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BSEF Position Paper
Grouping of Brominated Flame Retardants

Key messages:

- Brominated Flame Retardants are essential to protect lives and property, by inhibiting ignition of combustible materials, and by slowing the rate at which a fire propagates increasing escape time and time for emergency services to act.

- A wide variety of Brominated Flame Retardants are needed to satisfy the diversity of engineered materials used today, thereby protecting people, property and important societal innovation aimed at reducing carbon footprint in housing and transportation.

- Individual Brominated Flame Retardants are designed to work in a polymer system. They are widely different in structure and functionality. They are not one single group of similar chemicals. Substituting one brominated flame retardant with another or with a non-halogen flame retardant is not readily possible in all circumstances.

- REACH dossiers can be used to assess chemical similarities however more robust analysis should include detailed information on the working mechanism, uses and end use applications of chemicals under review.

- When identifying the essential use of a chemical or its alternatives, technical performance, durability of the final article, matrix compatibility, decomposition products are also important flame retardant characteristics for sound regulatory decision making.

BSEF, the International Bromine Council, hereby shares its views on a possible grouping of brominated flame retardants (BFRs) as announced in the recently adopted REACH Restriction Roadmap by the European Commission on 25 April[1].

"Flame Retardants" make up over a hundred chemical substances that protect lives, products, and property

Flame retardants are important chemistries with many essential uses and their value as a layer of public safety is often understated. The term "flame retardant" refers to a function and not to a specific family of chemicals. The market needs a wide variety of flame retardants to work with the wide variety combustible plastics and other materials used in consumer and industrial goods.

Flame retardants are a varied group of substances with the primary purpose of inhibiting ignition in combustible materials as well as slowing the speed of propagation of a fire. On a basic level, flame

[1] https://ec.europa.eu/docsroom/documents/49734

retardants are often discussed by functionality - gas phase reactivity, char forming behavior and/or water releasing substances.

- Gas phase chemistry is mainly based on halogenated compounds. Halogenated flame retardants are the most efficient in this area and the only possible choice in many materials, and bromine is the best performing halogen type.

- Charing flame retardants create a material barrier (the char) at the surface of the material when combustion starts. Phosphorous based compounds are generally utilized as char forming flame retardants.

- Water releasing compounds are typically hydrated metallic salts of aluminum or magnesium that break down in high heat situations to release water. These compounds require high loadings to be effective that dilute preferred material properties thus limiting their utility to a few key applications.

It is important to note that halogens are not directly substitutable by non-hal chemistries, the mechanism matters. It is also noteworthy that certain materials can demand multifunctional behavior to meet fire safe designs. Halogens can be used with phosphorous based and other compounds in a complementary or synergistic manner to provide fire protection for example.

Can Brominated flame retardants be one single group or Subgroups?

The basic commonality of brominated flame retardants is the use of bromine in their chemical structure, but the brominated flame retardants are vastly different, from a chemistry point of view, but also in the way they function and being used in their applications. BFRs need to be compatible with the plastic type they are used in. The reason there are so many different types of brominated flame retardants is because there are so many different plastics and associated properties that need to be matched for a particular use. BFRs are designed to work in specific combustible materials. As a result, the market requires many different solutions, with widely differing molecular structures and associated differing physicochemical properties.

The US National Academy of Sciences, Engineering, and Medicine (NASEM) undertook extensive work to examine the possibility of grouping all additive, non-polymeric, organohalogen Flame Retardants (ANOFRs) in a single class for regulatory purposes. In 2019, NASEM released its report[2] which stated that ANOFRs, which includes brominated flame retardants, “cannot be treated as a single class for the purposes of hazard assessment”.

NASEM, instead, recommended grouping ANOFRs into 14 subclasses, based on chemical structure, physicochemical properties, and predicted biologic activity, for purposes of further regulatory assessment. They outlined an approach for actual assessment of these subclasses based on different scenarios principally linked to data availability/ generation. While useful, this approach would most likely need to be supplemented by detailed review and correlation with data on substances or lead to

[2] National Academies of Sciences, Engineering, and Medicine. 2019. A Class Approach to Hazard Assessment of Organohalogen Flame Retardants. Washington, DC: The National Academies Press. https://doi.org/10.17226/25412.

the need for data generation to support grouping. Indeed, NASEM stated it will ultimately be an issue of the time and resources required to implement their proposed plan that will first need to be considered.

Additional factors in grouping concepts and alternatives assessment

When an product designer choses the plastic material used for a specific application, the choice of flame retardant solutions becomes much more narrow and focused. This makes it easier to drive comparative analysis of both hazard and risk for a group of commercially available chemistries.

Figure 1. shows a possible course of action. Starting with the application in mind a group of flame retardants are identified that can be used in the plastic material. Chemicals in the group can be compared on hazardous properties, chemicals with unacceptable hazard profiles and potential exposures are immediately removed from consideration.

The remaining chemicals in the group can be filtered by simple **exposure assessment**. First the application can be framed by how people or the environment are exposed. The frequency of contact can be defined in terms like high (often and in close contact with skin or the environment) or something low (not touched or in substantial contact with the environment – e.g. internal parts). Once framed, the risk of exposures can be evaluated by comparing potential migration to surfaces using quantifiable techniques like blooming or volatilization.

With hazard and exposure defined, chemical choices within a group can be placed into buckets of acceptability. The most sustainable choices are those with the lowest hazard or those with the lowest exposure. **Polymeric and reactive flame retardants** are great examples of chemistries that naturally fall into a preferred category for a wide range of applications because of low potential for bioavailability and migration.

The advantage of this concept is aligning a grouping strategy with market realities. Flame Retardants are grouped by fitness of use and commercial availability. The application and possibility of consumer or environmental exposures can be approximated in early stage product design by measured chemical migration in the material and this can be overlayed on hazard to dictate acceptable flame retardant choice.

BSEF is supportive of ECHA's intention to avoid regrettable substitution. However, a clear legal and scientific basis is needed in any approach to grouping of chemicals for regulatory purposes. Chemical regulation should always be based on sound science.

Further information

For further information, please contact Michael Hack, Secretary General (mhack@bsef.org) or Patrick Fox, Head of Public Affairs & Advocacy (pfox@bsef.org)

About BSEF

BSEF – the International Bromine Council, is the global representative body for bromine producers and producers of bromine technologies. Originally founded in 1997, BSEF works to foster knowledge on the societal benefits of bromine and its applications. The members of BSEF are Albemarle Corporation, ICL Industrial Products, Lanxess and Tosoh.

Figure 1. Diagram on flow of actions