

Se Ecotoxicology and Application to In Situ Bioremediation

Serge Doroshov and Teresa W-M Fan

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Executive Summary

Se contamination is one of the best-known cases that had led to serious population decline of aquatic top predators such as waterfowl and fish in a number of watersheds, including agricultural drainage systems of the San Joaquin Valley. The historical lessons of Se pollution underscore the urgent need for early-warning indicators of environmental deterioration in a given watershed. Unfortunately, no such indicators are known. Chemical analysis alone cannot uncover such indicators, due to the extensive transformations, foodchain bioavailability, biogeochemistry, and unknown toxicity mechanism(s) of Se, all of which are components of biological assimilatory capacity (BAC). Thus, the most useful indicator in a given ecosystem would be one that can gauge exceedance of BAC for top predators.

Consequently, this proposal will address the following objectives:

- 1) Probe the ecotoxic mechanisms underlying Se impact on resident, model fish of contaminated regional watersheds, using state-of-the-science biogeochemical and cellular imaging tools in laboratory experiments;
- 2) Utilize results from Objective 1 to establish biochemical indicators which can be assayed conveniently and have the potential to be used as an early warning tool for Se ecotoxicity;
- 3) Test these indicators in a Se-contaminated watershed, with the aim of assessing exceedance of biological assimilatory capacity (BAC) on a site-specific basis.

To achieve these objectives, we propose a work plan that, in essence, will test the hypothesis that protein-bound Se forms in intermediate food-chain organisms are an indicator of BAC exceedance. This will consist of probing the mechanisms of toxicity in two resident species of fish (mosquitofish and bluegill) of disparate toxicity thresholds, determining the biochemical forms of Se in a resident food organism (brine shrimp) as well as the fish species, and validating the relationship of Se toxicity to Se form(s) in field studies involving the same fish species.