TOXIC INDUSTRIAL CHEMICAL RECOMMENDED FOR GLOBAL PROHIBITION CONTAMINATES CHILDREN'S TOYS

Pamela Miller
and
Joseph DiGangi, Ph.D.

April 2017

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ACKNOWLEDGEMENTS

IPEN gratefully acknowledges the financial support provided by the Government of Sweden and other donors that made the production of this document possible. The expressed views and interpretations herein shall not necessarily be taken to reflect the official opinion of any of the institutions providing financial support. Responsibility for the content lies entirely with IPEN.

The authors would like to thank Alaska Community Action On Toxics (United States), Arnika Association (Czech Republic), Eco-Accord (Russia), CETAP (Brazil), Nature University (China), Japan Endocrine-Disruptor Preventive Action (Japan), Center for Environmental Justice and Development (Kenya), and Toxics Link (India) for assisting with sampling.

EXECUTIVE SUMMARY

Short chain chlorinated paraffins (SCCPs) are industrial chemicals primarily used in metalworking but also as flame retardants and softeners in plastics. Their harmful properties have attracted global concern and a Stockholm Convention expert committee has recommended world-wide elimination of SCCPs under the treaty. Governments will decide on global prohibition of SCCPs at the 8th Conference of the Parties in April/May 2017. This study examined consumer products from 10 countries and found SCCPs to be widely present in products favored by children including Mickey Mouse slippers, jump ropes, balls, and plastic ducks. The study also found a hand blender commonly used to prepare baby food which leaked SCCPs. Other baby-related products containing high levels of SCCPs included two baby bibs. Overall, 45% (27) of the samples contained SCCPs at concentrations ranging from 8.4 to 19,808 parts per million (ppm). Ten percent of the products exceeded weak EU regulatory limits including the two baby bibs, a beach ball, gym ball, plastic duck, and jump rope. Sixty-seven percent of the products exceeded typical Stockholm Convention hazardous waste limits. SCCPs adversely affect the kidney, liver, and thyroid; disrupt endocrine function; and are anticipated to be human carcinogens.

Rain boots purchased in China, contain 8.4 ppm of SCCPs.

IPEN RECOMMENDATIONS

- The use of SCCPs in articles should be prevented. Toxic chemicals used in industrial processes should not be present in children's toys, including plastic balls, jump ropes, and animals; and in food contact items, including hand blenders and microwave dishes.
- Stockholm Convention COP8 should list SCCPs in Annex A with no specific exemptions along with an additional remark in note "i" of Annex A requiring limitation of SCCPs in other chlorinated paraffin mixtures.
- SCCPs should not be used as plasticizers or flame retardants, particularly in children's products or food contact items (e.g. dishes or kitchen utensils). Measures should be taken to ensure that SCCPs are removed from the production and manufacturing of plastics to prevent harmful human exposures.
- In order to prevent regrettable substitutions, MCCPs (medium-chain chlorinated paraffins) and LCCPs (long-chain chlorinated paraffins), as well as other chemical alternatives that exhibit hazardous properties should not be considered as alternatives to SCCPs.
- Inspection and enforcement actions are needed to monitor levels of SCCPs in products and to prevent the distribution and use of products that contain SCCPs, particularly toys, childcare articles, and food contact items.

INTRODUCTION

Short-chain chlorinated paraffins (SCCPs) are widely used as industrial lubricants and coolants in metalworking applications. However, they are also present in consumer products when used as plasticizers and flame retardants, especially in polyvinyl chloride (PVC) plastic, as well as in rubber, textiles, and polymers. Additionally, they are used as plasticizers in such applications as sealants, adhesives, and paints.[1] According to a recent scientific study "*no other persistent anthropogenic chemical has been produced in such quantities [as SCCPs]*"[2] Production and use of SCCPs is increasing.[3]

In 2016, a Stockholm Convention expert committee recommended listing SCCPs in the treaty for global elimination.[4] Governments will decide on the listing at the 8th Conference of the Parties in April/May 2017. The expert committee noted that SCCPs are ubiquitous in the global environment, wildlife, and humans.[5] They also fulfill key treaty characteristics as they are persistent, bioaccumulative, and transported long distances to remote locations, including the Arctic and Antarctic. SCCPs are toxic to aquatic organisms at low concentrations; adversely affect the kidney, liver, and thyroid; and disrupt endocrine function.[6,7,8] SCCPs are classified in the 13th Edition of the Report on Carcinogens by the U.S. National Toxicology Program as "*reasonably anticipated to be human carcinogens based on sufficient evidence of carcinogenicity from studies in experimental animals.*"[9] SCCPs are found in fish, seals, walrus, and whales of the Arctic that serve as traditional foods of Indigenous peoples.[10,11,12] SCCPs are also found in the breast milk of Arctic Inuit women.[13]

The Stockholm Convention review of SCCPs found reports of contamination in consumer products – including children's products and food contact materials. This study investigated the levels of SCCPs in children's toys purchased in 10 countries and in hand blenders used to make baby food.

