

**CALFED BAY-DELTA PROGRAM
PROPOSAL
(July 28, 1997)**

**Integration of Mercury Studies and Results
on the San Francisco Bay-Delta System**

Applicants:

Thomas H. Suchanek, Darell G. Slotton, Brenda S. Johnson

*Division of Environmental Studies
University of California @ Davis*

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I. EXECUTIVE SUMMARY

A. Project Title:

Integration of Mercury Studies and Results on the San Francisco Bay-Delta System

Applicants:

Thomas H. Suchanek, Darell G. Slotton, Brenda S. Johnson

*Division of Environmental Studies
University of California, Davis*

B. Project Description and Primary Biological/Ecological Objectives:

This project will provide ongoing collaboration and integration among investigations addressing mercury contamination within the San Francisco Bay-Delta System and its watersheds. Pre-study collaboration and continuous integration of these projects will eliminate duplication of effort and provide the maximum information return from a system-wide perspective. We will encourage participation by not only the investigators responsible for the mercury projects, but California state agency scientists and CALFED personnel as well.

C. Approach/Tasks/Schedule:

Pre-study planning/collaboration: This will ensure that the most important regional issues relating to mercury impacts on the Bay-Delta system are both identified and addressed. This will also ensure that there is little or no duplication of efforts among the various projects. This portion of the work has already been initiated, providing integration of major projects prior to submission of mercury-related proposals to CALFED.

Semi-annual workshops: Two workshops per year for three years will allow us to share preliminary data and compile interim summary reports that synthesize information from multi-disciplinary studies into an integrated format.

Final report: At the end of the three year period, a final Integrative Report on Mercury Contamination Issues within the Bay-Delta System will be produced.

D. Justification for Project and Funding by CALFED:

Mercury pollution and, particularly, the bioaccumulation of toxic methyl mercury in food webs, is a global problem impacting aquatic ecosystems and consumers of aquatic organisms. In California, the threat from this stressor is compounded by the legacy of mining-related mercury contamination across wide areas of the state. Over the past 100 years, abandoned mercury mines in the Coast Range and remnant mercury used in gold and silver mining, primarily in the Sierra Nevada, have resulted in the deposition of significant quantities of mercury in Bay-Delta sediments. Both of these regions supply an ongoing loading of this stressor to the Bay-Delta and its watershed. Mercury has been clearly identified by many California state agencies as an aquatic pollutant of great concern. Its toxicity to higher order consumers of aquatic organisms is well established, while its effects on reproduction, development, and juveniles of all aquatic and aquatic-feeding species is only poorly understood. Because of the widespread nature of the bulk contamination in California, virtually every sub-region of the Bay-Delta and its watershed is effected. All of the named CALFED priority habitats and priority species (in addition to numerous others) are exposed to this ecosystem stressor. Mercury additionally constitutes a significant human health hazard from mercury-contaminated fish consumed throughout the entire system.

Suchanek, Slotton and Johnson: (Integration of Mercury Projects)

This integration, between several mercury related projects, will provide a clearing house for data and information that are collected from funded CALFED projects, as well as related studies funded by other sources. The integration format that will be used in the collaborative effort will produce a series of products that will clearly be greater than the sum of the parts. By coordinating the efforts of the major mercury-related investigations taking place throughout the Bay-Delta watershed study region, this project will promote communication between the groups, avoidance of duplication of funding and effort, and the most rapid generation for the state of an effective watershed-wide remedial program for mercury. The cost-effectiveness of potential future remedial work at major mercury point sources such as abandoned mines will depend on this type of coordinated data integration and evaluation.

This work is highly relevant and consistent with CALFED objectives of improving water quality, ecological function and ecosystem health.

E. Budget Costs and Third Party Impacts:

Budget Costs: \$125,819 (three years)

Third Party Impacts: None expected.

F. Applicant Qualifications: The applicants are all Ph.D. level University of California researchers with strong reputations in various facets of ecosystem assessment. Drs. Suchanek and Slotton bring a combined 18 years experience directing a wide variety of applied research, assessment, and remediation feasibility studies specifically focusing on the bioaccumulation and transport of mercury. In addition, Dr. Suchanek is the Western Regional Director of the National Institute for Global Environmental Change (sponsored by the Department of Energy) and has considerable experience in developing collaborative/integrative multi-disciplinary and inter-disciplinary teams to address specific environmental issues through the workshop format.

