Docket ID Number: EPA-HQ-OPPT-2016-0735

Comments to the U.S. Environmental Protection Agency (EPA) on the Scope of its Risk Evaluation for the TSCA Work Plan Chemicals:

CYCLIC ALIPHATIC BROMIDE CLUSTER or HEXABROMOCYCLODODECANE (HBCD) CAS Reg. Nos. 25637-99-4, 3194-55-6, 3194-57-8

Submitted on March 15, 2017 by

Safer Chemicals, Healthy Families
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I. INTRODUCTION

The Toxic Substances Control Act (TSCA), as amended in June 2016, requires the U.S. Environmental Protection Agency (EPA) to determine whether existing chemical substances pose an unreasonable risk to human health and the environment, both generally and for vulnerable subpopulations, without consideration of costs or other non-risk factors. When unreasonable risk is found, EPA must enact restrictions on the production (including both domestic manufacture and import), processing, distribution in commerce, use and/or disposal of that chemical, and/or materials and articles that contain that chemical, that are sufficient to extinguish such unreasonable risk.

Congress directed EPA to launch the risk evaluation process expeditiously. Accordingly, in section 6(b)(2)(A) of TSCA, it directed EPA to assure that evaluations are initiated within six months of the law's enactment on 10 substances drawn from the 2014 TSCA Work Plan list. EPA designated these 10 substances on December 19, 2016, and is now developing scoping documents for its evaluations. EPA's initial risk evaluations will provide an early test of the effectiveness of new law. It is therefore critical that they reflect the best information available on hazard and exposure, are based on a comprehensive understanding of the chemicals' conditions of use, and employ sound, precautionary methodologies that fully capture the risks they pose to human health and the environment.

Toward those ultimate environmental public health objectives, these comments provide information and recommendations to EPA on the scope its risk evaluation for one of the first ten Work Plan chemicals subject to the new TSCA requirements. These comments are jointly submitted as a collaborative work product by three not-for-profit organizations:

Safer Chemicals, Healthy Families (SCHF), a coalition of 450 national, state and local organizations committed to ensuring the safety of chemicals used in our homes, workplaces and in the many products to which our families and children are exposed each day.

Environmental Health Strategy Center works at the state and national levels to ensure that all people are healthy and thriving in a healthy economy, through affordable access to safer food, water, and products; and investments that create and retain good, green jobs; and

Healthy Building Network transforms the market for building materials to advance the best environmental, health and social outcomes, including reduced use of hazardous chemicals in building products as a means of improving human health and the environment.

SCHF and its partners took a leadership role during the legislative process that led to the passage into law of the Frank R. Lautenberg Chemical Safety for the 21st Century Act, advocating the most health protective and effective policy on toxic chemicals in use today;

Our comments consists of three parts:

1. **Summary Comment** – This overview provides general comments on the scope of EPA's risk evaluation, summarizes key findings from our attached technical report, and makes recommendations to EPA for related actions needed to meet TSCA requirements;

2. **Technical Appendix** – This technical report provides information on the production, trade, use, recycling, and disposal of this chemical, citing authoritative sources (with web links), emphasizing information not included in EPA's chemical use profile; and

3. **Consumer Appendix** – This document profiles specific consumer product uses of the chemical as reported by retailers, distributors, and/or product manufacturers.

II. GENERAL COMMENTS

As discussed in detail in our separate submission, "General Comments of Safer Chemicals Healthy Families on Risk Evaluation Scoping Efforts for Ten Chemical Substances under the Toxic Substances Control Act," in order to properly scope its risk evaluation to determine whether this chemical poses an unreasonable risk to human health and the environment:

- EPA must evaluate the complete life cycle of the chemical, including production and imports, *all* uses, and its fate at the end of its useful life;

- EPA must evaluate exposure to *all* vulnerable groups, including communities of color and low-income people who may be disproportionately exposed;

- If EPA finds that data on any chemical use, hazard or exposure are insufficient to support risk evaluation, EPA must require industry to produce such data;

- EPA must assess the aggregate exposure to the most vulnerable groups and the general population for this chemical;

- EPA should assess cumulative exposure and risk, whenever practicable, for this chemical in combination with other risk factors;

- EPA should abandon its presumed safety threshold model for non-cancer effects, as recommended in the expert "Science and Decisions" report.

III. METHODS and SOURCES

We accessed and analyzed several sources of information in an effort to identify manufacturers, importers, and uses of HBCD that were not included or not fully characterized in EPA's recent chemical use profile.[1] These sources included:

- Panjiva – the trade data authority. Panjiva offers an extensive database of U.S. imports and exports of goods, including chemicals, and materials or articles containing chemicals. EPA should access these data for a modest subscription fee;
- European, United Nations and other non-domestic agency sources;
- Chemical industry sources – from web sites, trade reports and other documentation;
- U.S. EPA data sources – the Toxics Release Inventory (TRI) database, Chemical Data Reporting (CDR) submissions (including 2016 submissions obtained through a Freedom of Information Act request), and other EPA sources.
- Pharos Chemical and Material Library – a user-friendly hazard database available free for a 14-day trial.

We also sought to clarify the amount of HBCD that is still present in building insulation that will enter the waste stream in coming years, and to estimate future releases from its recycling and disposal. We used our findings, along with the specific requirements of the statute, to inform our recommendations to EPA on the scope of its risk evaluation, and related necessary actions, on this chemical.

IV. SPECIFIC COMMENTS

The findings below, and recommendations that follow, are specific to the Cyclic Aliphatic Bromide cluster, including Hexabromocyclododecane (HBCD) and isomers, with Chemical Abstract Services Registry Numbers of 25637-99-4, 3194-55-6, and 3194-57-8.

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[1] U.S. EPA, Preliminary Information on Manufacturing, Processing, Distribution, Use and Disposal: HBCD, EPA-HQ-OPPT-2016-0735-0003, February 2017. https://www.regulations.gov/document?D=EPA-HQ-OPPT-2016-0735-0003

The specific comments below provide an executive summary of our technical analysis. Please refer to the Technical Appendix for details, methods, additional information, and citations to authoritative sources that provide the factual support for all comments.

A. Chemical Production and Trade

FINDING 1: Domestic manufacture of HBCD has ended; the major use of HBCD in rigid foam insulation for buildings has been replaced, except for stockpiles

FINDING 2: Imports of HBCD manufactured in China are surging to meet U.S. demand for flame retardant uses other than rigid foam board building insulation

Although domestic U.S. manufacturing of HBCD reportedly ceased by 2016, significant HBCD manufacturing still takes place in China. Ongoing Chinese production raises serious concerns about the health and environmental impacts of U.S. imports of HBCD, and materials and/or articles containing HBCD. In fact, imports of HBCD to the U.S. surged in 2016, totaling about 847,000 pounds, with about half of that volume from Chemtura's European stockpile and the balance from China, according Panjiva. These imports took place after the last CDR reporting period (2015), so are not reflected in EPA's use report.

Drawing down the European HBCD stockpile appears be Chemtura's effort to satisfy the residual market for rigid foam insulation board made from expanded polystyrene (EPS) and extruded polystyrene (XPS), which is transitioning to a new polymeric brominated flame retardant. HBCD in foam insulation board is now a legacy use, which requires its own assessment and management strategy. (See discussion below on Recycling and Disposal).

More than 400,000 pounds of HBCD was imported from China in 2016. Unabrom, possibly the last HBCD producer in the world, manufactures brominated flame retardants in the Weifang Ocean Chemical Development Zone of Shandong province, China, and operates two other brominated chemicals plants located in the Jiangsu province of China.

Imports of HBCD from China have dramatically surged upward since Albemarle and Chemtura ceased domestic production by 2016. HBCD imports have trended as follows:

2014: 9,372 pounds of HBCD, plus 259,000 pounds of plastic granules containing HBCD*
2015: 8,976 pounds of HBCD, plus 308,000 pounds of plastic granules containing HBCD
2016: 845,499 pounds of HBCD

* Trade data from Panjiva; percentage of HBCD in plastic granules unknown

These imports from China intend to satisfy U.S. markets other than insulation foam, which could grow over time. (See discussion of HBCD use below). Although HBCD use is being phased out globally under the Stockholm Convention on Persistent Organic Pollutants, the United States is not a signatory to that treaty. That means that non-foam insulation uses of HBCD are likely to continue and grow in the U.S., absent EPA adoption of TSCA restrictions.

B. Chemical Use

FINDING 3: Current uses of HBCD include textile coatings for furniture, carpet and furnishings; polystyrene foam packaging and transportation insulation panels; within foam and other components of products intended for children; and electronic & electrical parts (in high impact polystyrene)

FINDING 4: Other reported flame retardant uses of HBCD that may remain on the market include adhesives & sealants, paints & coatings, plastics & rubber

FINDING 5: The manufacturing of HBCD-containing products and the use of HBCD potentially exposes workers, fenceline communities, and the environment

The best data on HBCD use exists for Europe. Between 1988 and 2010, the European market share of HBCD consumption broke down as follows:

45% XPS foam insulation board
41% EPS foam insulation board
7% Polymer dispersions (for textiles coating in various applications)
6% EPS/XPS for packaging and insulation boards for transportation vehicles
1-2% HIPS (high impact polystyrene) in electrical & electronic products and other articles

In addition to its major use as a flame retardant in the styrenic rigid foam insulation boards, various government and industry sources reported that HBCD has been used in:

- Adhesives and Sealants
- Audio/Video Equipment Housings
- Concrete Bricks
- Electrical and Electronic parts (high impact polystyrene, HIPS)
- Fibers / Textile / Carpets /Furniture (textile coating for carpet tiles, draperies, wall coverings, upholstery fabric, bed mattress ticking, upholstery in transportation)
- Packaging, including Food Packaging (polystyrene)
- Paints and Coatings
- Plastics and Rubber, in more than 20 different polymer types (see Technical Report)
- Wires and Cables

Many of these uses have been banned in Europe and Japan, but are likely still present in the unrestricted U.S. market. The import of more than 400,000 pounds of HBCD from China in 2016 backs that conclusion.

Industry reported data demonstrates that HBCD continues to be found in consumer products, including those intended for children. HBCD was listed in 48 children's products submitted to Washington State since 2013 under its Children's Safe Product Act, including in clothing, toys, and car or booster seats. The most recent report reflected HBCD in an amount between 1000 and 5000 PPM in a car/booster seat submitted in October 2016. Independent research also identified likely HBCD in car seats in 2016. (Specifics are included in the Consumer Products part of this comment.)

HBCD is released into the environment from manufacturing plants that formulate EPS, XPS, HIPS, and polymer dispersions for textiles, according to a European study. Textile coating was a significant source of HBCD discharge into wastewater, with additional releases during the installation of foam insulation boards.

C. Chemical Recycling and Disposal

FINDING 6: About 100 million pounds of HBCD remains in the built environment in the U.S., a huge toxic legacy reservoir of future environmental releases as buildings are demolished or damaged, and from disposal activities

FINDING 7: Electronic waste recycling is another source of human exposure and environmental release of HBCD that presents an ongoing concern

Three decades of HBCD consumption in polystyrene foam insulation has created a widely dispersed, highly toxic, reservoir of a soon-to-be legacy chemical in the built environment. Using various data sources on historical consumption trends, as detailed in the technical report, **we estimate that between 30,000 and 60,000 metric tons of HBCD were consumed in the U.S. between 1988 and 2010.** (The midrange of this estimate equals 99 million pounds). Most of this consumption was driven by HBCD use in foam insulation board. Additional amounts of HBCD were added to building insulation between 2011 and 2016, so we may have underestimated the total amount of HBCD extant in the built environment in the U.S. Most of the insulation board ever installed that contains HBCD remains in service and will steadily reach the end of its useful life in the years ahead.

