

## **E. 1,2,5,6,9,10-Hexabromocyclododecane (HBCD)**

**CAS Number 3194-55-6**

### **1. Overview**

1,2,5,6,9,10-Hexabromocyclododecane (HBCD) is a flame retardant primarily used for expanded polystyrene foam and extruded foam, which are used in building insulation. HBCD can also be used as a fire retardant for textiles in furniture. This chemical is added to products – it is not chemically bound. Therefore it is more likely to dislodge from the product over time during use or after disposal (Environmental Protection Agency [EPA], 2010b; Government of Canada, 2010b).

According to the U.S. Environmental Protection Agency (EPA), HBCD is persistent by some measures, mobile in the environment and very bioaccumulative. EPA has noted that HBCD has low persistence according to half-life criteria set forth in the EPA Toxic Substances Control Act (TSCA) pre-manufacture notice program and the international Persistent Organic Pollutant protocol (EPA, 2010b). However, like other brominated flame retardants, this manmade chemical has been found in unexpected places in the natural environment, including the Arctic (European Commission [EC], 2008; European Chemicals Agency [ECHA], 2008; EPA, 2010b). A European risk assessment indicated HBCD has high potential for long range transport. Further, the concentration of HBCD has been found to be increasing in some wildlife, such as in guillemot eggs in the Baltic Sea (EC, 2008). Therefore, EPA suggests that HBCD is persistent in the environment with capability of long-range transport, as well as being very bioaccumulative (EPA, 2010b).

Concern has prompted some U.S. federal programs, such the EPA's Integrated Risk Information System (IRIS), the EPA Toxic Release Inventory (TRI) program and the Centers for Disease Control and Prevention's National Health and Nutrition Examination Survey (NHANES), to propose further assessment or monitoring. In addition, the European Union has named HBCD a Substance of Very High Concern, prompting additional requirements to be followed by producers and importers in the European Union (ECHA, 2008).

The health effects on children from low dose exposures have not been determined, but this chemical is pervasive in the environment. In laboratory studies on mammals, HBCD has been found to affect the thyroid (EPA, 2010b). The European Commission has also noted concerns about possible reproductive toxicity (EC, 2008). Because HBCD can be used as a substitute for decabromodiphenyl ether (decaBDE) in some applications (Minnesota Pollution Control Agency [MPCA], 2008), use might increase in coming years as decaBDE is phased out. For these reasons, this chemical is being named as a Minnesota Priority Chemical.

Information about the toxicity, exposure routes, and proposals related to HBCD can be found below.



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## **2. Exposure and Environmental Disposition**

(Note: This section includes examples of exposure and environmental information. This summary is not intended to be comprehensive.)

### **a. Environmental Protection Agency (EPA)**

#### **(1) Inventory Update Report (IUR)**

The 2006 IUR data show that 10 to 50 million pounds of HBCD were produced or imported into the United States during 2005 (EPA, 2010a). The two categories for this substance listed are:

Chemical	Maximum concentration in product category	Use in children's products
Fabrics, textiles, and apparel	1%-30%	No
Rubber and plastics (EPA, 2010a)	1%-30%	No

Neither of the product categories listed indicates specific intent for children. However, children use, contact, or are in proximity to textiles, like furniture and curtains, which could contain this substance.

#### **(2) Toxic Release Inventory (TRI)**

Reporting on HBCD releases is currently not required in the TRI. EPA plans to initiate rulemaking to require reporting of HBCD releases (EPA, 2010b).

### **b. National Institutes of Health (NIH)**

#### **(1) Hazardous Substances Data Bank (HSDB)**

HBCD has been found in minnows (Hazardous Substances Data Bank [HSDB], 2010).

#### **(2) Household Substances Database**

The Household Substances Database lists eight insulation products that contain HBCD in the range of 0.5% to 1.5%. One of these products is listed as an "old product" (National Library of Medicine [NLM], 2010b). Because this database only contains information for which there is a material safety data sheet (MSDS), it is unlikely that products such as furniture upholstery would be listed in this particular source (NLM, 2010a).

## **3. Toxicity**

(Note: The section below contains excerpts pertaining to the toxicity of the substance. It is not intended to provide a comprehensive summary.)

### **a. Canadian Government**

The Canadian Government has conducted a preliminary assessment of HBCD. In the draft assessment results, Canada found that "HBCD has the potential to remain in the environment for a long time, accumulate in organisms and cause harm to organisms." The Canadian government did not consider HBCD a threat to human health at the levels of current exposure. However, the government is considering methods to reduce releases to the environment (Government of Canada, 2010a).

