



Government
of Canada

Gouvernement
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Risk Management Scope for
2-Propanol, 1-chloro-, phosphate (3:1)
(TCPP)
Chemical Abstracts Service Registry Number
13674-84-5

Environment and Climate Change Canada

Health Canada

October 2016

CanadaThe wordmark for Canada, with a small red maple leaf icon integrated into the letter 'a'.

Summary of Proposed Risk Management

This document outlines the risk management options under consideration for TCPP, a substance that is part of the Certain Organic Flame Retardants Grouping. In particular, the Government of Canada is considering

1. A measure to limit TCPP to 1000 mg/kg in certain consumer products, specifically mattresses and upholstered furniture.

The risk management options outlined in this Risk Management Scope document may evolve through consideration of assessments and risk management options published for other Chemicals Management Plan (CMP) substances as required to ensure effective, coordinated, and consistent risk management decision-making.

Note: The above summary is an abridged list of options under consideration to manage these substance(s).

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1. Context

The *Canadian Environmental Protection Act, 1999* (CEPA) (Canada 1999) provides the authority for the Minister of the Environment and Climate Change and the Minister of Health (the Ministers) to conduct assessments to determine if substances are toxic to the environment and/or harmful to human health as set out in section 64 of CEPA^{1,2}, and if so, to manage the associated risks.

As part of the second phase of the CMP, the Ministers plan to assess and manage, where appropriate, the potential health and ecological risks associated with approximately 500 substances, in 9 substance groupings (Canada 2011a). The substance 2-Propanol, 1-chloro-, phosphate (3:1), Chemical Abstracts Service Registry Number³ (CAS RN) 13674-84-5, referred to throughout this document as TCPP (see Annex A), is included in the Certain Organic Flame Retardants Grouping of the Substance Groupings Initiative of the CMP (Canada 2016).

2. Issue

2.1 Draft Screening Assessment Conclusion

Health Canada and Environment and Climate Change Canada conducted a joint scientific assessment relevant to the evaluation of TCPP and TDCPP (2-Propanol, 1,3-dichloro-, phosphate (3:1), Chemical Abstracts Service Registry Number 13674-87-8, referred to throughout this document as TDCPP) in Canada. A notice summarizing the scientific considerations of the draft screening

¹ Section 64 [of CEPA]: *For the purposes of [Parts 5 and 6 of CEPA], except where the expression “inherently toxic” appears, a substance is toxic if it is entering or may enter the environment in a quantity or concentration or under conditions that*

- (a) have or may have an immediate or long-term harmful effect on the environment or its biological diversity;*
- (b) constitute or may constitute a danger to the environment on which life depends; or*
- (c) constitute or may constitute a danger in Canada to human life or health.*

² A determination of whether one or more of the criteria of section 64 are met is based upon an assessment of potential risks to the environment and/or to human health associated with exposures in the general environment. For humans, this includes, but is not limited to, exposures from ambient and indoor air, drinking water, foodstuffs, and the use of consumer products. A conclusion under CEPA is not relevant to, nor does it preclude, an assessment against the hazard criteria specified in the *Hazardous Products Regulations* and the *Controlled Products Regulations*, which are part of the regulatory framework for the Workplace Hazardous Materials Information System for products intended for workplace use. Similarly, a conclusion based on the criteria contained in section 64 of CEPA does not preclude actions being taken under other sections of CEPA or other Acts.

³ CAS RN: Chemical Abstracts Service Registry Number. The Chemical Abstracts Service information is the property of the American Chemical Society and any use or redistribution, except as required in supporting regulatory requirements and/or for reports to the Government of Canada when the information and the reports are required by law or administrative policy, is not permitted without the prior, written permission of the American Chemical Society.

assessment for these substances was published in the *Canada Gazette*, Part I, on October 8, 2016 (Canada 2016).

