycling at this time; however, this chemical has been identified in articles that are commonly recycled such as insulation, plastics and electronic materials. The processes for recycling these materials may include grinding, washing, and rinsing the recycled material and incorporating it into new formulations. Electronics waste recycling may involve recovery of plastics

through similar recycling processes, which are described more generally in Kirk Othmer (Kirk-Othmer, 2006). EPA has not identified specific worker activities related to the recycling TPP-containing products. Based on EPA's knowledge, worker activities are anticipated to be exposed to TPP from reclamation activities such as sorting, materials grinding steps and loading recovered materials into transport containers.

E.1.3 Uses

Paints and Coatings

Based on 2019 CDR data, TPP may be used in various paints and coatings for industrial, commercial and consumer applications. Typical process descriptions and worker activities for industrial and commercial uses in coating applications include manual application with roller or brush, air spray systems, airless and air-assisted airless spray systems, electrostatic spray systems, electrodeposition/electrocoating and autodeposition, dip coating, curtain coating systems, roll coating systems and supercritical carbon dioxide systems (U.S. EPA, 2018f; OECD, 2009).

Plastic and Rubber Products

The plastics manufacturing industry can be divided into three distinct phases: manufacturing of polymers and chemical additives, compounding of polymer resins and chemical additives, and converting of the compounded plastic into finished products. Compounders receive the polymer resins from these manufacturers and produce master batches of plastics with specific properties by blending the polymer with plastics additives (e.g., fillers, reinforcements). Converters receive the master batch of plastics from compounders and convert it into the finished plastic product. Compounding and converting can take place at the same facility (i.e., "in-house" manufacturing) or at separate facilities (U.S. EPA, 2014b).

Foam Seating and Bedding Products

2019 CDR Data indicate that TPP is used in foam seating and bedding products (U.S. EPA, 2019b). However, specific TPP-containing foam seating and bedding products are unknown. EPA plans further investigate the specific foam seating and bedding product use activities of TPP during the risk evaluation.

Furniture and Furnishings

2019 CDR Data indicate that TPP is used in furniture and furnishings (U.S. EPA, 2019b). However, specific uses of TPP in furniture and furnishings are unknown. EPA plans further investigate the use of TPP in furniture and furnishings during this risk evaluation.

Lubricants and Greases

2019 CDR Data indicate that TPP is used in lubricants and greases (U.S. EPA, 2019b). However, specific types of lubricants and greases and their uses are unknown. EPA plans further investigate the use of TPP in lubricants and greases during this risk evaluation.

Photographic Supplies, Film, and Photo Chemicals

2019 CDR Data indicate that TPP is used in photographic supplies, film, and photo paper (U.S. EPA, 2019b). EPA plans further investigate the use of TPP in photographic supplies, film, and photo paper during this risk evaluation.

Electrical and Electronic Products

2019 CDR Data indicate that TPP is used in electrical and electronic products (U.S. EPA, 2019b). EPA plans further investigate the use of TPP in electrical and electronic products during this risk evaluation.

Table_Apx E-1 Possible Unconfirmed Uses

Uses with Minimal Substantiation		
Use	Expected Users	Description of Use or Process and References
Construction	Industrial	Used as a building/construction material in rigid urethane foam for insulation of buildings and potentially in other materials. (Kirk Othmer Encyclopedia of Chemical Technology, 2001) NLM 2018, SPIN 2019 NLM's Hazardous Substances Databank (HSDB) reports that TPP is used in impregnating roofing paper, citing the 2013 Merck Index. SPIN identifies use of TPP in specialized construction activities, and as construction materials in Nordic countries, as recently as 2017. This use was categorized as Tier 2 because only outdated and international sources could be identified.
Laboratory Chemicals		Sigma Aldrich
Ink	Consumer	Microcell 2006 TPP is found in Microcell's Accustamp ink. However, the SDS is from 2006 and it may be outdated. No other ink containing TPP could be identified.
Repair and installation of machinery and equipment	Industrial	SPIN 2019 SPIN identifies use of TPP in repair and installation of machinery and equipment in Nordic countries, as recently as 2017. This use was categorized as Tier 2 because only an international source could be identified.
Reprographic agents	Industrial	SPIN 2019 SPIN identifies use of TPP in reprographic agents in Nordic countries, as recently as 2017. This use was categorized as Tier 2 because only an international source could be identified.