G. Monitoring and Data Evaluation:

This program will involve no field work, but will be a coordination of a number of field and laboratory projects. A major objective of the integration program is to provide each of the participants with the most current information from a variety of inter-related, multi-disciplinary projects. Another objective is to provide the mechanism for periodic peer-review data evaluation of each of the projects by the people most knowledgeable in the subject area.

H. Local Support/Coordination with other Programs/Compatibility with CALFED

Objectives: This project inherently has support and coordination from numerous agencies and programs involved in the study of mercury impacts on the San Francisco Bay-Delta system. These agencies/institutions include: the U.S. Geological Survey, the U.S. Fish and Wildlife Service, Lawrence Berkeley Laboratory, the California Division of Mines and Geology, the State Water Resources Control Board, the Central Valley and San Francisco Bay Regional Water Quality Control Boards, and the Contra Costa County Public Works Department. The primary groups submitting mercury-related proposals to CALFED have already been assembled to coordinate the proposals and avoid potential duplication of funding and effort. All of the participants have been very supportive of the process. The workshop/decision making format will include representatives of appropriate agencies in the process, as well as representatives of the CALFED program. Major decisions involving future direction of work and collaborative efforts will be made only with the input and approval of these participants. The workshop and data sharing format will be inclusive of other mercury-directed investigations that may be funded in future by CALFED, as well as related investigations occurring within the Bay-Delta watershed that are funded by other sources. The intent of this integration project is to bring all mercury-related investigations in the region together on a regular basis, thereby maintaining the highest level of communication and synergy.

UC Davis has provided pre-project integration meetings and initial workshops as a matching contribution to the project.

II. TITLE PAGE

**Integration of Mercury Studies and Results
on the San Francisco Bay-Delta System**

Applicants:

Thomas H. Suchanek¹ and Darell G. Slotton², Brenda S. Johnson³

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Submitted to: CALFED (July 28, 1997)

Type of Organization and Tax Status: State Agency (University of California)

Tax Identification Number: 94-6036494-W

Technical Contact Persons: Thomas H. Suchanek¹ and Darell G. Slotton²

**Financial Contact: George R. Max, Division Manager, Extramural Funds Division,
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RFP Project Group Type: Other Services

Sandra M. Dowdy JUL 25 1997
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III. PROJECT DESCRIPTION

A. Project Description and Approach

This proposal addresses one of the key areas of concern identified in the CALFED Bay-Delta Ecosystem Restoration Program Plan: water quality. We focus on the ecosystem stressor mercury, a contaminant having widespread impacts on California aquatic resources, largely as the result of historic mining for mercury, gold, and silver. The benefits of this project encompass ecosystem-wide health, including all of the invertebrate populations as well as vertebrates, especially fisheries, and human resources derived from this ecosystem.

A number of investigators are submitting proposals to CALFED that deal with various aspects of mercury contamination within the Bay-Delta system. These investigators have been in close communication with each other during the development phases of these projects in order to make sure that the studies being proposed are complementary rather than duplicative. The projects that we are aware of which deal with various aspects of mercury contamination, and for which collaboration/integration is proposed, are:

- 1) **The Role of Upstream Mercury Loading and Speciation on Localized and Downstream Bioaccumulation: A Regional Assessment of Sources and Fates of Mercury Throughout the Bay-Delta Watershed.** Applicants: T.H. Suchanek, D.G. Slotton, J.E. Reuter, B.S. Johnson, D.C. Nelson, J.F. Quinn, J.F. Mount, C.R. Goldman (U.C. Davis)
- 2) **The Effects of Wetland Restoration on the Production of Methyl Mercury in the San Francisco Bay-Delta System.** Applicants: T.H. Suchanek, D.G. Slotton, B.S. Johnson, J.E. Reuter, D.C. Nelson (U.C. Davis)
- 3) **The Status of Mercury as a Stressor to Habitats and Species of the San Francisco Bay-Delta Ecosystem.** Applicants: Mark Marvin-DiPasquale, Samuel Luoma, James Cloern, Ronald Oremland, David Krabbenhoft, James Kuwabara, Michael Saiki, Thomas May, George Aiken, Carol Kendall, Laurence Miller, Byeong-Gweon Lee, Robin Bouse, and Charles Armor (USGS)
- 4) **Mercury Fluxes in the Cache Creek Watershed: Characterization of Mercury Speciation and Transport From Mine Wastes, Mine Drainage and Natural Sources.** Applicants: Jim Rytuba (USGS), Charles Alpers (USGS), George Parks (Stanford University), Roger Ashley (USGS), Ron Churchill (CDMG), Gordon Brown (Stanford University) and Chris Kim (Stanford University)
- 5) **Localization and Characterization of Mercury Sources in Water, Colloids and Sediment in the Sacramento River Between Bend Bridge and Colusa, the Cosumnes River, and the Feather-Yuba-Bear River System.** Applicants: Charles Alpers (USGS), Joseph Domagalski (USGS), Howard Taylor (USGS), David Roth (USGS) and Jim Rytuba (USGS)
- 6) **Adverse Effects of Mercury on Birds and Amphibians in the Cache Creek Basin.** Applicants: Steve Schwarzbach and Larry Thompson (USFWS), Roger Hothem (BRD/USGS) and M. Jennings (BRD/USGS)
- 7) **Effects of Selenium on Mercury Bioaccumulation in Clapper Rails in the North Bay.** Applicants: S. Schwarzbach (USFWS)
- 8) **Cadmium, Mercury, and Selenium Contamination in Diving Ducks and Benthic Prey from Wintering Sites at San Pablo and Suisun Bays, CA and Breeding Grounds at Ruby Lake NWR, NV.** Applicants: John Takekawa, (USGS), James Haas (USFWS) and Steve Schwarzbach (USGS)

Suchanek, Slotton and Johnson: (Integration of Mercury Projects)

- 9) **Toxic Trace Element Fluxes from Marsh, Mudflat, and Shallow Subtidal Sediments: Determining the Contribution of Fluxes from Sediments to Non-point Source Pollution in the Bay.** Applicants: Peter Zawislanski and Angus E. McGrath (Lawrence Berkeley Lab)
- 10) **Mt. Diablo Mercury Mine Site Remediation and Mercury Export Reduction Project.** Applicants: Contra Costa County Department of Public Works

Our project will provide initial, ongoing and future collaboration among a collective set of mercury studies by initiating (1) pre-study collaboration/integration, (2) semi-annual workshops, and (3) a synthesis of mercury results from the participating studies. This effort is intended to steer ongoing and any future work in a direction that will provide a more complete understanding of mercury cycling and dynamics within the San Francisco Bay-Delta System and associated watersheds in order to improve water quality and protect biotic resources.

Important: We make no judgment regarding the quality of the proposals being submitted (see above). They are not inherently linked (although they are complementary) and there is NO intention for them to be considered for funding in an "all-or-nothing" context. We do, however, propose to establish a consortium of mercury investigators and investigations that will involve whichever mercury-related projects are funded by CALFED in order to improve the overall understanding to the sources, fates and impacts of this contaminant within the Bay-Delta system. We will also attempt to coordinate information derived from any other ongoing mercury studies outside of the CALFED process.

B. Location and/or Geographic Boundaries of Project

Although the individual projects referenced within this integration proposal address processes taking place within a wide geographic area of the Bay-Delta System and associated watersheds, this will not hinder the integration of the proposed projects. To the best of our knowledge, all of the projects being proposed address issues within the CALFED Study Area Boundary as specified in the ERPP and the CALFED RFP.

C. Expected Benefits

This project focuses on the ecosystem stressor mercury, a bioaccumulating toxic metal that exhibits bulk contamination and elevated loading patterns throughout many portions of the Bay-Delta watershed, related to historic mining of mercury, gold, and silver. Mercury has been clearly identified by many California state agencies as an aquatic pollutant of great concern. Its toxicity to higher order consumers of aquatic organisms is well established, while its effects on reproduction, development, and juveniles of all aquatic and aquatic-feeding species is only poorly understood. All of the named CALFED priority habitats and priority species are exposed to this ecosystem stressor, as are virtually all other co-occurring aquatic species and consumers of watershed aquatic organisms. Mercury additionally constitutes a significant human health hazard, through the consumption of fish from the Bay-Delta system.