Based on the information available, the draft screening assessment proposes that TCPP is harmful to human health under section 64 of CEPA because it is entering the environment in a quantity or concentration or under conditions that constitute or may constitute a danger in Canada to human life or health. It is proposed that TDCPP is not harmful to human health under section 64 of CEPA because it is not entering the environment in a quantity or concentration or under conditions that constitute or may constitute a danger in Canada to human life or health. However, TDCPP has effects of concern based on potential carcinogenicity. While available information does not indicate a risk to human health for Canadians at current levels of exposure, there may be a concern if exposures were to increase.

It is proposed that TCPP and TDCPP are not entering the environment in a quantity or concentration or under conditions that have or may have an immediate or long-term harmful effect on the environment or its biological diversity, or that constitute or may constitute a danger to the environment on which life depends (Canada 2016).

The draft screening assessment also proposes that TDCPP and TCPP meet the criteria for persistence but do not meet the criteria for bioaccumulation, as defined in the *Persistence and Bioaccumulation Regulations* made under CEPA (Canada 2000).

The exposure source of concern, identified in the draft screening assessment, is dermal exposure to TCPP from the foam and textile components of mattresses and upholstered furniture. As such, this document will focus on these exposure sources of concern (refer to section 5).

Of note, the proposed risk management options described in this document and the proposed conclusion outlined in the draft screening assessment are preliminary and may be subject to change. For further information on the draft screening assessment for TCPP and TDCPP, refer to [Draft Screening Assessment Certain Organic Flame Retardants Substance Grouping](#).

2.2 Proposed Recommendation Under CEPA

Based on the findings of the draft screening assessment conducted as per CEPA, the Ministers propose to recommend that TCPP be added to the List of Toxic Substances in Schedule 1 of the Act⁴.

⁴ When a substance is found to meet one or more of the criteria under section 64 of CEPA, the Ministers can propose to take no further action with respect to the substances, add the substance to the Priority

The Ministers will take into consideration comments made by stakeholders during the 60-day public comment period on the draft screening assessment and Risk Management Scope document in the preparation of the final screening assessment and Risk Management Approach document, if required. If TCPP is concluded to meet one or more of the criteria under section 64 of CEPA at the time of the final screening assessment and the Ministers recommend the addition of TCPP to Schedule 1, risk management instrument(s) will be proposed within 24 months from the date on which the final screening assessment is published, and finalized within 18 months from the date on which the risk management instrument(s) are proposed.

3. Proposed Risk Management

3.1 Proposed Human Health Environmental Objectives

Proposed human health objectives are quantitative or qualitative statements of what should be achieved to address human health concerns.

For this substance, the proposed human health objective is focused on addressing the exposure sources of concern outlined in section 5 of this document. As such, the proposed human health objective for TCPP is to reduce exposure of the general population to TCPP to levels that are protective of human health.

3.2 Proposed Risk Management Objective and Options under Consideration

Proposed risk management objectives set quantitative or qualitative targets to be achieved by the implementation of risk management regulations, instrument(s) and/or tool(s) for a given substance or substances. In this case, the proposed risk management objective for TCPP is to reduce dermal exposure of the general population to TCPP in certain consumer products, specifically mattresses and upholstered furniture, to levels which are protective of human health.

To achieve the proposed risk management objective and to work towards achieving the proposed human health objective, the risk management option under consideration for TCPP is:

1. A measure to limit TCPP to 1000 mg/kg (or 0.1 % w/w) in certain consumer products, specifically mattresses and upholstered furniture.

Following the publication of this Risk Management Scope document, additional information obtained from the public comment period and from other sources will be considered, along with the information presented in this document, in the Risk

Substances List for further assessment, or recommend the addition of the substance to the List of Toxic Substances in Schedule 1 of the Act.

Management Approach document and in the instrument selection and development process⁵. The risk management options outlined in this document may evolve through consideration of assessments and risk management options published for other CMP substances to ensure effective, coordinated, and consistent risk management decision-making.