Construction, remodeling, demolition, fires and explosions, and natural disasters all may release HBCD into the environment from its existing use in buildings. Transport, processing, and disposal of construction and demolition debris, and clean up after fires, natural disasters, and other damages will release additional HBCD into the environment. Additionally, in fire conditions, the decomposition of HBCD has been demonstrated to create dioxins and other toxic byproducts, which should be considered by the EPA as a likely risk of HBCD use.

Given the magnitude of this environmental reservoir of HBCD, and this chemical's environmental persistence and bioaccumulation potential, addressing rigid foam insulation board prior to and at the end of its useful life should be a very high EPA priority.

Electronic waste recycling also releases HBCD into the environment from its use in plastic components. A Canadian study estimated that a new electronics waste recycling facility would release more than 1,000 pounds per year of HBCD into the environment.

V. RECOMMENDATIONS

HBCD has been identified as a persistent organic pollutant under the Stockholm Convention on Persistent Organic Pollutants, and is being phased out across most of the world. Its deleterious ecological and public health impacts have already been well documented by the UNEP and EPA's European counterparts. EPA should utilize this foundation and start from the international consensus that HBCD poses an unreasonable risk and that all uses should be phased out.

Based on our research and findings above, we urge EPA to take the following actions in parallel during the scoping and conduct of the risk evaluation for HBCD.

A. EPA should include *all* uses and exposures within the scope of risk evaluation

The scope of the risk evaluation for HBCD should include, but not necessarily be limited to:

1. Environmental releases of HBCD and the toxic products from its decomposition from foam insulation board in the built environment during remodeling, demolition, fires, other damage, and cleanup of buildings and building sites; and from the open burning, transport, processing, recycling, incineration, and land disposal of construction and demolition debris in the United States over the remainder of the useful lifespan of all HBCD foam board;

2. Any environmental releases associated with all current and projected imports and distribution in commerce of HBCD and HBCD-containing materials and articles;

3. All exposures (occupational, fenceline-community, consumer, and general population) from all remaining industrial and product uses of HBCD; the use of HBCD as a reactant for basic inorganic chemical manufacturing; and all processing, recycling, and disposal of construction and demolition debris and electronic waste;

4. Exposures from indirect sources of HBCD, such as from household dust or water;

B. EPA should assess *all* potentially exposed or susceptible subpopulations

1. The long distance transport of HBCD from all of the above uses and disposal activities as it exposes indigenous native communities in Alaska, their traditional sustenance food and medicine sources, and the Arctic environment;

2. Exposures to workers involved in or affected by the intentional or accidental destruction of HBCD-containing products, including but not limited to firefighters and other emergency responders, construction and demolition workers, C&D waste workers, electronics recycling workers, and occupational bystanders;

3. A determination as to whether any of the HBCD use-related activities above result in disproportionate exposure to women of reproductive age, pregnant women and their fetuses, infants, children, and the elderly; and

4. A determination as to whether any communities of color, or people of lower socioeconomic status, and their local community environments, are disproportionately exposed to HBCD and thus constitute a "potentially exposed or susceptible subpopulation", based on Census Bureau data, geocoded locations of industrial facilities and disposal sites, and modeled or measured exposures.

C. EPA should require industry to develop new information to close data gaps

We believe that the EPA has more than enough data to support a determination that HBCD poses an unreasonable risk to human health and the environment. Indeed, EPA's past reports, including its "Hexabromocyclododecane (HBCD) Action Plan," clearly spelled out the dangers and the risks of this known persistent, bioaccumulative, and toxic chemical:

> "EPA has presented evidence which strongly suggests there is potential for exposure to the general population from HBCD in the environment, as well as exposure to HBCD from products and dust in the home and workplace. HBCD shows toxicity in repeated-dose (28- and 90-day feeding studies) tests. There may be some human health hazard concern based on thyroid effects and indications of developmental and transient neurobehavioral effects. These health effects combined with potential exposures suggests some concern for a potential risk to the general population from HBCD is warranted. Greater concern is warranted for workers who manufacture the chemical and produce products that contain it, given available expose information." [2]

[2] Available at https://www.epa.gov/sites/production/files/2015-09/documents/rin2070-az10_hbcd_action_plan_final_2010-08-09.pdf

However, should the agency determine that additional information is needed, EPA should require. in parallel to the scoping and conduct of the risk evaluation, that chemical manufacturers and processors fill data gaps whenever information is insufficient to support a determination of unreasonable risk. If so determined by EPA, candidates for additional data gathering under TSCA include but are not limited to the following:

1. HBCD releases and exposures from its remaining intact use in foam insulation board, including all disturbance, demolition and disposal-related scenarios;

2. The extent to which, and under what conditions, HBCD migrates out of foam insulation and other products into household dust and to the environment;

3. Current remaining uses and associated exposure data for workers, occupational bystanders, fenceline communities, consumers, and the general public.

D. EPA should require notification of *all* new uses, including in imported articles

In order to ensure the completeness of the risk evaluation to support an unreasonable risk determination, EPA needs to establish with some certainty which uses in the United States are truly historic or never took place in this country, and also ensure that such uses are not encouraged or take place again in the future without EPA's knowledge.

Therefore, EPA should:

1. Propose a Significant New Use Rule (SNUR) for HBCD and for imported articles that contain HBCD, including its use in rigid foam insulation board and other now historic uses; and

2. Propose an amendment to the existing SNUR on HBCD for use in textiles,[3] which expands its scope to include all imported articles.

By proposing a SNUR soon, i.e. during the risk evaluation of HBCD, EPA would enable industry to step forward and assert with clear evidence whether any such uses are in fact *existing* uses that continue rather than historic uses that would trigger notification if later reintroduced as new uses. This mechanism would provide EPA with more complete information on which to base its risk evaluation and unreasonable risk determination.

VI. CONCLUSION

We urge EPA to use its full authority under TSCA to support an expansive scope for the risk

[3] Available at https://www.federalregister.gov/documents/2015/09/23/2015-24178/significant-new-use-rule-for-hexabromocyclododecane-and-1256910-hexabromocyclododecane

evaluation of HBCD and the cyclic aliphatic bromide cluster, as recommend above. Given the environmental persistence and bioaccumulation potential of HBCD, it's especially critical that EPA address the legacy of some 100 million pounds of HBCD that remain in the built environment. With the market phase-out of HBCD in foam insulation board, and the international ban on HBCD that does not apply to the U.S., EPA should scrutinize, clarify and phase-out all remaining uses of HBCD. We believe that the marketplace and international community have already determined that HBCD poses an unreasonable risk to human health and the environment. So should the U.S. Environmental Protection Agency.

Technical Appendix

Hexabromocyclododecane (HBCD)

Technical Report on production, imports, use, end of life, exposure scenarios, and associated environmental and human health hazards.

Healthy Building Network

in collaboration with Safer Chemicals, Healthy Families

and Environmental Health Strategy Center

March 15, 2017

Outline

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   b. Importers and related foreign producers/shippers
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7. Health and Environmental Hazards Associated with HBCD

HBCD/cyclic aliphatic bromide cluster: Supplementary Information

Language highlighted in yellow indicate missing or possibly inaccurate information about these substances in the EPA Preliminary Information summary posted in February 2017.

Identifying Information

CAS Nos.: EPA lists 25637-99-4; 3194-55-6; 3194-57-8. The REACH list of HBCDD isomers also includes these additional CAS Nos: 134237-50-6, 134237-51-7, 134237-52-8, 25495-98-1.[1]

UN shipping code: UN3077 (this covers a wide range of chemicals)

Harmonized Tariff Schedule No.: 29035950 (per International Trade Commission [ITC], 1992[2])

Synonyms[3]: Cyclododecane, hexabromo- (CA Index Name for CASRN 25637-99-4); Cyclododecane, 1,2,5,6,9,10-hexabromo- (CA Index Name for CASRN 3194-55-6); HBCD; HBCDD; 1,2,5,6,9,10-Hexabromocyclododecane; Hexabromocyclododecane

Trade Names[4]: BRE 5300; Pyroguard F 800; Bromkal 73-6CD; Pyroguard SR 103; CD 75; Pyroguard SR 103A; CD 75P; Pyrovatex 3887; FR 1206; Safron 5261; FR 1206HT; Saytex HBCD; HBCD-LM; Saytex HBCD, KEBFR 75, Saytex HP 900

TSCA Docket: EPA-HQ-OPPT-2016-0735 https://www.regulations.gov/docket?D=EPA-HQ-OPPT-2016-0735. Note: The summary text on the docket website (not in the pdf) includes an incorrect CAS number. It reads: "Summary: The EPA has prioritized chemicals for risk evaluation to address risks of injury to health and the environment, including HBCD (CASRNs 25637-***98-4 (sic)***; 3194-55-6; and 3194-57-8). " The correct CAS number is 25637-99-4, not 25637-98-4.

2. Research Methods

In collaboration with Safer Chemicals Healthy Families and the Environmental Health Strategy Center, the Healthy Building Network research team reviewed the Chemical Data Reporting forms submitted for HBCD and the EPA Preliminary Information on Manufacturing, Processing, Distribution, Use, and Disposal (released in February 2017). It also reviewed a variety of national, European and United Nations reports, chemical industry literature, and a shipping database (Panjiva) with the goal of identifying potentially missing producers, importers, and uses of hexabromocyclododecane (HBCD). This research also sought to clarify the amount of HBCD that is present in building insulation that will be entering the waste stream in the coming years and estimate future releases from their recycling or disposal. Chemical hazard information

[1] https://pharosproject.net/material/show/2072121
[2] https://www.usitc.gov/publications/332/pub2720.pdf
[3] https://www.epa.gov/sites/production/files/2014-06/documents/hbcd_report.pdf
[4] https://www.epa.gov/sites/production/files/2014-06/documents/hbcd_report.pdf; http://www.openchem.com.cn/Cate.aspx?language=EN&categoryID=0303

is drawn from the Pharos Chemical and Material Library, available to any user for 15 days, after which a subscription is required.

In late 2016, EPA added HBCD to the list of chemicals reported to the Toxics Release Inventory. Facility releases over 100 pounds per year must be reported beginning this year (2017).[5] Subsequent reporting will generate additional knowledge about uses and releases of HBCD in the U.S.

Findings that are not included in the EPA Preliminary Information document, or were not publicly reported in CDRs, are highlighted in yellow.

3. Production/Trade

HBCD production, which began in the 1960s[6], surged worldwide in the 1990s as this chemical was used as a substitute for PBDE flame retardants,[7] but is now plummeting as chemical companies and polystyrene insulation manufacturers switch to polymeric brominated substances.

Company production data, reported under the 1986-2002 Inventory Update Rule (IUR), and subsequently through the Chemical Data Reporting (CDR) rule, has only been provided in broad ranges. Manufacturers, of whom there were only two in the United States, consider more precise data to be confidential business information.

Reported U.S. production/imports figures were 1-10 million pounds for 1986 and 1990, and 10-50 million pounds for the reporting years 1994, 1998 and 2002.[8]

A somewhat more precise picture of U.S consumption can be deduced from European and global data. In 2001, Europe accounted for 57 percent of global HBCD demand.[9] Worldwide, HBCD consumption that year was 36.8 million pounds.[10] This leaves fewer than 16 million pounds of the chemical available for the rest of the world, including the United States.

