United States
Environmental Protection Agency

Office of Chemical Safety and
Pollution Prevention

Proposed Designation of Triphenyl Phosphate (CASRN 115-86-6) as a High-Priority Substance for Risk Evaluation

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Acronyms and Abbreviations

Term	Description
ATSDR	Agency for Toxic Substances and Disease Registry
BOD	Biochemical oxygen demand
CAA	Clean Air Act
CASRN	Chemical Abstracts Service Registry Number
CBI	Confidential business information
CDR	Chemical Data Reporting
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CPDat	Chemical and Products Database
ECHA	European Chemicals Agency
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
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
MP	Melting point
NIH	National Institutes of Health
NKRA	Not known or reasonably ascertainable
NR	Not reported
OECD	Organisation for Economic Co-operation and Development
OH	Hydroxyl radical
PEL	Permissible exposure limit
SIDS	Screening Information Data Sets

Term	Description
SMILES	Simplified molecular-input line-entry system
TLV	Threshold limit value
TPP	Triphenyl phosphate
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act
VP	Vapor pressure
WS	Water solubility

1. Introduction

In section 6(b)(1)(B) of the Toxic Substances Control Act (TSCA), as amended, and in the U.S. Environmental Protection Agency's (EPA) implementing regulations (40 CFR 702.3)[1], a high-priority substance for risk evaluation is defined as a chemical substance that EPA determines, without consideration of costs or other non-risk factors, may present an unreasonable risk of injury to health or the environment because of a potential hazard and a potential route of exposure under the conditions of use, including an unreasonable risk to potentially exposed or susceptible subpopulations identified as relevant by EPA.

Before designating prioritization status, under EPA's regulations at 40 CFR 702.9 and pursuant to TSCA section 6(b)(1)(A), EPA will generally use reasonably available information to screen the candidate chemical substance under its conditions of use against the following criteria and considerations:

- the hazard and exposure potential of the chemical substance;
- persistence and bioaccumulation;
- potentially exposed or susceptible subpopulations;
- storage near significant sources of drinking water;
- conditions of use or significant changes in the conditions of use of the chemical substance;
- the chemical substance's production volume or significant changes in production volume; and
- other risk-based criteria that EPA determines to be relevant to the designation of the chemical substance's priority.

This document presents the review of the candidate chemical substance against the criteria and considerations set forth in 40 CFR 702.9 for a may present risk finding. The information sources used are relevant to the criteria and considerations and consistent with the scientific standards of TSCA section 26(h), including, as appropriate, sources for hazard and exposure data listed in Appendices A and B of the *TSCA Work Plan Chemicals: Methods Document* (February 2012) (40 CFR 702.9(b)). Final designation of the chemical substance as a high-priority chemical substance would immediately initiate the risk evaluation process as described in the EPA's final rule, *Procedures for Chemical Risk Evaluation Under the Amended Toxic Substances Control Act* (40 CFR 702).

Triphenyl phosphate (TPP) is one of the 40 chemical substances initiated for prioritization as referenced in the March 21, 2019 notice (84 FR 10491)[2]. EPA has determined that TPP is a suitable candidate for the proposed designation as a high-priority substance. The proposed designation is based on the results of the review against the aforementioned criteria and

[1]NOTE: For all 40 CFR 702 citations, please refer to: https://www.govinfo.gov/content/pkg/CFR-2018-title40-vol33/xml/CFR-2018-title40-vol33-part702.xml and https://www.regulations.gov/document?D=EPA-HQ-OPPT-2016-0654-0108

[2] https://www.federalregister.gov/documents/2019/03/21/2019-5404/initiation-of-prioritization-under-the-toxic-substances-control-act-tsca

considerations as well as review of the reasonably available information on TPP, including relevant information received from the public and other information as appropriate.

EPA will take comment on this proposed designation for 90 days before finalizing its designation of TPP. The docket number for providing comments on TPP is EPA-HQ-OPPT-2018-0458 and is available at www.regulations.gov.

The information, analysis and basis used for the review of the chemical is organized as follows:

- *Section 1 (Introduction):* This section explains the requirements of the amended TSCA and implementing regulations – including the criteria and considerations - pertinent to the prioritization and designation of high-priority chemical substances.

- *Section 2 (Production volume or significant changes in production volume):* This section presents information and analysis on national aggregate production volume of the chemical substance.

- *Section 3 (Conditions of use or significant changes in conditions of use):* This section presents information and analysis regarding the chemical substance's conditions of use under TSCA.

- *Section 4 (Potentially exposed or susceptible subpopulations):* This section presents information and analysis regarding potentially exposed or susceptible subpopulations, including children, women of reproductive age, and workers, with respect to the chemical substance.

- *Section 5 (Persistence and bioaccumulation):* This section presents information and analysis regarding the physical and chemical properties of the chemical substance and the chemical's fate characteristics.

- *Section 6 (Storage near significant sources of drinking water):* This section presents information and analysis considered regarding the risk from the storage of the chemical substance near significant sources of drinking water.

