

HOW BTEX ENTER FOOD

BTEX – benzene, toluene, ethylbenzene and xylenes – are volatile organic substances found mainly in fuels, emissions and certain industrial activities. Their detection in the environment does not necessarily mean that they reach food in measurable quantities: understanding contamination requires tracing the pathway from the source to the raw material and ultimately to the food consumed.

FROM SOURCES TO THE ENVIRONMENT

The main sources of BTEX include the extraction and distribution of petroleum products, fuel leaks, industrial processes, discharges and combustion-related emissions. Traffic and manufacturing activities may contribute to their presence in air, while accidents and leaks may affect soil and groundwater. Their distribution depends on the properties of individual compounds and environmental conditions, not merely on distance from the source.

Volatility favours transfer from liquids or soil to the atmosphere, but does not prevent some BTEX from dissolving in water or interacting with soil organic matter. In water, exchanges with air, microbial activity and site conditions influence persistence; in a contaminated aquifer, however, the movement of pollutants may maintain a source of exposure for considerable periods.

AIR: DEPOSITION AND CONTACT WITH FOOD

Near an emission source, vapours may come into contact with crops, bulk commodities or food exposed during processing. Adsorption onto surfaces and subsequent release depend on air concentration, duration of contact, temperature and food composition. For highly volatile substances, deposition alone does not necessarily produce lasting accumulation.

Any entry into plants through leaves should not be confused with systematic, significant transfer to edible tissues. Such a conclusion requires measurements in actual plant species, organs and conditions: BTEX in the surrounding air do not, by themselves, prove crop contamination.

SOIL AND WATER: POSSIBLE, NOT INEVITABLE, PATHWAYS

A fuel leak can contaminate soil and, in some cases, groundwater. Water used for irrigation, washing or food processing can then become a potential contact pathway. The quantity reaching a food commodity nevertheless depends on initial concentrations, water treatment, its use and food characteristics.

Transfer from soil to roots cannot be assumed either. Uptake, translocation, degradation and volatilisation are competing processes, and plant species can behave differently. Soil contamination data cannot therefore be converted directly into estimates of concentrations in edible tissues without analytical verification.



THE FOOD CHAIN: PROCESSING, STORAGE AND TRANSPORT

Contamination can also occur after harvesting, for instance through accidental contact with fuels, solvent vapours or storage environments insufficiently separated from chemical activities. Unsuitable equipment, cleaning products or technical chemicals may provide additional sources of unwanted organic compounds; not every solvent used in a facility, however, is a BTEX compound.

Under certain conditions, lipid-rich foods may retain organic substances more readily than aqueous matrices. This is a general physicochemical tendency, not evidence that fatty foods routinely contain BTEX. Packaging and food-contact materials call for separate assessment: migration from unsuitable materials, accidental contamination and manufacturing residues have different origins and control requirements.

CAN BTEX ALSO FORM WITHIN A PRODUCT?

Not every occurrence necessarily derives from environmental pollution. Specific mechanisms of benzene formation have been investigated in certain beverages containing particular ingredients under particular conditions. This phenomenon cannot be generalised to every BTEX compound or beverage; Chapter 4 examines its chemistry and experimental evidence.

DISTINGUISHING THE SOURCE, CONTAMINATION AND EXPOSURE

Investigating a case entails three distinct steps: identifying a credible source; showing that the substance has actually reached the food matrix; and measuring its concentration to assess ingestion. Detection of BTEX near a field, warehouse or watercourse points to a possible issue for investigation; it does not automatically quantify the dose ingested by consumers.

Sampling and storage are particularly delicate: opening a container, leaving a sample exposed to air or storing it incorrectly may cause volatile compounds to be lost and concentrations to be underestimated. Contamination introduced during collection can also distort a result. The quality of analytical evidence is discussed in Chapter 8.

PREVENTION AND CONTROLS THROUGHOUT THE FOOD CHAIN

Prevention starts by avoiding contact between food and contamination sources: suitable water supplies, proper fuel management, separation of chemicals from food commodities, plant maintenance and checks on the suitability of food-contact materials. Controls should be proportionate to the actual likelihood of the hazard and the vulnerability of the supply chain.

Regulation (EC) No 853/2004 requires hygiene measures to protect food from contamination during production, processing and distribution. Regulation (EC) No 1831/2003 lays down general requirements for food-contact materials. Neither provision, on its own, establishes a uniform numerical limit for all BTEX compounds in all foods.

WHAT CAN WE CONCLUDE?

Several plausible pathways could bring BTEX into contact with the food chain: air, water, soil, accidents and industrial handling. Their relative importance varies by context. According to the WHO, inhalation is generally the predominant route of benzene exposure in the general population. This does not rule out particular food-contamination incidents, but it does mean that food should not be portrayed as the main source without supporting data.

The essential distinction is between chemical hazard, the possibility of transfer and the concentration actually measured. Only the latter, considered alongside consumption and toxicological evidence, enables a sound interpretation of exposure.

SCIENTIFIC AND REGULATORY REFERENCES

- WHO (2019). Exposure to benzene: a major public health concern. [Source](#)
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- Regulation (EC) No 852/2004 on the hygiene of foodstuffs. [Source](#)
- Regulation (EC) No 1935/2004 on materials and articles intended to come into contact with food. [Source](#)