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Health Risk Assessment of Methyl Mercury in the Diet

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Problem Statement: Metals occur naturally in the environment and thus in foods. Inorganic mercury, a common air contaminant from burning coal and also from natural sources, is known to be converted by naturally occurring microorganism to methyl mercury. This form of mercury then bioaccumulates in fish, with predatory fish having higher amounts. Health risks of methyl mercury are typically calculated by extrapolation from observed health effects at high doses from consumption of contaminated fish in humans, and from exposure to experimental animals, to lower doses such as in fish that might be of concern for regulation.

Scientific Issues: Assuming that a threshold occurs in the dose-response relationship leads to the extrapolation to low doses of methyl mercury that may be considered protective of health. However, in the case of methyl mercury in fish, it is particularly important to incorporate the best science because naturally occurring levels in fish are very close to the extrapolated threshold, and conservative projections of safe concentrations will result in regulations and risk communications that unnecessarily concern the public, and, more importantly, may lead the public to reduce fish consumption, which itself is known to be associated with health benefits.

Current risk assessment: Several organizations have conducted dose response assessments of methyl mercury and all of them have projected these "safe" doses to concentrations in fish. These dose response assessments have undergone rigorous peer reviews and can be found at the International Toxicity Estimates for Risk (*ITER*) database, which is available at the National Library of Medicine's Toxnet. These assessments rely on extrapolation of risk from exposures to mothers and children in the Seychelles and Faroe Islands. Overall, the safe dose projections of these various organizations are within a 3-fold factor of each other. Projected "safe" concentrations in fish can sometimes be exceeded in populations eating a large amount of contaminated fish. Research into estimating the risks above these "safe" doses/concentrations has been conducted Aylward et al., 2014: http://chemicalriskassessment.org/methods/use-of-biomarkers-in-the-benchmark-dose-method/).

Discussion questions:

- Should the assessment of methyl mercury in fish be conducted differently from other exposure media?
- How would one incorporate the difference between populations exposed to high methyl mercury in fish and those exposed to background levels?
- Should dietary risk assessments be based on subpopulations with the highest exposure (e.g., pregnant mothers)?
- What role should possible mode of action considerations play in the assessment of health risks from exposure to methyl mercury?

Example: Methyl Mercury Risk Versus Benefits of Fish Consumption

I- Exposure and health risks to methyl mercury in fish and dietary patterns of different countries
II- Health benefits of fish consumption and dietary patterns involving fish