New index describes overall toxicological risk of a site

A new index that condenses the overall environmental impact of pollutants at a particular site into a single value has been developed. This unique number captures the health status of the territory in terms of the risk of the pollutants to animals and plants in ecosystems, human health and the long-term fate of the pollutants in the environment.

An environmental index is used to summarise complex environmental information in a single value. In the case of assessing the potential risk of toxic chemicals at a particular site, it is important to capture the local impact of the pollutants on human health and all parts of the environment, including water, soil, sediment and the air.

Researchers, partly funded by the EU RISKCYCLE project¹, have developed the Ecotoxicological Risk Index for a Chemical Assessment (ERICA). A database, holding physical and chemical properties and toxicity data derived from experiments or predictive models, was compiled for 186 potentially harmful chemicals.

It is recommended that a minimum of 19 priority toxic substances (likely to be found in water, soil, sediment and the air) are included when each ERICA value is compiled. The 19 chemicals include toxic metals, polycyclic aromatic hydrocarbons (PAHs), pesticides, particulate matter (PM$_{2.5}$ and PM$_{10}$), nitrogen oxides, carbon monoxide and ozone, amongst others. Other specific pollutants, identified during initial sampling and analysis of the site under investigation, should also be included.

In compiling ERICA, the physico-chemical properties of each pollutant are combined with the toxicity of the pollutants to human health and to plants and animals in ecosystems. The risk to human health is assessed in terms of both toxic (but not cancer-causing) and cancer-causing impacts. In addition, the longer-term transport and fate of the pollutants are incorporated to arrive at a single number which describes the environmental quality of a specific area, including possible future risk posed by the pollutants. The index can be used by policy makers and managers in risk assessment strategies and monitoring of sites, particularly potentially hazardous areas such as landfills.

The environmental quality or health status of a territory is described by one of eight categories, ranging from “very good” (an ERICA value of less than 25) to “extremely dangerous” (an ERICA value greater than or equal to 400). Descriptions of these categories include, for example, “very good”, where “the environmental health quality is satisfactory and pollution poses no risk for human and ecological receptors” to “dangerous” (ERICA 300-399), where human health and organisms in ecosystems “are in danger with substantial risks”.

The researchers highlight the benefits of ERICA, including the use of a concise and transparent method, based on clear criteria, to arrive at the index; the ability to present an overall picture of the health of a territory; the use of the index to monitor the long-term health of a site; and the ability to be used in cases where there is little data - ERICA can use models to predict potential impacts of pollutants.

Future developments include extending ERICA to cover the impacts of interactions between mixtures of chemicals on people, other organisms and the environment.

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