TOXIC TOY OR TOXIC WASTE: RECYCLING POPS INTO NEW PRODUCTS

SUMMARY FOR DECISION-MAKERS

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ARNIKA

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Brominated flame retardants from electronic waste are present in plastic children's toys

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IPEN is a leading global network of 700 non-governmental organizations (NGOs) working in more than 100 developing countries and countries with economies in transition. IPEN works to establish and implement safe chemicals policies and practices to protect human health and the environment. It does this by building the capacity of its member organizations to implement on-the-ground activities, learn from each other's work, and work at the international level to set priorities and achieve new policies. Its mission is a toxics-free future for all.

In 1998, IPEN focused on advancing the development and implementation of the Stockholm Convention on persistent organic pollutants (POPs). IPEN began engagement in the POPs Review Committee process for evaluating candidate chemicals for addition to the treaty when the Committee began operating in 2005. Today, its mission also includes promoting safe chemicals management through the SAICM process, halting the spread of toxic metals, and building a movement for a toxics-free future.

INTRODUCTION

Brominated flame retardants have been widely added to foam and plastics used consumer and electronic products. PentaBDE has been used extensively in polyurethane foam, but also appears in electronics. OctaBDE has been used in ABS and other plastics used in electronics such as office equipment. DecaBDE is widely found in plastics used in electronics and is a common component of electronic waste. In 2009, delegates at Stockholm Convention 4th Conference of the Parties (COP4) agreed to list commercial PentaBDE and OctaBDE in Annex A for global elimination (Stockholm Convention 2009). The COP also agreed to create an exemption that permitted recycling of plastics, foam, and other materials containing these substances until 2030. Due to concerns about the possible impacts of this recycling exemption, the COP requested the treaty's expert committee to examine its implications. Subsequently, the expert committee known as the POPs Review Committee developed recommendations on the recycling exemption for COP5. The Committee warned against the practice and recommended to "…eliminate brominated diphenyl ethers from the recycling streams as swiftly as possible" noting that,

> " *Failure to do so will inevitably result in wider human and environmental contamination and the dispersal of brominated diphenyl ethers into matrices from which recovery is not technically or economically feasible and in the loss of the long-term credibility of recycling."*
>
> *(Stockholm Convention 2011)*

Currently DecaBDE is under evaluation by the Stockholm Convention POPs Review Committee for addition to the Convention. The Committee has been examining risk management options, socio-economic considerations, alternatives, and waste management issues and will make a recommendation to the 8th Conference of the Parties about the listing of DecaBDE in the Convention at its meeting from 19 – 23 October 2015. Despite previous Committee recommendations against the practice, a small number of countries have suggested the possibility of recommending a recycling exemption for DecaBDE. We conducted a brief survey of PBDE flame retardants in Rubik's cubes, a children's product often made of recycled plastic, along with a few other plastic toys. We asked whether OctaBDE and DecaBDE commonly found in the plastic parts of electronic waste were present in the toys as predicted by a previous Committee technical report.

METHODS

The black parts of Rubik's cubes were tested because manufacturers often blacken the colour of recycled plastics for aesthetic reasons. Samples were analyzed for PBDEs at the Institute of Chemical Technology, an accredited laboratory in the Czech Republic. Brominated flame retardants were extracted by n-hexane and the leachate transferred into isooctane. Identification and quantification of flame retardants was accessed via gas chromatography/mass spectrometry in the mode of electron ionization (GC-MS/MS-EI). The limit of detection for was 0.1 ppb and the main components of congeners listed in the Stockholm Convention were analyzed.