E.1.4 Disposal

Disposal of a chemical should take into consideration the chemical's potential impact on air quality, migration to groundwater, effect on biological species, and disposal regulations (if any) (ATSDR, 2017). Currently, TPP is not regulated as a hazardous waste. However, TPP may be disposed of as a hazardous waste if it is present in or co-mingled with solvent mixtures that are RCRA regulated substances.

Demolished building materials are classified as Construction and Demolition (C&D) waste, which may be disposed in municipal solid waste landfills (MSWLFs) or C&D landfills (U.S. EPA, 2014a).

E.2 Preliminary Occupational Exposure Data

EPA presents below examples of occupational exposure-related information from the preliminary data gathering. EPA plans consider this information and data in combination of other data and methods for use in the risk evaluation. Note there are no OSHA Chemical Exposure and Health Data (CEHD) or NIOSH Health Hazard Evaluations for TPP within the last ten years.

Table_Apx E-2 Potentially Relevant Data Sources for Exposure Monitoring and Area Monitoring Data from NIOSH Health Hazard Evaluations for TPP[a]

Year of Publication	Report Number	Facility Description
1985	HETA-83-156-1622	Plastics manufacturing facility

[a] Table includes HHEs identified to date

Appendix F SUPPORTING INFORMATION – CONCEPTUAL MODEL FOR INDUSTRIAL AND COMMERCIAL ACTIVITIES AND USES

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	Manufacturing	Manufacturing	Manufacture via reaction of phosphorus pentoxide/phosphorus oxychloride and phenol; via reaction of triethyl phosphate and chloramine-T	Liquid Contact	Dermal	Workers	Yes	According to CDR, all domestically manufactured TPP is in liquid form (suspended in solution, 30-60% concentration), so dermal exposure to TPP suspended in liquid will occur.
				Solid Contact	Dermal	Workers	No	According to CDR, all domestically manufactured TPP is in liquid form (suspended in solution, 30-60% concentration). In addition, EPA has identified that the processes for manufacturing TPP involve the presence of solution throughout the operation; thus, dermal exposure to solid phase TPP is not expected to be a significant exposure pathway for TPP manufacturing.
				Vapor, Mist, Dust	Inhalation	Workers, ONU	No	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected. Mist generation is not expected during the manufacturing process. Because the manufacturing operation for TPP typically involves TPP suspended in solution, dust generation is not expected during the manufacturing process.
				Liquid, Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
	Import	Import	Repackaging	Liquid Contact	Dermal	Workers	Yes	According to CDR, multiple submitters indicated that they import TPP in liquid form. EPA interprets this as solid TPP suspended in solution. Exposure will occur if the imported material is repackaged
				Solid Contact	Dermal	Workers	Yes	According to CDR, multiple submitters indicated that they imported TPP in solid form. Exposure will occur if the imported material is repackaged
				Vapor, Mist	Inhalation	Workers, ONU	No	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected. Mist generation is not expected during the import (i.e. repackaging) process.
				Dust	Inhalation	Workers, ONU	Yes	According to CDR, multiple submitters indicated that they imported TPP in the form of large crystal pellets or other solid forms. Exposure will occur if the imported material is repackaged.
				Liquid, Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
Processing	Incorporated into Formulation, Mixture, or Reaction Product	Flame retardant in: All other chemical product and preparation manufacturing; Computer and electronic product manufacturing; Photographic film paper, plate, and chemical manufacturing; Plastic material and resin manufacturing; Plastic product manufacturing; Rubber product manufacturing; Textiles, apparel, and leather manufacturing; and Utilities	Unloading/transfer to mix tanks/product packaging	Liquid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during unloading and packaging operations as TPP can be used/transported in liquid form (suspended in solution, 30-60%) (according to CDR data).
				Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during as TPP can be used/transported in various solid forms (according to CDR data)
				Vapor, Mist	Inhalation	Workers, ONU	No	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected. Mist generation is not expected during unloading and transfer operations.
				Dust	Inhalation	Workers, ONU	Yes	Dust generation is expected during unloading and transfer operations as TPP can be used/transported in various solid forms (according to CDR data)
				Liquid, Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
Processing	Incorporated into Formulation, Mixture, or Reaction Product	Paint and coating manufacturing	Unloading/transfer to mix tanks/product packaging	Liquid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during unloading and transfer operations as TPP can be used/transported in liquid form (suspended in solution, 30-60%) (according to CDR data).
				Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during unloading and transfer operations as TPP can be used/transported in various solid forms (according to CDR data)