- *Section 7 (Hazard Potential):* This section presents the hazard information relevant to the chemical substance.

- *Section 8 (Exposure Potential):* This section presents information and analysis regarding the exposures to the chemical substance.

- *Section 9 (Other risk-based criteria):* This section presents the extent to which EPA identified other risk-based criteria that are relevant to the designation of the chemical substance's priority.

- *Section 10 (Proposed designation):* Based on the results of the review performed and the information and analysis presented, this section describes the basis used by EPA to support the proposed designation.

2. Production volume or significant changes in production volume

Approach

EPA considered current volume or significant changes in volume of the chemical substance using information reported by manufacturers (including importers). EPA assembled reported information for years 1986 through 2015 on the production volume for TPP reported under the Inventory Update Reporting (IUR) rule and Chemical Data Reporting (CDR) rule. [3] The national aggregate production volume, which is presented as a range to protect individual site production volumes that are confidential business information (CBI), is presented in Table 1.

Results and Discussion

Production volume of TPP in 2015, as reported to EPA during the 2016 CDR reporting period, was between 1 and 10 million pounds. Production volume of TPP as reported to EPA has generally decreased over the period 1986–2015, with significant fluctuations between some years (Table 1).

Table 1. 1986-2015 National Aggregate Production Volume Data (Production Volume in Pounds)

Chemical ID	1986	1990	1994	1998	2002	2006	2011	2012	2013	2014	2015
Triphenyl phosphate (TPP) (115-86-6)	>10M to 50M	>1M to10M	>10M to 50M	>10M to 50M	>10M to 50M	10M to <50M	11M	1M to 10M	1M to 10M	10M to 50M	1M to 10M

M = million

Reference: U.S. EPA (2013) and U.S. EPA (2017)

3. Conditions of use or significant changes in conditions of use

Approach

EPA assembled information to determine conditions of use or significant changes in conditions of use of the chemical substance. TSCA section 3(4) defines the term “conditions of use” to mean the circumstances, as determined by the Administrator, under which a chemical substance

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[3] Over time, the requirements for reporting frequency, production volume thresholds, and chemical substances under the Chemical Data Reporting (CDR) rule have changed. CDR was formerly known as the Inventory Update Rule (IUR). The first IUR collection occurred in 1986 and continued every four years through 2006. As part of two rulemakings in 2003 and 2005, EPA made a variety of changes to the IUR, including to change the reporting frequency to every five years to address burdens associated with new reporting requirements. Additional changes to reporting requirements were made in 2011, including to suspend and replace the 2011 submission period with a 2012 submission period, return to reporting every four years, and require the reporting of all years beginning with 2011 production volumes. The reporting of production volumes for all years was added because of the mounting evidence that many chemical substances, even larger production volume chemical substances, often experience wide fluctuations in production volume from year to year. In addition, also as part of the 2011 IUR Modifications final rule (76 FR 50816, Aug 16, 2011), EPA changed the name of the regulation from IUR to CDR to better reflect the distinction between this data collection (which includes exposure-related data) and the TSCA Inventory itself (which only involves chemical identification information).

is intended, known, or reasonably foreseen to be manufactured, processed, distributed in commerce, used, or disposed of.

A key source of reasonably available information that EPA considered for determining the conditions of use for TPP was submitted by manufacturers (including importers) under the 2012 and 2016 CDR reporting cycles. CDR requires manufacturers (including importers) to report information on the chemical substances they produce domestically or import into the United States greater than 25,000 pounds per site, except if certain TSCA actions apply (in which case the reporting requirement is greater than 2,500 pounds per site). CDR includes information on the manufacturing, processing, and use of chemical substances. Based on the known manufacturing, processing and uses of this chemical substance, EPA assumes distribution in commerce. CDR may not provide information on other life-cycle phases such as distribution or chemical end-of-life after use in products (i.e., disposal). While EPA may be aware of additional uses, CDR submitters are not required to provide information on chemical uses that are not regulated under TSCA.

For chemical substances under review that are included on the Toxics Release Inventory (TRI) chemical list, information disclosed by reporting facilities in Part II Section 3 ("Activities and Uses of the Toxic Chemical at the Facility") of their TRI Form R reports was used to supplement the CDR information on conditions of use. There is not a one-to-one correlation between conditions of use reported under CDR and information reported in Part II Section 3 of the TRI Form R because facilities are not required to disclose in their Form R submissions the specific uses of TRI chemical substances they manufactured on-site or imported.

TPP is not on the list of chemicals required to be reported to the TRI chemical list. For purposes of this proposed prioritization designation, EPA assumed end-of-life pathways that include releases to air, wastewater, and solid and liquid waste based on the conditions of use.

CDR Tables

Based on the publicly available[4] manufacturing information, industrial processing and use information, and consumer and commercial use information reported under CDR, EPA developed a list of conditions of use for the 2016 and 2012 reporting cycles (Tables 2 and 3, respectively).