European consumption increased slightly, from 9,500 metric tons in 2001 to 11,000 tons in 2007.[11] Global production reached 22,000 metric tons (48.5 million pounds) in 2003[12] and

[5] https://www.epa.gov/toxics-release-inventory-tri-program/addition-hexabromocyclododecane-hbcd-category-tri-list-final
[6] http://chm.pops.int/Portals/0/download.aspx?d=UNEP-POPS-POPRC6WG-EVAL-HBCD-draftRME-110412.En.doc.
[7] https://web.archive.org/web/20160304185013/http://oehha.ca.gov/multimedia/biomon/pdf/120408flamedoc.pdf
[8] https://pubchem.ncbi.nlm.nih.gov/compound/3194-55-6#section=Formulations-Preparations
[9] https://www.epa.gov/sites/production/files/2014-06/documents/hbcd_report.pdf
[10] Morf, Leo, Josef Tremp, Rolf Gloor, Yvonne Huber, Markus Stengele, and Markus Zennegg. “Brominated Flame Retardants in Waste Electrical and Electronic Equipment: Substance Flows in a Recycling Plant.” *Environmental Science & Technology* 39, no. 22 (2005): 8691–99.
[11] https://echa.europa.eu/documents/10162/13640/tech_rep_hbcdd_en.pdf
[12] de Wit CA, Herzke D, Vorkamp K. Brominated flame retardants in the Arctic environment - trends and new candidates. Sci Total Environ 2010;408:2885–918.

28,000 tonnes in 2011[13]. In the U.S., reported production totals remained in the 10-50 million pound range (between 4,535 metric tons to 22,679 metric tons) through 2014. In addition to serving domestic consumers, U.S. producers shipped about 5,000 metric tons of HBCD annually to Europe during the 2000s.[14]

A United Nations working group summarized the global production infrastructure in 2011 and documented a surge in production in China in 2010. "Production has been reported in China, Europe, Japan, and the USA. The current known annual production is approximately 28,000 tonnes per year (China: 9,000 to 10,000 tonnes in 2009, and 15,000 tonnes in 2010; 13,426 tonnes by the BSEF member companies in Europe and the US in 2009). Japanese production data is not available. No information on production in other countries was received," it reported.[15]

In 2015, after Japan and Europe banned HBCD, U.S. production fell back to 1-10 million pounds in 2015.[16] In 2015, Albemarle and Chemtura, the only two HBCD producers in Europe and the U.S., announced they would stop producing HBCD, which left China as the remaining manufacturing country.

Based on shipping data examined by the Healthy Building Network (HBN), it appears that any product manufacturer that wants to consume HBCD is using existing stocks in the U.S. or Europe, or importing newly produced HBCD from China. Records in the Panjiva database revealed approximately 847,000 pounds of HBCD shipments to the U.S. in 2016.

Based on historical consumption trends, HBN estimates that between 30,000 and 60,000 metric tons of HBCD were consumed in the U.S. between 1988 and 2010; most of that HBCD remains in polystyrene insulation in buildings. See *Estimated Future Releases of HBCD in the U.S* discussion below for further analysis.

- **DOMESTIC PRODUCERS**

In 1992, the U.S. International Trade Commission Synthetic Organic Chemicals directory listed two U.S. producers, but did not provide individual or cumulative production data. The two companies listed were Ethyl Corp. (now part of Albemarle) and Great Lakes Chemical (now owned by Chemtura).[17] Albemarle continued to produce HBCD until 2015, when the company announced it was replacing HBCD with a brominated polymeric flame retardant. Chemtura stopped producing HBCD in the USA in 2015, but appears to be continuing to import the chemical from stockpiles held in the Netherlands.

[13] UNEP, Report of the Persistent Organic Pollutants Review Committee on the work of its seventh meeting, Addendum Risk management evaluation of hexabromocyclododecane, November 8, 2011, http://echa.europa.eu/documents/10162/18074545/a4a_comment_551_1_attachment_en.pdf
[14] http://ec.europa.eu/environment/waste/studies/pdf/POP_Waste_2011.pdf
[15] UNEP/POPS/POPRC.7/19/Add.1, available at: http://chm.pops.int/Default.aspx?tabid=2472
[16] https://www.epa.gov/sites/production/files/2017-02/documents/hbcd.pdf
[17] https://www.usitc.gov/publications/332/pub2720.pdf

Until HBCD was banned, European demand outpaced production at the continent's sole HBCD plant, in the Netherlands. U.S. producers helped to fill this gap at a pace of about 5,000 tons per year in the 2000s.[18] After the EU banned HBCD, the trade reversed, and European stockpiles were shipped to the US.

- **Albemarle (Magnolia, Arkansas)**

In its 2015 CDR reports, Albemarle indicates that most of the HBCD is used for polystyrene insulation, and less than 10 percent is processed as a reactant for basic inorganic chemical manufacturing as an intermediate. Its CDR reports do not publicly disclose production and import information.

In 2014, at a plant in the Netherlands, Albemarle began producing a polymeric brominated flame retardant alternative to HBCD, which it markets as GreenCrest. It licenses this formulation from Dow.[19] In 2015, the company entered into a joint venture with ICL to produce the substitute chemical at factories in the Netherlands (2,400 metric tons per year capacity) and Israel (10,000 tpy).[20] In May 2016, Albemarle announced it was discontinuing production of HBCD.[21]

- **Chemtura (El Dorado, Arkansas)**

In October 2014, Chemtura CEO Craig Rogerson reported that "the substitution to Emerald Innovation(TM) 3000 had reached approximately 80% of our historic annual HBCD volume. We expect the vast majority of our customers to have switched by the end of the year."[22]

In 2015, Chemtura announced it would stop making HBCD worldwide, including at its El Dorado, Arkansas, plant. "Chemtura will permanently discontinue production of HBCD-based flame retardants during, or prior to, the fourth quarter of 2015. Sales of HBCD will continue until inventories are depleted," reads a company press release.[23]

HBCD is no longer listed on the company's website.

Its 2015 CDR report indicates that 100 percent of the chemical it produced was used in polystyrene insulation and in plastic beads to be used for further compounding into polystyrene insulation. Chemtura did not disclose the amounts of HBCD produced or imported in the 2012-2015 CDR reporting period.

- **IMPORTERS (and related FOREIGN PRODUCERS/SHIPPERS)**

Chemtura's plant in the Netherlands for many years was a leading HBCD producer. There also has been some production in Japan, according to UNEP. In 2008, Japan reported production

[18] http://ec.europa.eu/environment/waste/studies/pdf/POP_Waste_2011.pdf
[19] http://www.prnewswire.com/news-releases/albemarle-to-discontinue-production-of-hbcd-based-flame-retardants-to-focus-on-supplying-greencrest-polymeric-fire-safety-solutions-300262776.html
[20] http://investors.albemarle.com/phoenix.zhtml?c=117031&p=irol-newsArticle&ID=1962051
[21] http://investors.albemarle.com/phoenix.zhtml?c=117031&p=irol-newsArticle&ID=2165225
[22] https://www.euronext.com/en/content/chemtura-reports-third-quarter-2014-financial-results
[23] http://investor.chemtura.com/releasedetail.cfm?releaseid=936673

and imports of 2,844 tons.[24] Two production plants in the United Kingdom closed in 1997 and 2003.[25] In 2011, UNEP said China's production capacity stood at 9,000 to 10,000 metric tons per year, almost the size of the combined production in the US and Europe (13,426 tons).[26]

Chemtura announced in 2015 that it was discontinuing production of HBCD-based flame retardants worldwide by the end of the year, and in May 2016, Albemarle announced it too was discontinuing HBCD production.[27]

China is the location of the world's last known remaining producer.

In 2016 (after the CDR reporting period), U.S. imports of HBCD surged. Chemtura imported at least 199,948 kg of HBCD from its inventory in Europe. Other companies imported 184,347 kg of HBCD from China.

- **Importers that have submitted CDR data**

Chemtura (Amsterdam, Netherlands) → Chemtura (USA)

Chemtura's plant just east of Amsterdam produced HBCD, in the form of powder or granulate, at a "fairly static" pace of about 6,000 metric tons per year between 2003 and 2011.[28] Chemtura in the U.S. began importing HBCD stockpiles in 2016. Between March and June 2016, Chemtura shipped about 200,000 kilograms of HBCD from Europe to the United States, according to records in the Panjiva trade database.

BASF/Styropek EPS Beads (Altamira, Mexico; possibly Brazil and Argentina) → BASF/Styropek (U.S. Distribution)

BASF is a global producer of expanded polystyrene (EPS) beads. It appears to have eliminated HBCD from this product. In 2016, BASF announced it was no longer using HBCD in their expanded polystyrene (EPS) raw materials in the US (or China, Europe, or Korea).[29]

In 2015, BASF sold its EPS assets in the Americas to Styropek, a subsidiary of the Alta Group of Mexico.[30] In early 2015, Styropek acquired BASF's extruded polystyrene (EPS) assets in the Americas, including its production facilities in Altamira, Mexico; Guaratinguetá, Brazil; and General Lagos, Argentina.[31] Both Styropek and BASF submitted CDR reports. Stryopek's CDR

[24] http://chm.pops.int/Portals/0/download.aspx?d=UNEP-POPS-POPRC6WG-EVAL-HBCD-draftRME-110412.En.doc.
[25] http://ec.europa.eu/environment/waste/studies/pdf/POP_Waste_2011.pdf
[26] http://chm.pops.int/Portals/0/download.aspx?d=UNEP-POPS-POPRC6WG-EVAL-HBCD-draftRME-110412.En.doc.
[27] http://investor.chemtura.com/releasedetail.cfm?ReleaseID=936673
[28] http://ec.europa.eu/environment/waste/studies/pdf/POP_Waste_2011.pdf
[29] https://www.basf.com/hk/en/company/news-and-media/news-releases/cn/2016/06/Neopor.html
[30] http://www.styropek.com/
[31] http://www.plasticsnews.com/article/20140710/NEWS/140719990/basf-alpek-swap-business-units-as-they-change-jv-agreement

submissions redacted import data for 2015. There were no data for prior years, before it acquired BASF's EPS assets. BASF's CDR report for 2012 to 2015 redacts all import data.

BASF's CDR submission states that it imported pellets containing between 1% and 30% HBCD, and that these pellets are incorporated into an article in the construction sector.

Styropek produces EPS beads in Altamira, Mexico. Its CDR submission lists the following non-standard applications: Electrical and electronic products (11%), and Food packaging (3%) produced by the plastics manufacturing sector. The remaining 86% is for commercial building/construction materials.

Styropek says it is "the largest EPS manufacturer in North America." According to Alfa's first quarter 2015 financial report, "Our new and wholly-owned subsidiary, Styropek, operates approximately 230 Ktons per year of combined EPS capacity in Mexico, Brazil, Argentina and Chile as of April 1, 2015."[32]

"Styropek products are manufactured in our Altamira, Mexico, facility and distributed in the US territory through our 4 strategically located warehouses covering East coast, Midwest, West coast and Southwest regions," reads a company website.[33]

It is not known whether Styropek continues to incorporate HBCD in its EPS beads. Website url names, such as http://www.styropek.com/us/assets/sds-styropek-bf-serie-hbcdd-free-usa-(eng).pdf[34], say "HBCD-free." This suggests that the company no longer uses HBCD. Current safety data sheets for their EPS bead product line do not list HBCD as an ingredient.

