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Banned contaminants can persist in environment for decades

The contamination of hazardous substances in estuaries can have negative effects on biodiversity. Using experimentally supported indicators, this study analysed the environmental risks posed by 22 different contaminants in UK estuaries and coastal waters, finding that substances banned over 20 years ago continue to persist in the marine environment.

Estuaries, where rivers meet the sea, are home to a unique mix of plant and animal communities. Some of the most productive marine ecosystems in the world, estuaries are critical to the development and maintenance of a range of aquatic species.

Yet these vital ecosystems are under threat from human pollution, exposing the organisms living within to chemicals including metals, polychlorinated biphenyls (PCBs) — once used to reduce the risk of fire in electrical systems — and polycyclic aromatic hydrocarbons (PAHs), which can infiltrate the environment via the incomplete combustion of carbon-containing fuels and oil spills.

These contaminants, which accumulate in the sediment at the very bottom of the water, reduce water quality and may pose risks to aquatic organisms due to their toxic, mutagenic and, in some cases, carcinogenic properties.

To guard against these threats, the European Commission has developed two directives that require the assessment of chemical status in water: the Water Framework Directive (WFD)[1] and the Marine Strategy Framework Directive (MSFD)[2].

Using the assessment guidelines set out by the OSPAR Co-ordinated Environmental Monitoring Programme (CEMP), this study analysed the environmental risks posed by 22 priority pollutants: 6 metals, 10 PAHs and 6 PCBs, in UK estuaries and coastal waters.

Over 38 000 individual samples were analysed from 45 sites over a period of more than 10 years (1999–2011).

In order to compare the risk posed by the contaminants, the researchers used risk characterisation ratios (RCRs). European Commission chemicals regulation REACH defines RCRs as the Predicted Environmental Concentration divided by the Predicted No Effect Concentration.

The ratios used in this study were calculated by dividing the measured environmental concentration by internationally established quality standards: Effects Range Low (ERL), the concentration above which effects are possible, or Effects Range Median (ERM), the concentration above which effects are likely. Almost half (42.6%) of the samples exceeded international ERL standards, while a lesser percentage (7.7%) exceeded ERM values.

Continued on next page.

Source: Nicolaus, E. E. M., Law, R. J., Wright, S. R. & Lyons, B. P. (2015). Spatial and temporal analysis of the risks posed by polycyclic aromatic hydrocarbon, polychlorinated biphenyl and metal contaminants in sediments in UK estuaries and coastal waters. *Marine Pollution Bulletin* 95(1), pp.469-479. DOI: 10.1016/j.marpolbul.2015.03.012. This paper is freely available at: http://www.sciencedirect.com/science/article/pii/S0025326X15001447.

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1. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060.

2. Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0056.

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Banned contaminants can persist in environment for decades *(continued)*

Every chemical group had an average RCR above 1, meaning they are all likely to have an adverse environmental impact.

Of the individual contaminants studied, 18 had an RCR value above 1. The worst offenders were CB118 (a PCB), fluorene (a PAH) and mercury (a metal).

The researchers also carried out a detailed spatial assessment, which showed that only two sites did not exceed safety thresholds. Despite the prohibited use of these chemicals, many were still above defined environmental limits by the final sampling year (2011). In fact, the highest levels of PCB and PAH contamination were observed in 2011, even though environmental protection procedures had been in place for several years by this time.

The authors found that contaminants banned more than 20 years ago could be re-suspended in sediment to pose an ongoing environmental risk, thus leaving a limited number of mitigation measures available to policy makers. The authors recommend further studies in heavily polluted estuaries to improve knowledge of contamination hotspots and protect the organisms living in these areas.