

Title: Mathematical Modeling of Heavy Metals in the Natural Environment: Aluminum Toxicity in Relation to Acid Rain

PI: R. R. Noss, J. W. Male, and N. M. Ram

Objective:

The objective of the research is to develop a comprehensive model which accounts for the fate of heavy metals following discharge to a receiving stream.

Procedure:

The approach to the research will involve development of a mathematical model which will account for the various processes which affect the forms heavy metals, in particular aluminum, can take in the natural environment. These include chemical reactions such as chelation, oxidation, methylation, and complexation and physical processes such as adsorption and precipitation. The aim of the model will be to identify that fraction of the pollutant which is available for uptake by biota and therefore take into account the relative toxicities of the different forms of the metal. The research will emphasize the relationship between acid rain and aluminum in surface waters.

The approach will be to draw upon existing theoretical research, wherever possible, with the intent of developing a more practical tool for setting standards for the discharge of heavy metals to receiving streams. Field work may be necessary to provide data for calibration and verification, although existing information on the bioavailability of the metals will be utilized wherever possible.

The model will be used to evaluate the risk associated with different water quality standards and effluent limits and to address the impact of pH on Al. The analyses will involve the occurrence and duration of excessive concentrations of toxic metals based on the probability distribution of streamflows.

Expected Results:

The results will be presented as a technical report, detailing procedures used to develop the model and results of the analyses. It is expected that the results of the application of the model will provide guidance toward setting water quality standards.

Cost: \$37,000