[4] Some specific chemical uses may be claimed by CDR submitters as confidential business information (CBI) under section 14 of TSCA. In these cases, EPA indicated that the information is CBI.

Table 2. Triphenyl Phosphate (115-86-6) Categories and Subcategories of Conditions of Use (2016 CDR Reporting Cycle)[5]

Life-Cycle Stage	Category	Subcategory	Reference
Manufacturing	Domestic manufacturing/Import	CBI[6]	U.S. EPA (2019)
	Import	Import	U.S. EPA (2019)
Processing	Processing – incorporation into formulation, mixture, or reaction product	Solvents (which become part of product formulation or mixture) in photographic film paper, plate, and chemical manufacturing	U.S. EPA (2019)
		Flame retardants in: – All other chemical product and preparation manufacturing – Plastics product manufacturing – Utilities – Computer and electronic product manufacturing – Plastic material and resin manufacturing – Textiles, apparel, and leather manufacturing	U.S. EPA (2019)
		Paint additives and coating additives not described by other categories used in paint and coating manufacturing	U.S. EPA (2019)
Processing	Processing – incorporation into article	Solvents (which become part of product formulation or mixture) in photographic film paper, plate, and chemical manufacturing	U.S. EPA (2019)
		Plasticizers in plastics Product manufacturing	U.S. EPA (2019)
Distribution in commerce [a,b]	Distribution in commerce		
Commercial Use	Photographic supplies, film, and photo chemicals	Photographic supplies, film, and photo chemicals	U.S. EPA (2019)
Commercial Use	Plastic and rubber products not covered elsewhere	Plastic and rubber products not covered elsewhere	U.S. EPA (2019)

[5] Certain other uses that are excluded from TSCA are not captured in this table.
[6] At this time, "CBI" indicates that a data element has been claimed CBI by the information submitter; it does not reflect the result of an EPA substantiation review.

Life-Cycle Stage	Category	Subcategory	Reference
Manufacturing	Domestic manufacturing/Import	CBI[6]	U.S. EPA (2019)
	Import	Import	U.S. EPA (2019)
Commercial Use	Lubricants and greases	Lubricants and greases	U.S. EPA (2019)
Commercial Use	Paints and coatings	Paints and coatings	U.S. EPA (2019)
Consumer Use	Photographic supplies, film, and photo chemicals	Photographic supplies, film, and photo chemicals	U.S. EPA (2019)
Consumer Use	Plastic and rubber products not covered elsewhere	Plastic and rubber products not covered elsewhere	U.S. EPA (2019)
Consumer Use	Foam seating and bedding products	Foam seating and bedding products	U.S. EPA (2019)
[a] CDR includes information on the manufacturing, processing, and use of chemical substances. CDR may not provide information on other life-cycle phases such as distribution or chemical end-of-life after use in products (i.e., disposal). The table row is highlighted in gray to indicate that no information is provided for this life-cycle stage. **[b] EPA is particularly interested in information from the public on distribution in commerce.**			

Table 3. Triphenyl Phosphate (115-86-6) Categories and Subcategories of Conditions of Use[7] (2012 CDR Reporting Cycle)

Life-Cycle Stage	Category	Subcategory	Reference
Manufacturing	Domestic manufacturing	Domestic manufacturing	U.S. EPA (2019)
Manufacturing	Import	Import	U.S. EPA (2019)
Processing	Processing – incorporation into formulation, mixture or reaction product	Flame retardants in: - Plastic material and resin manufacturing - Rubber product manufacturing - Utilities - Computer and electronic product manufacturing - Photographic film paper, plate, and chemical manufacturing	U.S. EPA (2019)
Processing	Processing – incorporation into formulation, mixture or reaction product	Plasticizers in all other chemical product and preparation manufacturing	U.S. EPA (2019)

[7] Certain other uses which are excluded from TSCA are not captured in this table.

Life-Cycle Stage	Category	Subcategory	Reference
Processing	Processing – incorporation into article	Flame Retardants in: - Furniture and related product manufacturing - Plastics material and resin manufacturing - Plastic products manufacturing	U.S. EPA (2019)
Distribution in Commerce [a,b]	Distribution in commerce		
Commercial Use	Electrical and electronic products	Electrical and electronic Products	U.S. EPA (2019)
Commercial Use	Foam seating and bedding products	Foam seating and bedding products	U.S. EPA (2019)
Commercial Use	Furniture and furnishings not covered elsewhere	Furniture and furnishings not covered elsewhere	U.S. EPA (2019)
Commercial Use	Lubricants and greases	Lubricants and greases	U.S. EPA (2019)
Commercial Use	Photographic supplies, film, and photo chemicals	Photographic supplies, film, and photo chemicals	U.S. EPA (2019)
Commercial Use	Plastic and rubber products not covered elsewhere	Plastic and rubber products not covered elsewhere	U.S. EPA (2019)
Consumer	Plastic and rubber products not covered elsewhere	Plastic and rubber products not covered elsewhere	U.S. EPA (2019)
Disposal [a]	Disposal		

[a] CDR includes information on the manufacturing, processing, and use of chemical substance. CDR may not provide information on other life-cycle phases such as distribution or chemical end-of-life after use in products (i.e., disposal). The table row is highlighted in gray to indicate that no information is provided for this life-cycle stage.
[b] EPA is particularly interested in information from the public on distribution in commerce.

