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Science for Environment Policy

Spatial assessment and ranking of relevant environmental contaminants

A risk-based tool built using multi-criteria decision analysis has been developed to rank environmental contaminants, giving each a level of concern. It can be used by decisionmakers to prioritise areas for further assessments, based on expected human health impacts.

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The range of toxic substances and the types of diseases they could lead to presents a significant challenge to decisionmakers responsible for protecting public health. Evaluating all environmental and health data on such substances, with the ultimate aim of taking appropriate action, is an extremely complex task.

In this study researchers addressed this problem by developing an easy-to-use ranking tool. This can help decisionmakers to identify, at the regional scale, which contaminants are likely to pose the greatest risks to health and which areas should be prioritised for further investigation.

Funded by the EU's 2-FUN[1] project, the tool was based on a multi-criteria decision analysis using a Weight-of-Evidence approach. This method provides an integrated assessment able to incorporate different types of data. The tool integrates three lines of evidence:

1. 'Environmental contamination', which provides information about the amount and distribution of the contaminants in the environment. This also indicates the potential exposure of people in the area.
2. 'Intake', which provides information from programmes monitoring the concentration of chemicals in body tissues, providing an integrated estimation of actual exposure.
3. 'Observed effects' provides information on the human health impacts that can be linked to exposure levels.

Decisionmakers can choose which substances to investigate in particular areas, based on available monitoring data, and use the tool to explore the associated health effects, according to available toxicological and epidemiological information. Using expert judgements the health effects are paired with individual chemicals and different weight, or emphasis, is assigned to each line of evidence. The model also accounts for the severity of the health effect and the uncertainty surrounding the causal link between the contaminant and the effect.

The tool can then be used to rank each pairing of chemical substances and associated health effects, allowing decisionmakers to target those chemicals that pose the greatest health risk to the population within a specified area. The chemicals can be ranked at the regional scale so that priority substances can be investigated in a more detailed risk assessment.

The researchers tested the tool in seven areas of Flanders, Belgium. They examined the exposure of 14-15 year-olds to soil contaminated with lead, cadmium, benzene and polycyclic aromatic hydrocarbons (PAHs) from a range of possible sources, including the chemical and petroleum industries, intensive agriculture, harbours and road traffic.

Environmental contamination data came from soil surveys of possible contaminated sites in Flanders. Data on biomarkers of exposure (intake) and biomarkers of health impacts (observed effects) were taken from a biomonitoring programme of adolescents. The tool ranked lead as a primary concern in five of the areas, cadmium was ranked second in most, and PAHs had the lowest ranking. The screening also concluded that, at the regional level, none of the considered chemicals were associated with health risks requiring an urgent in-depth assessment.

In conclusion, improvements to monitoring environmental and health concerns are currently being put in place across the EU, and efforts are being made to ensure easy access to multiple datasets via an EU-wide data centre. Tools such as the one developed in this study will therefore play an increasingly important role in helping decisionmakers to set priorities.

1. 2-FUN (Full-chain and UNcertainty Approaches for Assessing Health Risks in Future ENvironmental Scenarios) was supported by the European Commission under the Sixth Framework Programme. See: http://www.2-fun.org/