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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, properties, uses and end use applications of chemicals under review.

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

BSEF, the International Bromine Council, hereby expresses its views on a possible grouping of brominated flame retardants (BFRs) as announced in ECHA's regulatory strategy for flame retardants on 14 March. [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 retardants are often discussed by functionality - gas phase reactivity, char forming behaviour and/or water releasing substances.

[1] https://echa.europa.eu/documents/10162/2082415/flame_retardants_strategy_en.pdf/9dd56b7e-4b62-e31b-712f-16cc51d0e724?t=1678871526283

- 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 aluminium 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 halogen-based flame retardants are for most applications not directly substitutable by non-halogenated chemistries as assumed by ECHA's regulatory strategy. It is also noteworthy that certain materials can demand multifunctional behaviour to meet fire safe designs. Halogens can be used with phosphorous-based and other compounds in a complementary or synergistic manner to provide comprehensive fire protection for example. To meet certain flammability standards for electronic products brominated flame retardants are the only existing solution, and there is no simple drop-in replacement available.

Can brominated flame retardants be one single group?

The basic commonality of brominated flame retardants (BFRs) is the presence of bromine in their chemical structure, but the range of available brominated flame retardants are vastly different both from a chemistry point of view but also in the way they function and the applications they are essential for. For example, 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 biological activity, for purposes of further regulatory assessment. BSEF notes that ECHA's regulatory strategy differentiates between only two groups of BFRs (aromatic and aliphatic BFRs).

[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.

Additional factors in grouping concepts and alternatives assessment

When a 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**[3]. First the application can be framed by how people are exposed, and if it is released from the application or not. The frequency of contact can be defined in terms like high (often and in close contact with people) or something low (no or low exposure to people), or if potentially it can be released to the environment from an application due to the nature of the flame retardant used, see figure below.

Once framed, the risk of exposures can be evaluated by comparing potential release like blooming or volatilization, using quantifiable techniques.

With hazard and exposure defined, chemical choices within a group can be placed into categories 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, and following REACH principles.

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.

[3] An exposure assessment under REACH is in principle part of the Chemical Safety Assessment (CSA), but is in most cases to generic (using Use descriptors system) and not application specific, and is not required for all registered substances.

Figure 1. Diagram on flow of actions