CDR Summary and Additional Information on Conditions of Use

For the 2016 CDR, manufacturers and importers reported the following functional uses of TPP: as a solvent, flame retardant, additive, and plasticizer. TPP was reported as used in industrial sectors that manufacture chemical products, computer and electronics products, paints and coatings, photographic products, plastic material and resin, and plastic products. TPP was also used in the utilities sector. Companies reported commercial and consumer uses in photographic supplies and in plastic and rubber products. Two additional commercial uses that were not also reported as consumer uses were for lubricants and greases and for paints and coatings. An additional consumer use for TPP was for foam seating and bedding products. Consumer uses were also identified in additional databases, which are included in the Exposure Potential section (Section 8).

The uses reported for the 2012 CDR were similar to the 2016 CDR except: 1) TPP was not used as a solvent or additive; 2) it was used by the furniture and related product manufacturing sector and in the rubber product manufacturing sector but not in the textiles or paints and coatings sectors; 3) the chemical was used commercially for electrical and electronic products, foam seating and bedding, and furniture but not for paints and coatings; and 4) consumer use was not reported in photographic products or in foam seating and bedding (Tables 2 and 3, respectively). In conclusion, according to CDR data, industrial, commercial and consumer uses have changed somewhat between the 2012 and 2016 CDR.

Additional information on uses of TPP is available in public comments submitted to EPA on the Initiation of Prioritization Process. The American Coatings Association reported use of TTP as a plasticizer and additive in adhesives, sealants, and lubricants in concentrations between 0.1% and 10% (EPQ-HQ-OPPT-2018-0458-0003). The Aerospace Industries Association commented that TPP is used in “hydraulic fluids, coating materials, foams, lubricants, and engine oils. Specific aerospace industrial uses include, but may not be limited to: penetrants used for non-destructive inspection, hydraulic fluids, engine and transmission oils, edge-filling and potting compounds, epoxy adhesives for bonding inserts in honeycomb sandwich panels, ducts and construction of structural composite parts, leveling compounds to assist in drainage, lubricants for bending and swaging aluminum, titanium and corrosion resistant steel (CRES) tubes and ducts, flexible wing coatings, heat resistant secondary fuel barriers, specialty foams for insulation and microwave absorption, landing gear greases, oils and lubricants” (EPQ-HQ-OPPT-2018-0458-0004). More information on uses may be found following this screening review.

Should the Agency decide to make a final decision to designate this chemical substance as a high-priority substance, further characterization of relevant TSCA conditions of use will be undertaken as part of the process of developing the scope of the risk evaluation.

4. Potentially exposed or susceptible subpopulations

Approach

In this review, EPA considered reasonably available information to identify potentially exposed or susceptible subpopulations, such as children, women of reproductive age, workers, consumers or the elderly. EPA analyzed processing and use information included on the CDR Form U. These data provide an indication about whether children or other susceptible subpopulations may be potentially exposed. EPA also used human health hazard information to identify potentially exposed or susceptible subpopulations.

Results and Discussion

Based on the 2012 and 2016 CDR data, TPP was not reported in children's products, although there is potential for exposure to children from some consumer products that were reported to CDR. While the most recent health effects assessments reviewed did not discuss the susceptibility of children to potential adverse health effects of exposure to TPP, effects were observed in developmental toxicity studies. Pregnant women or women of reproductive age are therefore included as a potentially exposed or susceptible subpopulation with respect to TPP. At this stage, EPA identified children, women of reproductive age, workers and consumers as subpopulations who may be potentially exposed or susceptible subpopulations for TPP.

Children

EPA used data reported to the 2012 and 2016 CDR to identify uses in products and articles intended for children over time for TPP. Table 4 summarizes the non-CBI CDR information regarding commercial and consumer use and if the chemical substance was being used in products intended for children. The 2012 and 2016 CDR did not include any uses in children's products. However, some of the consumer products reported to CDR could potentially expose children to TPP, including foam bedding and seating, and rubber and plastic products. EPA also identified potential developmental hazards that would impact any stage of children's development.

Table 4. Uses in Children's Products Information[8]

Chemical	Year	Product Category	Consumer or Commercial	Used in Products Intended for Children
Triphenyl phosphate (115-86-6)	2012	Plastic and rubber products	Consumer	NKRA
	2016	Plastic and rubber products	Consumer	NKRA

Note(s): NKRA = not known or reasonably ascertainable
Reference: U.S. EPA (2019)

Women of reproductive age (e.g., pregnant women per TSCA statute)

EPA identified developmental and reproductive toxicity studies following TPP exposure; however, only developmental effects were observed (Section 7, Table 7). Although no

[8] Certain other uses which are excluded from TSCA are not captured in this table

reproductive hazards were identified, EPA considers women of reproductive age as potentially exposed. During the scoping and risk evaluation process, reproductive hazards will be considered again following a systematic search of the relevant scientific literature.

