USGS

# WATER RESOURCES RESEARCH GRANT PROPOSAL

**Title**: Bioavailability of Particle-Associated Pesticides in Northern San Francisco Bay

**Focus Categories:** NPP, TS, AG

**Keywords:** agriculture, contaminant transport, herbicides, insecticides, invertebrates, pesticides, suspended sediments

**Duration:** 9/99 - 5/02

**Federal Funds Request:** $122,323

**Non-Federal Matching Funds Pledged:** $222,600

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## Abstract

There is clear evidence that pesticides from agricultural and municipal sources are entering the surface water of the San Francisco Bay watershed via runoff, and that their concentrations are sufficiently high that sensitive aquatic species may be at risk. The vast majority of work to date has been on dissolved phase pesticides, but USGS scientists have recent data indicating that many insecticides and herbicides with relatively low Km values (log Km of 2-3) are present on suspended particles at concentrations well above those predicted by equilibrium partitioning theory. Our objectives are to determine how rapidly sediment-associated pesticides can be desorbed in an aqueous environment, how this desorption may be affected by salinity or dissolved organic matter concentration, if they can be rapidly desorbed in the more chemically rigorous environment of a deposit-feeder's gut, and finally if they are in sufficient concentration to cause toxicity in sensitive species. Suspended sediment and recently deposited bottom sediment will be collected on at least six occasions from the Sacramento, San Joaquin, and Napa Rivers near their point of discharge into northern San Francisco Bay. The sediments will be analyzed for a wide range of pesticides including organochlorine insecticides, organophosphate insecticides, and many herbicides. Aqueous desorption experiments will be done to establish rate and extent of pesticide desorption from these sediments as an indication of potential bioavailability. Salinity and dissolved organic matter content of the water will be manipulated to examine the influence of these variables. Filter and deposit-feeding organisms ingest pesticide-contaminated particles, and in this case the relevant extractant is not water but digestive fluid. In vitro digestive fluid extraction, a novel approach to measuring contaminent bioavailability, will be used to determine the rate and extent of pesticide desorption that may be expected within the digestive tract, and thus

place a upper limit on the bioavailable pesticide fraction. Finally, we will evaluate the potential for particle-associated pesticides to cause toxicity to aquatic life, either through ingestion of the particle or indirectly following aqueous desorption. Toxicity tests will be done with the cladoceran Ceriodaphni dubia. the algae Selanastrum capricornutum, and the amphipod Corophium spinicorne. The results of this research will be of particular value to environmental management agencies, and help to determine whether measurement of dissolved pesticides only, as is typically done now in the San Francisco Bay and tributary rivers, is adequate, or if protection of aquatic life must also consider the bioavailability and potential toxicity of the particle-associated fraction.