3.3 Risk Management Information Gaps

In order to make informed decisions on the proposed risk management, more information is needed on the following:

1) Use of TCPP in textiles

- The use of TCPP in textiles for mattresses and upholstered furniture including:
 - Whether this substance is used for this application
 - How this substance is used for this application (e.g. sprayed on the surface, incorporated into a back-coating)
 - Whether the textiles are treated with TCPP in Canada, or treated abroad and imported

2) Changing use patterns and economic impacts

- Ongoing and anticipated changes in the use of TCPP in mattresses and upholstered furniture whether in response to:
 - Changes in performance-based flammability requirements and/or standards
 - Market forces
 - Other reasons (please provide information on these reasons)
- Would your company anticipate economic impacts if it was required to only import or manufacture mattresses and upholstered furniture containing 1000 mg/kg or less of TCPP in the foam and textile components of these products? If so, what impacts would you anticipate?
- How long would it take for your company or industry to reduce TCPP in mattresses and upholstered furniture to 1000 mg/kg or less?

3) Concentrations needed to meet performance-based flammability requirements

- Is TCPP being used in mattresses or upholstered furniture to meet performance-based flammability requirements and/or standards,

⁵ The proposed risk management regulation(s), instrument(s) or tool(s) will be selected using a thorough, consistent and efficient approach and take into consideration available information in line with the Government of Canada's Cabinet Directive on Regulatory Management (TBS 2012a), Red Tape Reduction Action Plan (TBS 2012b) and the Red Tape Reduction Act (Canada 2015).

including those in place in other countries? If so, which requirements and/or standards?

- Minimum concentrations of TCPP, if any, in foam required to meet performance-based flammability requirements and/or standards for mattresses and/or upholstered furniture.
- Minimum concentrations of TCPP, if any, in textiles required to meet performance-based flammability requirements and/or standards for mattresses and/or upholstered furniture.

4) Alternatives to TCPP

- Alternatives to TCPP, and their feasibility as replacements for use in foam and/or textiles.

4. Background

4.1 General Information on TCPP

TCPP is a chlorinated alkyl phosphate ester. This substance is structurally similar to TDCPP, also assessed by Health Canada and Environment and Climate Change Canada (Canada 2016). A third structurally similar chlorinated alkyl phosphate ester, ethanol, 2-chloro-, phosphate (3:1) (tris(2-chloroethyl) phosphate or TCEP), CAS RN 115-96-8, was evaluated under the CMP Challenge to Industry (Canada 2009).

4.2 Current Uses and Identified Sectors

TCPP is generally used as a flame retardant and plasticizer, with some other minor uses (Umweltbundesamt, 2001; Canada 2013; EU 2008). It is mainly used as an additive flame retardant in polyurethane foam, with some use in other plastics and as a back coating in textiles. End uses of polyurethane foams containing TCPP include rigid foam insulation, upholstered furniture, mattresses, and car seats, as well as products such as carpet underlay made from recycled foam, among other foam-based products (Umweltbundesamt, 2001; EU 2008; Canada 2013; Canada 2016). TCPP is primarily used in rigid foam in building applications, particularly insulation, with some use in flexible foam for upholstered furniture (EU 2008; Canada 2013). It is also used in spray polyurethane foam (EU 2008; Canada 2013; Canada 2016).

In Canada, responses to a s. 71 survey conducted in 2013 (Canada 2013) indicated that 1 000 000 to 10 000 000 kg TCPP were imported into Canada in 2011, both as the neat substance and in consumer, commercial or industrial products. This estimate may not fully capture quantities of the substance in imported manufactured items. TCPP was not manufactured in Canada. Uses of TCPP identified in Canada include in flexible foam products (e.g. furniture); building and construction materials; and in spray foam insulation (Canada 2013;

CEH 2013). TCPP is also present in a waterproofing spray for textiles used outdoors (e.g. tents) intended for consumer use (Empack 2014; Canada 2016). TCPP is listed on the *Domestic Substances List* (DSL) of CEPA in Canada.

