The Contaminant Without a Limit

Emerging Brominated Flame Retardants, Analytical Blind Spots and the Next Generation of Food-Chain Surveillance

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Abstract

The European Food Safety Authority's July 2026 reassessment of emerging and novel brominated flame retardants (BFRs) exposes a consequential asymmetry in modern food safety: the ability to identify a chemical does not necessarily provide sufficient occurrence, toxicokinetic or hazard evidence to characterise its risk. EFSA reviewed 27 substances but could complete a reassuring dietary assessment for only three on the available evidence. This article examines why the remaining uncertainty cannot be converted either into a presumption of safety or into an allegation of harm. It connects environmental transfer, animal-feed pathways, analytical method selection, laboratory reporting limits and legally enforceable contaminant controls. Comparative analysis distinguishes European general food-law duties from substance-specific maximum levels and considers the different operational frameworks of Spain, Great Britain and the United States. A proposed risk-prioritised surveillance architecture would combine suspect screening, targeted confirmation and exposure modelling across feed, food and processing environments. The concept is explicitly a research programme rather than an approved compliance method.

Keywords: *brominated flame retardants; emerging contaminants; food-chain surveillance; animal feed; non-target screening; exposure assessment; environmental transfer; regulatory uncertainty*

Knowledge category: Food Safety & Emerging Research | Regulatory Affairs

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Meta description: Emerging brominated flame retardants expose gaps in food testing, exposure evidence and regulatory controls. A practical framework for surveillance and risk. (157 characters)

Internal tags: Chemical Safety; Emerging Contaminants; Animal Nutrition; Analytical Chemistry; EU Food Law; Traceability; Sustainability

01 | Why this is a 2026 issue, not an invented new hazard

On 27 July 2026 EFSA published its update of the risk assessment of emerging and novel brominated flame retardants in food (EFSA Journal 24(7):e10187; DOI 10.2903/j.efsa.2026.10187). The assessment covers 27 substances and revisits a topic EFSA had examined in 2012. It is therefore inaccurate to describe the chemical family as newly discovered in 2026. The current development is the contrast between an expanded evidence base and persistent inability to complete risk characterisation for many compounds. EFSA's public account identifies BEH-TEBP, EH-TBB and DBDPE as three substances for which available dietary-exposure evidence did not indicate a health concern. That finding cannot be extrapolated to every brominated flame retardant, every exposure route or future exposure patterns. [1–3]

02 | Chemical use and environmental entry are not food uses

BFRs are employed in materials such as electronics, plastics and textiles to reduce flammability. Their relevance to food is typically incidental: release from articles, waste handling, dust, soil, water and environmental transport may eventually contaminate feed and food. The distinction matters legally. A substance that is not intentionally used as a food ingredient can still be a food contaminant; the absence of a food-additive authorisation is not the same question as whether a contaminant has a prescribed maximum level. Many BFRs are persistent or lipophilic, but physicochemical properties and biological behaviour differ across individual molecules. A class-wide assumption of identical bioaccumulation would be scientifically unsound. [1,2]

03 | Why three reassuring assessments do not clear twenty-four others

Risk characterisation requires at least a credible exposure estimate and a defensible interpretation of hazard data. When measurements are sparse, frequently below quantification limits, geographically concentrated or methodologically incomparable, an apparent low detection frequency may reflect inadequate surveillance rather than true absence. Similarly, missing toxicology cannot be filled by an arbitrary safety factor without a justified point of departure. EFSA explicitly identifies knowledge gaps for several substances. The correct classification is "insufficient evidence for a complete assessment," not "proven dangerous" and not "proven harmless." [1,2]

04 | Food-chain transfer: the feed-to-food interface

Fish, meat, milk and derived products are important matrices in environmental BFR surveillance because some compounds can enter organisms and partition into lipid-containing tissues. Feed ingredients, fishmeal, fats and recycled or environmentally exposed raw materials merit risk-based attention. This does not establish that any particular commercial feed is contaminated. Monitoring plans should begin with supply-chain geography, environmental context, ingredient origin, lipid content and available occurrence evidence. Food-processing interventions that control microorganisms do not automatically destroy persistent organic contaminants. Thermal processing may redistribute a contaminant between fractions without demonstrating detoxification. [1,2]