MATERIALS AND METHODS

SCCPs are chlorinated paraffin mixtures of alkane chains having carbon chain lengths ranging from 10-13.[14] For this study, children's toys and several other consumer goods were screened for chlorine using a hand-held XRF analyzer to identify samples made of polyvinyl chloride (PVC). Chosen PVC samples were analyzed for SCCPs at the Institute of Chemical Technology, an accredited laboratory in the Czech Republic. SCCPs were extracted by hexane and dichloromethane mix (1:4). The extract was transferred into cyclohexane and diluted. Identification and quantification of SCCPs was accessed via gas chromatography/time-of-flight high resolution mass spectrometry (GC/TOF-HRMS) in the mode of negative chemical ionization (NCI). SCCPs were analyzed with the limit of quantification (LOQ) 1 mg/kg (ppm).

RESULTS AND DISCUSSION

Laboratory analyses of 60 toys and other children's articles from 10 countries (Brazil, Canada, China, Czech Republic, India, Japan, Kenya, Netherlands, Russia, and United States) found that 45% (27) of the samples contained SCCPs at concentrations ranging from 8.4 to 19,808 parts per million (ppm) (see Table 1 in Annex 1). Toys and children's articles analyzed in this survey included plastic animals, jump ropes, sandals, rain boots, plastic balls, pendants, and swim gear. Table 1 summarizes results by country and includes descriptions of the samples analyzed. Of the products that contained SCCPs, 44% (twelve) were not labeled as to the country in which they were manufactured and did not contain brand information. A majority of the labeled products containing SCCPs were manufactured in China (twelve), with one each manufactured in Germany, Kenya, and Russia.

Jump rope purchased in Japan, contains 19,808 ppm of SCCPs.

EXPOSING CHILDREN TO TOXIC INDUSTRIAL CHEMICALS

SCCPs are pervasive in a broad range of household products that may contribute to human exposure. Children are more vulnerable because their physiology and behavior may cause higher exposures through skin absorption, inhalation, and ingestion. This study found a hand blender which contained SCCP contamination, with a level measured in leachate of 3.3 ppb. This product can contaminate prepared foods and is commonly used to prepare baby food. Two baby bibs were found that contained more than 4,000 ppm SCCPs. Other products favored by children included Mickey Mouse slippers, jump ropes, balls, and plastic ducks. None of the product labeling indicated that they contained substances of current global concern.

SCCPS FOUND IN OTHER STUDIES OF HOUSEHOLD PRODUCTS

The levels of SCCPs found in this study were similar to those observed in previous studies. SCCPs exceeded permitted levels in children's products tested in Norway, with concentrations ranging from 1,600 – 107,000 ppm (0.16-10.7%).[15] When conducting tests on household articles, the Swedish Chemicals Agency found that of 62 articles tested, 16 contained SCCPs in high concentrations; and 11 of the articles contained lower concentrations of SCCPs that were thought to have resulted from contamination in the manufacturing or delivery process.[16] In Germany, 19 of 84 plastic products contained SCCPs, with concentrations ranging from 440-50,000 ppm.[17] Levels of SCCPs ranging from 4,000 – 69,000 ppm (0.4-6.9%) were found in mats tested in Austria.[18] In Sweden, a recent study demonstrated that hand blenders used in food preparation for babies and infants are unexpected and serious sources of exposure to SCCPs. Eight out of twelve hand blenders leaked SCCPs into prepared food. The scientists concluded: *"the presence of chlorinated paraffins in household appliances that contaminate food during preparation is unacceptable and actions have to be taken immediately."*[19]

SOME PRODUCTS EXCEED EU REGULATORY LIMITS

In 2015, the European Commission set a weak regulatory limit of 0.15% by weight (1,500 parts per million) for SCCPs in articles.[20] Six of the toys in this study (10%) significantly exceeded this standard with levels of 4,376 ppm (a baby bib purchased in India), 4,866 ppm (a baby bib purchased in Kenya), 6,918 (beach ball purchased in Kenya), 9,715 ppm (a gym ball purchased in the Czech Republic), 13,973 ppm (a plastic duck purchased in Brazil), and 19,808 ppm (a jump rope purchased in Japan). Several countries where SCCPs are banned (including Austria, Germany, Norway, and Sweden) have taken enforcement actions when inspections revealed that SCCPs exceeded permitted levels in household products.