## **b. Environmental Protection Agency**

### (1) Action Plan

The EPA Hexabromocyclododecane Action plan, which contains summaries of study results, notes that disturbances in the thyroid hormone system were observed in both male and female rats in laboratory studies after repeated exposure to HBCD. Further, transient changes in learning and memory were observed in males, and delayed eye opening was observed in second generation offspring. There was high, dose-dependent pup mortality during lactation (EPA, 2010b).

### (2) Integrated Risk Information System (IRIS)

IRIS currently contains no information related to HBCD. However, HBCD was nominated for review and it is presently on the IRIS agenda, though a date for completion has not been determined (EPA, 2010c).

## **4. Statutory Requirements**

The following table shows how HBCD meets the statutory requirements of Minn. Stat. 2010 116.9401 – 116.9407.

Statute	Relative information	References
<b>Minn. Stat. 2010 116.9401</b>		
Subd. (e)(1) harm the normal development of a fetus or child or cause other developmental toxicity	Developmental effects	EC 2008 EPA 2010b
Subd. (e)(2) cause cancer, genetic damage, or reproductive harm		
Subd. (e)(3) disrupt the endocrine or hormone system	Thyroid effects	EC 2008 ECHA 2008 EPA 2010b
Subd. (e)(4) damage the nervous system, immune system, or organs, or cause other systemic toxicity		
Subd. (e)(5) be persistent, bioaccumulative, and toxic	Persistent, Bioaccumulative and Toxic	EC 2008 ECHA 2008 EPA 2010b
Subd. (e)(6) be very persistent and very bioaccumulative		
<b>Minn. Stat. 2010 116.9403</b>		
Subd. (a) (1): has been identified as a high-production volume chemical by the United States Environmental Protection Agency	10 million to 50 million	EPA 2010b
Subd (2) Meets any of the following criteria:		
Subd. (a)(2)(i): the chemical has been found through biomonitoring to be present in human blood, including umbilical cord blood, breast milk, urine, or other bodily tissues or fluids	Adipose tissues, blood, breast milk, serum,	EPA 2010b

Statute	Relative information	References
Subd. (a)(2)(ii): the chemical has been found through sampling and analysis to be present in household dust, indoor air, drinking water, or elsewhere in the home environment	Household dust, indoor air	EPA 2010b Government of Canada, 2010a and 2010b
Subd. (a)(2)(iii): the chemical has been found through monitoring to be present in fish, wildlife, or the natural environment	Wildlife	EC 2008 HSDB 2010

## **5. Current Regulations**

### **a. Federal**

There do not appear to be current federal laws regulating manufacture or use of HBCD.

### **b. States**

There do not appear to be current state laws related to HBCD.

## **6. Planned Actions**

### **a. Federal**

#### Environmental Protection Agency

The EPA has indicated that it plans to consider the following actions related to HBCD in order to protect human health and the environment:

- Initiating rulemaking under TSCA 5(b)(4) to add HBCD to the list of chemicals that may present risk to human health or the environment. This is planned for the end of 2011.
- Initiating rulemaking under TSCA 5(a)(2) to develop a significant new use rule (SNUR) related to domestic manufacturing or processing of HBCD for use as a flame retardant on consumer textiles. The SNUR would also apply to importing textiles containing HBCD. This would require manufacturers to notify EPA before any use of this sort is initiated. EPA would have the opportunity to review the use and prohibit it.
- Initiating rulemaking under TSCA section 6(a) to regulate HBCD. This could allow prohibition of the manufacturing, processing, or distribution of the substance. EPA notes that the rule could be targeted as appropriate.
- Adding HBCD to the EPA Toxic Release Inventory, requiring manufacturers or importers to report releases to the environment.
- Conducting an alternatives assessment under the EPA's Design for the Environment and Green Chemistry program.

## **b. States**

### Washington

Year: 2010

HBCD (under CAS # 25637-99-4), has been placed on the Washington Chemicals of High Concern for Children list under the Children's Safe Products Act. Washington plans to implement reporting requirements for manufacturers related to this designation (Washington, 2010).

## **7. Conclusion**

HBCD is being named a Minnesota Priority Chemical because it is persistent, bioaccumulative, and toxic and it has been found in the home environment. It is likely that children are exposed to the chemical through house dust and breast milk. Further, in laboratory studies on mammals, this chemical has been found to affect the thyroid and show possible toxicity to the reproductive system. Concern about this chemical has prompted the U.S. EPA to create an action plan. An additional review has been proposed by the EPA IRIS program and inclusion in NHANES is being considered. Research related to this chemical continues, and MDH will monitor results.

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