05 | A negative laboratory report may be a method limitation

A certificate reporting "not detected" is meaningful only when the analyte list, sampling plan, extraction recovery, detection limit, quantification limit, matrix effects and measurement

uncertainty are known. Targeted gas or liquid chromatography coupled with mass spectrometry can quantify selected compounds when suitable reference standards and validated methods exist. High-resolution mass spectrometry can support suspect screening and prioritisation, but tentative identifications are not equivalent to confirmed quantitative results. A method validated for fatty fish cannot simply be assumed fit for dry cereal, feed premix or aqueous beverage. [1,4]

06 | Sampling design may dominate instrument sensitivity

Highly sensitive instrumentation does not repair an unrepresentative sample. Persistent contaminants may be distributed heterogeneously among feed lots, dust-rich process environments and different food fractions. Composite sampling can improve coverage while potentially diluting localised signals; individual-unit sampling can expose heterogeneity at higher cost. A scientifically defensible programme should specify its decision purpose in advance: source identification, prevalence estimation, high-end exposure assessment or regulatory compliance. These purposes require different sample sizes and acceptance criteria. The proposed research programme below explicitly separates screening from legally determinative official testing.

07 | The regulatory boundary in the European Union

Regulation (EC) No 178/2002 establishes general food-safety obligations, including that unsafe food must not be placed on the market. Council Regulation (EEC) No 315/93 lays down general procedures concerning contaminants; Commission Regulation (EU) 2023/915 prescribes maximum levels for specified contaminants in specified foods. It is incorrect to infer from those instruments that every emerging BFR has a harmonised numerical maximum. Where no substance-specific maximum applies, general safety obligations, risk assessment and competent-authority powers remain relevant, but enforcement must not invent a legal threshold. Regulation (EU) 2017/625 governs official controls. Any analytical result must be interpreted against the precise substance, matrix, date and applicable legal provision. [5–8]

08 | Spain: competent authorities and defensible operator decisions

EU food law applies directly in Spain where relevant. Food business operators remain responsible for placing safe products on the market and for traceability; official controls are exercised through the competent authorities, with national coordination including AESAN. A manufacturer should distinguish routine internal screening, a supplier investigation and a formal non-compliance decision. A voluntary surveillance trigger can be lower than an established legal limit, but it should be clearly documented as an internal risk-management threshold, not described as a statutory maximum. Escalation should account for analytical confidence, estimated exposure, available toxicology and the specific lot history. [5–8]

09 | Great Britain, Northern Ireland and the United States

Great Britain operates under its applicable domestic food-safety and contaminants framework, including retained or assimilated legislation as subsequently amended; Northern Ireland requires separate consideration of relevant EU-linked rules under the Windsor Framework. Numerical equivalence must be verified rather than assumed. In the United States, the Federal Food, Drug, and Cosmetic Act prohibits adulterated food, and FDA evaluates chemical contaminants through risk-

based authorities and guidance; a universal numerical US tolerance for all emerging BFRs should not be presumed. The Environmental Protection Agency also regulates chemical substances under separate environmental legislation. These systems answer overlapping but legally distinct questions. An export dossier should identify each destination, substance, food category, analytical evidence and applicable rule. [9–11]

10 | The industrial paradox: absence of a limit is not absence of risk

Commercial specifications frequently ask whether a contaminant is "within legal limits." That phrase becomes ambiguous when no relevant numerical maximum exists. A technically meaningful answer should state whether the substance was tested, the method and reporting limit, whether a binding limit exists for that food, and how any detection was evaluated. Suppliers should avoid categorical "BFR-free" claims unless supported by a precisely defined analyte scope and suitable detection capability. Equally, a detection alone does not establish an unacceptable health risk. This distinction protects customers against both false reassurance and disproportionate rejection.

