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Hexabromocyclododecane (HBCD)
Answers to frequently asked questions

For our Environment

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Editorial note: The text has been translated from the German FAQ-version dated December 2016. Please consider that in spite of this translation some contents focus to more or less specific circumstances in Germany.

In May 2013 the chemical **h**exa**b**romo**c**yclo**d**odecane, or HBCD, was identified as persistent organic pollutant (POP) under the Stockholm Convention; "persistent" in this context means poorly degradable in the environment. The consequence of this is a worldwide ban on the sale and use of this substance, which is currently being implemented gradually by all countries involved. For a long time, HBCD was the economically most important flame retardant used in polystyrene insulation material. We have compiled information on why the chemical should no longer be used, what bans are already in effect in the European Union (EU), what transitional phases apply, how the authorisation requirement for HBCD under the REACH Regulation is implemented, what alternatives to HBCD exist and how insulation materials containing HBCD must be disposed of.

What is hexabromocyclododecane (HBCD)?

HBCD is a ring-shaped brominated hydrocarbon molecule. Its chemical formula, $C_{12}H_{18}Br_6$, describes three chemical compounds identical in chemical composition and structure but differing in the spatial arrangement of the bromine atoms. HBCD is solid at ambient temperatures and has a very low water solubility. One of its properties is especially important in technical terms: It delays the ignition of plastics and slows flame spread.

What is HBCD used for?

Because of its technical properties, HBCD is used predominantly as flame retardant for plastics. The substance can either completely prevent fires or at least delay the spreading of the flames. However, once a fire is fully developed, even articles treated with HBCD will burn.

HBCD is used mainly in polystyrene insulation material for buildings – both in expandable polystyrene (EPS) and extruded polystyrene (XPS). It may also be found in packaging plastics made of EPS, for example in EPS packaging for globally traded electrical and electronic equipment. To a lesser extent, the substance was also used in the back-coatings of curtains and upholstery fabrics or in plastic housings. According to information by the European Chemicals Agency ECHA, annual HBCD consumption in Europe was about 12,000 tonnes in 2006.

Is HBCD the same substance as HBCDD?

HBCD and HBCDD are often used synonymously. HBCDD as abbreviation for **H**exa**B**romo**C**yclo**D**o**D**ecane is somewhat less ambiguous than the abbreviation HBCD (with just one D), which could also stand for the names of other substances. The CAS (Chemical Abstracts Service Registry) number is often used to clearly identify substances; the CAS number for the common technical isomer mixture is 25637-99-4.

Is the use of HBCD now prohibited?

Yes, in nearly all applications. An exemption still applies to insulation materials made of expanded polystyrene (EPS). The ban on trade and use of HBCD goes back to the Stockholm Convention and is implemented in the European Union (EU) through Annex I to the POPs Regulation (Regulation (EC) No 850/2004 on persistent organic pollutants). Since 22 March 2016, products (substances, mixtures[1] and articles) containing HBCD in concentrations of more than 100 mg/kg may no longer be produced or placed on the market in the EU. By way of derogation, the sale and use in buildings of remaining stocks of insulation material was allowed until 22 June 2016. Furthermore EPS insulation material containing HBCD may be produced and used in buildings beyond that date in the EU if its producer has obtained an authorisation under REACH, the European chemicals regulation. The same applies to HBCD-containing EPS insulation materials imported from outside the EU.

The exemption for the placing on the market and use of HBCD-containing EPS insulation material will likely end on 21 February 2018 (6 months after the end of the period for review of the current authorisations). However, even now sufficient amounts of EPS insulation materials without HBCD are available so that the use of HBCD-containing products should be abandoned.

(Cf. How is the use of HBCD regulated under chemicals legislation?
How are the two regulatory fields (REACH Regulation, POPs Regulation) related?
How can I tell whether an insulation material contains HBCD?)

[1] The terms "preparations" and "mixtures" in chemical legislation are synonymous. Throughout this publications only the term "mixtures" is used.

What properties harmful for the environment and health does HBCD have?