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
				Vapor, Mist	Inhalation	Workers, ONU	No	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected. Mist generation is not expected during unloading or paint and coating manufacturing processes
				Dust	Inhalation	Workers, ONU	Yes	Dust generation is expected during unloading operations as TPP can be used/transported in various solid forms (according to CDR data)
				Liquid, Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
Processing	Incorporated into Formulation, Mixture, or Reaction Product	Solvent used in Photographic film, paper, and chemical manufacturing	Unloading/transfer to process equipment/ product manufacturing	Liquid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during unloading and transfer operations as TPP can be used/transported in liquid form (suspended in solution, 30-60%) (according to CDR data).
				Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during unloading and transfer operations as TPP can be used/transported in various solid forms (according to CDR data)
				Vapor, Mist	Inhalation	Workers, ONU	No	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected. Mist generation is not expected during unloading operations.
				Dust	Inhalation	Workers, ONU	Yes	Dust generation is expected during unloading and transfer operations as TPP can be used/transported in various solid forms (according to CDR data)
				Liquid, Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
Processing	Incorporated into article	Solvent in photographic film paper, plate, and chemical manufacturing	Unloading/ product manufacturing	Liquid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during unloading operations, as TPP can be used/transported in liquid form (suspended in solution, 30-60%) (according to CDR data).
				Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during unloading operations, as TPP can be used/transported in various solid forms (according to CDR data)
				Vapor, Mist	Inhalation	Workers, ONU	No	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected. Mist generation is not expected during unloading operations.
				Dust	Inhalation	Workers, ONU	Yes	Dust generation is expected during unloading operations) as TPP can be used/transported in various solid forms (according to CDR data)
				Liquid, Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
Processing	Incorporated into article	Plasticizer used in plastics product manufacturing	Unloading and plastics converting	Liquid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during unloading operations, as TPP can be used/transported in liquid form (suspended in solution, 30-60%) (according to CDR data).
				Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during unloading operations as TPP can be used/transported in various solid forms (according to CDR data), and product handling
				Vapor, Mist	Inhalation	Workers, ONU	No	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected. Mist generation is not expected during unloading operations
				Dust	Inhalation	Workers, ONU	Yes	Dust generation is expected during unloading operations, as TPP can be used/transported in various solid forms (according to CDR data), and in product finishing operations
				Liquid, Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
Processing	Recycling	Recycling	Recycling	Liquid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during recycling, as TPP can be incorporated in different liquid products
				Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during recycling, as TPP can be incorporated in different solid products
				Vapor, Mist	Inhalation	Workers, ONU	No	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected. Mist generation is not expected during recycling processes.
				Dust	Inhalation/ Dermal	Workers	Yes	Dust exposure is expected during recycling, as particulates from solid products containing TPP can be generated

