Could Exposure to Highly Sequestered HOCs in Soil Pose Risks?

The Debate and Answers

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Chemical contamination of soil remains an issue of global concern. Remediation of contaminated sites has been a long term practice which costs billions of dollars annually. Regardless of such high costs, pace of remediation is extremely slow. Traditional risk assessment (RA) approach of contaminants in soil relies on measurement of total extractable concentrations, assuming 100% bioavailability. This approach does not consider the influence of soil-contaminant interactions in modifying potential risks that may result from exposure, and is thereby regarded as too conservative and unsustainable. On the other hand, risk based (RB) approaches are cost-effective, as they adjust risks based on contaminant bioavailability or bioaccessibility. However, regulatory adoption of the RB approach is constrained by certain uncertainties such as the unclear fate of highly-sequestered contaminant residues in soil. Minimising such uncertainties requires a clear understanding of the dynamic nature of soil-contaminant interactions. Empirical approaches have provided basic macroscopic understanding of such interactions, but do not provide detailed information on microscale locations of contaminants in soil and why contaminants are likely to remain potentially “locked-up” or be released again, especially in historically contaminated soils. In contrast, complementary use of advanced spectroscopic, chromatographic, and radiorespirometry and radiocombustion techniques could provide molecular information which may be useful for refuting, or accepting and enhancing macroscopically-derived hypothesis of soil-contaminants interactions. Hydrophobic organic contaminants (HOCs) are toxic, mutagenic, bioaccumulatory, and persistent. Minimising risks from exposure to HOCs in soil has implications for human and ecological health. This paper appraises the debate on the long-term fate of highly sequestered HOC residues in soil, and discusses whether it is necessary to further investigate potential risks that may result from exposure to these residues, especially with changing exposure conditions. Such investigations may help minimise uncertainties associated with RB approaches to managing historically-contaminated soils.