5. Exposure Sources and Identified Risks

Exposure of the general population to TCPP is primarily from certain consumer products made with flexible foam, although environmental media also contribute to exposure (Canada 2016). TCPP is an additive flame retardant, and is therefore able to migrate out of materials in which it is contained, potentially resulting in exposure. TCPP has been detected in the foam component of upholstered furniture at a concentration up to 9% w/w (Keimlein et al., 2003; Canada 2016). The use of TCPP as a back coating in furniture textiles is described in the international literature (EU 2008; Danish EPA 2014), although it has not specifically been identified in Canada at this time (Canada 2016).

The critical effects for characterization of risk to human health associated with exposure to TCPP are reproductive and developmental toxicity, based on the overall data available on health effects of TCPP (Canada 2016).

Dermal exposure to TCPP found in flexible foam in mattresses and upholstered furniture, and potentially in textile coverings of these products, is the exposure of concern. The general population can be exposed to TCPP when the substance migrates from textiles or from flexible foam and comes into contact with the skin. The draft screening assessment contains exposure scenarios which derive levels of exposure for dermal contact with representative foam-based products with which the general population has the greatest dermal contact. Exposure levels from dermal contact are based on a migration rate for TCPP in foam (TNO Quality of Life 2005 cited in EU 2008; Canada 2016).

According to the draft screening assessment (Canada 2016), for TCPP, exposure from dermal contact when lying on a piece of foam furniture was estimated to be 210 µg/kg-bw/d for an infant and 55 µg/kg-bw/d for an adult. Comparison of these estimates with the range of subchronic LOAELs (Lowest Observed Adverse Effect Levels) (52 to 99 mg/kg-bw/day) resulted in margins of exposure (MOEs) ranging from 250 to 470 for infants and 950 to 1800 for adults. Margins of exposure for TCPP, based on the use of consumer products -- specifically from mattresses and upholstered furniture made with foam -- are considered to be potentially inadequate to account for uncertainties in the exposure and health effect databases (Canada 2016).

Exposure levels for scenarios where children mouth foam objects were also calculated in the draft screening assessment. The MOEs for these scenarios were found to be adequate to account for uncertainties in the exposure and health effects databases for TCPP. MOEs for dermal and inhalation exposure to TCPP in spray insulation and waterproofing tent spray were also found to be

adequate. Furthermore, MOEs derived for environmental media were found to be adequate to account for uncertainties in the exposure and health effects databases for TCPP (Canada 2016).

6. Risk Management Considerations

6.1 Alternatives and Alternate Technologies

Flame retardant substances are generally used to meet performance-based flammability requirements and/or standards. These requirements do not specify that chemical flame retardants need to be used; rather they may require a product or components thereof to pass a laboratory test such as a cigarette smoulder or open flame ignition test. Performance-based flammability requirements exist internationally for various types of products, including electronics, building materials, mattresses and upholstered furniture, among others (UL 2014; ASTM 2014; Canada 1980; California 2013; US CPSC 2004 & 2006). They can be regulatory, and may exist at different levels of government (Canada 1980; California 2013). Voluntary standards for flammability are also developed by independent standard development organizations (ASTM 2014; CSA Group 2015; ISO 2014; UL 2014; UFAC 2014).

Using chemical flame retardants in their products is one means through which companies can ensure that their products meet performance-based flammability requirements. However, technologies other than chemical flame retardants that allow products to meet performance-based flammability requirements also exist. For instance, products may be made of materials with a low flammability or materials that require lower quantities of flame retardants to meet standards. For example, concentrations of flame retardants tend to be higher in lower density foams, which tend to ignite more easily than higher density foams (Eastern Research Group 2014). Materials such as foams may also be covered with a protective barrier made of a material that does not burn easily (US EPA 2014).