HBCD has four critical properties when present in the **environment**. The substance is toxic, especially to aquatic organisms such as crustaceans and algae. It is also persistent because it is poorly biodegradable. It has been detected, for example, in over 10-year-old sediment layers. HBCD can be found in virtually all environmental samples, even in samples from rural or very remote areas, as well as in air, albeit its concentrations decrease with increasing distance from the pollution source. Furthermore, HBCD accumulates in living organisms, the technical term for this is 'bioaccumulative'. HBCD is already detectable today in fish, marine mammals and birds of prey living in Arctic regions. The fact that the substance spreads to such remote regions is proof of its "long-range transport potential" – the fourth negative property that makes HBCD so dangerous for the environment. Because of these properties, HBCD has been identified as a "substance of very high concern" (SVHC) based on the criteria set by the European REACH Regulation and as persistent organic pollutant under the international Stockholm Convention. The Risk profile on hexabromo-cyclodedecane for inclusion of HBCD in the scope of the Stockholm Convention summarises the substance's environmental properties.[2]

HBCD also has the potential to induce adverse **health** effects. Animal studies have shown it to disturb pre- and post-natal development, the observed effects relating to development of the nervous system and to behaviour. That is why the CLP Regulation requires HBCD to carry the hazard statements H361 "Suspected of damaging fertility or the unborn child" and H362 "May cause harm to breast-fed children" in the EU.

So far the substance has been found in humans only in insignificant trace levels, as shown by various studies from several countries in and outside Europe (see monograph on HBCDD, 2015, and erratum (2016))[3]. For Germany, a current publication (Fromme et al., 2016)[43] provides data on HBCD levels in the blood of 42 randomly selected adults 20 to 68 years of age. Alpha-HBCD was found in 3 samples and beta-HBCD was found in 4 samples only, with 15 ng/g of fat the maximum concentration. The levels measured are thus well below the HBM I value of 300 ng/g of fat (1600 ng/l of blood plasma) which the German Human Biomonitoring Commission (HBM Commission) has set for HBCD and which indicates the level below which no adverse effects on human health are expected. A new method for the analysis of HBCD in blood plasma has just been developed in Germany. A research project carried out by the German Environment Agency will soon deliver information on how HBCD levels in blood plasma of the German population have developed over time. This study uses archived human samples from the German Environmental Specimen Bank. In addition, data from human biomonitoring show that the chemical can occur in mother's milk. In various studies, concentrations ranging from 0.13 to 5.4 ng HBCD per gram of milk fat were detected. These concentrations are below those that would be considered to pose a health risk to breastfed babies under European HBCD risk assessment.

(Cf. What makes a persistent organic pollutant like HBCD so critical for humans and the environment in the long run?
Can the use of HBCD-containing products entail health or environmental risks?)

2 Further information on environmental concentrations of HBCD can be found in: Christoph Koch, Thomas Schmidt-Kötters, Roman Rupp, Bernd Sures (2015): Review of hexabromocyclo-dodecane (HBCD) with a focus on legislation and recent publications concerning toxicokinetics and -dynamics. Environmental Pollution, Vol. 199, pp. 26-34.

3 Stoffmonographie für 1,2,5,6,9, 10-Hexabromcyclododecan (HBCDD) – HBM-Werte für HBCDD im Fettanteil der Muttermilch oder des Blutplasmas. Stellungnahme der Kommission „Human-Biomonitoring" des Umweltbundesamtes. Bundesgesundheitsblatt 2015, Vol. 58, pp. 889–907

4 Hermann Fromme, Bettina Hilgera, Michael Albrecht, Wolfgang Gries, Gabriele Leng, Wolfgang Völkel (2016): Occurrence of chlorinated and brominated dioxins/furans, PCBs, and brominated flame retardants in blood of German adults. International Journal of Hygiene and Environmental Health, Vol. 219, pp. 380-388.

What makes a persistent organic pollutant like HBCD so critical for humans and the environment in the long run?

The reason that the substance is problematic is that it can spread globally, on the one hand, and readily accumulates in living organisms, on the other. Effects occur whenever effect thresholds are exceeded. In the case of persistent organic pollutants, it may take years before this happens, i.e. effects occur with a time lag. Also, HBCD's low water and good fat solubility impede laboratory testing for its environmental effects, making it difficult to forecast them precisely.

In the case of substances with similar properties, such as the insecticide DDT or polychlorinated biphenyls (PCBs), it took decades for adverse effects to manifest themselves. Therefore, it was only long after the use of these chemicals had ceased that the full extent of the damage and its causes were recognised. By that time large quantities of these persistent chemicals had already found their way into the environment and organisms. Even children born long after these substances were banned still exhibited high body burdens, which were the higher the longer the child was breast-fed and the older the exposed mother was at birth of her first child. These exposures were up to four times as high as those of non-breastfed children and persist into adulthood.