In 2014 and 2015, according to shipping records in the Panjiva database, BASF and Styropek imported 10,699,771 kilograms (23.6 million pounds) of "Styropor" (the German term for Styrofoam) beads into the U.S. from Mexico and Central America. Most of the U.S. imports listed in Panjiva come from Mexico, although a substantial amount was also shipped via Panama and Columbia.

Campine (Beerse, Belgium) → Azalea Color Company/Durr Marketing Associates (Greensburg, Pa.) and Kingspan Insulation / Pactiv Building Products (Winchester, Va.)

Campine produces flame retardant masterbatches in Beerse, Belgium. It advertises both HBCD and non-HBCD formulations. "Campine's BU Plastics has developed an extensive knowledge in formulating HBCD-based flame-retardant masterbatch solutions to meet our customer's specific process requirements and deliver requested product performance," reads a company website.

[32] https://www.alfa.com.mx/down/reportes/Alfa15Ii.pdf
[33] http://www.styropek.com/us/
[34] http://www.styropek.com/us/assets/sds-styropek-bf-serie-hbcdd-free-usa-(eng).pdf and http://www.styropek.com/us/assets/sds-styropek-bfl-serie-hbcdd-free-usa-(eng).pdf

"We also stand ready with industry-ready new-generation solutions based on polymeric flame-retardants."[35]

It is a substantial operation. "About 1,000 tonnes per annum are 'micronised' in the EU to produce fine particles for specific applications. This was undertaken at a plant in Belgium," reported IOM Consulting in 2008.[36]

Two CDR filings provide detailed information about shipments from Campine to the U.S. market.

According to one CDR report, Durr Marketing Associates imports pellets containing between 30% and 60% HBCD by weight, and that all of pellets are incorporated into construction products. The CDR lists shipment totals from Campine to Durr of 22,046 pounds in 2012, 504,265 pounds in 2013, 427,769 pounds in 2014, and 333,517 pounds in 2015.

Durr Marketing is affiliated with, and shares the same address as, Azalea Color Company. Azalea is also identified in many of the shipment's commodity descriptions. The Omya Group, a global distributor of specialty chemicals, sells bromine-based flame retardants under the Saytex brand name. The Saytex® word mark is owned by Albemarle.[37] Omya lists Saytex® bromine-based flame retardants for use as functional fillers in coatings, adhesives and sealants.[38] Azalea Color Co. lists "flame retardant masterbatches" from Campine for use in adhesives and sealants[39], plastics[40], composites[41] and rubber.[42]

Another CDR report describes shipments from Campine to Pactiv in Winchester, Virginia. This report also describes the imported materials as pellets containing 30-60% HBCD for use in construction products. These imports totalled 202,647 pounds in 2015, none in prior years. In 2014, Kingspan Insulation announced that it was acquiring Pactiv Building Products. Kingspan Insulation manufactures XPS insulation in Winchester.[43]

Unknown sources → Dow Chemical

Dow Chemical's CDR report says it imports pellets containing at least 90 percent HBCD for use in construction products. Its report redacts the amount of imports for each year (2012 to 2015).

Dow manufacturers XPS insulation under the Styrofoam(™) name in six North American locations (Channahon IL, Dalton GA, Ironton OH, LaPorte TX, Pevely MS, and Varenne, Quebec).

[35] http://www.campine.biz/index.php/plastics/bup-applications
[36] https://echa.europa.eu/documents/10162/13640/tech_rep_hbcdd_en.pdf
[37] Trademark Electronic Search System (TESS), U.S. Patent and Trademark Office.
[38] https://www.omya.com/Documents/Germany/Product%20Offer%20DE_CON_EN.pdf
[39] http://www.azaleacolor.com/C1257B33004772A1/direct/adhesives
[40] http://www.azaleacolor.com/C1257B33004772A1/direct/plastics
[41] http://www.azaleacolor.com/C1257B33004772A1/direct/composites
[42] http://www.azaleacolor.com/C1257B33004772A1/direct/rubber
[43] https://www.trustgreenguard.com/wp-content/uploads/2014/08/PBP-Announcement1.pdf

Dow owns the technology (intellectual property) to produce a polymeric brominated flame retardant replacement to HBCD. It licenses what it calls “BLUEDGE Technology” to the three major brominated flame retardant manufacturers. Chemtura markets it as Emerald Innovation 3000™, ICL as FR-122P, and Albemarle as GreenCrest™.[44]

Dow has been converting its XPS insulation around the world to use its brominated replacement for HBCD. It has done so far in Japan[45], Europe, and, as of November 2016, Canada,[46] but has not announced that it has converted insulation made in the U.S. Dow plans to open its own plant in Idaho to produce the replacement brominated flame retardant in early 2018.[47]

A search of the Panjiva database did not find any relevant shipments to Dow, so the scale of Dow’s HBCD imports could not be determined. Historically, the company was a prodigious consumer of HBCD. A Dow presentation in 2008 asserts that it held a 50% share of the XPS industry.[48]

- **Imports (2012-2015) Not in CDR Reports**

Weidong International (Broker, China -- manufacturer uncertain) → Netchem Inc. (Batavia, Ohio warehouse)

Netchem Inc. (headquartered in Canada) “distributes Specialty Chemicals throughout the Western Hemisphere, from strategically located warehouses, for just-in-time deliveries,” according to its website.[49] One of these warehouses is operated by Burd Brothers, in Batavia, Ohio (4005 Borman Drive, Batavia, Ohio, 45103). This warehouse is the consignee of multiple HBCD shipments, in Netchem’s name, from China, in 2014 and 2015.

According to Panjiva, Netchem imported four shipments of HBCD, totaling 4,080 kilograms, in 2015, and another four shipments, totaling 4,260 kilograms, in 2014. All eight imports were imported from Weidong International, a chemicals broker based in Shuogang, Shandong, China.

These imports do not appear to have been reported in any CDR reports to EPA.

Netchem advertises HBCD on its website for us in polystyrene foam, polypropylene, and textiles.[50]

[44] http://building.dow.com/en-us/newsroom/2016/20161117a
[45] http://www.dow.com/en-us/news/press-releases/dow-produces-first-xps-insulation-material-with-new-sustainable-polymeric-flame-retardant
[46] http://www.dow.com/en-us/building/industry-updates/canada-styrofoam-flame-retardant-announced
[47]http://www.plasticsnews.com/article/20160707/NEWS/160709888/dow-building-styrofoam-plant-in-idaho
[48] http://extrudedpolystyrene.com.au/wp-content/uploads/2014/03/Styrofoam-Technical-Presentation.pdf
[49] http://www.netcheminc.com/company-profile/
[50] http://www.netcheminc.com/category/products-list/plastics-polymers-and-coatings-industry/

HSH Aerospace Finishes (Belgium) → HSH Interplan (Anaheim, Calif.)

A Panjiva import record from 2014 indicates HBCD may be a component of HSH Aerospace Finishes' product, Interplan1200. This product is a waterborne fire-resistant primer for aircraft cabin interiors.[51]

- **Imports from China (2016)**

In 2016, U.S. companies began importing HBCD from China. This is after the CDR reporting period (2012 to 2016), and these companies involved do not appear in CDR reports.

Producer: Unibrom Corp. (Weifang, Shandong Province, China) → Mosaic Color and Additives (Greenville, Tenn.) and MPI Chemie BV (Houston, Texas)

Unibrom manufactures brominated flame retardants in the Weifang Ocean Chemical Development Zone of Shandong province. It also imports bromine from India, Ukraine, Jordan, and elsewhere for processing at two additional bromochemical plants in Jiangsu province.[52] It has subsidiaries in Kazakhstan; Hamburg, Germany; and Sugar Land, Texas, and has an agent in Russia.[53]

Unibrom may be the last remaining manufacturer of HBCD in the world.

Unibrom created a website for the US market in 2015[54], and began advertising HBCD for sale on the UnibromUSA.com site in 2016.[55] This site offers HBCD in powder or granular form, under the EcoFlame brand name, for use "as an additive for plastics, textiles, adhesives, coatings, XPS (extruded polystyrene foam), EPS (expanded polystyrene system) and other styrenic based resin systems."[56]

In 2016, Unibrom in China shipped 40,144 kg of HBCD to Mosaic Color and Additives, and 20,072 kilograms of HBCD to MPI Chemie BV.

Mosaic Color and Additives is a custom compounding company operating in Greenville, S.C. Its website does not mention HBCD or any other flame retardant.[57]

51 http://web.archive.org/web/20061006105416/http://www.aerospace-technology.com/contractors/paints/hsh/
52 http://www.unibrom.com/abouten.html
53 http://www.unibrom.com/contacten.html
54 http://www.whois.com/whois/unibromusa.com
55 http://web.archive.org/web/20160402212317/http://unibromusa.com/products11en.htm
56 http://www.unibromusa.com/products11en.htm
57 mosaiccolor.com/technical-compounding/

MPI Chemie is a global chemical trader based in the Netherlands. In 2014, it advertised "Milebrome HBCD" for sale,[58] but has since removed this from its website. However, a listing for Milebrome HBCD powder and granules remains on a SpecialChem website[59]. It lists many uses, including many not identified in EPA's Preliminary Information.

- ABS
- Polyamide, Nylon, Nylon 6, Nylon 6-6
- Polybutylene Terephthalate
- Polycarbonate
- Ultra-high-molecular-weight polyethyelene
- Polyetherketones (PEEK, PEKK, PEK)
- Other Polyesters
- Polyimide
- Polysufone
- Polyoxymethylene (also known as acetal, polyacetal and polyformaldehyde)
- Fluoropolymers
- Polyphenylene Ether (PPE)
- Polyphenylene Sulfide (PPS)
- Electronics / Computers
- Fibers/ Textiles/ Carpets
- Furnitures
- Buildings & constructions

Shanghai Openchem Co (China trader) → Mosaic Color And Additives and Chemie BV

Shanghai Openchem, a chemical trading company, lists HBCD on its website[60] and, according to records in the Panjiva database, shipped 117,441 pounds of "Hexabromocyclododecane AP 750" to Mosaic Color. HBCD AP 750 is a product of Everchem. Everchem, based in Milan Italy, is a global distributor of "chemical additives for the flame retardant plastic and rubber market."[61] It continues to offer HBCD on its website[62] and on the SpecialChem site, where it lists applications as "HIPS(high impact polystyrene), PP (polypropylene), EPS(expanded polystyrene), XPS(extruded polystyrene foam), rubber (NBR; SBR and natural rubber) and textile back-coating."[63]

Mosaic Color and Additives, as noted above, is a custom compounding company in Greenville, S.C.

[58] https://web.archive.org/web/20140228065535/http://www.mpi-chemie.com:80/category/brominated-flame-retardants/product/cas-25637-99-4-milebrome-hbcd-series.html
[59] http://polymer-additives.specialchem.com/product/a-mpi-chemie-milebrome-hbcd
[60] http://www.openchem.com.cn/Cate.aspx?language=EN&categoryID=0303
[61] http://www.everkem.com/en/
[62] http://www.everkem.com/en/ritardanti-di-fiamma/
[63] http://polymer-additives.specialchem.com/product/a-everkem-ap-750

Wuhan Golden Resources (China trader) → 3N International (Akron, Ohio)

Wuhan Golden Resources Chemical Company (based in Wuhan, Hubei, China) is a specialty chemical trader. It does not list HBCD on its website.[64] sells a variety of specialty 3N International, a broker based in Akron, imported 40,000 kg of HBCD from Wuhan Golden Resources in 2016. It has listed HBCD among its brominated retardant offerings since 2006.[65]

Panjiva records of imports include:
2016: 384,295 kg of HBCD
2015: 4,080 kg of HBCD + 140,000 kg of plastic granules containing HBCD
2014: 4,260 kg HBCD + 117,600 kg of plastic granules containing HBCD + primer (no quantity of HBCD given - 1 drum of Interplan 1200)

4. Use

The major uses for HBCD are XPS and EPS insulation. In Europe, where the most precise information is available, XPS insulation consumed 45% of HBCD between 1988 and 2010, and EPS insulation consumed another 41%, according to a 2011 EU study. Polymer dispersions (7%), EPS/XPS for other application (6%), and HIPS for electrical products, were the other substantial users of the estimated 170,000 metric tons of HBCD consumed in the European Union between 1988 and 2010.[66]

Current marketing and other industry literature, European and United Nations surveys, and CDR reports made available in 2017, provide further details on some uses identified in EPA's Preliminary Information documents, and identifies additional uses.