IMPLICATIONS OF ADDING SCCPS TO THE STOCKHOLM CONVENTION

The Stockholm Convention expert committee (known as the POPs Review Committee or POPRC) recommended listing SCCPs in Annex A of the treaty for global elimination. The POPRC also recommended including controls to limit the presence of SCCPs in other chlorinated paraffin mixtures. Governments will decide on the listing at the 8th Conference of the Parties in April/May 2017. Listing SCCPs in Annex A of the treaty would prohibit production, use, import, and export of SCCPs, except for purposes of environmentally sound disposal in accordance with Convention provisions.

The POPRC did not recommend exemptions for SCCPs production or use and its analysis of alternatives indicates that none are needed. The use of SCCPs in metal cutting can be substituted with vegetable oil-based formulations. These are widely available and provide better heat dissipation and produce less smoke during machining. There are also gas-based systems using supercritical carbon dioxide. For flame retardancy, alternative techniques are available, such as using inherently flame-resistant materials, flammability barriers, product re-design, and elimination of all flame retardants when they are simply not needed. For example, none of the products in this study required any form of flame retardancy. There are alternative chemical plasticizers and alternative sealants that can provide the same function without using SCCPs.

STOCKHOLM CONVENTION HAZARDOUS WASTE LIMITS

The Stockholm Convention also includes measures to address releases from stockpiles and wastes in Article 6. This includes establishment of hazardous waste limits known as low POP content levels (LPCLs). These limits define the value at which wastes are considered to be POPs wastes and therefore must be *"Disposed of in such a way that the persistent organic pollutant content is destroyed or irreversibly transformed" (*Stockholm Convention Article 6.1 d ii.) Thus, LPCLs are crucial for defining which wastes are hazardous according their POPs content. The provisional LPCLs for most POPs listed in the treaty have been set at 50 ppm. However, lower limits have been proposed for some substances.[21] For example, PCBs have had a provisional LPCL of 50 ppm, but a limit of 10 ppm has been proposed. If SCCPs are listed in the Convention, then an expert group will study the matter and make a proposal for LPCL for consideration at the Conference of the Parties in 2019.

Using 50 ppm as a "typical" LPCL for comparison reveals that a significant proportion of the products in this study would be considered hazardous waste. Eighteen toys (67%) exceeded 50 ppm SCCPs. If a lower LPCL of 10 ppm is used for comparison, then 96% of the samples (26 of 27) exceeded this limit and would be classified as hazardous waste and subject to treaty waste provisions.

CONCLUSION

SCCPs are substances of global concern and recommended for worldwide elimination under the Stockholm Convention. Surprisingly, SCCPs are widely present in children's toys made of plastic. Ninety-six percent of the toys with measureable concentrations of SCCPs contained levels of 10 ppm or greater. These results compare with other studies that found SCCPs in consumer products, even though they are banned—often in high concentrations and above permitted levels. Products containing SCCPs are likely to be a significant pathway for human exposure and particularly harmful for infants and children.

Bath thermometer purchased in Canada, contains 241 ppm of SCCPs.

ANNEX 1. SCCPS IN CHILDREN'S PRODUCTS

TABLE 1. SAMPLE DESCRIPTIONS AND ANALYTICAL RESULTS

Sample Description	Country of purchase	Manufactured in	SCCPs (ppb)
Hand immersion blender: Mainstay brand	USA (Alaska)	China	3.3 (leachate)

Toys/children's articles:			SCCPs (ppm)
Swimming goggles (Óculos Denatação)	Brazil	China	28
Wallpaper with pattern	Brazil	Not labeled	34
Plastic duck	Brazil	Not labeled	13,973
Plastic duck	Canada	China	11.9
Bath thermometer with ladybird	Canada	Not labeled	241
Plastic pendant	Canada	China	368
Plastic elephant	Canada	China	739
Rain boots	China	Not labeled	8.4
Plastic ball	China	Not labeled	29
Swimming ring with duck	China	Not labeled	37
Jump rope	China	Not labeled	136
Mickey Mouse slippers	China	Not labeled	587
Plastic spaghetti ropes (Wiky)	Czech Republic	China	13
Wallpaper with pattern	Czech Republic	Not labeled	56.6
Gym ball (Tesco)	Czech Republic	China	9,715
Plastic fish	India	Not labeled	902
Baby bib	India	Not labeled	4,376
Seat for child toilet	Japan	China	31

Sample Description	Country of purchase	Manufactured in	SCCPs (ppm)
Jump rope	Japan	China	19,808
Jump rope	Kenya	China	678
Baby bib	Kenya	Not labeled	4,866
Plastic ball	Kenya	China	6,918
Jump rope	Kenya	China	678
Ball ("Frozen")	Netherlands	Germany	102
Jump rope	Russia	Russia	48
Plastic ball	Russia	China	109
Plastic balls	Russia	China	803

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