11 | Why ingredient innovation needs upstream chemical intelligence

Novel proteins, fermented ingredients, animal-derived fractions and functional food systems can introduce new sourcing and processing pathways. Their safety qualification should consider environmental contaminants when the material's provenance makes them plausible. It would be inappropriate to imply that fermentation, ultra-filtration or protein hydrolysis reliably removes BFRs without compound-specific partition and mass-balance studies. For industry ingredient development and food-safety activities, the relevant opportunity is analytical qualification and evidence-based supplier screening, not a claim that any existing product eliminates these contaminants. This approach can support responsible innovation without manufacturing a product benefit.

12 | The mixture question and its scientific limits

Humans encounter multiple environmental chemicals, potentially with overlapping biological effects. EFSA notes that a combined assessment of BFR families is a future direction. Yet summing concentrations or hazard quotients indiscriminately is not a validated mixture assessment. Relative potency, common modes of action, exposure correlations, toxicokinetics and data gaps must be considered. A provisional prioritisation index can be useful for deciding what to study, but should not be sold as a clinical risk score. Mixture assessment is a genuine research challenge precisely because compounds and datasets are heterogeneous. [1,4]

13 | Research & Innovation Opportunity

Unresolved problem. Food businesses often have narrow targeted contaminant panels, while environmental literature identifies additional compounds for which occurrence and hazard data remain incomplete. This creates a gap between supplier certificates and the evolving scientific risk landscape. Existing targeted testing, suspect screening, exposure modelling and digital traceability are established technologies; their combination is not claimed as a patentable invention.

Hypothesis and not established fact. A tiered "Evidence-Weighted Emerging Contaminant Sentinel" could improve early identification of high-priority food-chain signals by connecting supply-chain

provenance, targeted measurements, high-resolution suspect-screening results, toxicological confidence and dietary-exposure scenarios. Its value would lie in more informative prioritisation, not automatic certification of safety.

Validation pathway. Begin with three contrasting matrices -lipid-rich animal food, compound feed and a low-fat processed food- and multiple independent lots and suppliers. Predefine a limited target analyte panel with authentic standards, sample-preparation recovery requirements, blanks and confirmatory criteria. Run a separate suspect-screening workflow with explicit identification-confidence levels. Benchmark screening against targeted reference results, blinded spikes and independent laboratories. Use transparent exposure scenarios and evaluate false-positive rates, missed detections, reproducibility, turnaround time and cost.

Regulatory safeguards. No private index substitutes for a statutory maximum, official sampling rule or competent-authority risk assessment. Detection and quantification limits must be disclosed, and confidential supplier data protected. A pilot should publish negative findings and failure modes as well as successful detections. Adoption should depend on independent validation rather than a compelling dashboard.

14 | Evidence hierarchy and practical decision rules

Established evidence: BFRs can enter environmental and food-chain compartments; EFSA published an updated 2026 assessment covering 27 emerging and novel compounds; available evidence supports its stated conclusions for three specific substances but leaves material gaps for others. Established law: EU general food-safety duties are not synonymous with substance-specific maximum levels. Expert interpretation: suppliers and manufacturers should use a documented, matrix-specific and jurisdiction-aware surveillance programme. Hypothesis: integrated suspect screening and evidence weighting could improve prioritisation; this has not been validated by this article. A defensible industrial decision begins with a precise question, a suitable analytical method and an explicit statement of uncertainty. [1–8]

15 | Conclusion: uncertainty must be managed, not marketed

The July 2026 EFSA opinion illustrates a mature scientific problem: the frontier of chemical detection can advance faster than the evidence needed to characterise risk. Neither an empty regulatory cell nor a negative result from a limited analyte panel is a universal safety certificate. Food and biotechnology companies should build surveillance systems that distinguish confirmed concentrations, plausible exposure, toxicological knowledge and legal status. The future opportunity is not to promise elimination of every emerging contaminant. It is to make uncertainty visible, testable and actionable before it becomes a food-chain crisis.

Related Knowledge Areas

Food Safety; Biotechnology; Animal Nutrition; Regulatory Affairs; AI & Food; Processing Technologies; Sustainability; Emerging Research.

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