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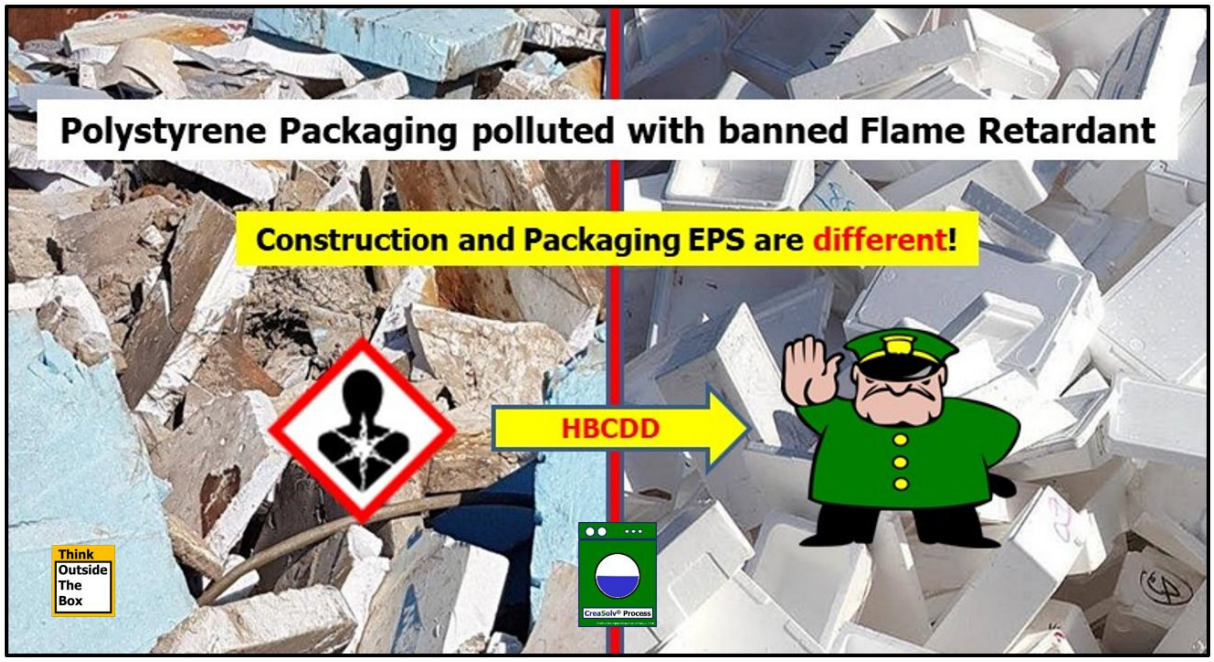
Packaging Polystyrene
90% polluted with Flame Retardant HBCDD



A recent study[1)] reveals that the flame retardant hexabromocyclododecane (HBCDD) was present in 90% of 20 Irish and 50 UK polystyrene packaging samples examined. HBCDD is considered as a POP (persistent organic pollutant) and its production and placing on the market is banned since March 2016. Flame retardants are used in expanded polystyrene (EPS) building insulation materials but not for packaging! The present EU concentration limit for HBCDD in articles is 0.01%.

63 (90%) of 70 samples contained HBCDD and 6 exceeded the limit value.
This finding should be alarming in many aspects because it may point to:

- poor or inefficient sorting capabilities and EPS packaging waste being mixed up with EPS insulation waste from demolition containing the flame retardant HBCDD (if we exclude that this was done intentionally)
- no or poor incoming control for flame retardants in EPS waste collection
- state-of-the-art recycling technologies like re-granulation cannot separate imbedded impurities or dangerous additives like HBCDD and complete combustion is mandatory in appropriate incinerators (this may be costly).
- no or poor quality control for recycled polystyrene (obligation for recyclers under REACH) in general and for packaging end-uses especially
- no or poor control of authorities that regulations are followed

Another recent Danish study concluded that we have only recycling technologies for less than 40% of our household plastic waste and our sorting capabilities are not good enough for an efficient circular economy[2)], this study demonstrates the performance/quality of recycling activities, except we would believe that it is unique for UK and Ireland.
The suspicion that Germany's recycling quota are much lower than reported makes this assumption difficult.

UK and Ireland are definitely not alone with the issue of EPS waste polluted with flame retardants.
In 2017 Canada's largest city Toronto conducted a pilot project to find a consistent outlet for compacted EPS waste[3]. "After distribution of compressed EPS to potential re-processors for evaluation, no viable market could be established for either the compressed EPS, or standard baled material, with the existing quality".
Plastics processors detected fire retardants in the samples, which are used in insulating foams and the report described their presence as problematic.
The consultant also contacted 3 other Canadian companies: GreenMantra Technologies and Pyrowave, which use chemical recycling technologies to break down plastics, and Polystyvert, which uses essential oils to dissolve EPS before later separating it for recycling.
"According to the city's report[4] (see also page 13), issues related to the presence of fire retardants, contamination, freight costs and inexperience processing MRF (material recovery facility)-generated material dimmed hopes that those outlets would regularly take the city's EPS."[3]

Looking at the present plastic waste exports from industrialized countries shifting away from China (banning imports for quality reasons) to other Asian countries one may be interested in finding out more about the quality of the polystyrene shipped. According to the Basel Convention[5] hazardous waste is not allowed to cross borders. But how good is the control at borders when even recyclers have problems with imbedded dangerous substances?

Conclusion and Path Forward

Obviously, we have a sorting and recycling problem with plastic waste streams, which contain dangerous impurities and additives because state-of-the-art recycling techniques like re-granulation fail to separate those. To cope with it we need better sorting technologies, exact identification of plastic waste streams, more sophisticated recycling processes and complying with existing regulations (e.g. REACH) in regard to the content of recycled polymers, if we really want to change to a Circular Economy.
Failing only on one is enough to struggle.

In the case of expanded polystyrene waste there exists a test for rapid identification of HBCDD[6] that can be carried out also with handheld instruments[7] in order to avoid pollution and mix-up of waste streams.
The solvent-based CreaSolv® Process is able to separate HBCDD and recycle polystyrene.
The PolyStyreneLoop Cooperative will build a demo plant in Terneuzen, The Nethaerlands.

CreaSolv® is a registered trademark of CreaCycle GmbH

In order to protect resources and our environment, high-quality recycling technologies for plastic waste are required, which allow the reuse of polymers without breaking up the polymer chains.
CreaCycle GmbH and the Fraunhofer Institute for Process Engineering and Packaging (IVV) in Freising, Germany combined their competencies in a cooperation aimed at "Plastic/Raw-Material Recycling with a Solvent-based Purification Technology" (selective extraction) and developed the CreaSolv® Process that is based on physical changes and leaves the polymer composition intact.
Proprietary CreaSolv® Formulations from CreaCycle with the lowest risk potential possible for user and environment dissolve selectively a target polymer. This reduces besides the hazard also the cost for the equipment. After the separation of imbedded impurities or undesired polymers the recycled polymer can be reused in its original application.

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