RESULTS

Laboratory analysis of fifteen Rubik's cube and six additional samples (thermo cup, hair clip and hand band, finger skateboard, toy robot and hockey stick) from six EU member states including Czech Republic, Germany, Hungary, Poland, Slovakia, and Sweden found that seventeen samples (81%) contained OctaBDE at concentrations ranging from 1 to 95 ppm (see Table 1). Three samples (14%) contained OctaBDE at levels greater than 50 ppm – the low POPs content limit in wastes for PCBs (which PBDEs resemble) and one of the low POPs content levels recently approved at the Basel Convention COP12. Nineteen samples (90%) contained DecaBDE, a common toxic chemical found in electronic waste. Six of the samples (29%) contained DecaBDE at levels greater than 50 ppm. Taken together, nine samples (43%) exceeded 50 ppm.

TABLE 1: CONCENTRATION OF PBDEs IN PRODUCTS FROM CZECH REPUBLIC, GERMANY, HUNGARY, POLAND, SLOVAKIA, AND SWEDEN (PPM)

Type	Name, made in	Country of purchase	OctaBDE (ppm)	DecaBDE (ppm)
Rubik's cube	Toys-Cubic, China	Czech Republic	0	2
Rubik's cube	Toys-Cubic, China	Czech Republic	17	6
Rubik's cube	QJ Magic Cube, China	Czech Republic	4	4
Rubik's cube	Toys, China	Czech Republic	4	17
Rubik's cube	Not labeled	Czech Republic	47	82

Type	Name, made in	Country of purchase	OctaBDE (ppm)	DecaBDE (ppm)
Rubik's cube	I Love You Magic Cube, China	Czech Republic	75	96
Hair headband	Not labeled	Czech Republic	9	33
Thermo cup	Banquet, Akcent Bike, Travel Mug 400 ml, China	Czech Republic	3	6
Hair clip	Not labeled	Czech Republic	19	18
Toy - finger skate-board	Finger Skate Board, China	Czech Republic	95	121
Hockey stick	Not labeled	Czech Republic	6	9
Toy - robot	Not labeled	Czech Republic	0	1
Rubik's cube	Games & More, Simba, China	Germany	1	3
Rubik's cube	Games & More, Simba, China	Germany	1	4
Rubik's cube	Kocka Rubik's/Cube Buvos original 3x3	Hungary	6	58
Rubik's cube	4x4x4, China	Poland	1	3
Rubik's cube	QJ Magic Cube, China	Poland	0	0
Rubik's cube	Toys-Cubic, China	Poland	51	79
Rubik's cube	Toys-Cubic, China	Poland	22	35
Rubik's cube	Toys-Cubic, China	Slovakia	26	98
Rubik's cube	Robetoy ab	Sweden	0	0

CONCLUSION AND RECOMMENDATIONS

This brief survey indicates that the Stockholm Convention POPs Review Committee correctly predicted the dispersal of flame retardant chemicals into products where they should not be present as a result of recycling materials such as plastics that contain them. The results add to concerns about the existing Stockholm Convention recycling exemption for PentaBDE and OctaBDE and provide a warning against a recycling exemption for DecaBDE.

Toxic recycling

The data shows that OctaBDE and DecaBDE used in plastics for electronics are being recycled into plastic children's toys. This finding is in accordance with the study of Chen et al. (2009) and an analysis of the POP-BDE stream in the Netherlands by Leslie et al. (2013) illustrating that 22% of the POP-BDE in waste electrical and electronic equipment is expected to end up in recycled plastics. This survey also complements a recent study by Samsonek and Puype (2013) which found flame retardants from electronic waste recycled into plastic food contact materials such as thermo cups and kitchen utensils. The problem of recycling materials containing POPs and contaminating "new products" also occurs in recycled foam products such as carpet padding. (DiGangi J, Strakova J, and Watson A, 2011)

Substances listed in the Stockholm Convention such as PentaBDE and OctaBDE should not be present in children's products, consumer products, food contact materials, and other products. These articles should also not contain DecaBDE due to its toxic properties and since the Stockholm POPs Review Committee in 2014 agreed that DecaBDE, "…is likely as a result of its long-range environmental transport to lead to significant adverse human health and environmental effects such that global action is warranted." (Persistent Organic Pollutants Review Committee 2014)

