Mercury Bioaccumulation Remains Unresponsive to Point-Source Mercury Remediation: Investigating Factors and Potential New Approaches to the Problem

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Mercury concentrations in fish from a stream and reservoir downstream of an industrial facility remain high some 50 years after the original major releases to the environment. Fish mercury levels remain high despite substantial abatement and remedial actions that have reduced mercury inputs to the stream by more than 90%. Source reduction efforts have included floodplain soil removal, bank armoring, storm drain relining, and carbon treatment. These actions aim at reducing inorganic mercury inputs to the stream; a strategy that assumes reducing inorganic mercury precursor will limit methylation and subsequent bioaccumulation. More recently other factors affecting bioaccumulation have been investigated, including those factors that affect the concentration of dissolved methylmercury in the water, those that affect the rate of net methylation (methylmercury formation minus methylmercury destruction by microbial and photolytic action), and those that affect how methylmercury concentrations are magnified in the food chain. In early 2008, a multi-organizational technical working group convened in an effort to develop new and innovative strategies for reducing mercury levels in fish near the facility. Of particular outcome was to conduct two field tests that demonstrate two potential alternatives to source removal that could improve the situation quickly. One field test focused on reducing flow argumentation in the creek's headwaters by 50% to minimize resuspension and mobilization of mercury present in the stream sediment, and the second test involved stannous chloride addition to mercury-contaminated storm drains to chemically reduce Hg(II) to Hg(0), where it could be potentially removed from the headspace. The flow modification test was successful at reducing approximately 10-15% of mercury flux without increasing stream concentration, with no observed negative impacts to the stream as measured by concurrent toxicity testing. Laboratory studies of storm drain water found that mixing of excess thiosulfate and Sn(II) caused approximately 90% of Hg(II) reduction to Hg(0). Preliminary results from both studied alternatives showed promise, and longer and more sophisticated field tests are planned for late 2008 and 2009. Given the high cost of conventional source removal technologies, the complexity of mercury methylation processes, the lengthy remediation timelines for this site, and the uncertain response in fish, continued applied research and development

of new remediation technologies is warranted and could provide substantial long-term benefits.