By coordinating the efforts of the major mercury-related investigations taking place throughout the Bay-Delta study region, this project will promote communication among the groups, avoidance of duplication of funding and effort, and yield the most rapid generation of an effective watershed-wide remedial program for mercury. The cost-effectiveness of potential future remedial work at major mercury point sources such as abandoned mines will depend on this type of multi-disciplinary and inter-disciplinary coordinated data evaluation.

D. Background and Biological/Technical Justification

Mercury contamination is clearly a serious problem throughout the Bay-Delta and most of its extended watershed, largely as a result of historic mining practices. In recent years, much excellent work has been done in the area of mercury biogeochemistry within the Bay-Delta watershed, including the various projects of Suchanek and Slotton at UC Davis and other investigators from the USGS, the Central Valley Regional Water Quality Control Board, Lawrence Berkeley Laboratory, US Fish and Wildlife Service, and the State Toxic Substances Monitoring Program. A coherent, logical "mercury plan" is desired for the state, which will effectively direct future potential remedial work to cost-effectively reduce the ultimate movement of this contaminant through the system and into aquatic food webs. In order to best and most rapidly achieve this overall goal, it is imperative that the major mercury-related investigations within the system be integrated. We intend to provide this integration.

E. Proposed Scope of Work

Pre-study planning/collaboration: This will ensure that the most important regional issues relating to mercury impacts on the Bay-Delta system are both identified and addressed. This will also ensure little or no duplication of efforts among the various projects. This portion of the work has already been initiated, providing integration of major projects prior to submission of mercury-related proposals to CALFED.

Semi-annual workshops: Two workshops per year for three years will allow us to share preliminary data and compile interim summary reports that synthesize information from multi-disciplinary studies into an integrated format.

Final report: At the end of the three year period, a final Integrative Report on Mercury Contamination Issues within the Bay-Delta System will be produced.

In addition to the specified workshops and products, there will be a high level of ongoing communication and collaboration between the respective investigators responsible for the individual projects, as well as CALFED and state/local agency representatives.

F. Monitoring and Data Evaluation

This program in and of itself will involve no field work, but will be a coordination of several field and laboratory projects. A major objective of the integration program is to provide each of the participants with the most up-to-date information from a variety of inter-related, multi-disciplinary projects. Another objective is to provide the mechanism for periodic peer-review data evaluation of each of the projects by the people most knowledgeable in the subject area. We anticipate that the data produced from this project will be evaluated by the individual project Principal Investigators and their participating scientists and collaborators, by CALFED and the appropriate California state agencies, and by national and international mercury experts with whom our U.C. Davis Mercury Group communicates on an ongoing basis.

G. Implementability

This project is designed as a vehicle to integrate the study plans and ongoing results from several mercury-related projects within the San Francisco Bay-Delta System and Watersheds. The project does not contain any construction or habitat manipulation components. No threatened or endangered species will be collected in this work. The project has widespread support from numerous public and governmental entities, most of the major participants have already been assembled, and integration of the various potential projects has already begun.

IV. COSTS AND SCHEDULE TO IMPLEMENT PROPOSED PROJECT

A. Budget Costs

Note: UC Davis has provided pre-project integration meetings and initial workshops as a matching contribution to the project.

This budget was constructed with the assumption that approximately 20 participants will attend each of the mercury integration workshops. Seven workshops are planned. One initial pre-study planning workshop, plus 6 semi-annual workshops over three years (see Schedule Milestones below).

TOTAL FOR 3 YEARS (1998-2000)

Project Task	Direct Labor (person-months)	Direct Salary and Benefits	Equipment	Supplies & Expendables	Travel	Service Contracts	Miscellaneous and Other Direct Costs
Task 1: Convene a pre-study workshop	1	\$3,763	\$0	\$214	\$5,000	\$0	\$1,450
Task 2: Coordinate semi-annual meetings and ongoing work	12	\$45,154	\$0	\$1,071	\$25,001	\$0	\$7,250
Task 3: Produce final integrated summary report	5	\$18,814	\$0	\$214	\$5,000	\$0	\$1,450

Note: Budget breakdown continued on next page.