Consideration of women of reproductive age as a potentially exposed or susceptible subpopulation was also based on exposure because women of reproductive age are potential workers in the manufacturing, processing, distribution in commerce, use, or disposal of the chemical substance.

Workers
Please refer to the Exposure Potential section (Section 8) for a summary of potential occupational exposures, which EPA indicates that workers are potentially exposed or susceptible subpopulations based on greater exposure.

Consumers
Please refer to the Exposure Potential section (Section 8) for a summary of potential consumer exposures, which EPA indicates that consumers are potentially exposed or susceptible subpopulations based on greater exposure.

5. Persistence and bioaccumulation

Approach
EPA reviewed reasonably available information, such as physical and chemical properties and environmental fate characteristics, to understand on TPP's persistence and bioaccumulation.

Physical and Chemical Properties and Environmental Fate Tables
Table 5 and Table 6 summarize the physical and chemical properties and environmental fate characteristics of TPP, respectively.

Table 5. Physical and Chemical Properties of Triphenyl Phosphate

Property or Endpoint	Value[a]	Reference
Molecular Formula	$C_{18}H_{15}O_4P$	CRC Handbook (Rumble, 2018)
Molecular Weight	326.283 g/mole	CRC Handbook (Rumble, 2018)
Physical State	Solid	HSDB (2019) citing CRC Handbook (Haynes, 2014)
Physical Form	Crystals, prisms, needles	CRC Handbook (Rumble, 2018)
Purity	100% and 99% reported in studies	HSDB (2019)
Melting Point	49.39 ºC	CRC Handbook (Rumble, 2018); HSDB (2019)
Boiling Point	414 ºC	ECHA (2019)
Density	1.2055 g/cm^3 at 50 ºC[b]	CRC Handbook (Rumble, 2018)
	1.21 g/cm^3 at 50 ºC	ECHA (2019)

Property or Endpoint	Value[a]	Reference
Vapor Pressure	6.4×10^{-6} mm Hg at 25 ºC (extrapolated)[b]	ECHA (2019) citing Dorby and Keller (1957)
	6.28×10^{-6} mm Hg at 25 ºC (extrapolated)	Physprop (2012)
Vapor Density	1.19 (relative vapor density to air =1)	HSDB (2019) citing Toscano (2012)
Water Solubility	1.9 mg/L at 20 ºC	ECHA (2019) citing Saeger et al. (1979)
Log K_{OW}	4.59	HSDB (2019) citing Hansch et al. (1995)
Henry's Law Constant	3.31×10^{-6} (atm-m^3/mol) at 25 ºC (estimated)[c]	HSDB (2019) citing EPI Suite (2012)
Flash Point	220 ºC (closed cup)	HSDB (2019) citing NFPA (2010)
Auto Flammability	Nonflammable	HSDB (2019) citing O'Neil (2013)
Viscosity	11 mm^2/s at 323 ºC	ECHA (2019)
Refractive Index	1.55 at 60 ºC	HSDB (2019) citing Larranaga (2016)
Dielectric Constant	TBD	TBD
Surface Tension	TBD	TBD

Notes:
[a]Measured unless otherwise noted;
[b]Selected value;
[c]EPI Suite[TM] physical property inputs: Log K_{OW} = 4.59, MP = 50.5 ºC, VP = 6.4×10^{-6} mm Hg, WS = 1,900 mg/L, SMILES:O=P(Oc(cccc1)c1)(Oc(cccc2)c2)Oc(cccc3)c3
TBD = to be determined, if reasonably available. **EPA is particularly interested in information from the public on these properties or endpoints.**

Table 6. Environmental Fate Characteristics of Triphenyl Phosphate

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 (2012)
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 (2012)
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 (2012)
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)

Notes:
[a]Measured unless otherwise noted
[b]EPI Suite[TM] 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

Results and Discussion

TPP is a moderately water-soluble solid (1.9 mg/L). Its extrapolated vapor pressure (6.4×10^{-6} mm Hg) and estimated Henry's Law constant (3.31×10^{-6}) indicate that this chemical has low to moderate potential to volatilize from surface water and soil. Measured log K_{oc} values of 3.40–3.55 indicate that TPP will likely have moderate adsorption to soil. In air, vapor-phase TPP is estimated to react with photochemically-produced hydroxyl radicals at a rate corresponding to a TPP half-life of 12 hours.