It is hardly possible to remove persistent and accumulative substances from the environment and removing existing environmental loads takes long time and enormous technical, organizational and financial resources. The bioaccumulation over extended periods of time also means that even after (theoretical) complete removal some time would elapse until all organisms are once again free of such substances. The intention behind putting a stop to the use of HBCD is to prevent such a development.

(Cf.What properties harmful for the environment and health does HBCD have?)

Can the use of HBCD-containing products entail health or environmental risks?

Given proper use, people living in houses fitted with HBCD-containing insulation panels are unlikely to suffer negative health effects. According to current knowledge, HBCD releases from the panels during the use phase and subsequent exposure of residents via indoor air or house dusts are very low.

Since HBCD is widely distributed in the environment today, it can enter the human body not only through the direct use of products but also via food. HBCD has been detected in high-fat foods in particular, this contamination resulting from accumulation processes across the food chain (another, less likely source is food processing). Overall, the quantities ingested via food are considered small.

As long as the concentrations of HBCD in human blood are below the HBM I value of 300 ng/g fat (1600 ng/l blood plasma), no adverse health effects are expected. The HBM I value is a toxicology-based value set by the German Human Biomonitoring Commission for tolerable concentrations of substances in blood. In the studies conducted to date, measured concentrations in blood were well below this value.

Acute environmental effects in the immediate vicinity of buildings fitted with HBCD-containing insulation panels are also unlikely, because the concentrations of the poorly water-soluble HBCD leaching even from unprotected exterior insulation through rainwater are very low.

(Cf. What properties harmful for the environment and health does HBCD have?
What makes a persistent organic pollutant like HBCD so problematic for humans and the environment in the long run?)

How is the use of HBCD regulated under chemicals legislation?

HBCD is subject to the relevant provisions of the European Union's chemicals law. The central regulations are:

➔ The CLP Regulation

- Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP Regulation) sets out how the effects of chemicals are to be tested, classified and labelled in the EU.
- It provides that HBCD must be labelled throughout the EU with the health-related hazard statements H361 "Suspected of damaging fertility or the unborn child" and H362 "May cause harm to breast-fed children".
- HBCD has no legally binding harmonised classification with regard to hazard statement H410 "Very toxic to aquatic life with long lasting effects". However, as early as 2004 the competent technical committee adopted the corresponding classification under the previous Dangerous Substances Directive (N; R50/53). This classification and the EU risk assessment must be taken into account in the classification and labelling of HBCD.
- Classification and labelling information on substances can be looked up in the Classification and Labelling Inventory run by the European Chemicals Agency (ECHA).

➔ The REACH Regulation

- Regulation (EC) No 1907/2006 concerning the registration, evaluation, authorisation and restriction of chemicals (REACH Regulation) lays down requirements *inter alia* for the registration and authorisation of substances on the European market and for communication within the supply chain (in particular, by means of safety data sheets), and establishes restrictions on substances.
- Being persistent, bioaccumulative and toxic (PBT), HBCD has been identified as a "substance of very high concern" (SVHC). As such a PBT substance it was included in the Candidate List of Substances of Very High Concern for Authorisation under the REACH Regulation in October 2008.
- Inclusion in this candidate list entails certain communication duties if an article contains HBCD (obligation of producers and importers to notify ECHA under REACH Art. 7(2) and of producers, importers or suppliers to communicate information to downstream professional users and consumers under REACH Art. 33). In the professional sector, this information must be supplied together with the article and consumers must receive it not later than 45 days after sending a corresponding request for information (in German).
- Furthermore, HBCD is included in the "List of Substances Subject to Authorisation" in Annex XIV to the REACH Regulation. This means that the use of the substance in the EU has been subject to authorisation since 21 August 2015. The term "use" means the direct handling of the substance, or a mixture containing the substance, e.g. for the production of flame-retardant articles, i.e. the authorisation requirement refers to the production processes in which HBCD are used. Applications for authorisation had to be submitted to the European Chemicals Agency (ECHA) by 21 February 2014 at the latest; failing that, uses could not be continued after 21 August 2015. Authorisations granted under REACH are reviewed at the latest after a date specified in the authorisation. For PBT substances, an authorisation is granted only if no feasible alternatives are available and socio-economic reasons so warrant.
- By 21 February 2014, ECHA had received a total of two applications for authorisation of the temporary use of HBCD, which were filed by the same consortium consisting of thirteen firms. One is for the manufacture of flame-retarded unexpanded pellets to produce expanded polystyrene (EPS)) (Use 1 – application for authorisation) and the other is for the manufacture of articles from the pellets and onward use of these articles in building applications (Use 2 – application for authorisation). ECHA's scientific committees – the Committee for Risk Assessment (RAC)

and the Committee for Socio-economic Analysis (SEAC) – gave their opinions on these applications for authorisation, and on 9 January 2015 ECHA sent the adopted opinions to the European Commission (COM), the Member State competent authorities and the applicants. The opinions are published on ECHA's website:

1) Use for production of flame-retarded unexpanded EPS pellets
2) Use for production of flame-retarded EPS articles for building applications

The opinions recommend authorising the uses for a period of two years. Based on these opinions, the European Commission issued an implementing decision through which the applicant consortium was granted authorisation to use HBCD in the EU for the production of flame-retarded EPS for building applications until 21 August 2017, subject to the condition that the applicants report on the progress made towards substitution. The decision was published in the Official Journal of the European Union in January 2016.

- The authorisation requirement under REACH refers to the manufacture and use of HBCD, and not to HBCD in finished articles. This means that articles already produced (stockpiles) or articles imported into the EU can still be placed on the market legally after the 21 August 2015 sunset date under REACH. However, in the case of HBCD the provisions of the POPs Regulation mean that articles containing HBCD may be manufactured, used and placed on the market either not at all or only subject to certain conditions (see Table 1).

➔ The POPs Regulation

- Regulation (EC) No 850/2004 on persistent organic pollutants (POPs Regulation) transposes the decisions taken under the international Stockholm Convention – also known as POPs Convention – into European Union law.
- The production, placing on the market and use of substances listed in **Annex I** to the POPs Regulation are prohibited. Exemptions apply to the uses specified in that Annex and the exemptions stated in Article 4 of the POPs Regulation. The provisions on HBCD in Annex I to the POPs Regulation were defined by Regulation (EU) 2016/293 of 1 March 2016, which provides for a stepwise ban starting from 22 March 2016 on the use and placing on the market of HBCD on its own, in mixtures or articles when occurring in concentrations above 100 mg/kg. The exact deadlines are indicated in Table 1.
- **Annex IV** to the POPs Regulation, in turn, indicates the concentration limits above which POPs in waste must be destroyed and a material may no longer be directly recycled.
  The provisions on HBCD in Annex IV to the POPs Regulation were defined by Regulation (EU) 2016/460 of 30 March 2016. This regulation sets a concentration limit of 1000 mg/kg, above which materials containing HBCD are excluded from recycling starting 30 September 2016 (destruction requirement in Art. 7(2) of the POPs Regulation). The aim of this provision is to remove POPs from the economic cycle.

*(Cf. How are the two regulatory fields (REACH Regulation, POPs Regulation) related?
What has been agreed for HBCD under the Stockholm Convention?
How are insulation materials containing HBCD disposed of and can they be recycled?)*

Table 1

Provisions on and deadlines for HBCD on its own and in preparations (mixtures), articles and waste

Affected use / group of products	Provision	Exemptions	Remarks
Production of HBCD (on its own or as constituent of a preparation*)	Prohibited since 22 March 2016 under POPs Regulation, Annex I	Production for uses for which an authorisation[A] has been granted under REACH Regulation.	
Placing on the market[B] / use of HBCD on its own or in a preparation (this includes production processes of HBCD-containing insulation materials)	Prohibited since 22 March 2016 under POPs Regulation, Annex I [concentration limit in substance / preparation for unintentional trace contaminations 100 mg/kg = 0.01% by weight].	Uses covered by an authorisation[A] under REACH Regulation (until 21 August 2017 at the latest), and use for scientific research and as analytical standard.	
Placing on the market of expanded polystyrene articles with HBCD for use in buildings (EPS insulation materials)	Prohibited since 23 March 2016 under POPs Regulation, Annex I [concentration limit in article for unintentional trace contaminations 100 mg/kg = 0.01% by weight].	1. Articles already in use before 23 March 2016 may continue to be used and placed on the market. 2. Articles produced before 23 March 2016 may be placed on the market and used until 22 June 2016. 3. When produced within the scope of an authorisation granted under the REACH Regulation (until 21 February 2018 at the latest[C]). 4. Imported articles (until 21 February 2018 at the latest[C]). 5. Articles produced or imported under points 3. and 4. and already in use before 22 February 2018[C] may continue to be used.	In the case of 2., 3. and 4., the material must be identifiable as containing HBCD by labelling or other means throughout its lifecycle.
Placing on the market of extruded polystyrene articles with HBCD for use in buildings (XPS insulation materials)	Prohibited since 23 March 2016 under POPs Regulation, Annex I [concentration limit in article for unintentional trace contaminations 100 mg/kg = 0.01% by weight].	1. Articles already in use before 23 March 2016 may continue to be used and placed on the market. 2. Articles produced before 23 March 2016 may be placed on the market and used until 22 June 2016.	