Suchanek, Slotton and Johnson: (Integration of Mercury Projects)

Budget breakdown: (con'd)

Summary Information:

TOTAL FOR 3 YEARS (1998-2000)

Project Task	Direct Costs (Subtotal)	Indirect Costs (Overhead) 10%	Year 1	Year 2	Year 3	TOTAL COSTS	
Task 1: Convene a pre-study workshop	\$10,427	\$1,043	\$11,469	\$0	\$0	\$11,469	
Task 2: Coordinate semi-annual meetings and ongoing work	\$78,476	\$7,848	\$28,775	\$28,775	\$28,775	\$86,324	
Task 3: Produce final integrated summary report	\$25,478	\$2,548	\$0	\$0	\$28,026	\$28,026	
						\$125,819	CALFED REQUEST
							\$125,819

V. APPLICANT QUALIFICATIONS

Dr. Suchanek has led multi-disciplinary and inter-disciplinary ecosystem projects/programs for over 18 years, primarily dealing with the effects of anthropogenic stressors on ecosystem health, and has focused on the impacts of mercury on California resources since 1991. All of these programs have involved multiple investigators from many disciplines and several have involved multi-million dollar budgets. Dr. Suchanek is also western regional director of the National Institute for Global Environmental Change (a Department of Energy sponsored program) for which he administers a \$1.2M/yr program dealing with anthropogenic impacts on ecological systems. Dr. Suchanek is Principle Investigator for an ongoing inter-disciplinary project (which is in its final phases) studying the biogeochemistry and ecosystem impacts of mercury contamination from the Sulphur Bank Mercury Mine Superfund Site on the aquatic ecosystem of Clear Lake, CA. He is also a Co-Principle Investigator for the Center for Ecological Health Research (an EPA-funded program at U.C. Davis), in which he specializes on issues relating to the impacts of mercury on ecosystem health, especially at Clear Lake. Numerous reports and publications (see list in References section) dealing with a variety of mercury issues have resulted from these and related studies, and the final product will be a set of effective remedial recommendations (to the U.S. Environmental Protection Agency) targeted to lower mercury levels in edible fishes within Clear Lake. In both the Clear Lake and NIGEC projects, he has effectively developed collaborative/integrative multi-disciplinary and inter-disciplinary teams to address specific environmental issues through the workshop format.

Dr. Slotton has directed applied research projects addressing heavy metal contamination and bioaccumulation issues in California aquatic ecosystems for over 12 years, with a primary focus on mercury. He has led investigations of copper, zinc, and cadmium contamination at Iron Mountain Mine and Camanche Reservoir, where sediment resuspension and metals transport, solubility, and bioavailability were investigated in a multi-year project. Since 1985, he has run a mercury biogeochemistry monitoring and research program at Davis Creek Reservoir in the California Coast Range, as well as a mercury analytical laboratory at UC Davis. One area of specialization has been the use of various bioindicators to explore mercury cycling and transport questions. Since 1993, Dr. Slotton has led a research program in the foothill gold mining region of the Sierra Nevada, primarily focusing on benthic invertebrates as proxies for relative bioavailable mercury concentrations and loading in the various tributaries. He is in the third year of a study of mercury mass loading, bioaccumulation, and remedial options at the Mt. Diablo Mercury Mine and Marsh Creek watershed. Other recent projects include mercury assessment studies throughout the Cache Creek and Putah Creek watersheds, and investigations of potential mercury bioaccumulation problems in gravel mining lakes. Dr. Slotton has also been a part of the Clear Lake Superfund Mercury Project (see above) since its inception.

Dr. Johnson currently serves as Regional Integrator for the Center for Ecological Health Research at UC Davis. In this capacity, she is developing conceptual and strategic linkages among those research programs being conducted by Center scientists that focus on the ecological function of the Sacramento River and Sierra Nevada Watersheds, and Clear Lake, Lake Tahoe, and San Francisco Bay-Delta ecosystems. She has led and participated in a number of large-scale interdisciplinary ecological studies combining approaches as diverse as molecular genetics, ecotoxicology, population modeling, and GIS. In her integration role, Dr. Johnson is involved in reconstruction of the ecological history of much of the region that CALFED has delineated as the Category III Study Area.

