Assessing the Magnitude of and Developing a Management Program for Excessive Bioaccumulation of Organochlorine Pesticides and PCBs in Delta and Delta Tributary Fish

Project Information

1. **Proposal Title:**

   Assessing the Magnitude of and Developing a Management Program for Excessive Bioaccumulation of Organochlorine Pesticides and PCBs in Delta and Delta Tributary Fish

2. **Proposal applicants:**

   G. Fred Lee, G. Fred Lee & Associates

3. **Corresponding Contact Person:**

   G. Fred Lee
   G. Fred Lee & Associates
   27298 East El Macero Drive El Macero, CA 95618
   530 753-9630
   gfredlee@aol.com

4. **Project Keywords:**

   Ag/Urban Runoff
   Bioaccumulation
   Pesticides

5. **Type of project:**

   Research

6. **Does the project involve land acquisition, either in fee or through a conservation easement?**

   No

7. **Topic Area**:

   Ecosystem Water and Sediment Quality

8. **Type of applicant:**

   Private for profit

9. **Location - GIS coordinates:**

   Latitude: 38.000

   Longitude: 121.300

   Datum:

Describe project location using information such as water bodies, river miles, road intersections, landmarks, and size in acres.

waterbodies located throughout the San Joaquin and Sacramento Rivers and the Delta, that contain excessive concentrations of organochlorine pesticides and PCBs. At this time, there are more than 15 waterbodies in this area that are known.

10. **Location - Ecozone:**

    3.1 Keswick Dam to Red Bluff Diversion Dam, 3.2 Red Bluff Diversion Dam to Chico Landing, 3.3 Chico Landing to Colusa, 3.4 Colusa to Verona, 3.5 Verona to Sacramento, 6.4 Colusa Basin, 8.1 Feather River, 8.2 Yuba River, 9.2 Lower American River, 10.2 Putah Creek, 12.1 Vernalis to Merced River, 12.2 Merced River to Mendota Pool, 12.3 Mendota Pool to Gravelly Ford, 13.1 Stanislaus River, 13.2 Tuolumne River, 13.3 Merced River, West San Joaquin Basin, 1.1 North Delta, 1.2 East Delta, 1.3 South Delta, 1.4 Central and West Delta, 11.1 Cosumnes River, 11.2 Mokelumne River, 11.3 Calaveras River, Code 15: Landscape

11. **Location - County:**

    Alameda, Butte, Calaveras, Colusa, Contra Costa, Fresno, Madera, Merced, Placer, Sacramento, San Joaquin, Solano, Stanislaus, Tuolumne, Yolo, Yuba

12. **Location - City:**

    Does your project fall within a city jurisdiction?

    No

13. **Location - Tribal Lands:**

    Does your project fall on or adjacent to tribal lands?

    No

14. **Location - Congressional District:**

    3,4,5,7,10,11,18,19,20

15. **Location:**

    California State Senate District Number: 4,5,6,7,12,14,16

    California Assembly District Number: 2,3,4,7,8,9,10,11,15,17,25,26,29,30

16. **How many years of funding are you requesting?**

    3

17. **Requested Funds:**
    a) Are your overhead rates different depending on whether funds are state or federal?

       No

If no, list single overhead rate and total requested funds:

Single Overhead Rate: included in salaries

Total Requested Funds: 763,972

b) Do you have cost share partners already identified?

Yes

If yes, list partners and amount contributed by each:

G. Fred Lee & Associates 154,000.00

c) Do you have potential cost share partners?

No

d) Are you specifically seeking non-federal cost share funds through this solicitation?

No

If the total non-federal cost share funds requested above does not match the total state funds requested in 17a, please explain the difference:

18. **Is this proposal for next-phase funding of an ongoing project funded by CALFED?**

No

Have you previously received funding from CALFED for other projects not listed above?

Yes

If yes, identify project number(s), title(s) and CALFED program.

01-N61-01 SJR Low-DO Directed Action Project Directed Action Ecosystem

19. **Is this proposal for next-phase funding of an ongoing project funded by CVPIA?**

No

Have you previously received funding from CVPIA for other projects not listed above?