Affected use / group of products	Provision	Exemptions	Remarks
Placing on the market of other articles containing HBCD (e.g. expanded polystyrene packaging, textiles with HBCD-containing back coatings, plastic housings)	Prohibited since 22 March 2016 under POPs Regulation, Annex I [concentration limit in article for unintentional trace contaminations 100 mg/kg = 0.01% by weight].	Articles already in use before 23 March 2016 may continue to be used and placed on the market.	
Insulation materials already in use in buildings			These continue to be allowed. When disposing of them, the provisions of waste legislation must be complied with.
Environmentally sound management of HBCD-containing waste (destruction obligation)	Applies from 30 September 2016 under POPs Regulation, Annex IV [concentration limit 1000 mg/kg = 0.1%]. Art. 7 (2), POPs Reg.: Waste containing HBCD must be "disposed of or recovered […] in such a way as to ensure that the persistent organic pollutant content is destroyed or irreversibly transformed…"	Art. 7, (4) a): Waste containing or contaminated by HBCD may be otherwise disposed of or recovered in accordance with the relevant Community legislation, provided that the content of HBCD in the waste is below the concentration limit to be specified in Annex IV.	
Waste classification of HBCD-containing insulation materials	Since 1 August 2017, the provisions of the POPs-waste-surveillance regulation apply. Thus, waste insulation material containing HBCS may not be mixed with other waste and its disposal must be documented .		Applies to insulation materials with the waste code number "17 06 04 insulation material with the exception of such waste that falls under the waste code numbers 17 06 and 17 06 03.

* The term "preparation" corresponds to the term "mixture" in the REACH and CLP Regulations.

A Authorisations were issued for Use 1): Formulation of flame retarded expanded polystyrene (EPS) to solid unexpanded pellets using hexabromocyclododecane as the flame retardant additive (for onward use in building applications) and for Use 2: Manufacture of flame retarded expanded polystyrene (EPS) articles for use in building applications. The authorisations apply only to the companies stated therein and their supply chains. They are valid until 21 August 2017 at the latest and are not applicable after that date.

B Placing on the market also includes import into the EU.

C Should the authorisation under the REACH Regulation be withdrawn, a shorter time limit may apply.

What has been agreed for HBCD under the Stockholm Convention?

- The Stockholm Convention is a global agreement to eliminate or restrict the use of persistent organic pollutants, or POPs. To date, 23 substances or groups of substances are covered by the Convention.
- In addition to being persistent, bioaccumulative and toxic (PBT), a substance listed as POP in the Stockholm Convention has a particular potential for long-range transport (LRT). Under the Convention, all of these critical properties, other environmental and health risks, and socioeconomic aspects must be adequately considered and demonstrated in a multi-annual assessment process on the basis of sound information and data. The text of the Convention and further information on the various processes and regulations are available on the Stockholm Convention's website.
- The POPs Review Committee (POP RC) – the Stockholm Convention's assessment body – had confirmed HBCD to be a POP as defined by the criteria set out in Annexes D-F to the Convention. After this, the Conference of the Parties (COP) to the Stockholm Convention decided at its sixth meeting (COP6) in May 2013 to include the substance in Annex A (substances for elimination) to the Convention. This results in a worldwide ban on the use of and trade in HBCD. Furthermore, for such substances the Convention requires extensive measures to eliminate existing stockpiles as well as waste treatment measures ensuring the destruction or irreversible transformation of POPs contained in waste. Following the adoption of decisions by the Conference of the Parties and the translation of all texts into the UN languages, the Stockholm Convention Secretariat deposits the amendments to the annexes with the United Nations depositary, whereby they are officially published. For the decisions taken by COP6 this was the case in November 2013. They had to be implemented by the Contracting Parties within a year, i.e. by 26 November 2014. For HBCD the European Commission registered a temporary opt-out from the Convention rules with the United Nations to allow the European Union to retain the longer deadline (21 August 2015) set previously under REACH until which the use of HBCD was permitted without authorisation.
- The decision on HBCD under the Stockholm Convention allows a five-year exemption for the use of HBCD as flame retardant in insulation boards for building applications. The reason behind this is that manufacturers of flame-retarded polystyrene insulation material were to be given sufficient time to change their production processes so as to be able to supply sufficient amounts of insulation material not containing any HBCD. To apply an exemption, Contracting Parties have to register for it with the Stockholm Convention Secretariat (Article 4 of the Convention). Almost all countries worldwide are Parties to the Stockholm Convention; European Parties include the individual EU member states (including Germany) and the EU itself, which is represented by the European Commission. The EU has registered for the exemption for HBCD in EPS insulation materials which expires on 26 November 2019 at the latest.
- The COP6 decision further provides that polystyrene containing HBCD must be easily identifiable by labelling or other means throughout its life cycle. Recycling was ruled out for articles containing HBCD.
- Decisions adopted under the Stockholm Convention must be transposed into EU law. This is done by Regulation (EC) No 850/2004 on persistent organic pollutants (POPs Regulation). The decisions concerning concentration limits for HBCD-containing articles and waste were implemented through this regulation in March 2016.