In aerobic aquatic environments, TPP is readily biodegradable; it achieved 83–94 percent of its theoretical biological oxygen demand (BOD) over a 28-day incubation period using a sewage sludge inoculum and the Japanese MITI test method. In addition, TPP had a half-life of 32 days in loamy sand under anaerobic conditions. TPP is likely to undergo slow hydrolysis due to a measured half-life of 19 days at pH 7. Based on these results, this chemical is not likely to persist in subsurface environments, groundwater, or enclosed pipes. Additionally, this chemical is expected to have low bioaccumulation potential based on its measured bioconcentration factor of 132–573 for rainbow trout and an estimated bioaccumulation factor of 73.

6. Storage near significant sources of drinking water

Approach

To support the proposed designation, EPA screened each chemical substance under its conditions of use with respect to the seven criteria in TSCA section 6(b)(1)(A) and 40 CFR 702.9. The statute specifically requires the Agency to consider the chemical substance's storage near significant sources of drinking water, which EPA interprets as direction to focus on the chemical substance's potential human health hazard and exposure.

EPA reviewed reasonably available information, specifically looking to identify certain types of existing regulations or protections for the proposed chemical substances. EPA considered the chemical substance's potential human health hazards, including to potentially exposed or susceptible subpopulations, by identifying existing National Primary Drinking Water Regulations under the Safe Drinking Water Act (40 CFR Part 141) and regulations under the Clean Water Act (CWA; 40 CFR 401.15). In addition, EPA considered the consolidated list of chemical substances subject to reporting requirements under the Emergency Planning and Community Right-to-Know Act (EPCRA; Section 302 Extremely Hazardous Substances and Section 313 Toxic Chemicals), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; Hazardous Substances), and the Clean Air Act (CAA) Section 112(r) (Regulated Chemicals for Accidental Release Prevention). Regulation by one of these authorities is an indication that the substance is a potential health or environmental hazard which, if released near a significant source of drinking water, could present an unreasonable risk of injury to human health or the environment.

Results and Discussion

TPP is not currently subject to the federal regulations named in the previous paragraph.

7. Hazard potential

Approach

EPA considered reasonably available information from peer-reviewed assessments and databases to identify potential human health and environmental hazards for TPP (Tables 7 and 8, respectively).

Because there are very few publicly available assessments for TPP with cited environmental hazard data, EPA used the infrastructure of ECOTOXicology knowledgebase (ECOTOX) to identify single chemical toxicity data for aquatic and terrestrial life (U.S. EPA, 2018). It uses a comprehensive chemical-specific literature search of the open literature that is conducted according to the Standard Operating Procedures (SOPs)[9]. The environmental hazard information was populated in ECOTOX and is available to the public. In comparison to the approach used to survey human health hazard data, EPA also used a read-across approach to identify additional environmental hazard data for isomers of TPP, if available, to fill in potential data gaps when there were no reported observed effects for specific taxa exposed to TPP (Table 8).

Potential Human Health and Environmental Hazard Tables

EPA identified potential human health environmental hazards based on a review of the reasonable available information for TPP (Tables 7 and 8, respectively).

Table 7. Potential Human Health Hazards Identified for Triphenyl Phosphate

Human Health Hazards	Tested for Specific Effect	Effect Observed	Data Source
Acute Toxicity	X		EPA (2015); UK (2009); OECD (2002)
Repeated Dose Toxicity	X	X	EPA (2015); UK (2009); OECD (2002)
Genetic Toxicity	X		EPA (2015); UK (2009); OECD (2002)
Reproductive Toxicity	X		EPA (2015); UK (2009); OECD (2002)
Developmental Toxicity	X	X	EPA (2015); UK (2009); OECD (2002)
Toxicokinetic			
Irritation/Corrosion	X	X	EPA (2015); UK (2009); OECD (2002)
Dermal Sensitization	X		EPA (2015); UK (2009); OECD (2002)
Respiratory Sensitization			
Carcinogenicity			
Immunotoxicity	X		EPA (2015); UK (2009); OECD (2002)
Neurotoxicity	X		EPA (2015); UK (2009); OECD (2002)
Epidemiological Studies or Biomonitoring Studies	X	X	EPA (2015)

Note: The X in the Effect Observed column indicates when a hazard effect was reported by one or more of the referenced studies. Blank rows indicate when information was not identified during EPA's review of reasonably available information to support the proposed designation.