The draft Risk Management Evaluation of DecaBDE warns against a recycling exemption for DecaBDE noting that, "recycling of materials containing c-decaBDE will inevitably result in wider human and environmental contamination and dispersal of PBDE. It should be avoided if the aim is to eliminate emissions and exposure to c-decaBDE." (Persistent Organic Pollutants Review Committee, 2015) In addition, the draft Risk Management Evaluation notes that the socio-economic impacts of not allowing recycling of materials containing DecaBDE are "limited" since recycling rates are very low (Persistent Organic Pollutants

Review Committee, 2015). Finally, the report notes that a recycling exemption may provide a loophole for export of DecaBDE-containing materials to developing countries that do not have the infrastructure to deal with it; "It was recently reported that plastic pellets from recycled material contaminated with c-decaBDE is subject to export and that this recyclate may end up in products where they can pose a hazard to human health." (Persistent Organic Pollutants Review Committee, 2015)

On 10 September 2015, the Committee for Socio-Economic Analysis of the European Chemicals Agency (SEAC) agreed with tightening the regulation of DecaBDE in plastics and textiles (European Chemicals Agency 2015). On the recycling issue, the Agency committee warned that, "Articles made from recycled materials containing decaBDE will generally have the same risk profile as articles made from virgin materials that are intentionally treated with decaBDE, in terms of their potential for decaBDE emission" (European Chemicals Agency 2015). The European Chemicals Agency Committee concluded that it, "has not identified the need for derogating any other uses (including recycling)" and notes that "the existing practice in the recycling sector is to separate wastes containing brominated flame retardants, regardless of the proposed restriction" (European Chemicals Agency 2015). The latter point is exactly what the previous Stockholm Convention POPs Review Committee decision recommended.

Recommendations against a recycling exemption for PBDEs have now been made by the Stockholm Convention POPs Review Committee in 2011, the draft Risk Management Evaluation of DecaBDE by the Stockholm Convention POPs Review Committee in 2015, and the European Chemicals Agency Committee for Socio-Economic Analysis in 2015. The data in this brief survey support these recommendations and illustrate that recycling materials containing toxic flame retardant chemicals can distribute them into children's products.

Action levels for triggering POPs destruction

The Stockholm Convention requires that after the treatment of POPs waste, it should no longer exhibit POPs characteristics. This has resulted in an effort by the Conference of the Parties to define low POPs content thresholds above which treatment is required. At the recent COP12 of the Basel Convention, Parties strangely decided on two optional low POPs content threshold limits for the sum of HexaBDE, HeptaBDE (congeners in commercial OctaBDE), PentaBDE and TetraBDE (congeners in commercial PentaBDE) of 50 ppm or 1000 ppm (Basel Convention 2015). The ineffectiveness of the 1000 ppm level is clearly illustrated by a study performed by ESWI/BiPro (2011) which illustrates that for a limit of 1000 ppm, a negligible proportion of waste containing POP-PBDEs would be actually be classified as POPs waste. This runs counter to the objectives of the Stockholm Convention. Basel Convention Parties recognized that

having two low POP content levels created confusion and that "knowledge limitations have posed challenges to the setting of such values and that therefore a review of all provisional low persistent organic pollutant content values would be timely" (Basel Convention 2015).

The survey data shows that three toy samples (14%) contained OctaBDE at levels equal to or greater than 50 ppm. In addition, six products contained DecaBDE at levels greater than 50 ppm (29%). These levels raise concerns because PBDEs are very similar in structure to PCBs. The POPs Review Committee has noted that, "There is an increasing evidence suggesting similar toxicological profiles and therefore, equivalent hazards and concerns, between PBDEs and PCBs…" (UNEP/POPS/POPRC.3/20/Add.6).