How are the two regulatory fields (REACH Regulation, POPs Regulation) related)?

The POPs Regulation ((EC) No 850/2004) and the REACH Regulation ((EC) No 1907/2006) are independent pieces of legislation which must be complied with in the EU in parallel, the rule being that whichever provision is stricter shall apply. Consequently, the POPs Regulation's provisions regulating placing on the market, waste treatment and labelling must be complied with, as must the authorisation and communication obligations under the REACH Regulation. In addition, in Germany the provisions of German waste legislation concerning the classification of HBCD-containing waste insulation material apply.

(Cf. How is the use of HBCD regulated under chemicals legislation?
How are HBCD-containing wastes classified under waste legislation?)

Do I need to apply for authorisation under REACH to use insulation boards containing HBCD for building applications?

The REACH authorisation requirement refers to the production and use of the substance as such and as mixture with other substances. To use a mixture containing HBCD, for instance for production of an insulation board, an authorisation for use of the substance is required (own authorisation or authorisation obtained by a supplier for this use). No authorisation is required for the use of an article containing HBCD, such as insulation boards. The customer/craft company may use the article for building applications without authorisation. The placing on the market of HBCD-containing insulation materials will, however, be banned completely in the coming years.

(Cf. Is the use of HBCD now prohibited?
How is the use of HBCD regulated under chemicals legislation?)

How are insulation materials containing HBCD classified under waste legislation?

Art. 7 (2) of the POPs Regulation ((EC) No 850/2004) provides that waste containing persistent organic pollutants (POPs) must be disposed of or recovered in such a way as to ensure “that the persistent organic pollutant content is destroyed or irreversibly transformed”. Waste is considered “POP-containing” if the POP-concentration in the waste is equal to or above a specific limit value, which is listed in Annex IV to the POPs Regulation. For HBCD, a limit value of 1000 mg/kg has been set . The limit value is intended to exclude HBCD from circular economy.

Furthermore, since 1 August 2017, waste containing POPs that is not considered hazardous waste, such as HBCD-containing insulation material, is subject to the “regulation on separate collection and surveillance of non-hazardous wastes containing persistent organic pollutants” (Verordnung über die Getrenntsammlung und Überwachung von nicht gefährlichen Abfällen mit persistenten organischen Schadstoffen (POP-Abfall-Überwachungsverordnung - POP-Abfall-ÜberwV)
The regulation mainly concerns polystyrene insulation material fitted with HBCD as flame retardant. The HBCD content in expanded polystyrene (EPS) is commonly 0.7% and that in extruded polystyrene (XPS) about 1.5%. Since the threshold for classification as hazardous waste is 3%, this waste is considered non-hazardous according to the POP-Abfall-ÜberwV. Mixing with other wastes is prohibited, proof of proper management must be provided and treatment in municipal waste incineration plants is permissible.
HBCD-containing insulation waste in Germany must be assigned to the waste code “17 06 04 insulation materialswith the exception of such material that falls under waste code 17 06 01 and 17 06 03”.
The provisions of the POP-Abfall-ÜberwV also apply to other types of waste that may contain POPs and are not classified as hazardous, such as construction components (16 01 22, 16 02 16), used appliances (16 02 14), plastic wastes (17 02 03), shredder light weight fraction (19 10 04) or used electric or electronic equipment (20 01 36).
However, the POP Regulation’s requirement that the POP content in waste must be destroyed or irreversibly transformed also applies to these wastes. Incineration of the waste is the suitable method to achieve this. Methods to selectively separate HBCD from polystyrene waste are being tested.

