Interaction of Se Biogeochemistry With Foodchain Disruption in Full-Scale Evaporation Basins

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Executive Summary:
Preliminary investigation in hypersaline ponds of TLDD indicates that Se volatilization may be combined with brine shrimp harvest to reduce Se Load in waters and biota. In addition, it appears that both processes could be enhanced by manipulating the water chemistry via fertilizer input, which would increase microphyte population that are food for the brine shrimp. If mechanistically understood, this coupled process should prove to be a highly economical and flexible option for remediating Se ecotoxic risk in agricultural drainage systems. These advantages are due to a market demand for brine shrimp and the practicality of implementing the option together with other drainage mitigation plans such as IFDM and reverse osmosis.

Our objectives are to mechanistically understand the effect of fertilization and brine shrimp harvest on Se biogeochemistry and to uncover conditions that simultaneously favor Se volatilization and brine shrimp production while minimizing the accumulation of Se ecotoxic indicators. We will approach these objectives by investigating the following:

1. Change in Se status in TLDD hypersaline ponds (Hacienda A4 in particular since we have data on its Se status before harvest began) elicited by brine shrimp harvest;
2. Changes in water chemistry associated with fertilizer input;
3. Effects of fertilizer input on nutrient status of microalgae and brine shrimp, microalgal community, as well as Se status in TLDD hypersaline ponds so that these effects may be related to changes in water chemistry, thereby guiding additional nutrient supplementation.

We will collect water and brine shrimp samples on a monthly basis so that changes before and after fertilization events can be followed. Water samples will be processed to harvest microalgae and trap Se volatiles. Total Se and a broad spectrum of nutrient elements in microalgae, brine shrimp, and water will be acquired, long with speciation of ecotoxic indicators of Se (i.e. proteinaceous Se and selenomethionine) in microalgae and brine shrimp. Se volatilization activity will be estimated from total Se and individual metabolites in the volatile traps conducted in the laboratory and in situ. Microalgal community will be acquired from the genetic (16S rRNA) profile. The various Se and nutrient parameters will be related to brine shrimp harvest activity, fertilization events, and microalgal community so that conditions that encourage both Se volatilization and brine shrimp production can be revealed. This information should be useful for both improving the operation at TLDD and engineering the Se volatilization/foodchain disruption approach for remediating other Se-laden drainage systems.