Table 1. HBCD historical uses or uses not listed in EPA Preliminary Information (highlighted fields are new or more specific information)

Uses	CDR reports (2012 - 2015)	Listed in EPA Use Profile (Feb 2017)	Historic	Current Marketing
Audio/Video Equipment Housings	no	no	ACC (2001)	
Concrete Bricks	no	no	UNEP (2015)	
Food packaging (polystyrene)	yes	Yes, but listed as "Past and potential other uses"		Styropek CDR, Rani (2014)

[64] http://grchemical.com/?page_id=17
[65] http://www.3ninc.com/brominated_FRs.htm and http://web.archive.org/web/20060624123533/http://www.3ninc.com/brominated_FRs.htm
[66] Table 6-70: Estimated consumption in tonnes of HBCD in the EU for the relevant applications, in http://ec.europa.eu/environment/waste/studies/pdf/POP_Waste_2011.pdf

Packaging (polystyrene), not specifically food packaging	no	Yes, listed in Past and potential other uses. Says there is no evidence HBCD is used in the US for this.	EC (2008)	Rani (2014)[67]
Electrical and electronic parts (HIPS)	yes	Yes, listed in Past and potential other uses	Ullmann's (2003), CECBP (2008), Dedeo (2014)	Styropek CDR, Milebrom
Fluoropolymers	no	no		Milebrom
Other plastics, including: ABS, Nylon, Nylon 6, Nylon 6-6, Polyamide, Polycarbonate, Polybutylene Terephthalate, Polyetherketones (PEEK, PEKK, PEK), Polyesters, Polysufone, Polyoxymethylene, Polyvinyl Chloride (PVC) Styrene-acrylonitrile (SAN), polypropylene, and Ultra-high-molecular-weight polyethylene.	no	no	Ullmann's (2003), EC (2008), EC (2011), UNEP (2015)	Milebrom, Netchem
Rubber (NBR; SBR and natural rubber)	no	no		Azalea-Rubber, Everkem
Soil Amendment (Agricultural and Horticultural)	no	no	EC (2011); NYS BUD	
Textile coating (e.g., Carpet tiles, Upholstery fabric, bed mattress ticking, upholstery in transportation, draperies and wall coverings)	no	Yes, listed as Past and potential other uses, except for automobile textiles and military, institutional and aviation applications	CECBP (2008), EC (2008), EC (2011), Dedeo (2014)	Unibrom, Netchem, Milebrom
Video cassette housings	no	no	Säll (2010),UNEP (2016)	
Wet-applied construction products: Flame retardant adhesives/sealants/paints/coatings	Possibly (construction products)	no	Ullmann's (2003), EC (2008), EC (2011), HSH Interplan, UNEP (2015)	Unibrom, Johns Manville, Azalea-Adhesives

SOURCES:

- ACC: Brominated Flame Retardant Industry Panel, American Chemistry Council. "Data Summary and Test Plan for HBCD," December 20, 2001.
- Azalea-Adhesives: http://www.azaleacolor.com/C1257B33004772A1/direct/adhesives
- Azalea-Rubber: http://www.azaleacolor.com/C1257B33004772A1/direct/rubber

[67] Testing on packaging materials in South Korea. Tested materials were treated with HBCD or contained recycled EPS/XPS, per Stockholm (2015).

- CECBP (2008), https://web.archive.org/web/20160304185013/http://oehha.ca.gov/multimedia/biomon/pdf/120408flamedoc.pdf
- Dedeo: Dedeo, Michel, and Suzanne Drake. "Healthy Environments: Strategies for Avoiding Flame Retardants in the Built Environment," October 15, 2014. http://perkinswill.com/sites/default/files/PerkinsWill_FlameRetardantAlternatives.pdf
- EC (2008): European Commission Risk Assessment (2008), https://echa.europa.eu/documents/10162/661bff17-dc0a-4475-9758-40bdd6198f82 (referenced by US. National Library of Medicine TOXNET HSDB database, accessed February, 23, 2017)
- EC (2011): http://ec.europa.eu/environment/waste/studies/pdf/POP_Waste_2011.pdf
- Everkem: http://polymer-additives.specialchem.com/product/a-everkem-ap-750
- HSH Interplan, Panjiva record and website (see section above)
- Johns Manville: LAWX SDS, https://www.jm.com/content/dam/jm/global/en/Facings/Facings-sds/LAWX%20235%20SDS_EN.pdf Milebrom: http://polymer-additives.specialchem.com/product/a-mpi-chemie-milebrome-hbcd
- Netchem: website, http://www.netcheminc.com/category/products-list/plastics-polymers-and-coatings-industry/
- NYS BUD: In 2006, the New York State Dept. of Environmental Conservation, provided a "beneficial use determination" allowing the Gaia Institute to use recycled EPS in "GaiaSoil." http://www.dec.ny.gov/docs/materials_minerals_pdf/budwst.pdf The Gaia Institute has marketed this material for use on urban rooftops. Promotional video for GaiaSoil: https://youtu.be/lJofmW6V7BQ?t=2m20s
- Rani: https://www.ncbi.nlm.nih.gov/pubmed/24630246
- Säll: http://www.unece.org/fileadmin/DAM/env/lrtap/TaskForce/popsxg/2010/Exploration%20of%20management%20options%20for%20HexabromocyclododecaneMarch2010FinalinclAnnex.pdf
- UNEP (2015): UNEP/CHW.12/5/Add.7/Rev.1
- UNEP (2016): United Nations Environment Prgoramme, UNEP-POPS-BATBEP-GUID-SUB-SC6-10-Austria-2.En.pdf
- Ullman's: Ullmann's Encyclopedia of Industrial Chemistry. 6th ed.Vol 1: Federal Republic of Germany: Wiley-VCH Verlag GmbH & Co. 2003 to Present, p. V5 626 (2003)
- Unibrom: http://www.unibrom.com/Public/Uploads/EcoFlame-B-641(1).pdf

- **Recent changes in use patterns**

Production of HBCD began in the 1960s, but its use in polystyrene insulation did not begin until the 1980s.[68]

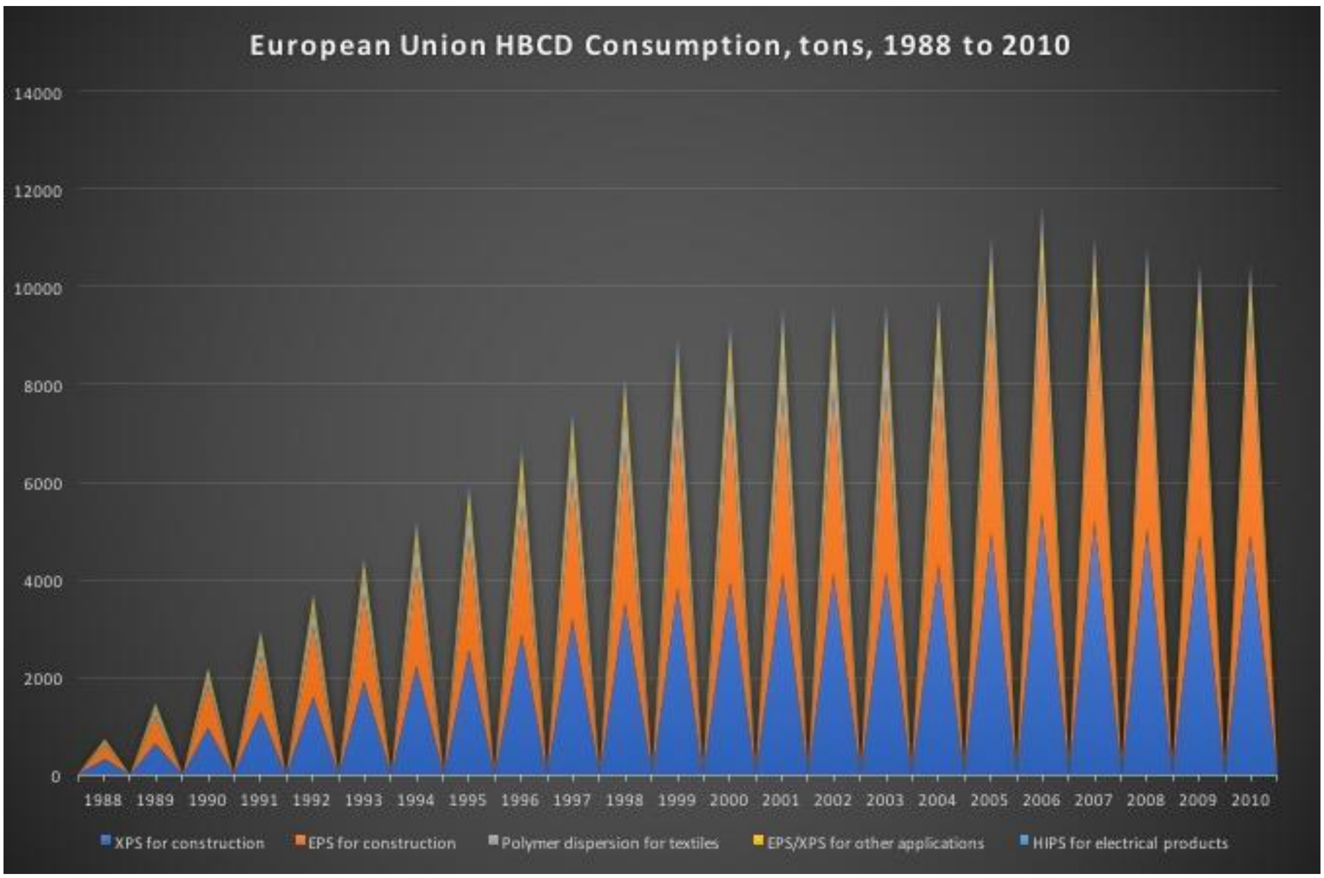
In 2011, an extensive study of HBCD by the European Commission found that "the main downstream uses of HBCD are in polymer and textile industries. HBCD is used in four principal product types, which are XPS, EPS, HIPS and polymer dispersion for textiles. The main use (90%) of HBCD is in EPS and XPS in building and construction. About 2% of the total use of HBCD is in HIPS, in electronic products and articles. The remaining use of approximately 6% is in EPS and XPS in packaging material and insulation boards of transport vehicles. About 2% is currently used in textile coating for upholstery fabrics, bed mattress ticking, draperies and wall coverings and interior textiles."

[68] http://ec.europa.eu/environment/waste/studies/pdf/POP_Waste_2011.pdf

Since then, many countries have banned the use of HBCD, including Japan and the EU countries.[69] Even in countries that have not yet banned HBCD, like the United States, consumption is dwindling, because flame retardant manufacturers have transitioned to other brominated substances.[70] Outside China, HBCD production no longer occurs.

