Mitigating Selenium Ecostoxic Risk by Combining Foodchain Breakage with Natural Remediation

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Executive Summary

In the San Joaquin Valley agricultural drainage waters, the utmost issue with selenium is toxicity to top predators such as aquatic birds, which receive their selenium primarily through their diet, including aquatic invertebrates and fish. Past research has shown that waterborne selenium concentration is not always a reliable predictor of selenium toxicity. This is because Se biogeochemistry (biotransformations and foodchain transfer, in particular) plays a pivotal role in determining the ecotoxic risk of Se at particular sites. Consequently, these processes must be evaluated for any *in situ* bioremediation effort and they may be exploited to mitigate Se contamination problems. These concepts form the foundation of the proposed project at the Tulare Lake Drainage District (TLDD) evaporation basin and flow-through wetland sites.

The objectives of the proposed research are keyed around the foodchain system in TLDD drainage waters, which include:

1) evaluating the efficacy of reducing Se risk resulting from intensive commercial harvest of brine shrimp (*Artemia franciscana*) and other macroinvertebrates in TLDD basins;
2) assessing effects of fertilizer inputs on algal dynamics for optimizing the harvest of brine shrimp and other macroinvertebrates as well as Se volatilization so that total and bioavailable Se are reduced in TLDD basins;
3) evaluating ecotoxic status in different cells of the TLDD flow-through wetland trial so that conditions leading to reduced ecotoxic risk can be discerned.

These objective will be achieved by analyzing Se status (total Se burden, Se and Se form allocation in protein fraction) in both water-column and benthic macroinvertebrates at TLDD flow-through wetland and basins where harvest activities are occurring, investigating algal dynamics by microscopy, pigment analysis, and 16S RNA typing in those basins manipulated by fertilizer additions, and determining conditions that optimize brine shrimp and other macroinvertebrate crops, enhance Se volatilization, and minimize ecotoxic risk in both water-column and sediment foodchains. The basic nature of the information obtained should lend applicability to other Se-laden drainage or drainage reuse systems. If successful, the proposed research should lead to a long-term and economical measure ofr managing San Joaquin Valley drainage systems with minimal ecotoxic risk.