[9] The ECOTOX Standard Operating Procedures (SOPs) can be found at: https://cfpub.epa.gov/ecotox/help.cfm?helptabs=tab4

Table 8. Potential Environmental Hazards Identified for Triphenyl Phosphate

Media	Study Duration	Taxa Groups	High-Priority Chemical Candidate Phosphoric Acid, Triphenyl Ester (CASRN 115-86-6)		Isomers of Phosphoric acid, triphenyl ester (CASRN 115-86-6) NONE		Data Sources
			Number of Studies	Observed Effects	Number of Studies	Observed Effects	
Aquatic	Acute exposure	Vegetation	1	X	-		Mayer et al. (1981)
		Invertebrate	7	X	-		Huckins et al. (1991); Lo and Hsieh (2000); Mayer et al. (1981); Scanlan et al. (2015); Whyard et al. (1994)
		Fish	15	X	-		Ahrens et al. (1978); Geiger et al. (1986); Huckins et al. (1991); Isales et al. (2015); Liu et al. (2013a); Liu et al. (2013b); Mayer and Ellersieck (1986); Mayer et al. (1981); Palawski et al. (1983); Sitthichaikasem (1978); Solomon et al. (2000)
		Non-Fish Vertebrates (i.e., amphibians, reptiles, mammals)	-		-		
	Chronic exposure	Vegetation	-		-		
		Invertebrate	-		-		
		Fish	7	X	-		Kim et al. (2015); Liu et al. (2012); Liu et al. (2013a); Liu et al. (2013b); Mayer et al. (1981); Sitthichaikasem (1978)
		Non-Fish Vertebrates (i.e., amphibians, reptiles, mammals)	-		-		

Media	Study Duration	Taxa Groups	High-Priority Chemical Candidate Phosphoric Acid, Triphenyl Ester (CASRN 115-86-6)		Isomers of Phosphoric acid, triphenyl ester (CASRN 115-86-6) NONE		Data Sources
			Number of Studies	**Observed Effects**	**Number of Studies**	**Observed Effects**	
Terrestrial	Acute exposure	Vegetation	-		-		
		Invertebrate	25	X	-		Boyd et al. (2016); Kang et al. (2006); Wang et al. (2005); Wang et al. (2012); Wang et al. (2013); Wu and Jiang (2004); Wu et al. (2004); Wu et al. (2007)
		Vertebrates	-		-		
	Chronic exposure	Vegetation	-		-		
		Invertebrate	-		-		
		Vertebrates	-		-		

The dash indicates that no studies relevant for environmental hazard were identified during this initial screening and thus the "Observed Effects" column is left blank. The X in the Observed Effects column indicates when a hazard effect was reported by one or more of the referenced studies. The N/A in the Observed Effects column indicates when a hazard effect was not reported in the abstract of one of the referenced studies (full reference review has not been conducted).

8. Exposure potential

Approach
EPA considered reasonably available information to identify potential environmental, worker/occupational, consumer exposures, and general population to TPP.

Release potential for environmental and human health exposure
TPP is not included on the TRI chemical list. EPA considered conditions of use reported in CDR and the physical and chemical properties to inform potential environmental releases of TPP.

Worker/Occupational and consumer exposure
EPA's approach for assessing exposure potential was to review the physical and chemical properties, conditions of use reported in CDR, and information from the National Institutes of Health Consumer Product Database and the Chemical and Products Database (CPDat) for TPP to inform occupational and consumer exposure potential. The results of this review are detailed in the following tables.

General population exposure
EPA identified environmental concentration, and ecological biomonitoring data to inform TPP's exposure potential to the general population.

Results and Discussion

Release potential for environmental and human health exposure
When chemicals are incorporated into formulations, mixtures, or used as reaction products, the industrial releases may be a relatively low percentage of the production volume. Lower percentage releases occur when a high percentage of the volume is incorporated without significant process losses during its incorporation into a formulation, mixture, or product. The actual percentages, quantities, and media of releases of the reported chemical associated with this processing or use are not known.

When chemical substances have industrial use as solvents in product formulations or mixtures, the industrial and/or end use releases may be a relatively high percentage of the production volume. Higher percentage releases occur when the chemical's intended use is as a solvent that may evaporate into the atmosphere or may be collected and disposed to aqueous media. In some cases, some engineering controls or capture for recycle or reclamation may reduce these losses. The actual percentage and quantity of release of the reported chemical associated with this category are not known but could be high.

Worker/Occupational exposures
Worker exposures to this chemical may be affected by many factors, including but not limited to volume produced, processed, distributed, used and disposed of; physical form and concentration; processes of manufacture, processing, and use; chemical properties such as vapor pressure, solubility, and water partition coefficient; local temperature and humidity; and exposure controls such as engineering controls, administrative controls, and the existence of a personal protective equipment (PPE) program.

TPP has an Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL)[10]. The PEL is 3 milligrams (mg)/cubic meter (m^3) over an 8-hour work day, time weighted average (TWA). This chemical also has a National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL)[11] of 3 mg/m^3 TWA. The American Conference of Governmental Industrial Hygienists (ACGIH) set the Threshold Limit Value (TLV) at 3 ppm TWA.

TPP has a vapor pressure of approximately 6.3×10^{-6} mm Hg at 25 ºC/77 ºF. EPA assumes that inhalation exposure is negligible when vapors are generated from liquids with vapor pressures below 0.001 mm Hg at ambient room temperature conditions.

TPP is indicated as being used in paints and coatings. Products used as paints and coatings may be applied via spray or roll application methods. These methods may generate mists to which workers may be exposed.