While the U.S. has been among the last markets to replace HBCD in polystyrene insulation, major production shifts are imminent BASF is advertising a polystyrene insulation board available in the US without HBCD.[71] Dow is building a plans to open a new Styrofoam™ insulation factory in Idaho early in 2018, using its polymeric brominated flame retardant.[72]

Remaining HBCD consumers in the United States are drawing from domestic and European stockpiles or importing newly produced HBCD from China.



HEALTHY BUILDING NETWORK GRAPHIC. Based on:

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69 http://www.exiba.org/hbcd-banned; http://www.dow.com/en-US/news/press-releases/Dow%20Produces%20First%20XPS%20Insulation%20Material%20with%20New%20Sustainable%20Polymeric%20Flame%20Retardant#q=flame%20retardant&t=All

70 http://www.prnewswire.com/news-releases/albemarle-to-discontinue-production-of-hbcd-based-flame-retardants-to-focus-on-supplying-greencrest-polymeric-fire-safety-solutions-300262776.html; http://investor.chemtura.com/releasedetail.cfm?releaseid=936673

71 https://www.basf.com/hk/en/company/news-and-media/news-releases/cn/2016/06/Neopor.html

72 http://www.plasticsnews.com/article/20160707/NEWS/160709888/dow-building-styrofoam-plant-in-idaho

Table 6-70: Estimated consumption in tonnes of HBCD in the EU for the relevant applications (based on data from [ECB 2008], [Nordic COM 2007], [IOM 2008], [PS foam 2011]), in http://ec.europa.eu/environment/waste/studies/pdf/POP_Waste_2011.pdf

5. End of Life

Three decades of HBCD consumption in polystyrene insulation has created a widely-dispersed, highly toxic, reservoir of a soon-to-be legacy chemical in the built environment.

Some HBCD, being an unbound additive to polymeric products, migrates during the service life of the products in which it is used. The rate at which HBCD migrates depends upon the surface area, conditions of use, and many other factors.[73] However, the vast majority (99.986% in EPS, according to an EU study[74]) remains in insulation as it enters the waste stream.

Most of the polystyrene insulation that has been produced with HBCD remains in service. The first insulation with HBCD entered commerce in the late 1980s (see European Union consumption graphic above).

Given that the service life of polystyrene insulation can range from 25 years[75] to 60 years[76] and beyond, the ultimate fate of most HBCD in the world's buildings is to be determined.

"There are multiple end-of-life pathways for insulation products including reuse, recycling, landfilling or incineration," notes the EPA alternatives assessment for HBCD. "The manner in which a product is handled after use contributes to its environmental and human health impacts… For insulation materials, the end-of-life usually occurs when the building is altered, demolished, or burned down. During demolition, HBCD may be released in dust."[77]

From litter to recycling to disposal in landfills and incinerators, there are many ways HBCD is released from polystyrene insulation waste. XPS insulation fragments in the ocean can transfer high levels of HBCDs to mussels.[78] HBCD-contaminated dust can be generated from e-waste recycling operations, migrate through the air, and deposit upon surrounding farmland. Styrofoam insulation is also found in marine debris, from which high levels of HBCD can be

[73] *Overview of information relevant to Best Available Techniques (BAT) and Best Environmental Practices (BEP) for the production and use of hexabromocyclododecane (HBCD) under the Stockholm Convention*, Draft prepared by the Secretariat on behalf of the task team on BAT and BEP for the new POPs for consideration at the expert meeting on Best Available Techniques (BAT) and Best Environmental Practices (BEP) and the Toolkit, Bratislava, Slovakia, 25-27 October 2016, published Sept. 2016. (Slovakia)

[74] http://ec.europa.eu/environment/waste/studies/pdf/POP_Waste_2011.pdf

[75] http://www.nsf.org/newsroom_pdf/BASF_WalltiteECO_EEA_Analysis_Final.pdf

[76] http://www2.owenscorning.com/literature/pdfs/foam-product-declaration.pdf

[77] https://www.epa.gov/sites/production/files/2014-06/documents/hbcd_report.pdf

[78] *Environ Sci Technol*. 2016 May 17;50(10):4951-60. doi: 10.1021/acs.est.5b05485. Epub 2016 May 6. Styrofoam Debris as a Source of Hazardous Additives for Marine Organisms. Jang M1,2, Shim WJ1,2, Han GM1, Rani M1, Song YK1,2, Hong SH1,2.

transferred to organisms like mussels. In addition, the practice of incinerating HBCD can lead to releases of HBCD, along with dioxins and furans.[79]

Working groups of the Basel Convention and Stockholm Conventions, global agreements to curb hazardous waste and persistent organic pollutants, have been focusing on this issue in recent years.

"It is likely that releases from EPS/XPS will be more significant in the future; particularly from about 2025 onwards, as increasing number of buildings containing HBCD retarded EPS and XPS will be refurbished or demolished," warned a Stockholm Convention working group in 2011.

"There will also be industrial/municipal wastewater discharges to surface waters and through leachate from landfills," added a Basel Convention working group in 2014.

- **Estimated Future Releases of HBCD in the United States**

The lack of precise consumption and production data for the United States can confound efforts to estimate the amount of HBCD latent in building products and other materials.

The European Union, where such data are much more available, "estimated that about 170,000 tonnes of HBCD have been consumed between 1988 to 2010, which by 2017 (taking into account all applications used) is estimated to total about 23 million tonnes of HBCD containing waste. Out of this, less than one million tonnes of waste have been disposed of by 2010 and it is expected that in 2050 more than 5,000 tonnes of HBCD will have to be disposed of from the construction and demolition (C&D) sector in the EU annually (EC 2011)."[80]

Polystyrene insulation is currently handled like regular C&D debris, most of which is dumped in C&D landfills or municipal solid waste landfills. "In landfills, weathering and degradation (via UV light, microorganisms, and physical impact) will cause these materials to release HBCD over time to the soil, and to a lesser extent to water and air," notes EPA."[81]

Liselott Säll in 2010 estimated current releases of HBCD from the manufacture, use, and end of life of insulation and HBCD-bearing textiles and plastics in Europe. In 2006, when only a fraction of the coming tide of insulation boards were in the waste stream, a considerable amount of HBCD was released from insulation boards becoming waste, 8,512 kg by Säll's calculation. "It is likely that those releases will be more significant in the future; particularly from about 2025

[79] https://www.epa.gov/sites/production/files/2014-06/documents/hbcd_report.pdf and http://www.unece.org/fileadmin/DAM/env/lrtap/TaskForce/popsxg/2010/Exploration%20of%20management%20options%20for%20HexabromocyclododecaneMarch2010FinalinclAnnex.pdf and Slovakia.

[80] UNEP/POPS/POPRC.7/19/Add.1, available at: http://chm.pops.int/Default.aspx?tabid=2472

[81] https://www.epa.gov/sites/production/files/2014-06/documents/hbcd_report.pdf

onwards, as increasing numbers of buildings containing HBCD will be subject to refurbishment and demolition in the future," she warns.[82]

Säll did not attempt to quantify emissions on a cumulative basis, due to a lack of market data. "Since there is no historic data available of HBCD production over these decades in context to market data of HBCD containing products there is no possibility to assess historic emissions of HBCD."[83]

A rough way to have an idea of the scale of this issue, globally and in the U.S., is to estimate global production and some sense of the U.S.'s potential share of consumption. Generally, while it has produced a high the U.S. accounts for less than 20 percent of the global market for polystyrene, and in recent years, its share has trended closer to 10 percent.

In 2001, the Americas (that is, all of North and South America) consumed an estimated 2,800 tons of HBCD, according to UN estimates. This compares to 3,900 tons consumed in Asia, and 9,500 tons in Europe.[84] U.S. consumption that year therefore was less than 17 percent of global production. Plastics industry biennial reports for EPS consumption provide further proportional context. The North American share of EPS consumption was around 15% from 2001 to 2005, then dropped steadily to 9% in 2013. During the peak period of HBCD production (2001 to 2013), North America's share of global HBCD consumption averaged 12.4%. A reasonable assumption is that the U.S. would account for the bulk of this consumption. A logical estimate would be that U.S. consumption has accounted for between 10% and 15% of global production.

While historical global HBCD production figures are not available, they can further be estimated using disparate data sets. The European Commission provides consumption estimates for the EU from 1988 through 2010. These estimates, for the years 2001 and 2003, represent 57% and 44% of global production figures. The EC's estimated that the EU consumed total 170,000 metric tons for XPS, EPS, textiles, and electrical products between 1988 and 2010. Using the above range of 44% to 57% of Europe's share yields a range of about 300,000 to 400,000 metric tons of global production during that time.

Applying the above 10% to 15% U.S. share of global production provides a first-ever estimate of the amount of HBCD consumption in the U.S. The Healthy Building Network, based on the above assumptions, estimates that **between 30,000 and 60,000 metric tons of HBCD were consumed in the U.S. between 1988 and 2010; most of that HBCD remains in polystyrene insulation in buildings.**

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82 http://www.unece.org/fileadmin/DAM/env/lrtap/TaskForce/popsxg/2010/Exploration%20of%20management%20options%20for%20HexabromocyclododecaneMarch2010FinalinclAnnex.pdf

83 http://www.unece.org/fileadmin/DAM/env/lrtap/TaskForce/popsxg/2010/Exploration%20of%20management%20options%20for%20HexabromocyclododecaneMarch2010FinalinclAnnex.pdf

84 UNEP-CHW-OWEG.9-INF-23.English available at: http://www.basel.int/TheConvention/OpenendedWorkingGroup(OEWG)/Meetings/OEWG9/MeetingDocuments/tabid/3684/Default.aspx

- ***Recycling (Polystryene Insulation)***

Post-consumer recycling of XPS and EPS insulation does not exist to the best of our knowledge. However, food grade polystyrene recycling does take place to a limited extent, and HBCD (as noted above) may be present in this material.[85]

In North America (Canada, Mexico, and the U.S.), chemical manufacturers sold over 2.6 million tons of polystyrene, including expanded polystyrene in 2014.[86] By contrast, an industry association reported that 36,400 tons of post-consumer polystyrene packaging products were recycled in 2013.[87] Similarly, the US EPA reported that in 2012, over 2.24 million tons of polystyrene containers and packages were discarded, and just 20,000 tons (0.9%) were recovered.[88] The bottom line: post-consumer polystyrene recycling represents less than 1% of all the polystyrene resins sold in North America.

Although, as EPA notes, "XPS may also be melted and reused in the manufacture of new insulation board (Herrenbruck n.d.)," there is no evidence of manufacturers using *post-consumer* XPS or EPS insulation in practice.