(Cf. How are insulation materials containing HBCD disposed of and can they be recycled?
Can the use of HBCD-containing products entail health or environmental risks?)

How are insulation materials containing HBCD disposed of and can they be recycled?

When containing HBCD, polystyrene insulation material must be collected separately from other waste during demolition and renovation operations. The POPs Regulation ((EC) No 850/2004) requires, in Art. 7 (2), that waste containing POPs must be disposed of or recovered in such a way as to ensure that “the persistent organic pollutant content is destroyed or irreversibly transformed”.
In the management of wastes containing HBCD, the required destruction is achieved through thermal treatment (incineration).
The heat generated during incineration of HBCD-containing insulation material is utilised (energy recovery from insulation material). During incineration HBCD is completely destroyed and its bromine content is captured in flue gas treatment as salt. The salt-containing residues from flue gas treatment are normally used to backfill underground cavities from rock salt mining. This means that given compliance with the provisions of occupational safety and health legislation, no health risks occur during the various stages (demolition, transport and thermal treatment) of the disposal of HBCD-containing insulation boards.

In the future, mechanical recycling of HBCD-containing insulation material will be allowable only if its HBCD content is below the limit value of 100 mg/kg listed in Annex I to the POPs Regulation, which has been applicable since 22 March 2016 for materials and articles newly placed on the market. The same applies to HBCD-containing packaging, housing plastics and textiles.
Expanded polystyrene (EPS) that does not contain any HBCD and arises as scrap in building and renovation activities, e.g. in the installation of external thermal insulation composite systems, can however be recycled mechanically. Following collection, in bulk or in pressed form, size reduction and extrusion, the scrap can be used to produce polystyrene “re-granulate”.
One reason that EPS from the demolition of buildings has to be incinerated to date is that building-typical adhesions make mechanical recycling impossible. Methods to selectively extract pollutants and HBCD from polystyrene material are currently being tested (e.g. the CreaSolv® process).

A screening test based on x-ray fluorescence analysis is available, which allows differentiation between HBCD-free and HBCD-containing PS foam waste.

(Cf. How are HBCD-containing wastes classified under waste legislation? How can I tell whether insulation material contains HBCD?)

What alternatives to HBCD-containing insulation materials exist?

In Germany, buildings account for over 60 percent of total energy consumption and correspondingly large is the savings potential in this sector. The German Energy Saving Ordinance (EnEV) therefore requires new buildings to be fitted with effective thermal insulation to reduce their energy demand. Heating costs and greenhouse gas emissions can also be significantly reduced in existing buildings by using external thermal insulation composite systems.

The German Environment Agency emphasizes that a wide selection of **alternative insulation materials** is available. These include mineral materials such as mineral wool, mineral foam, foam glass or expanded clay. Good thermal insulation is also provided by thermal insulation materials made from renewable raw materials such as insulating fibreboards or wood chip-, cellulose- or hemp-based materials. Mineral wool, for example, is suitable for many applications in building construction and modernization, excepting the thermal insulation of building parts that have contact with the soil (perimeter insulation). In Germany, a ban on certain mineral wool fibres which may cause health problems guarantees that the mineral wool used is not harmful to health. Since 2000, fibers with long term adverse health effects may no longer be produced, used or placed on the German market for thermal and sound insulation purposes in building construction including technical insulation(Chemical Prohibitions Ordinance - Chemikalien-Verbotsverordnung – ChemVerbV).