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
				Liquid/ Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
Industrial, Commercial, Use	Foam Seating and Bedding Products	e.g. foam and upholstery, plasticizer in automobile upholstery	Foam handling and product assembly	Liquid Contact	Dermal	Workers	No	TPP and TPP-containing article components are not expected to be handled or used in the liquid form.
				Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during this use (Foam Seating and Bedding Products), during the handling of foam and manufacture of products
				Vapor, Mist	Inhalation	Workers, ONU	No	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected.
				Dust	Inhalation	Workers, ONU	Yes	Dust generation is expected during this use (Foam Seating and Bedding Products), as TPP-containing articles may need to be cut during finishing operations.
				Liquid/ Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
Industrial, Commercial, Use	Plastic and Rubber Products, Not Covered Elsewhere	Plastic and Rubber Products	Use of Plastic and Rubber products	Liquid Contact	Dermal	Workers	No.	TPP and TPP-containing article components are not expected to be handled or used in the liquid form.
				Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during this use (Plastic and Rubber Products, Not Covered Elsewhere).
				Vapor, Mist	Inhalation	Workers, ONU	No	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected. Mist generation is not expected during this use (Plastic and Rubber Products, Not Covered Elsewhere).
				Dust	Inhalation	Workers, ONU	Yes	Dust generation is expected during this use (Plastic and Rubber Products, Not Covered Elsewhere).

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
				Liquid/ Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
Industrial, Commercial, Use	Photographic Supplies, Film, and Photo Chemicals	Photographic Supplies, Film, and Photo Chemicals	Unloading/Spray Coating Applications	Liquid Contact	Dermal	Workers	Yes	There is potential exposure to liquids to workers during the manufacture and use of Photographic Supplies, Film, and Photo Chemicals.
				Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during this manufacture and handling of Photographic Supplies, Film, and Photo Chemicals.
				Vapor	Inhalation	Workers, ONU	No	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected.
				Mist	Inhalation	Workers, ONU	Yes	The potential for exposure to TPP suspended in mist exists during film and photographic paper coating applications, when spray coating methods are utilized (Photographic Supplies, Film, and Photo Chemicals)
				Dust	Inhalation	Workers, ONU	No	Dust generation is not expected during this use (Photographic Supplies, Film, and Photo Chemicals)
				Liquid/ Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
Industrial, Commercial, Use	Paints and Coatings	Paints and Coatings	Unloading/ Spray Coating Applications	Liquid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during unloading and application of paints and coatings containing TPP.
				Solid Contact	Dermal	Workers	No	Paints and coatings containing TPP are not expected to be handled or used as solids.
				Vapor	Inhalation	Workers, ONU	No	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected.
				Mist	Inhalation	Workers, ONU	Yes	The potential for exposure to TPP suspended in mist exists during spray coating applications (Paints and Coatings)
				Dust	Inhalation	Workers, ONU	No	Handling and use of paints and coatings is not expected to generate dust.
				Liquid/Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
Industrial, Commercial, Use	Lubricants and Greases	Lubricants and Greases	Use of lubricants and greases	Liquid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during the use of Lubricants and Greases
				Solid Contact	Dermal	Workers	No	Lubricants and greases containing TPP are not expected to be handled or used as solids.
				Vapor, Mist	Inhalation	Workers, ONU	Yes	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected. Mist generation is possible during the use of some Lubricants and Greases.
				Dust	Inhalation	Workers, ONU	No	Handling and use of lubricants and greases is not expected to generate dust.
				Liquid/Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
Industrial, Commercial, Use	Electrical and Electronic Products	Electrical and Electronic Products	Use of Electrical and electronic products	Liquid Contact	Dermal	Workers	No	TPP and TPP-containing article components are not expected to be handled or used in the liquid form.
				Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during the use and handling of Electrical and Electronic Products
				Vapor, Mist	Inhalation	Workers, ONU	No	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected. Mist generation is not expected during this use (Electrical and Electronic Products).
				Dust	Inhalation	Workers, ONU	No	Dust generation is not expected during the manufacture or use of Electrical and Electronic Products).
				Liquid/Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
Industrial, Commercial, Use	Furniture and Furnishings, Not Covered Elsewhere	Furniture and Furnishings, Not Covered Elsewhere	Use of furniture and furnishings	Liquid Contact	Dermal	Workers	No	TPP and TPP-containing article components are not expected to be handled or used in the liquid form.
				Solid Contact	Dermal	Workers	Yes	The potential for exposures to workers exists during the manufacture of Furniture and Furnishings, Not Covered Elsewhere)
				Vapor, Mist	Inhalation	Workers, ONU	No	Due to the volatility of TPP (VP =2.00*10^ -6 Torr) at room temperature, inhalation exposure to TPP in the vapor phase is not expected. Mist generation is not expected during this use (Furniture and Furnishings, Not Covered Elsewhere).
				Dust	Inhalation	Workers, ONU	Yes	Dust generation is expected during the manufacture of Furniture and Furnishings, Not Covered Elsewhere
				Liquid/Solid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.

