

4. BROMINATED FLAME RETARDANTS IN FOOD

Brominated flame retardants are substances used to reduce the flammability of materials such as plastics, electronic components, textiles and insulation. They are not intentionally added to food. Some may, however, be released from products during use, disposal or recycling, disperse into the environment and enter the food chain. Their presence in food is therefore primarily an environmental contamination issue, not an inherent property of food.

ONE FAMILY, MANY DIFFERENT SUBSTANCES

The abbreviation BFR stands for brominated flame retardants and does not refer to a single molecule. It covers substances with different structures, uses, properties and toxicological profiles. Among the most extensively studied are polybrominated diphenyl ethers (PBDEs), hexabromocyclododecanes (HBCDDs), tetrabromobisphenol A (TBBPA), polybrominated biphenyls (PBBs) and various brominated phenols. More recently, attention has extended to chemicals used as substitutes for traditional flame retardants.

The mere presence of bromine does not establish that a substance is hazardous or persistent. Molecular structure is more important: some BFRs are highly lipophilic and resistant to degradation, whereas others behave differently. This is why EFSA assesses the main chemical families separately.

PBDEs: FROM TECHNOLOGY TO THE FOOD CHAIN

PBDEs have been widely used in plastics, electronic equipment and upholstery. Some congeners may persist in the environment and accumulate in organisms' fatty tissues. Even after restrictions or the discontinuation of certain uses, older products and waste can remain sources of emissions.

In its update published in January 2024, EFSA reviewed PBDE occurrence in food and evidence concerning health effects, paying attention to combined exposure to certain congeners. Effects on nervous-system development are particularly important among the critical outcomes examined. Conclusions concerning PBDEs must not automatically be extended to all other brominated flame retardants.

HBCDDs: THE CASE OF INSULATION MATERIALS

HBCDDs have been used mainly as flame retardants in insulation, including polystyrene. They are mixtures of stereoisomers whose behaviour differs in the environment and in

organisms. EFSA's 2021 assessment identified neurodevelopmental changes observed in experimental studies as the critical effect and used a margin-of-exposure approach.

Overall, EFSA concluded that estimated dietary exposure in European countries did not raise health concerns for most population groups. It nevertheless identified a possible concern for breastfed infants under scenarios involving high milk consumption and high contamination levels in breast milk, stressing the need for better data. This qualification does not support general recommendations against breastfeeding, whose benefits are widely recognised.

TBBPA, BROMINATED PHENOLS AND OTHER GROUPS

TBBPA is used especially in the production of resins and electronic components. Unlike many flame retardants physically blended into materials, it can be chemically incorporated into a polymer matrix, although this does not entirely exclude releases during a product's life cycle. EFSA's July 2024 update identified no health concern from estimated dietary exposure to TBBPA and the derivatives assessed.

For brominated phenols, EFSA's October 2024 opinion was able to assess principally 2,4,6-tribromophenol because data on other substances were scarce. Estimated dietary exposures did not indicate a health concern in the population groups that could be assessed. The lack of information on other compounds is not proof of their harmlessness.



EFSA'S 2026 OPINION ON EMERGING COMPOUNDS

On 27 July 2026, EFSA published an update on emerging and novel brominated flame retardants, reviewing information on 27 substances. For most, the available data were insufficient to complete a quantitative risk assessment. On the evidence then available, estimated dietary exposure to BEH-TEBP, EH-TBB and DBDPE did not raise a health concern. This conclusion does not automatically apply to the other substances reviewed and does not remove the need for further studies.

IN WHICH FOODS MAY THEY OCCUR?

For persistent, lipophilic brominated substances, studies have often found occurrence in foods of animal origin, including fish and seafood, meat, milk, eggs and their derivatives. Distribution depends on the substance, environmental origin, the animal's diet and the food matrix's lipid content. These observations cannot be converted into a universal ranking of the 'most contaminated' foods: geography, sampling periods and analytical methods can substantially change the picture.

