

Inclusion of the CreaSolv® technology in the two UNEP Basel technical guidelines:

- **“General Technical Guidelines on the Environmentally Sound Management of POP containing waste” and**
- **“Technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with hexabromocyclododecane” (HBCDD)**

The Basel Technical Guidelines

The *“General Technical Guidelines on the Environmentally Sound Management of POP containing waste”* and - *“Technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with hexabromocyclododecane”* provide guidance for the environmentally sound management of wastes consisting of, containing or contaminated with POPs in general and the flame retardant HBCDD specifically. Inter alia, the documents list commercially available technologies which ensure the destruction and irreversible transformation of the POP containing wastes. These Guidelines were developed by the Basel Small Intersessional Working Group on POPs Waste (SIWG) and adopted by the Conference of the Parties to the Basel Convention in May 2015.

The CreaSolv® process¹ technology

The CreaSolv® process recovers ExpandedPolyStyrene (EPS) and eXtruder PolyStyrene (XPS) from PS foam waste containing HBCDD, mainly from demolition. Due to the molecular-level nature of this solvent-based recycling process, it is possible to recycle the same sample of polystyrene multiple times, without causing significant deterioration in purity or quality. The CreaSolv® process” is an innovative technology, which has the potential to recover base polymers and separate the non-desirable additives/waste material, i.e. the HBCDD POP content. It makes use of a CreaSolv® solvent, a proprietary liquid formulation that is neither classified as VOC nor as a hazardous compound. In a first step the polystyrene is dissolved and the PS solution is cleaned from insoluble waste components (dirt, cement, glue, metals, foreign polymers etc.) in a mechanical solid-liquid separator. Insoluble waste components are dried to recover the solvent for further reuse within the process. The insoluble material is treated as “POP free” demolition waste. The HBCDD cannot be removed directly from PS mechanically. In a second step an additional extractive purification unit separates dissolved HBCDD from the PS gel. Also in this step the solvents are recovered from the HBCDD solution in a solvent recovery unit and re-used in the process. Solvents incorporated in the remaining clean PS gel are removed in polymer drying unit, finally resulting in granules of recycled PS. For closing the loop these can be used for production of EPS, GeneralPurpose PS or XPS. The remaining HBCDD concentration is below 100 ppm in the recovered polystyrene. The HBCDD containing sludge from the purification unit is further processed in a bromine recovery unit (BRU). The HBCD is 99,999% destructed at > 1100° C, converted into HBr and further into bromine for use of a new sustainable polymer brominated flame retardant in the same application and by that closing the bromine loop.

More information about the CreaSolv® process technology is available [here](#).

¹ CreaSolv® is a registered trademark of the CreaCycle GmbH, Grevenbroich (Germany).

(Additional link to be included to Fraunhofer on line publication of scientific article, available 2nd week of May 2016, according to M. Schlummer, unpublished version will be sent 1st week of May 2016)

Inclusion of the CreaSolv[®] process [technology in the General Technical Guidelines and the HBCDD guidelines.](#)

A technology to be included in these guidelines has to fulfil two main criteria: commercial availability and proof of ability to destroy one POP.

In May 2015 it was approved that **the technology is mentioned as an emerging technology in a footnote to paragraph 144 under section IV.D.2 of the General Technical Guidelines.**

As the technology has demonstrated its ability to destroy at least one POP and commercial availability is proven by the concrete commercial offer made by EPC Engineering Consulting in close co-operation with Fraunhofer IVV and Creacycle GmbH to the foundation. For preparing the demonstration plant it is necessary to include the technique in the main text of the guideline and the specific guideline on HBCDD. This will confirm that the technique is accepted as an environmentally sound method to handle HBCDD containing EPS and XPS foam waste.

Characterisation of the CreaSolv[®] technology

The CreaSolv[®] process involves a chain of steps. The first one is the dissolution of the polymer followed by the extraction of the additives/wastes. This initial step should be characterised as D9 (Physicochemical treatment), as provided in Annex IV A of the Basel Convention².

After this first step, there are two material streams: the bromine containing stream and the polystyrene stream. Each stream undergoes a second treatment. The bromine containing stream is incinerated, leading to destruction of HBCDD followed by recovery of bromine. These steps should be classified as D10 (Incineration on land) followed by R5 (Reclamation of other inorganic materials). The polystyrene stream is recycled in the production of new EPS. This step would classify as R3 (Recycling of organic substances not used as solvents).

This chain demonstrates the evolution of waste management technology over the decades. When this list of disposal operations was initially drafted, waste management was nine out of ten times a single step technology. Later more advanced technologies came in and the question was raised about how to characterize them. The Dutch High Court of State has ruled that the first treatment step is decisive to define an operation as either for disposal or for recycling. In the case of the CreaSolv[®] technology the first step is a disposal operation D9 (Physicochemical treatment). Following the line of the Dutch High Court of State CreaSolv[®] process would be classified as a disposal operation and should therefore be acceptable as a technology to treat HBCDD containing EPS wastes.

Conclusion

² Basel Convention, Annex IV Disposal Operations <http://www.basel.int/Portals/4/Basel%20Convention/docs/text/BaselConventionText-e.pdf>

The inclusion of the CreaSolv® technology in the main body text of the General Technical Guidelines and the HBCDD guidelines would give a positive signal and is a necessary step for the uptake of this technology by industry.