Life Cycle Stage	Category	Subcategory	Release / Exposure Scenario	Exposure Pathway	Exposure Route	Receptor / Population	Plans to Evaluate	Rationale
Disposal	Waste Handling, Treatment and Disposal	Disposal of TPP containing wastes	Worker handling of wastes	Solid Contact	Dermal	Workers	Yes	Dermal exposure is expected for this condition of use.
				Dust	Inhalation	Workers	Yes	TPP is solid at room temperature, EPA plans to evaluate the inhalation pathway.
				Liquid Contact	Dermal	ONU	No	Dermal exposure by ONU is not expected for this condition of use as they are not expected to directly handle the chemical.
				Dust	Inhalation	ONU	Yes	TPP is solid at room temperature, EPA plans to evaluate the inhalation pathway.

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

Table_Apx G-1 Consumer Exposure Conceptual Model Supporting Table

Life Cycle Stage	Category	Subcategory	Release from source	Exposure Pathway	Exposure Route	Receptor	Plans to Evaluate	Rationale
Consumer Use	Lubricants and greases	Hydraulic fluids	Direct contact through use of products/articles containing TPP	Air/Particulate	Inhalation	Consumers/ Bystanders	Yes	Inhalation via air and/or particulate exposure may occur during product/article use. EPA plans to analyze inhalation exposure.
				Article/Product Contact	Dermal	Consumers	Yes	Dermal exposure may occur via use of articles containing TPP. EPA plans to analyze dermal exposure.
				Air/Particulate	Inhalation	Consumers and Bystanders	Yes	Inhalation of air and/or particles from articles/products containing TPP may occur for this condition of use. EPA plans to analyze inhalation exposure.
Consumer Use	Electrical and electronic records	Electrical and electronic records	Direct contact through use of products/articles containing TPP	Air/Particulate	Inhalation	Consumers/ Bystanders	Yes	Inhalation via air and/or particulate exposure may occur during product/article use. EPA plans to analyze inhalation exposure.
				Article/Product Contact	Dermal	Consumers	Yes	Dermal exposure may occur via use of articles containing TPP. EPA plans to analyze dermal exposure.
				Air/Particulate	Inhalation	Consumers and Bystanders	Yes	Inhalation of air and/or particles from articles/products containing TPP may occur for this condition of use. EPA plans to analyze inhalation exposure.
				Dust	Ingestion	Consumers/ Bystanders	Yes	Ingestion of TPP sorbed onto dust may occur for this condition of use. EPA plans to analyze dust exposure via ingestion.

