



## WATER RESOURCES RESEARCH GRANT PROPOSAL

**Project ID:** 2003WI45B

**Title:** Role of the Hyporheic Zone in Methylmercury Production and Transport to Lake Superior

**Project Type:** Research

**Focus Categories:** Geochemical Processes, Toxic Substances, Non Point Pollution

**Keywords:** mercury

**Start Date:** 03/01/2003

**End Date:** 02/29/2004

**Federal Funds:** \$33272.00

**Matching Funds:** \$33843.00

**Congressional District:** 2nd

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**Abstract:** This proposal focuses on groundwater transport of methylmercury (MeHg) to Lake Superior. Production of MeHg in the Lake Superior watershed is a problem of major concern because fish in many lakes in this region, including near shore areas of Lake Superior, contain concentrations of MeHg exceeding health advisory guidelines. The main source of MeHg to these near shore areas appears to be transport from the surrounding watershed. We know that production of MeHg occurs in anoxic subsurface waters in association with sulfate reduction. However, we do not know the major contributing areas to Lake Superior. We believe hyporheic zones near Lake Superior may be important because these sites provide an environment conducive to both methylation and potentially rapid transport to the lake. Identification of major sources is an essential step in developing management strategies for the MeHg problem.

The objectives of this proposal are (1) to measure MeHg concentrations and rates of mercury methylation and demethylation in contrasting hyporheic zones in the Lake Superior watershed, and (2) to evaluate the potential flux of MeHg to Lake Superior from these zones through measurements of hydraulic conductivities and gradients.

Our approach will involve investigation of contrasting sites from watersheds with a mixed wetland/forest composition and a forest only composition. Wells will be installed in the hyporheic zones in transects

perpendicular to the river. These wells will be used to sample hyporheic waters for concentration measurements of total mercury and MeHg and key supporting parameters (dissolved oxygen, sulfate, sulfide, dissolved organic carbon, pH, specific conductance, iron, and manganese). Additional wells and automated water table sensors (Ecotone®) will be installed for measuring and recording groundwater elevations. Hydraulic conductivities of the hyporheic zone soils will also be characterized to enable calculation of transport rates. All measurements will be made seasonally. For methylation and demethylation rate measurements, intact sediment cores will be obtained at various depths within the hyporheic zone. The cores will be spiked at various depths with inorganic mercury [Hg(II)] and MeHg with distinct isotopic signatures. The concentrations of MeHg formed or inorganic mercury produced by demethylation will be measured using ICP-MS techniques.

The results of this investigation will provide information on the sources of MeHg to Lake Superior. Information on sources is essential for developing management plans and for evaluating the rate and extent of response to strategies for mitigation of mercury emissions into the environment.

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