Consumer exposure
CDR reporting indicate that TPP is used in consumer products, 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). The EPA's Chemical and Products Database (CPDat) reported uses of TPP in consumer products are listed in
Table 9.

Table 9. Exposure Information for Consumers

Chemical Identity	Consumer Product Database Consumer Uses (List)
Triphenyl Phosphate (115-86-6)	Adhesive, antioxidant, arts crafts products, automotive, automotive care, building material, electrical insulation, electronics, flooring, fluid property modulator, furniture, insulation, lubricant, metal surface treatment, paint, photographic, plastic building material, plastic, plastic softener, printing, rubber, softener, solvent, stabilizer, textile, toys, wall building material

Reference: CPDat

General population exposure
Releases of TPP from certain conditions of use, such as manufacturing and processing activities, as well as use and disposal of products containing TPP, may result in general population exposures via drinking water ingestion. Results from EPA databases indicate TPP was reported in water, soil, sediment, vegetation/diet, and other environmental matrices (Table 10).

Existing assessments also indicated TPP was detected in wastewater effluent, landfill leachate, sewage sludge, ambient air, indoor air, and indoor dust, as well as in fish (including shellfish)

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[10] OSHA, 2019. Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs). https://www.osha.gov/dsg/annotated-pels/tablez-1.html
[11] NIOSH, 2005. NIOSH Pocket Guide to Chemical Hazards. https://www.cdc.gov/niosh/npg/npgd0644.html

and dolphins (EPA 2015, UK 2009, OECD 2002). On the basis of its fate properties, such as the Henry's Law constant and soil organic carbon-water partition coefficient, EPA anticipates possible presence of TPP in soil and surface water. OECD indicated that general population exposure to TPP through normal use is minimal (OECD 2002). Susceptible subpopulations will respond differently to TPP exposure compared with the general population (Section 4).

Table 10. Exposure Information for the Environment and General Population

Database Name	Env. Concen. Data Present?	Human Biomon. Data Present?	Ecological Biomon. Data Present?	Reference
California Air Resources Board	no	no	no	CARB (2005)
Comparative Toxicogenomics Database	no	no	no	MDI (2002)
EPA Ambient Monitoring Technology Information Center – Air Toxics Data	no	no	no	U.S. EPA (1990)
EPA Discharge Monitoring Report Data	yes	no	no	U.S. EPA (2007)
EPA Unregulated Contaminant Monitoring Rule	no	no	no	U.S. EPA (1996)
FDA Total Diet Study	yes	no	no	FDA (1991)
Great Lakes Environmental Database	no	no	no	U.S. EPA (2018)
Information Platform for Chemical Monitoring Data	no	no	no	EC (2018)
International Council for the Exploration of the Sea	no	no	no	ICES (2018)
OECD Monitoring Database	no	no	no	OECD (2018)
Targeted National Sewage Sludge Survey	no	no	no	U.S. EPA (2006)
The National Health and Nutrition Examination Survey	no	no	no	CDC (2013)
USGS Monitoring Data –National Water Quality Monitoring Council	yes	no	no	USGS (1991a)
USGS Monitoring Data –National Water Quality Monitoring Council, Air	no	no	no	USGS (1991b)
USGS Monitoring Data –National Water Quality Monitoring Council, Ground Water	yes	no	no	USGS (1991c)
USGS Monitoring Data –National Water Quality Monitoring Council, Sediment	yes	no	no	USGS (1991d)
USGS Monitoring Data –National Water Quality Monitoring Council, Soil	yes	no	no	USGS (1991e)
USGS Monitoring Data –National Water Quality Monitoring Council, Surface Water	yes	no	no	USGS (1991f)
USGS Monitoring Data –National Water Quality Monitoring Council, Tissue	no	no	yes	USGS (1991g)

[a] Concen.= concentration; [b] Biomon.= biomonitoring

9. Other risk-based criteria that EPA determines to be relevant to the designation of the chemical substance's priority

EPA did not identify other risk-based criteria relevant to the designation of the chemical substance's priority.

10. Proposed designation and Rationale

Proposed Designation: High-priority substance

Rationale: EPA identified and analyzed reasonably available information for exposure and hazard and is proposing to find that TPP may present an unreasonable risk of injury to health and/or the environment, including potentially exposed or susceptible subpopulations (e.g. workers, consumers, women of reproductive age, children). This is based on the potential hazard and potential exposure of TPP under the conditions of use described in this document to support the prioritization designation. Specifically, EPA expects that that the manufacturing, processing, distribution, use and disposal of TPP may result in presence of the chemical in surface water, ingestion of the chemical in drinking water, inhalation of the chemical in ambient and indoor air, exposure to workers and exposure to the general population, including exposure to children. In addition, EPA identified potential environmental (e.g., aquatic toxicity, terrestrial toxicity), and human health hazards (e.g., repeated dose toxicity, developmental toxicity, irritation/corrosion, and observations in epidemiological studies and biomonitoring studies).

11. References

Note: All hyperlinked in-text citations are also listed below

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