Life Cycle Stage	Category	Subcategory	Release from source	Exposure Pathway	Exposure Route	Receptor	Plans to Evaluate	Rationale
Consumer Use	Plastics and rubber products, not covered elsewhere	Thermoplastics	Direct contact through use of products/articles containing TPP	Air/Particulate	Inhalation	Consumers/ Bystanders	Yes	Inhalation via air and/or particulate exposure may occur during product/article use. EPA plans to analyze inhalation exposure.
				Dust	Ingestion	Consumers/ Bystanders	Yes	Ingestion of TPP sorbed onto dust may occur for this condition of use. EPA plans to analyze dust exposure via ingestion.
				Article/Product Contact	Dermal	Consumers	Yes	Dermal exposure may occur via use of articles containing TPP. EPA plans to analyze dermal exposure.
				Article/Product Mouthing	Ingestion	Bystanders	Yes	Ingestion via object to mouth or subsequent hand to mouth from product dermal contact. EPA plans to analyze mouthing via ingestion.
		Vulcanization accelerator	Direct contact through use of products/articles containing TPP	Article/Product Contact	Dermal	Consumers	Yes	Dermal exposure may occur for this condition of use. EPA plans to analyze dermal exposure.
				Dust	Ingestion	Consumers	Yes	Ingestion of TPP sorbed onto dust may occur for this condition of use. EPA plans to analyze dust exposure via ingestion.
				Air/Particulate	Inhalation	Consumers and Bystanders	Yes	Inhalation of air and/or particles from articles/products containing TPP may occur for this condition of use. EPA plans to analyze inhalation exposure.
Consumer Use	Photographic Supplies, Film, and Photo Chemicals	Cellulose acetate film	Direct contact through use of products/articles containing TPP	Air/Particulate	Inhalation	Consumers/ Bystanders	Yes	Inhalation via air and/or particulate exposure may occur during product/article use. EPA plans to analyze inhalation exposure.
				Dust	Ingestion	Consumers/ Bystanders	Yes	Ingestion of TPP sorbed onto dust may occur for this condition of use. EPA plans to analyze dust exposure via ingestion.

Life Cycle Stage	Category	Subcategory	Release from source	Exposure Pathway	Exposure Route	Receptor	Plans to Evaluate	Rationale
				Article/Product Contact	Dermal	Consumers	Yes	Dermal exposure may occur via use of articles containing TPP. EPA plans to analyze dermal exposure.
				Article/Product Mouthing	Ingestion	Bystanders	Yes	Ingestion via object to mouth or subsequent hand to mouth from product dermal contact. EPA plans to analyze mouthing via ingestion.
		Flame retardants in camping tents	Direct contact through use of products/articles containing TPP	Air/Particulate	Inhalation	Consumers/ Bystanders	Yes	Inhalation via air and/or particulate exposure may occur during product/article use. EPA plans to analyze inhalation exposure.
				Dust	Ingestion	Consumers/ Bystanders	Yes	Ingestion of TPP sorbed onto dust may occur for this condition of use. EPA plans to analyze dust exposure via ingestion.
				Article/Product Contact	Dermal	Consumers	Yes	Dermal exposure may occur via use of articles containing TPP. EPA plans to analyze dermal exposure.
				Article/Product Mouthing	Ingestion	Bystanders	Yes	Ingestion via object to mouth or subsequent hand to mouth from product dermal contact. EPA plans to analyze mouthing via ingestion.
Consumer Use	Foam setting and bedding products	Foam and upholstery	Direct contact through use of products/articles containing TPP	Air/Particulate	Inhalation	Consumers/ Bystanders	Yes	Inhalation via air and/or particulate exposure may occur during product/article use. EPA plans to analyze inhalation exposure.
				Dust	Ingestion	Consumers/ Bystanders	Yes	Ingestion of TPP sorbed onto dust may occur for this condition of use. EPA plans to analyze dust exposure via ingestion.
				Article/Product Contact	Dermal	Consumers	Yes	Dermal exposure may occur via use of articles containing TPP. EPA plans to analyze dermal exposure.
				Article/Product Mouthing	Ingestion	Bystanders	Yes	Ingestion via object to mouth or subsequent hand to mouth from product dermal contact. EPA plans to analyze mouthing via ingestion.

