

Banned chemicals continue to endanger environmental health in the Middle East and North Africa

A class of man-made chemicals formerly used as flame retardants in a wide range of products continues to pose a significant threat to environmental health.

SHARJAH, EMIRATE OF SHARJAH, UNITED ARAB EMIRATES, July 13, 2026 /EINPresswire.com/ -- Hidden pollutants banned under international agreements continue to pose a significant threat to environmental health across the Middle East and North Africa (MENA).

In a study recently published in the journal *Environmental Research*, scientists from the University of Sharjah have renewed attention to contamination by polybrominated diphenyl ethers (PBDEs), a class of man-made chemicals formerly used as flame retardants in a wide range of products, including electronics, household appliances, vehicles, furniture, and upholstery.

Although PBDEs have been largely banned or phased out worldwide because of their adverse environmental and health effects, they continue to persist in the environment. Legacy products containing these chemicals remain in circulation, and PBDEs can be detected in consumer goods manufactured from recycled plastics, including kitchen utensils and children's toys.

"Across the Middle East and North Africa, environmental pollution is often discussed through visible pressures: urbanization, industrial expansion, water scarcity, waste management, and rapid infrastructure growth," said Khaled Abass, professor of human health and climate change at the University of Sharjah.

Less visible but increasingly important "is the persistence of legacy chemicals embedded in consumer products, electronic waste, sediments, soils, and indoor environments," he added.

The study, a systematic review led by Prof. Abass, found that PBDE contamination across MENA is highly heterogeneous, strongly dependent on location and environmental media. The researchers reported especially elevated levels in industrialized and urban settings.

PBDEs were extensively used for decades as flame retardants in electronics, textiles, plastics, and household materials. While these properties improved the safety of products, they were also found to create long-term environmental challenges. PBDEs are highly persistent and can

accumulate in ecosystems, moving through air, dust, water, soil, sediments, and living organisms.

Prof. Abass and colleagues show that PBDE contamination in the MENA region reflects a complex interplay of industrial activity, urban infrastructure, indoor pollution reservoirs, waste management, and atmospheric transport.

PBDE occurrence and MENA region

The systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which help researchers to follow a standardized framework for the transparent reporting of systematic reviews and meta-analyses. A comprehensive literature search was performed in PubMed, Scopus, and Web of Science to identify peer-reviewed articles published in English, with no restriction on publication date, up to November 2025.

The initial search retrieved 186 records. After the removal of duplicates, 102 articles remained for title and abstract screening. Subsequently, 54 full-text articles were assessed for eligibility. Of these, 16 studies were excluded because they were not relevant to the review objective or did not meet the predefined inclusion criteria. Ultimately, 38 studies satisfied all eligibility requirements and were included in the final analysis.

The selected studies covered seven countries in the MENA region. Turkey contributed the largest share of the evidence base, with more than 17 studies, followed by Kuwait with eight studies. Tunisia, Morocco, Bahrain, Iran, and Egypt were each represented by one to three studies, providing targeted but valuable insights into PBDE distribution and occurrence across air, soil, sediment, water, indoor dust, and biota. "The breadth of matrices and geographic coverage enabled a comprehensive assessment of PBDE contamination patterns," the authors write.

One of the review's most significant findings was the widespread BDE-209, a brominated flame retardant belonging to the PBDE family, in soils and sediments. According to Prof. Abass, this distribution pattern points to the historical use of deca-BDE formulations and the strong tendency of highly brominated congeners to absorb onto particles and accumulate in solid environmental matrices. "In simple terms, sediments and soils can function as long-term chemical archives, preserving evidence of past use while continuing to act as potential sources of exposure," he explained.

MENA's regional picture remains uneven. Turkey contributes the largest body of evidence and consistently exhibits contamination hotspots in industrialized and densely urban areas, whereas remote and coastal background locations generally show lower contamination concentrations. By contrast, many other countries in the region remain poorly represented in scientific literature, resulting in substantial gaps in regional environmental health surveillance. "The absence of data should not be mistaken for the absence of contamination," Prof. Abass noted. "Rather, it may

simply reflect limited monitoring capacity and infrastructure as well as poor research investment across parts of MENA,” Prof. Abass explained.

Beyond outdoors

The authors’ search for traces of PBDE contamination extends beyond the outdoor environment to encompass indoor settings, where people work, live, and spend much of their time.

Indoor air and dust can serve as significant reservoirs of PBDEs, particularly in environments containing large numbers of electronics, flame-retardant-treated materials, and inadequate ventilation. Children may be especially vulnerable because inadvertent ingestion of contaminated dust can be a major exposure pathway. These concerns have direct relevance to homes, schools, offices, electronic repair shops, and recycling settings.

Across the countries examined, the study found that BDE-209 remained the dominant PBDE congener in soils, sediments, and atmospheric particulates, reflecting the long-term influence of commercial deca-BDE formulations. In contrast, lower-brominated congeners such as BDE-47 and BDE-99 were more prevalent in indoor environments, highlighting the continued contribution of electronics, foam furnishings, and other consumer products as sources of contamination. The authors note, “Evidence from Kuwait and Morocco highlighted the long-term persistence of PBDEs through historical deposition, sediment accumulation, and possible in situ transformation processes.”

Perhaps the study’s most important contribution is its reframing of PBDE contamination in the context of MENA as a regional environmental-management challenge rather than merely a collection of isolated chemical measurements. “PBDEs connect product safety, e-waste, recycling, indoor exposure, industrial emissions, sediment contamination, and food-chain risks,” Prof. Abass explains. “Managing them requires coordinated monitoring across air, water, soil, sediment, dust, and biota.”

The findings also carry an important forward-looking warning. As countries across the MENA expand recycling, waste recovery, and circular-economy initiatives, chemical safety considerations must be integrated into those systems from the outset. “Without screening for legacy flame retardants, recycled materials may become pathways for reintroducing hazardous chemicals into consumer products and indoor environments,” warns Prof. Abass.

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