Substances such as PBDEs that resemble PCBs should not have weak low POPs content limits. The low POPs content limit should be 50 ppm or less for POP-BDEs and DecaBDE. In addition, the 50 ppm low POPs content limit should be tightened as it is not a health-based standard and should be much lower considering the properties of POPs.

An inappropriate definition of low POPs content creates a loophole that allows responsible parties to select disposal options that may be less costly, but that leave behind substantial POPs residues. This is inconsistent with the intent of the Convention and permits the use of POPs waste disposal options that cannot truly be considered environmentally sound. Such disposal options result in significant new releases of POPs to the environment which are harmful to human health and ecosystems. A weak low POPs content limit such as 1000 ppm opens the door for permitting the production and sale of products that contain unacceptably high levels of POPs as contaminants. It also further facilitates the export of hazardous, POPs-contaminated wastes from developed to developing countries. Finally, as long as these less costly options are allowed by using weak low POPs content limits, superior POPs waste disposal technologies that are able to destroy all the POPs content of the waste, and that leave behind virtually no POPs residues may remain economically non-viable.

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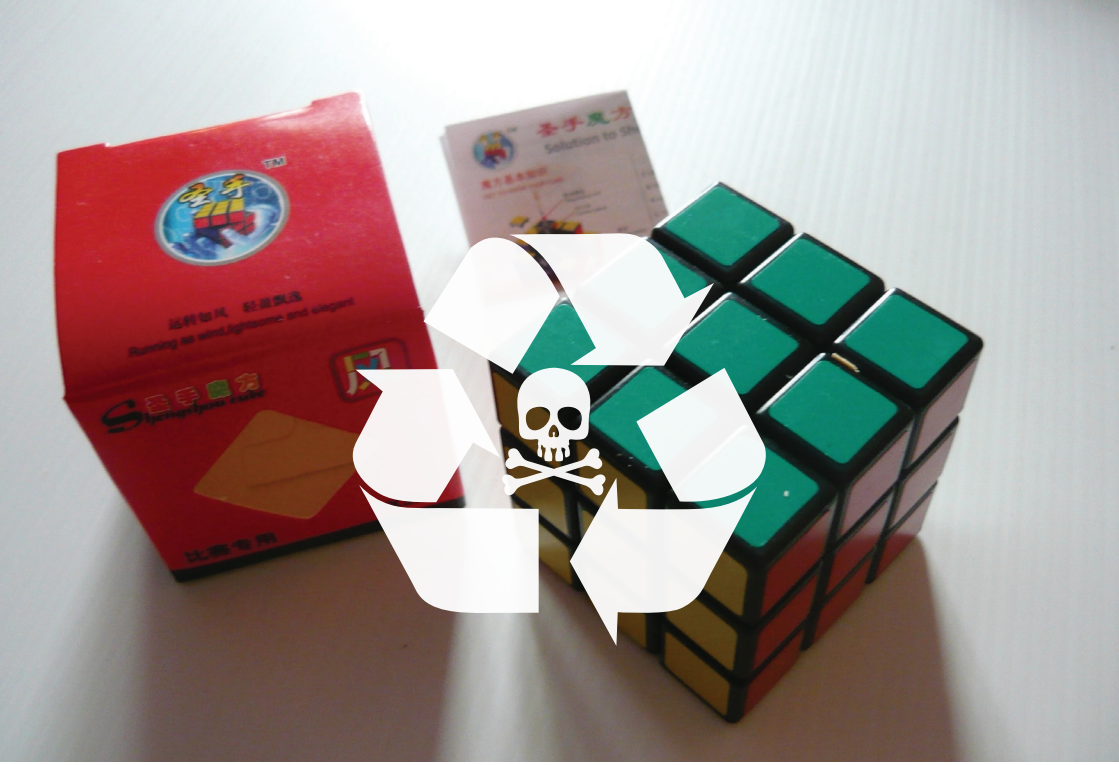

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