



SCIENCE BRIEF (June 2004)

IMPROVED ECOLOGICAL RISK ASSESSMENTS FOR METALS IN THE ENVIRONMENT

ISSUE

Ecological risk assessment (EcoRA) is a process that evaluates the potential for adverse ecological effects occurring as a result of exposure to metals or other stressors. EcoRA provides necessary information for decision-making related to environmental policies, remedial targets, management, and future use scenarios. Because scientific knowledge is not perfect, all EcoRAs have uncertainties. However, the uncertainties in EcoRA for metals have been particularly large both because of major gaps in scientific knowledge and because of the use of inappropriate methods and procedures (originally developed for organic substances).

SIGNIFICANCE

Significant improvements to EcoRA for metals have resulted from research done by the Metals in the Environment Research Network (MITE-RN). The generalized process derived initially for organic substances has been replaced by a process specific to and appropriate for metals. This new approach to EcoRA recognizes the realities that: metals are naturally occurring; some are essential; adverse effects can only occur if metals are biologically available (bioavailable); metal bioavailability is mainly controlled by external environmental conditions (in contrast to organic substances for which intrinsic properties are most important).

BACKGROUND

Scientific research conducted by the Metals in the Environment Research Network (MITE-RN) has been focused on addressing key research needs required to estimate long-term risks to ecosystems from metals more accurately. Information derived from MITE-RN has been used, together with relevant information from other research published in the global scientific literature, to provide an improved EcoRA framework for metals that substantially reduces uncertainties inherent in the previous framework.

FINDINGS

Specific requirements for EcoRA for metals and implementation of such have been laid out for all four iterative phases of EcoRA: hazard identification, exposure analysis, effects analysis, and risk characterization. Specific information requirements have been determined for the three increasing levels of EcoRA complexity, from problem formulation through screening to detailed assessment. Key information requirements to minimize uncertainty include: conceptual diagrams; determinations of bioavailability, predicted environmental concentrations (PECs) and predicted no effect concentrations (PNECs); assessment of metal tolerance by organisms; and, risk characterization based on weight of evidence determinations and appropriate criteria for establishing causality. This improved approach to EcoRA for metals obviates the use of arbitrary uncertainty factors and ensures environmental protection while minimizing unnecessary overprotection that inappropriately penalizes industry.

FUTURE RESEARCH

EcoRA is a framework that will be continually improved as new scientific information is developed. Further improvements to this framework for metals assessment will continue to be made as appropriate new information becomes available.

ADDITIONAL INFORMATION

P. M. Chapman and F. Wang. 2000. Issues in ecological risk assessment of inorganic metals and metalloids. *Human and Ecological Risk Assessment*, volume 6, number 6, pages 965 to 988.

P. M. Chapman, F. Wang, C. R. Janssen, R. R. Goulet and C. N. Kamunde. 2003. Conducting ecological risk assessments for inorganic metals and metalloids: Current status. *Human and Ecological Risk Assessment*, volume 9, number 4, pages 641 to 697. [Selected as the Ecological Risk Assessment Paper of the Year 2003 by the journal's Editorial Board]

<http://www.mite-rn.org/research/era/era.shtml>

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