Producers of polystyrene insulation materials have already to a large extend replaced HBCD with **other flame retardants**. In the case of expanded polystyrene (EPS), the replacement predominantly used is a brominated polymer which is added to the polystyrene at a rate of about 1%. According to current knowledge, this replacement substance does not have the problematic environmental properties that HBCD has, because due to their size its plastic-like molecules are not bioavailable and are incorporated more firmly into the plastic matrix. In addition, low-molecular-weight brominated substitutes, mostly based on tetrabromobisphenol A (TBBPA), are used to a small extent. The German Environment Agency advises against the use of these last-mentioned substitutes. The United States Environmental Protection Agency has published an extensive comparative assessment of HBCD and flame retardant alternatives. According to the Rigid Foam Industry Association (Industrieverband Hartschaum, IVH), all its member companies had fully switched over to the polymeric flame retardant by the end of 2014 and are supplying more than 80% of the German market with these EPS insulation materials. The Association also offers certification with the BFA QS EPS label for EPS insulation materials using this flame retardant.

The German Environment Agency recommends, on precautionary grounds, that suitable halogen-free flame retardants should be developed for EPS and XPS insulation materials as well as for all other flammable insulation materials.

Helpful guidance is also provided by the Blue Angel. When planning and carrying out construction and restoration work, Germany's **Blue Angel eco-label** offers a convenient way to find alternatives to thermal insulation materials and composite systems containing hazardous substances. Such products can be found on the Blue Angel website under the following product groups:

- Low-emission thermal insulation material and suspended ceilings (RAL UZ 132)
- External thermal insulation composite systems (RAL UZ 140)

(Cf. How can I tell whether an insulation material contains HBCD?)

How can I tell whether an insulation material contains HBCD?

HBCD was identified as a substance of very high concern under the EU's REACH Regulation in 2008. Since that time, producers and also suppliers have been required to provide you with information on the use of the substance in all articles. The German Environment Agency offers an online form (in German) which you can use to ask the producer, supplier or importer whether HBCD was used as flame retardant. Also, since 2011 this information must be provided to final consumers under the Construction Products Regulation as part of the declaration of performance for products with CE marking.

In addition, Annex I to the POPs Regulation ((EC) No 850/2004) now provides that HBCD in expanded polystyrene (EPS) insulation materials yet to be placed on the market until the final ban becomes effective in two to three years "must be identifiable by labelling or other means throughout its life cycle". The POPs Regulation also imposes a general ban on the placing on the market of new HBCD-containing extruded polystyrene (XPS) from 22 June 2016.

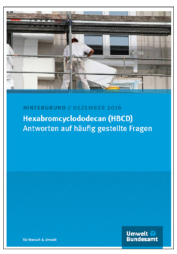
A farther-reaching option is to clearly and durably mark polystyrene insulation materials not containing any HBCD or, better yet, to use labelling informing about alternative flame retardants used. The Rigid Foam Industry Association (Industrieverband Hartschaum, IVU) is taking this approach by only certifying insulation materials that are equipped with the new polymeric, brominated flame-retardant additive (Polymeric FR) through the association's own, regularly audited BFA QS EPS (German website) quality label. Since the information about the quality label usually figures on the packaging or the technical fact sheets on insulation materials, some manufacturers have additionally started to add clearly visible, coloured plastic beads to insulation boards equipped with the polymeric flame retardant. Insulation materials bearing the Blue Angel eco-label also do not contain any HBCD.

When polystyrene insulation material has already been installed in a building and the information at issue is needed for waste management, only chemical analysis can provide it. A screening test using x-ray fluorescence analysis is now available, which can be carried out on site by trained personnel. It allows differentiation with regard to whether the material contains bromine at all and whether the flame retardant is a low-molecular-weight, extractable molecule (like HBCD) or a non-extractable, brominated polymeric compound. Further analytical methods providing more detailed information are available.

(Cf. What alternatives to HBCD-containing insulation materials exist?
How is the use of HBCD regulated under chemicals legislation?)

What alternatives exist to HBCD-containing textiles?

There are various possible ways to reduce the flammability of textiles. HBCD is easily replaceable in this sector. Firstly the structure and density of a fabric has a decisive influence on its flammability, so that the latter can be reduced by a denser weave. Flame retardant alternatives include, for example, the permanent finishing of cellulose fibres with reactive flame retardants based on phosphorus, or inherently flame-retarded polyester fibres by means of chemically bound, phosphorus-containing flame retardant molecules. Fabrics made from poorly flammable fibre material such as polyaramides or from non-flammable glass fibres have also proved their suitability. Another possibility are so-called intumescence systems which swell up in the event of a fire to form poorly flammable barrier layers.
In Germany, furnishing textiles must only meet fire-safety requirements when used in certain public buildings. In other countries, the UK for example, rules on the flammability of furnishings also apply to private households, so that flame-retarded textiles are used to a greater extent in these countries.



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