Where chemical flame retardants are concerned, a number of factors come into play in determining whether one flame retardant is a good alternative to another. Different flame retardants are appropriate for application to different materials and for different end uses. Their physical and chemical properties affect their ability to meet performance-based flammability requirements as well as the uses in which they can be effective. Flame retardant properties such as pH, viscosity, the ability to mix evenly and stability in exothermic reactions can impact the quality of end products such as foams (Eastern Research Group, 2014). Cost is also a factor in decisions regarding alternative flame retardants.

TCPP may be used as an alternative to TCEP in polyurethane foams following concerns raised about the health effects of TCEP (EU 2008). The Phosphate Ester Flame Retardant Consortium has indicated that replacement of TCEP by TCPP is essentially complete for all applications where replacement is possible

in Europe (EU 2008). The European Union's 2008 assessment of TCPP (EU 2008) notes, however, that TCPP was not able to meet the California performance-based flammability standard for upholstered furniture in place prior to 2013 – California TB 117 (California 2000) – therefore different flame retardants such as TDCPP were used for products regulated by that standard. While initially identified as a substitute for PentaBDE in Europe, the flame retardant industry has indicated that increases in the use of TCPP are linked mostly with the decline in TCEP use and increase in the market for polyurethane generally (EU 2008).

It should be noted that although TDCPP can be an alternative to TCPP in certain circumstances, TDCPP has hazardous properties, namely the potential for carcinogenicity (Canada 2016). While available information does not indicate a risk to human health for Canadians at current levels of exposure, there may be a concern if exposures were to increase. To address this concern, options on how best to monitor changes in the use of TDCPP are being considered.

6.2 Technical Considerations, Current Industry Practices and Economic Context

Changes to performance-based flammability requirements are affecting the need for chemical flame retardants, especially flame retardants used in polyurethane foam in upholstered furniture. Within North America prior to 2013, California standard TB 117 required that upholstered furniture in the California marketplace must pass an open flame test, which led to an increased market for using certain flame retardants on the foam used in upholstered furniture (California 2000; Stapleton et al. 2011; Stapleton et al. 2012). The revised standard, California Technical Bulletin 117-2013 (California 2013), no longer requires an open flame test, but still requires a cigarette smoulder test. It also allows for the use of barrier materials on upholstered furniture to allow the furniture to pass the flammability tests. Stakeholders have indicated that changes to this standard will reduce the use of flame retardants in upholstered furniture (Eastern Research Group 2014; personal communication from stakeholder to Health Canada).

Companies producing foam may manufacture their foam so that it can pass the most stringent flammability standards, even if the end products containing the foam are not subject to those stringent flammability standards. For example, TCPP may be found in the EU in foam-based greeting cards (EU 2008), given that the same foam could be used in furniture, which is subject to flammability standards. In Europe, particularly in the United Kingdom and Ireland, regulatory requirements such as the *Furniture and Furnishings (Fire) (Safety) Regulations 1988* (UK 1988) and the *Industrial Research and Standards (Fire Safety) (Domestic Furniture) Order, 1995* (Ireland 1995) may be contributing to the use of flame retardants, including TCPP (EU 2008). Consultations on significant amendments to the *Furniture and Furnishings (Fire) (Safety) Regulations 1988*, which could reduce the need for flame retardants, took place in 2014 (UK 2014).

It is important to note that more flame retardants are believed to be imported into North America through manufactured items than as raw materials. Data from Industry Canada (Industry Canada 2014) indicate that Canada is a net importer of mattresses and upholstered seating.

Canada has regulations under the *Canada Consumer Product Safety Act* (CCPSA) that set out performance-based flammability requirements for mattresses and other textile products that are imported, sold or advertised in Canada (for example: Canada 1980; Canada 2011b). As with other performance-based standards, the applicable regulations under the CCPSA do not instruct how the requirements are to be met. Various options are available to manufacturers, including the use of materials that are less flammable, or that are inherently flame resistant (such as wool); fire barrier systems; or flame retardant chemicals. It is not expected that Canada's federal flammability requirements for mattresses or textile products drive the flame retardant market.

7. Overview of Existing Risk Management

7.1 Related Canadian Risk Management Context

TCPP is not currently subject to any substance-specific risk management in Canada.