As of October 2015, no polystyrene insulation manufacturer in the USA claimed to use post-consumer polystyrene, only post-industrial (pre-consumer) material. The Healthy Building Network and BlueGreen Alliance reviewed industry literature and were unable to find any recent EPS insulation product literature asserting any standard amounts of recycled content. In contrast to EPS manufacturers, the leading manufacturers of XPS insulation -- Owens Corning, Dow, and Kingspan -- make more definitive claims about their recycled content, and it's all pre-consumer. According to a certification from SCS Global Services, the Owens Corning FOAMULAR® line of rigid polystyrene insulation contains an "average 20% *pre-consumer* recycled polystyrene content."[89] *(emphasis added)*

- ***E-waste Recycling***

The use of HBCD in plastic components of electronic equipment such as computers can introduce this flame retardant to e-waste recycling facilities. A study of inputs and outputs from a "modern e-waste recycling plant" in Switzerland traced HBCD from specific product types to various outputs. The study calculated the mean value of HBCD of all incoming e-waste to be 17

[85] Rani (2014), https://www.ncbi.nlm.nih.gov/pubmed/24630246
[86] American Chemistry Council, "North American Resins Industry Expands in 2014 Despite Weakness in Key Export Markets," 2015, http://www.americanchemistry.com/2009-year-in-review
[87] EPS Industry Alliance, *2013 EPS Recycling Rate Report*, 2014 http://www.epspackaging.org/images/stories/2013_EPS_Recycling_brochure_small.pdf
[88] US EPA, "Advancing Sustainable Materials Management: Facts and Figures," *epa.gov*, last updated September 30, 2015, http://www.epa.gov/waste/nonhaz/municipal/pubs/2012_msw_dat_tbls.pdf
[89] SCS Global Services, *Rigid Polystyrene Insulation including FOAMULAR® Extruded Polystyrene (XPS) Rigid Foam Insulation, Canadian Foamular and Codeboard XPS* (SCS Recycled Content Standard V7-0 certification), issued Oct 1, 2015 http://www.scscertified.com/products/cert_pdfs/OwensCorning_2015_SCS-MC-01132_s.pdf?r=1

parts per million. The plastics fractions of this waste contained on average 60 ppm HBCD. The highest concentrations of HBCD on the Swiss market at the time were estimated to be 1,400 ppm in TV housing rear covers. During the recycling process, where different waste materials are commingled and are crushed, flame retardants migrate and cross-contaminate other materials. Further, "in the case of a recycling process that is not equipped with an efficient air pollution control device as the modern plant in this study, a significant flow of dust-borne BFRs may be transferred into the environment."[90]

A Canadian study modeled the dispersion and fate of HBCD from a new, 30,000 ton per year, e-waste recycling facility in Edmonton, Alberta. Its "evaluation of the potential emission of HBCD indicates that up to 500 kilograms per year may be released from a landfill and recycling facility such as that operating in Edmonton." Some of these releases may be dispersed through the atmosphere "into surrounding agricultural land and forested parkland," including the Banff National Park. These modeled air concentrations "are similar to those measured at locations with a history of e-waste recycling. Since HBCD has been shown to bioaccumulate, the HBCD released from this source has the long-term potential to affect agricultural food crops and the (Banff) park ecosystem."[91]

The long-term, bioaccumulative, impacts of this dispersal into food crops are poorly understood, as data on dietary exposure to HBCD is "non-existent," a 2014 study notes.[92]

Säll argues that governments "must take appropriate measures to ensure" that recovered materials do not contain more than 0.1% HBCD. The European flame retardant industry concurred (it recommends incineration).[93]

However, the two leading e-waste recycling certification organizations in the United States (e-Stewards and R2) do not appear limit HBCD content in their standards. Therefore, controls on HBCD releases from e-waste recycling operations do not appear to be commonly employed best practices in the U.S.

6. Other Potentially Vulnerable Populations / Exposure Scenarios

The manufacturing and use of HBCD potentially exposes workers and surrounding communities to HBCD in the air and water.

- Manufacturing releases

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[90] Morf, Leo, Josef Tremp, Rolf Gloor, Yvonne Huber, Markus Stengele, and Markus Zennegg. "Brominated Flame Retardants in Waste Electrical and Electronic Equipment: Substance Flows in a Recycling Plant." *Environmental Science & Technology* 39, no. 22 (2005): 8691–99.
[91] Tomko, Geoffrey, and Karen McDonald. "Environmental Fate of Hexabromocyclododecane from a New Canadian Electronic Recycling Facility." *Journal of Environmental Management* 114 (January 15, 2013): 324–27.
[92] Labunska, Iryna, Mohamed Abdallah, Igor Eulaers, Adrian Covaci, Fang Tao, Mengjiao Wang, David Santillo, Paul Johnston, and Stuart Harrad. "Human Dietary Intake of Organohalogen Contaminants at E-Waste Recycling Sites in Eastern China." *Environment International* 74 (2015): 209–20. doi:10.1016/j.envint.2014.10.020.
[93] http://www.cefic-efra.com/images/stories/Newsletter/Efra_Newsletter_December_2014.pdf

A study in 2005 measured dust and HBCDD concentrations in the Netherlands HBCD chemical plant and the Belgian HBCD micronization plant and calculated dermal exposures.[94]

Säll projected, in Europe, small amounts of HBC and wastewater releases from the manufacture and micronizing of HBCD (3.01 kg/year in total).

- Use in formulations

Säll projected more significant releases of HBCD from formulators: 435.4 kg/year from EPS and HIPS formulation, 107.5 kg/year from XPS formulation, and 56.4 kg/year from formulating polymer dispersions for textiles, in Europe.

- Professional uses

Säll estimated that, in 2006, the installation of insulation boards released 236 kilograms of HBCD into the air in Europe. The use of HBCD in textile coating, she estimated, released 1,130 kg of HBCD into wastewater. Other releases come from the industrial use of EPS, XPS, and HIPS.

- Releases during use

HBCD migrates from insulation and other products containing it during use and is found in household dust.[95]

"HBCD is an additive flame retardant and thus it is not chemically bound to the polymer and can thus be emitted from polymer products by diffusion. If the product has a long service life, releases can occur during the whole lifetime of the product. The leaching of HBCD from products can be expected to be higher in urban areas due to population density. For instance **in Internet cafes and offices, high levels of flame retardants have been detected. T**he release rates can be expected to decline with time, if the predominant release mechanism is solid phase diffusion."[96]

7. Health and Environmental Hazards Associated with HBCD

Hazards taken from Pharos CML, February 24, 2017
Hazards associated with CAS: 25637-99-4; 3194-55-6; 3194-57-8 (The additional CAS numbers listed at the beginning of the document do not add any hazards or lists beyond those already covered.)

94 https://echa.europa.eu/documents/10162/13640/tech_rep_hbcdd_en.pdf
95 http://pubs.acs.org/doi/pdf/10.1021/acs.est.6b02023
96 http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=env/jm/mono(2011)7/part2&doclanguage=en

Purple hazards are of urgent concern to avoid; Red are very high concern to avoid; Orange are high concern to avoid. More details on hazards and hazard levels here.

Hazard and Level	**Sources**
Human Health Hazards	
Persistent Bioaccumulative Toxicant (PBT)	➢ UNEP Stockholm Conv - Persistent Organic Pollutants - Priority POP ➢ WA DoE - PBT - PBT ➢ EU - SVHC Authorisation List - PBT - Banned unless Authorised ➢ OR DEQ - Priority Persistent Pollutants - Priority Persistent Pollutant - Tier 1 ➢ EU - ESIS PBT - PBT ➢ ChemSec - SIN List - PBT / vPvB (Persistent, Bioaccumulative, & Toxic / very Persistent & very Bioaccumulative) ➢ US EPA - Toxics Release Inventory PBTs - PBT ➢ OSPAR - Priority PBTs & EDs & equivalent concern - PBT - Chemical for Priority Action * ➢ EHP - San Antonio Statement on BFRs & CFRs - Flame retardant substance class of concern for PB&T & long range transport *
PBT	➢ EC - CEPA DSL - Persistent, Bioaccumulative and inherently Toxic (PBiTE) to the Environment (based on aquatic organisms)
Developmental	➢ EU - GHS (H-Statements) - H362 - May cause harm to breast-fed children ➢ Australia - GHS - H362 - May cause harm to breast-fed children ➢ US EPA - PPT Chemical Action Plans - Developmental Effects ^
Developmental	➢ EU - GHS (H-Statements) - H361 - Suspected of damaging fertility or the unborn child ➢ Australia - GHS - H361 - Suspected of damaging fertility or the unborn child
Reproductive	➢ US EPA - PPT Chemical Action Plans - Reproductive effects ^
Reproductive	➢ EU - Annex VI CMRs - Reproductive Toxicity - Category 2
Endocrine	➢ OSPAR - Priority PBTs & EDs & equivalent concern - Endocrine Disruptor - Chemical for Priority Action * ➢ TEDX - Potential Endocrine Disruptors - Potential Endocrine Disruptor
Environmental Hazards	
Chronic Aquatic	➢ Australia - GHS - H410 - Very toxic to aquatic life with long lasting effects ➢ US EPA - PPT Chemical Action Plans - Highly toxic to aquatic organisms ^
Acute Aquatic	➢ New Zealand - GHS - 9.1A (algal) - Very ecotoxic in the aquatic environment ➢ US EPA - PPT Chemical Action Plans - Acute Aquatic toxicity - TSCA Criteria met

*Hazard of brominated flame retardants
^Hazard of HBCDD/HBCD isomers

Docket ID Number: EPA-HQ-OPPT-2016-0735

Consumer Appendix

Consumer Products Containing Hexabromocyclododecane (HBCD)

Introduction. HBCD is generally found in extruded or expanded polystyrene foam. Some of this foam has consumer applications. Below is a list of products that are made for consumers and/or sold on retail websites and contain HBCD (CASRN 25637-99-4, 3194-55-6 or 3194-57-8) based on product testing reports or from Safety Data Sheets (SDS). Attached as well is a list of HBCD-containing products reported to the State of Washington as required by state regulation.

Methodology. To find these products, Safer Chemicals, Healthy Families staff searched for reports describing the results of product testing for HBCD and searched via Google for SDSs referring to the CASRNs. Where possible, we then confirmed the products described were sold on major retail websites such as www.amazon.com or www.homedepot.com.

Notes. The product descriptions quoted below are from the seller's website, unless otherwise noted. Safer Chemicals, Healthy Families has not independently verified the accuracy of the product descriptions.

PRODUCTS FOUND VIA LABORATORY TESTING

In a 2012-2013 study, the Washington Department of Ecology detected HBCD in the poly foam beans of a beanbag chair, as well as the rubber palm fabric of a protective glove.[1] The Department did not disclose the brand names of these items.

A 2016 study by the Ecology Center found brominated cyclododecanes believed to be HBCD in the expanded polystyrene foam of the following two child car seat brands:[2]

- **Chicco Legend KeyFit 30**

Product Description:
"Seat interior lined with EPS [expanded polystyrene] energy-absorbing foam for improved impact protection"

Sold At:
http://www.target.com/p/chicco-keyfit-30-infant-car-seat/-/A-15068637
https://www.amazon.com/Chicco-Keyfit-Infant-Seat-Papyrus/dp/B00YXUVJOO/ref=pd_bxgy_75_img_2

- **Recaro ProRide (Aspen)**

Product Description (under "High-Performance Comfort"):
"For comfort and safety, the soft, cushiony car seat is made with expanded polystyrene foam (EPS) that absorbs external forces."

Sold At:

https://www.amazon.com/dp/B00V851WNU/ref=twister_B0143NI920

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[1] Washington Department of Ecology, "Flame Retardants in General Consumer and Children's Products," June 2014, p. 28 & 33, https://fortress.wa.gov/ecy/publications/documents/1404021.pdf

[2] The Ecology Center, "Traveling with Toxics," December 2016, p 14-15, https://drive.google.com/file/d/0B6mFf0-94D1SVEJjdzFsZzhPVVU/view

PRODUCTS FOUND VIA SDS

Additionally, at least one type of product containing HBCD, Insulfoam, is sold for anyone to buy in different varieties on the Lowe's and The Home Depot websites. Insulfoam contains <1% HBCD (CASRN 3194-55-6) according to the SDS here: http://insulfoam.com/wp-content/uploads/2014/04/MSDS_Aug-2015.pdf, available from here: http://insulfoam.com/brochures/.

