



WATER RESOURCES RESEARCH GRANT PROPOSAL

1. Title: Association of Methylmercury with Dissolved Organic Carbon: Implications for Bioaccumulation in Maine Freshwater Fish.

2. Focus Categories: HYDGEO, TS, WQL

3. Keywords: Dissolved Organic Carbon, Organometallic Compounds, Contaminant Transport, Fish Ecology, Lakes

4. Duration: 1/9/98-31/8/00

5. Federal Funds Requested: \$56,021

6. Non-Federal Funds Pledged: \$112,342

7. Principal Investigators: Aria Amirbahman (Department of Civil and Environmental Engineering) and Terry A. Haines (Department of Biological Sciences). University of Maine.

8. Congressional District: Second

9. Statement of Critical Regional Problems:

High concentrations of mercury ($>0.5 \mu \text{g/g}$ wet weight) have been found in many species of freshwater fish in waters unaffected by direct discharge throughout the US. More fish consumption advisories resulting from mercury have been issued by state health agencies than for all other contaminants combined. This problem is especially acute in New England generally, and in Maine specifically. The Maine Department of Human Services Bureau of Health has issued a blanket fish consumption advisory because of mercury for all fresh waters in the state. This reduces recreational opportunity and eliminates a source of high quality protein for residents. These high mercury concentrations also pose a threat to fish-eating birds and mammals. The source of the mercury is believed to be atmospheric deposition, but the mercury concentrations in biota are not uniform from water to water. Rather, mercury contamination of biota is highly variable and it is common for a lake containing fish with high mercury concentration to be located within a few hundred meters of another lake with relatively low fish mercury levels. In order to better target fish consumption advisories and to identify lakes where mercury contamination of biota is most likely to occur, a better understanding of the environmental factors that control the bioavailability of methyl mercury is needed.

10. Statement of Results and Benefits:

The role of dissolved organic carbon (DOC) in the bioavailability of mercury (and other trace metals) is complex. Studies of the role of water chemistry in fish mercury concentration nearly always identify DOC as an important variable, but have produced conflicting results concerning the nature of the interaction. The mercury burden in higher organisms consists almost entirely of monomethyl mercury (CH_3Hg), and uptake is almost entirely through the diet, with a biomagnification factor of about 10 between trophic levels. However, uptake of CH_3Hg from water into the bottom of the food chain (e.g., algae) has a bioconcentration factor of ca. 10^5 . Dissolved organic carbon is most likely to affect the supply or bioavailability of MeHg to algae rather than transfer through the food chain to fish. This proposed research focuses on the characterization of natural DOC in Maine lakes and the interaction between DOC and CH_3Hg as it relates to bioavailability of CH_3Hg to algae. Through this approach we hope to identify key parameters that control CH_3Hg bioavailability, and thereby improve our ability to identify classes of surface waters that are likely to have either high or low CH_3Hg bioavailability. Our findings may be useful in improving the ability to predict CH_3Hg concentration in fish, permitting the refinement of fish consumption advisories to exempt lakes where CH_3Hg is unlikely to bioaccumulate, thereby increasing recreational fishing opportunities.