No

20. **Is this proposal for next-phase funding of an ongoing project funded by an entity other than CALFED or CVPIA?**

    No

    Please list suggested reviewers for your proposal. (optional)

21. **Comments:**

Environmental Compliance Checklist

Assessing the Magnitude of and Developing a Management Program for Excessive Bioaccumulation of Organochlorine Pesticides and PCBs in Delta and Delta Tributary Fish

1. **CEQA or NEPA Compliance**
   a) Will this project require compliance with CEQA?

      No
   b) Will this project require compliance with NEPA?

      No
   c) If neither CEQA or NEPA compliance is required, please explain why compliance is not required for the actions in this proposal.

      This is a research project.

2. **If the project will require CEQA and/or NEPA compliance, identify the lead agency(ies).** *If not applicable, put "None".*

   CEQA Lead Agency:
   NEPA Lead Agency (or co-lead:)
   NEPA Co-Lead Agency (if applicable):

3. **Please check which type of CEQA/NEPA documentation is anticipated.**

   CEQA
   -Categorical Exemption
   -Negative Declaration or Mitigated Negative Declaration
   -EIR
   Xnone

   NEPA
   -Categorical Exclusion
   -Environmental Assessment/FONSI
   -EIS
   Xnone

   If you anticipate relying on either the Categorical Exemption or Categorical Exclusion for this project, please specifically identify the exemption and/or exclusion that you believe covers this project.

4. **CEQA/NEPA Process**
   a) Is the CEQA/NEPA process complete?

      None

   b) If the CEQA/NEPA document has been completed, please list document name(s):

5. **Environmental Permitting and Approvals** (*If a permit is not required, leave both Required? and Obtained? check boxes blank.*)

LOCAL PERMITS AND APPROVALS

Conditional use permit

Variance

Subdivision Map Act

Grading Permit

General Plan Amendment

Specific Plan Approval

Rezone

Williamson Act Contract Cancellation

Other

STATE PERMITS AND APPROVALS

Scientific Collecting Permit

CESA Compliance: 2081

CESA Compliance: NCCP

1601/03

CWA 401 certification

Coastal Development Permit

Reclamation Board Approval

Notification of DPC or BCDC

Other

FEDERAL PERMITS AND APPROVALS

ESA Compliance Section 7 Consultation

ESA Compliance Section 10 Permit

Rivers and Harbors Act

CWA 404

Other

PERMISSION TO ACCESS PROPERTY

Permission to access city, county or other local agency land.
Agency Name:

Permission to access state land.
Agency Name:

Permission to access federal land.
Agency Name:

Permission to access private land.
Landowner Name:

6. **Comments.**

Land Use Checklist

Assessing the Magnitude of and Developing a Management Program for Excessive Bioaccumulation of Organochlorine Pesticides and PCBs in Delta and Delta Tributary Fish

1. **Does the project involve land acquisition, either in fee or through a conservation easement?**

   No

2. **Will the applicant require access across public or private property that the applicant does not own to accomplish the activities in the proposal?**

   No

3. **Do the actions in the proposal involve physical changes in the land use?**

   No

   If you answered no to #3, explain what type of actions are involved in the proposal (i.e., research only, planning only).

   research only

4. **Comments.**

Conflict of Interest Checklist

Assessing the Magnitude of and Developing a Management Program for Excessive Bioaccumulation of Organochlorine Pesticides and PCBs in Delta and Delta Tributary Fish

Please list below the full names and organizations of all individuals in the following categories:

- Applicants listed in the proposal who wrote the proposal, will be performing the tasks listed in the proposal or who will benefit financially if the proposal is funded.
- Subcontractors listed in the proposal who will perform some tasks listed in the proposal and will benefit financially if the proposal is funded.
- Individuals not listed in the proposal who helped with proposal development, for example by reviewing drafts, or by providing critical suggestions or ideas contained within the proposal.