VI. Compliance With Standard Terms and Conditions

Agreement No. _____

Exhibit _____

STANDARD CLAUSES - INTERAGENCY AGREEMENTS

Audit Clause. For contracts in excess of \$10,000, the contracting parties shall be subject to the examination and audit of the State Auditor for a period of three years after final payment under the contract. (Government Code Section 8546.7).

Availability of Funds. Work to be performed under this contract is subject to availability of Category III funds.

Interagency Payment Clause. For services provided under this agreement, charges will be computed in accordance with State Administrative Manual Section 8752.1.

Termination Clause. Either State agency may terminate this contract upon 30 days advance written notice. The State agency providing the services shall be reimbursed for all reasonable expenses incurred up to the date of termination.

NONDISCRIMINATION COMPLIANCE STATEMENT

COMPANY NAME THE REGENTS OF THE UNIVERSITY OF CALIFORNIA

The company named above (hereinafter referred to as "prospective contractor") hereby certifies, unless specifically exempted, compliance with Government Code Section 12990 (a-f) and California Code of Regulations, Title 2, Division 4, Chapter 5 in matters relating to reporting requirements and the development, implementation and maintenance of a Nondiscrimination Program. Prospective contractor agrees not to unlawfully discriminate, harass or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, disability (including HIV and AIDS), medical condition (cancer), age, marital status, denial of family and medical care leave and denial of pregnancy disability leave.

CERTIFICATION

I, the official named below, hereby swear that I am duly authorized to legally bind the prospective contractor to the above described certification. I am fully aware that this certification, executed on the date and in the county below, is made under penalty of perjury under the laws of the State of California.

Sandra M. Dowdy
Contracts and Grants Analyst

OFFICIAL'S NAME
JUL 24 1997

DATE EXECUTED Sandra M. Dowdy
Contracts and Grants Analyst

EXECUTED IN THE COUNTY OF

Yolo

PROSPECTIVE CONTRACTOR'S SIGNATURE
Sandra M. Dowdy

PROSPECTIVE CONTRACTOR'S TITLE

PROSPECTIVE CONTRACTOR'S LEGAL BUSINESS NAME

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA

VII. LETTER OF COMMITMENT FROM PARTICIPANTS

See Attachment (Commitment Letter) on following two pages.



DIVISION OF ENVIRONMENTAL STUDIES

DAVIS, CALIFORNIA 95616

Date: 23 July 1997

To: CALFED

From: Consortium of Mercury Related Projects

Re: Statement of Commitment to Collaborate on Bay-Delta Mercury Projects

Of utmost importance is a thorough understanding of the sources, fates and impacts of mercury on the San Francisco Bay-Delta Ecosystem. Only through a cooperative, collaborative, multi- and inter-disciplinary effort by committed participants can this be accomplished.

We, the undersigned, agree to enter into a collaborative and integrative effort to improve our understanding of the stressor mercury on ecosystem health of the San Francisco Bay-Delta system. We understand that not all of the projects being proposed may be funded, but the representatives for those that are funded commit to participate in the collaborative integration effort described in detail in the proposal by Suchanek, Slotton and Johnson entitled "**Integration of Mercury Studies/Results in the San Francisco Bay-Delta System**". We will especially endeavor to reduce and/or eliminate duplication of effort for those projects that are ultimately funded.

Mercury-Related Projects being proposed to CALFED:

- 1) **The Role of Upstream Mercury Loading and Speciation on Localized and Downstream Bioaccumulation: A Regional Assessment of Sources and Fates of Mercury Throughout the Bay-Delta Watershed.** Applicants: T.H. Suchanek, D.G. Slotton, J.E. Reuter, B.S. Johnson, D.C. Nelson, J.F. Quinn, J.F. Mount, C.R. Goldman (U.C. Davis)

Representative: Tom Suchanek
Tom Suchanek

- 2) **The Effects of Wetland Restoration on the Production of Methyl Mercury in the San Francisco Bay-Delta System.** Applicants: T.H. Suchanek, D.G. Slotton, B.S. Johnson, J.E. Reuter, D.C. Nelson (U.C. Davis)