- **R-Tech Insulating Sheathing**

From the top summary:
"Numerous household, hobby and construction uses"
Product Overview:
"Designed for use as wall sheathing, basement and foundation insulation or siding underlayment"

Sold At: http://www.homedepot.com/p/R-Tech-1-in-x-4-ft-x-8-ft-R-3-85-Insulating-Sheathing-320821/202532854

- **Insulfoam Garage Door Insulation Kit**

Product Information:
"The Insulfoam garage door insulation kit is 1 of the easiest and most cost-effective ways to increase the energy efficiency of your home . . . Light-weight, rigid insulation panels come with a maintenance-free facer that give your garage a professionally-finished look"

Sold At: https://www.lowes.com/pd/Insulfoam-R4-8-Faced-Polystyrene-Foam-Board-Insulation-Common-1-25-in-x-1-6875-ft-x-8-ft-Actual-1-25-in-x-1-6875-ft-x-4-5-ft/50244957

Extract of Reports Submitted to Washington State Under its Children's Safe Product Act

Chemical: **Hexabromocyclododecane**

Chemical Reported **48** times between **6/1/2012** and **3/13/2017**.

Date Searched: **3/13/2017**

The reports are based on the data provided to the agency. The presence of a chemical in a children's product does not necessarily mean that the product is harmful to human health or that there is any violation of existing safety standards or laws. The reporting triggers are not health-based values.

Component	Concentration	Chemical Function	Product Family		Product Class		Product Description		Target Age	Company	Documents	Date Submitted
Surface coatings (paints, plating, waterproofing etc.)	PQL less than 100 ppm	No function - Contaminant	Baby Feeding/Hygiene	54100000	Baby Feeding	54101500	Baby Feeding – Bibs	10000732	Under 3	Carter's, Inc.		2/29/2016
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	No function - Contaminant	Baby Feeding/Hygiene	54100000	Baby Feeding	54101500	Baby Feeding – Bibs	10000732	Under 3	Carter's, Inc.		2/28/2014
Synthetic Polymers (synthetic rubber, plastics, foams etc.)	Equal to or greater than 1,000 but less than 5,000 ppm	Flame Retardant	Baby Welfare	54110000	Baby Furniture/Transportation/Safety	54111500	Baby Car/Booster Seats	10000792	Under 3	Thorley Industries		10/18/2016
Surface coatings (paints, plating, waterproofing etc.)	PQL less than 100 ppm	No function - Contaminant	Footwear	63010000	General Purpose Footwear	63010300	Shoes – General Purpose	10001077	3 to 12	Ashko Group LLC		1/30/2014
Surface coatings (paints, plating, waterproofing etc.)	PQL less than 100 ppm	No function - Contaminant	Footwear	63010000	Indoor Footwear	63010400	Indoor Footwear – Fully Enclosed Uppers	10001078	3 to 12	Ashko Group LLC		1/17/2014
Synthetic Polymers (synthetic rubber, plastics, foams etc.)	Equal to or greater than 100 but less than 500 ppm	Component of plastic resin or polymer process	Clothing	67010000	Clothing Accessories	67010100	Headwear	10001329	3 to 12	Greenbrier International Inc.		11/27/2013
Inks/Dyes/Pigments	PQL less than 100 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Full Body Wear	67010200	Overalls/Bodysuits	10001332	3 to 12	LT Apparel Group		3/7/2016
Surface coatings (paints, plating, waterproofing etc.)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Full Body Wear	67010200	Overalls/Bodysuits	10001332	Under 3	Carter's, Inc.	View	2/29/2016
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Full Body Wear	67010200	Overalls/Bodysuits	10001332	Under 3	Carter's, Inc.		2/28/2014
Inks/Dyes/Pigments	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Full Body Wear	67010200	Dresses	10001333	Under 3	Carter's, Inc.	View	2/29/2016
Surface coatings (paints, plating, waterproofing etc.)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Full Body Wear	67010200	Dresses	10001333	Under 3	Carter's, Inc.	View	2/29/2016
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Full Body Wear	67010200	Dresses	10001333	Under 3	Carter's, Inc.		2/28/2014
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Lower Body Wear/Bottoms	67010300	Trousers/Shorts	10001335	Under 3	Carter's, Inc.		2/28/2014
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Sleepwear	67010500	Night Dresses/Shirts	10001339	Under 3	Carter's, Inc.		2/28/2014
Inks/Dyes/Pigments	PQL less than 100 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Sportswear	67010600	Sportswear – Full Body Wear	10001342	Under 3	LT Apparel Group		3/7/2016
Inks/Dyes/Pigments	PQL less than 100 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Sportswear	67010600	Sportswear – Full Body Wear	10001342	Under 3	LT Apparel Group		3/7/2016
Inks/Dyes/Pigments	PQL less than 100 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Sportswear	67010600	Sportswear – Full Body Wear	10001342	3 to 12	LT Apparel Group		3/7/2016
Synthetic Polymers (synthetic rubber, plastics, foams etc.)	PQL less than 100 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Sportswear	67010600	Sportswear – Full Body Wear	10001342	Under 3	LT Apparel Group		3/7/2016
Synthetic Polymers (synthetic rubber, plastics, foams etc.)	PQL less than 100 ppm	Manufacturing additive (to facilitate manufacturing process)	Clothing	67010000	Sportswear	67010600	Sportswear – Full Body Wear	10001342	Under 3	LT Apparel Group		3/7/2016
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Sportswear	67010600	Sportswear – Full Body Wear	10001342	Under 3	LT Apparel Group		3/7/2016
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Sportswear	67010600	Sportswear – Full Body Wear	10001342	Under 3	Carter's, Inc.		2/28/2014
Synthetic Polymers (synthetic rubber, plastics, foams etc.)	PQL less than 100 ppm	Manufacturing additive (to facilitate manufacturing process)	Clothing	67010000	Sportswear	67010600	Sportswear – Lower Body Wear	10001343	3 to 12	LT Apparel Group		3/7/2016
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Sportswear	67010600	Sportswear – Lower Body Wear	10001343	3 to 12	LT Apparel Group		3/7/2016

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Inks/Dyes/Pigments	PQL less than 100 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Sportswear	67010600	Sportswear – Upper Body Wear	10001344	Under 3	LT Apparel Group		3/7/2016
Inks/Dyes/Pigments	PQL less than 100 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Sportswear	67010600	Sportswear – Upper Body Wear	10001344	Under 3	LT Apparel Group		3/7/2016
Inks/Dyes/Pigments	PQL less than 100 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Sportswear	67010600	Sportswear – Upper Body Wear	10001344	Under 3	LT Apparel Group		3/7/2016
Inks/Dyes/Pigments	PQL less than 100 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Sportswear	67010600	Sportswear – Upper Body Wear	10001344	3 to 12	LT Apparel Group		3/7/2016
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Sportswear	67010600	Sportswear – Upper Body Wear	10001344	3 to 12	LT Apparel Group		3/7/2016
Surface coatings (paints, plating, waterproofing etc.)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Underwear	67010700	Pants/Briefs/Undershorts	10001347	Under 3	Carter's, Inc.		2/29/2016
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Underwear	67010700	Pants/Briefs/Undershorts	10001347	Under 3	Carter's, Inc.		2/28/2014
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Underwear	67010700	Socks	10001348	3 to 12	Ashko Group LLC		2/27/2014
Surface coatings (paints, plating, waterproofing etc.)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Upper Body Wear/Tops	67010800	Jackets/Blazers/Cardigans/Waistcoats	10001350	Under 3	Carter's, Inc.		2/29/2016
Synthetic Polymers (synthetic rubber, plastics, foams etc.)	PQL less than 100 ppm	Manufacturing additive (to facilitate manufacturing process)	Clothing	67010000	Upper Body Wear/Tops	67010800	Jackets/Blazers/Cardigans/Waistcoats	10001350	Under 3	LT Apparel Group		3/7/2016
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Upper Body Wear/Tops	67010800	Jackets/Blazers/Cardigans/Waistcoats	10001350	Under 3	LT Apparel Group		3/7/2016
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Upper Body Wear/Tops	67010800	Jackets/Blazers/Cardigans/Waistcoats	10001350	Under 3	Carter's, Inc.		2/28/2014
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Upper Body Wear/Tops	67010800	Sweaters/Pullovers	10001351	Under 3	Carter's, Inc.		2/28/2014
Surface coatings (paints, plating, waterproofing etc.)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Upper Body Wear/Tops	67010800	Shirts/Blouses/Polo Shirts/T–shirts	10001352	Under 3	Carter's, Inc.		2/29/2016
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Upper Body Wear/Tops	67010800	Shirts/Blouses/Polo Shirts/T–shirts	10001352	Under 3	Carter's, Inc.		2/28/2014
Inks/Dyes/Pigments	Equal to or greater than 100 but less than 500 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Full Body Wear	67010200	Full Body Wear Variety Packs	10001355	3 to 12	LT Apparel Group		3/7/2016
Synthetic Polymers (synthetic rubber, plastics, foams etc.)	PQL less than 100 ppm	Component of plastic resin or polymer process	Clothing	67010000	Full Body Wear	67010200	Full Body Wear Variety Packs	10001355	3 to 12	LT Apparel Group		3/7/2016
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Sleepwear	67010500	Sleepwear Variety Packs	10001358	Under 3	Carter's, Inc.		2/28/2014
Inks/Dyes/Pigments	PQL less than 100 ppm	Coloration/Pigments/Dyes/Inks	Clothing	67010000	Upper Body Wear/Tops	67010800	Upper Body Wear/Tops Variety Packs	10001361	3 to 12	LT Apparel Group		3/7/2016
Surface coatings (paints, plating, waterproofing etc.)	PQL less than 100 ppm	No function - Contaminant	Fabric/Textile Furnishings	75020000	Bedding	75020200	Blankets/Throws (Non Powered)	10002224	Under 3	Carter's, Inc.		2/29/2016
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	No function - Contaminant	Fabric/Textile Furnishings	75020000	Bedding	75020200	Blankets/Throws (Non Powered)	10002224	Under 3	Carter's, Inc.		2/28/2014
Textiles (synthetic fibers and blends)	PQL less than 100 ppm	No function - Contaminant	Clothing	67010000	Underwear	67010700	Pantyhose/Stockings	10002425	Under 3	Carter's, Inc.		2/28/2014
Synthetic Polymers (synthetic rubber, plastics, foams etc.)	Equal to or greater than 500 but less than 1,000 ppm	Component of plastic resin or polymer process	Toys/Games	86010000	Toys/Games Variety Packs	86010900	Toys/Games Variety Packs	10005186	3 to 12	Greenbrier International Inc.		11/27/2013
Synthetic Polymers (synthetic rubber, plastics, foams etc.)	Equal to or greater than 100 but less than 500 ppm	No function - Contaminant	Toys/Games	86010000	Toys/Games Variety Packs	86010900	Toys/Games Variety Packs	10005186	3 to 12	Greenbrier International Inc.		9/9/2015
Surface coatings (paints, plating, waterproofing etc.)	Equal to or greater than 1,000 but less than 5,000 ppm	Flame Retardant	Toys/Games	86010000	Toy Vehicles – Non-ride	86011100	Toy Vehicles – Non–ride (Non Powered)	10005193	3 to 12	Greenbrier International Inc.		9/6/2016