7.2 Pertinent International Risk Management Context

Internationally, some risk management actions have either been taken for TCPP or have implications for TCPP:

United States of America:

California recently passed a bill requiring manufacturers of covered flexible polyurethane or upholstered furniture products subject to TB 117-2013 (California 2013), to indicate whether or not the product contains added flame retardant chemicals at concentrations above 1000 parts per million, by including a specified statement on that label (California 2014).

Europe:

In Europe, Commission Regulation (EC) No 506/2007 imposes testing and information requirements on the importers or manufacturers of certain priority substances, including TCPP, in accordance with Council Regulation (EEC) No 793/93 on the evaluation and control of the risks of existing substances (EC 2007)

Due to potential concerns for carcinogenicity for TCPP, a concentration limit for TCPP in toys has been set at 5 mg/kg by the European Commission (EC 2014).

TCPD is found on the List of Undesirable Substances issued by the Environmental Protection Agency of Denmark (Danish EPA 2009).

Other International RM:

In Australia, TCPD is subject to secondary notification conditions: under Section 65 of the *Industrial Chemicals (Notification and Assessment) Act 1989*, secondary notification of the chemical is required where a person becomes aware of any circumstances that may warrant a reassessment of its hazards and risks (Australia 2013).

8. Next Steps

8.1 Public Comment Period

Industry and other interested stakeholders are invited to submit comments on the content of this Risk Management Scope or other information that would help to inform decision-making (such as outlined in section 3.3). Please submit additional information and comments prior to December 7, 2016. The Risk Management Approach document, if required, will outline and seek input on the proposed risk management instrument(s), will be published at the same time as the final screening assessment. At that time, there will be further opportunity for consultation.

Comments and information submissions on the Risk Management Scope should be submitted to the address provided below:

Environment and Climate Change Canada
Chemicals Management Division
Gatineau Quebec K1A 0H3
Tel: 1-800-567-1999 | 819- 938-3232
Fax: 819-938-3231
Email: eccc.substances.eccc@canada.ca

Companies that have a business interest in TCPD are encouraged to identify themselves as stakeholders. Stakeholders will be informed of future decisions regarding TCPD and may be contacted for further information.

8.2 Timing of Actions

Action	Date
Electronic consultation on the Risk Management Scope	October 8, 2016 to December 7, 2016
Submission of additional studies or information on TCPP	On or before December 7, 2016
Publication of responses to public comments on the draft screening assessment and Risk Management Scope	No later than the time of publication of the final screening assessment
Publication of the final screening assessment and, if required, the Risk Management Approach document	Expected to be Fall 2017
Publication of responses to public comments on the Risk Management Approach, if applicable and if required, the proposed instrument(s)	24-months from the publication of the final screening assessment
Consultation on the proposed instrument(s), if required	60-day public comment period starting upon publication of each proposed instrument
Publication of the final instrument(s), if required	18-months from the publication of each proposed instrument

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ANNEX A. Substances Targeted for Risk Management

Table 1a) Substance identity for TCPP (from Canada 2016)

CAS RN	13674-84-5 (TCPP)
Chemical group (DSL Stream)	Organics
Chemical formula	C ₉ H ₁₈ Cl ₃ O ₄ P
Chemical structure	
SMILES^a string	O=P(OC(CCl)C)(OC(CCl)C)OC(CCl)C
Molecular mass	327.57 g/mol

^a Simplified Molecular Input Line Entry System

Table 1b) Isomers of TCPP (from Canada 2016). Risk management is proposed to target all isomers of TCPP.

CAS RN	13674-84-5	76025-08-6	76649-15-5	6145-73-9
Chemical name	Tris(2-chloro-1-methylethyl) phosphate	Bis(1-chloro-2-propyl)-2-chloropropyl phosphate	Bis(2-chloropropyl)-1-chloro-2-propyl phosphate	Tris(2-chloropropyl) phosphate
Chemical structure				