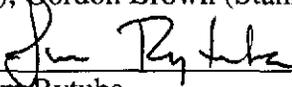
Representative: Tom Suchanek
Tom Suchanek

- 3) **The Status of Mercury as a Stressor to Habitats and Species of the San Francisco Bay-Delta Ecosystem.** Applicants: Mark Marvin-DiPasquale, Samuel Luoma, James Cloern, Ronald Oremland, David Krabbenhoft, James Kuwabara, Michael Saiki, Thomas May, George Aiken, Carol Kendall, Laurence Miller, Byeong-Gweon Lee, Robin Bouse, and Charles Armor (USGS)

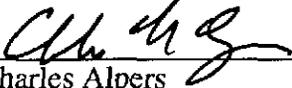
Representative: Mark Marvin-DiPasquale
Mark Marvin-DiPasquale

Consortium of Mercury Related Projects

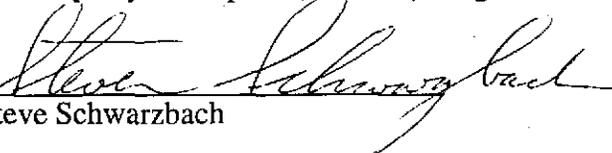
- 4) **Mercury Fluxes in the Cache Creek Watershed: Characterization of Mercury Speciation and Transport From Mine Wastes, Mine Drainage and Natural Sources.** Applicants: Jim Rytuba (USGS), Charles Alpers (USGS), George Parks (Stanford University), Roger Ashley (USGS), Ron Churchill (CDMG), Gordon Brown (Stanford University) and Chris Kim (Stanford University)

Representative: 
Jim Rytuba

- 5) **Localization and Characterization of Mercury Sources in Water, Colloids and Sediment in the Sacramento River Between Bend Bridge and Colusa, the Cosumnes River, and the Feather-Yuba-Bear River System.** Applicants: Charles Alpers (USGS), Joseph Domagalski (USGS), Howard Taylor (USGS), David Roth (USGS) and Jim Rytuba (USGS)

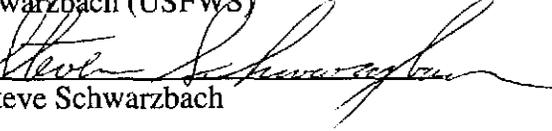
Representative: 
Charles Alpers

- 6) **Adverse Effects of Mercury on Birds and Amphibians in the Cache Creek Basin.** Applicants: Steve Schwarzbach and Larry Thompson (USFWS), Roger Hothem (BRD/USGS) and M. Jennings (BRD/USGS)

Representative: 
Steve Schwarzbach



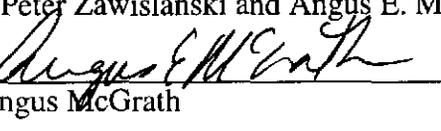
- 7) **Effects of Selenium on Mercury Bioaccumulation in Clapper Rails in the North Bay.** Applicants: S. Schwarzbach (USFWS)

Representative: 
Steve Schwarzbach

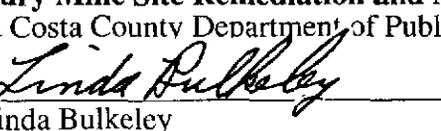
- 8) **Cadmium, Mercury, and Selenium Contamination in Diving Ducks and Benthic Prey from Wintering Sites at San Pablo and Suisun Bays, CA and Breeding Grounds at Ruby Lake NWR, NV.** Applicants: John Takekawa, (USGS), James Haas (USFWS) and Steve Schwarzbach (USGS)

Representative: 
Steve Schwarzbach

- 9) **Toxic Trace Element Fluxes from Marsh, Mudflat, and Shallow Subtidal Sediments: Determining the Contribution of Fluxes from Sediments to Non-point Source Pollution in the Bay.** Applicants: Peter Zawislanski and Angus E. McGrath (Lawrence Berkeley Lab)

Representative: 
Angus McGrath

- 10) **Mt. Diablo Mercury Mine Site Remediation and Mercury Export Reduction Project.** Applicants: Contra Costa County Department of Public Works

Representative: 
Linda Bulkeley