

Developing Ambient Water Quality Criteria for Mercury: A Probabilistic Site-Specific Approach

This project examined the development of ambient water quality criteria (AWQC) for the protection of wildlife for mercury. Mercury is considered a serious risk to wildlife in many areas. As a result, the Great Lakes Water Quality Initiative and others have developed AWQC. These AWQC have been controversial, however, because (1) the AWQC were single values that did not account for site-specific conditions; (2) derivation of the AWQC relied on a single NOAEL, and (3) the AWQC had an unknown level of conservatism because of reliance on both average and conservative assumptions and uncertainty factors. Rather than develop a single value AWQC for total mercury, we derive an AWQC model that explicitly incorporates factors controlling bioavailability, methylation rates and bioaccumulation in the aquatic environment (e.g., pH, DOC, sulfate). To derive our AWQC model, field data was collected including numerous water quality parameters and total mercury and methylmercury concentrations in whole body fish tissue from 31 lakes in Ontario and an additional 10 lakes in Nova Scotia. An independent dataset consisting of 51 water bodies in the United States was then used to confirm the validity and robustness of the AWQC model. Next we combined the results of chronic-feeding studies with similar protocols and endpoints, in a meta-analysis to derive a dose-response curve for mink exposed to mercury in the diet. Using this approach, one can derive an LD5 or other similar endpoint that can then be used as the basis for deriving -wildlife AWQC. In the final step, we used a probabilistic risk model to estimate the concentrations of methylmercury in water that would lead to levels in fish sufficient for there to be a 10% probability of exceeding the mink LD5. This analysis was repeated for various combinations of pH and DOC. The result is an AWQC model for mercury for the protection of wildlife that can be used for a variety of site-specific conditions.

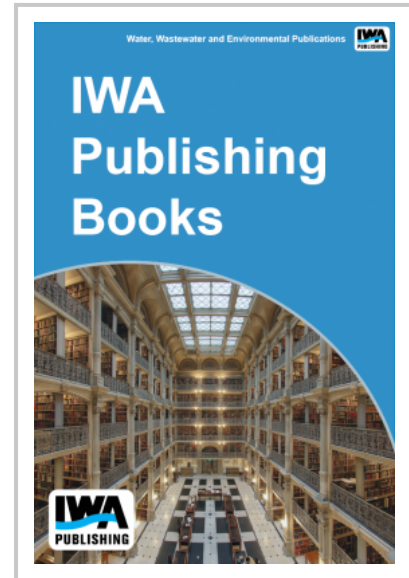


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