Entry into the food chain may occur through water, sediments, airborne particles and feed. Some substances may accumulate in organisms and, in particular food webs, increase in concentration at higher trophic levels. Persistence and biomagnification are not, however, shared to the same extent by all BFRs.

OCCURRENCE, EXPOSURE AND RISK ARE NOT SYNONYMS

Detecting a trace in food means that the substance can be measured by a particular analytical method; this does not itself demonstrate a health risk. Estimating exposure requires the concentration, the amount and frequency of food consumption and the consumer's body weight. Risk assessment then compares estimated exposure with relevant toxicological evidence while accounting for uncertainties.

Results below the limit of quantification require particular care: 'not quantified' does not necessarily mean 'absent'. Studies may also omit members of a chemical family, especially emerging compounds. EFSA notes that combined assessment of different BFR families remains a scientific question requiring further work.

EUROPEAN RESTRICTIONS AND FOOD CONTROLS

In the EU, some brominated flame retardants are prohibited or subject to use restrictions, including under legislation on chemicals, electrical and electronic equipment and persistent organic pollutants. Industrial restrictions must be distinguished from maximum levels for specific contaminants in food: they are not the same thing.

Commission Recommendation 2014/118/EU encouraged monitoring of traces of brominated flame retardants in food. Regulation (EU) 2023/915 sets maximum levels for numerous food contaminants but must not be interpreted as a general list of limits for every BFR. Even without a specific harmonised food maximum, general food-safety legislation and scientific exposure assessment remain relevant.

WHAT THIS FAMILY OF CONTAMINANTS TEACHES US

Brominated flame retardants show how products designed to perform a useful technical function may generate unforeseen environmental problems when persistent substances are released over time. They also illustrate the importance of current, substance-specific assessments: estimated dietary exposure to some compounds does not currently raise concern, while others present concerns or major knowledge gaps. The role of research and controls is to distinguish these situations, not collapse them into a single judgement.

SCIENTIFIC AND REGULATORY REFERENCES

[EFSA – Brominated flame retardants \(topic page, updated 27 July 2026\) —
https://www.efsa.europa.eu/en/topics/topic/brominated-flame-retardants](https://www.efsa.europa.eu/en/topics/topic/brominated-flame-retardants)

[EFSA CONTAM Panel \(2021\) – Update of the risk assessment of
hexabromocyclododecanes \(HBCDDs\) in food, EFSA Journal 19\(3\):6421 —
https://doi.org/10.2903/j.efsa.2021.6421](https://doi.org/10.2903/j.efsa.2021.6421)

[EFSA – Update of the risk assessment of polybrominated diphenyl ethers \(PBDEs\) in
food \(24 January 2024\) — https://www.efsa.europa.eu/en/topics/topic/brominated-flame-
retardants](https://www.efsa.europa.eu/en/topics/topic/brominated-flame-retardants)

[EFSA – Update of the scientific opinion on tetrabromobisphenol A \(TBBPA\) and its
derivatives in food \(15 July 2024\) —
https://www.efsa.europa.eu/en/topics/topic/brominated-flame-retardants](https://www.efsa.europa.eu/en/topics/topic/brominated-flame-retardants)

[EFSA – Update of the risk assessment of brominated phenols and their derivatives in
food \(23 October 2024\) — https://www.efsa.europa.eu/en/topics/topic/brominated-flame-
retardants](https://www.efsa.europa.eu/en/topics/topic/brominated-flame-retardants)

[EFSA – Update of the risk assessment on emerging and novel brominated flame
retardants in food \(27 July 2026\) —
https://www.efsa.europa.eu/en/topics/topic/brominated-flame-retardants](https://www.efsa.europa.eu/en/topics/topic/brominated-flame-retardants)

[European Commission – Recommendation 2014/118/EU on monitoring traces of
brominated flame retardants in food — https://eur-lex.europa.eu/legal-
content/EN/TXT/?uri=CELEX:32014H0118](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014H0118)

[European Commission – Regulation \(EU\) 2023/915 on maximum levels for certain contaminants in food \(updated text\) — https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32023R0915](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32023R0915)