Life Cycle Stage	Category	Subcategory	Release from source	Exposure Pathway	Exposure Route	Receptor	Plans to Evaluate	Rationale
		Plasticizer in automobile upholstery	Direct contact through use of products/articles containing TPP	Air/Particulate	Inhalation	Consumers/ Bystanders	Yes	Inhalation via air and/or particulate exposure may occur during product/article use. EPA plans to analyze inhalation exposure.
				Dust	Ingestion	Consumers/ Bystanders	Yes	Ingestion of TPP sorbed onto dust may occur for this condition of use. EPA plans to analyze dust exposure via ingestion.
				Article/Product Contact	Dermal	Consumers	Yes	Dermal exposure may occur via use of articles containing TPP. EPA plans to analyze dermal exposure.
				Article/Product Mouthing	Ingestion	Bystanders	Yes	Ingestion via object to mouth or subsequent hand to mouth from product dermal contact. EPA plans to analyze mouthing via ingestion.
Consumer Handling of Disposal and Waste	Wastewater, Liquid wastes and solid wastes	Wastewater, Liquid wastes and solid wastes	Direct contact through use of products/articles containing TPP	Article/Product Contact	Dermal	Consumers	Yes	Dermal exposure may occur for this condition of use. EPA plans to analyze dermal exposure..
				Dust	Ingestion	Consumers	Yes	Ingestion of TPP sorbed onto dust may occur for this condition of use. EPA plans to analyze dust exposure via ingestion.
				Air/Particulate	Inhalation	Consumers and Bystanders	Yes	Inhalation of air and/or particles from articles/products containing TPP may occur for this condition of use. EPA plans to analyze inhalation exposure.
			Long-term emission/mass-transfer through use of products containing TPP	Dust	Ingestion	Consumers	Yes	Ingestion of TPP sorbed onto dust may occur for this condition of use. EPA plans to analyze dust exposure via ingestion.

Life Cycle Stage	Category	Subcategory	Release from source	Exposure Pathway	Exposure Route	Receptor	Plans to Evaluate	Rationale
				Air/Particulate	Inhalation	Consumers and Bystanders	Yes	Inhalation of air and/or particles from articles/products containing TPP may occur for this condition of use. EPA plans to analyze inhalation exposure.

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	Rationale
All	Emissions to Air	Emissions to Air	Near facility ambient air concentrations	Inhalation	General Population	Yes	TPP deposition to nearby bodies of water and soil are expected exposure pathways, not covered under other EPA regulations, and, therefore in scope.
			Indirect deposition to nearby bodies of water and soil catchments	Oral Dermal	General Population	Yes	
				TBD	Aquatic and Terrestrial Receptors	Yes	
	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 plans to analyze the release of TPP into surface water and indirect partitioning to sediment exposure pathways to aquatic and terrestrial receptors.
				Oral Dermal	General Population	Yes	EPA plans to analyze the release of TPP into surface water and indirect partitioning to sediment and bioaccumulation exposure pathways to the general population.
			Drinking Water via Surface or Ground Water	Oral Dermal and Inhalation (e.g. showering)	General Population	Yes	EPA plans to analyze the release of TPP into surface water and indirect partitioning to drinking water.
			Biosolids: application to soil and/or migration to groundwater and/or surface water	Oral (e.g. ingestion of soil) Inhalation	General Population	Yes	EPA plans to analyze the pathway from biosolids to the general population and terrestrial species.
				TBD	Terrestrial receptors	Yes	

Life Cycle Stage	Category	Release	Exposure Pathway / Media	Exposure Routes	Receptor / Population	Plans to Evaluate	Rationale
Disposal	Solid and Liquid Wastes	Municipal landfill and other land disposal	Leachate to soil, ground water and/or migration to surface water	Oral Dermal	General Population	Yes	EPA plans to analyze the pathway from municipal landfills and other land disposal to the general population, aquatic and terrestrial receptors.
				TBD	Aquatic and Terrestrial Receptors		