The information provided on this form will be used to select appropriate and unbiased reviewers for your proposal.

Applicant(s):

G. Fred Lee, G. Fred Lee & Associates

Subcontractor(s):

Are specific subcontractors identified in this proposal? Yes

If yes, please list the name(s) and organization(s):

Scott Ogle Pacific EcoRisk

Helped with proposal development:

Are there persons who helped with proposal development?

No

Comments:

Budget Summary

Assessing the Magnitude of and Developing a Management Program for Excessive Bioaccumulation of Organochlorine Pesticides and PCBs in Delta and Delta Tributary Fish

Please provide a detailed budget for each year of requested funds, indicating on the form whether the indirect costs are based on the Federal overhead rate, State overhead rate, or are independent of fund source.

Independent of Fund Source

Year 1												
Task No.	**Task Description**	**Direct Labor Hours**	**Salary *(per year)***	**Benefits *(per year)***	**Travel**	**Supplies & Expendables**	**Services or Consultants**	**Equipment**	**Other Direct Costs**	**Total Direct Costs**	**Indirect Costs**	**Total Cost**
1.1	Sediment Sampling	337	25,505	included in salary	3,516	11,200				40221.0		40221.00
1.2	Sediment bioaccumulation testing	25	1,625	included in salary		900	90,000			92525.0		92525.00
1.3	Sediment toxicity testing						40,000			40000.0		40000.00
1.4	Analysis of sediment & test organism tissue for OCl and metals						131,900			131900.0		131900.00
1.5	Task management	120	14,160	included in salary						14160.0		14160.00
1.6	Reports	40	5,000	included in salary						5000.0		5000.00
2.1	Collection of Fish						72,816			72816.0		72816.00
2.2	Analysis for OCl Pesticides & PCBs						75,420			75420.0		75420.00
2.3	Analysis for dioxins						37,400			37400.0		37400.00
2.4	Analysis for selenium						2,500			2500.0		2500.00
2.5	Task administration, labor & reporting	580	47,330	included in salary						47330.0		47330.00
3.1	Overall project coordination & administration	468	57,200	included in salary						57200.0		57200.00
3.2	Project reporting	500	75,000	included in salary						75000.0		75000.00
3.3	IEP Data entry - DWR						2,500			2500.0		2500.00
4	External peer review						70,000			70000.0		70000.00
		2070	225820.00	0.00	3516.00	12100.00	522536.00	0.00	0.00	763972.00	0.00	763972.00

Year 2												
Task No.	**Task Description**	**Direct Labor Hours**	**Salary *(per year)***	**Benefits *(per year)***	**Travel**	**Supplies & Expendables**	**Services or Consultants**	**Equipment**	**Other Direct Costs**	**Total Direct Costs**	**Indirect Costs**	**Total Cost**
		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Year 3												
Task No.	**Task Description**	**Direct Labor Hours**	**Salary *(per year)***	**Benefits *(per year)***	**Travel**	**Supplies & Expendables**	**Services or Consultants**	**Equipment**	**Other Direct Costs**	**Total Direct Costs**	**Indirect Costs**	**Total Cost**
		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Grand Total=763972.00

Comments.

Budget Justification

Assessing the Magnitude of and Developing a Management Program for Excessive Bioaccumulation of Organochlorine Pesticides and PCBs in Delta and Delta Tributary Fish

Direct Labor Hours. Provide estimated hours proposed for each individual.

G. Fred Lee 800 hrs Anne Jones-Lee 260 hrs Scott Ogle 120 hrs

Salary. Provide estimated rate of compensation proposed for each individual.

G. Fred Lee $150/hr Anne Jones-Lee $100/hr Scott Ogle - $125/hr

Benefits. Provide the overall benefit rate applicable to each category of employee proposed in the project.

included in salary

Travel. Provide purpose and estimate costs for all non-local travel.

travel to collect samples $3,516

Supplies & Expendables. Indicate separately the amounts proposed for office, laboratory, computing, and field supplies.

laboratory and field supplies $12,100

Services or Consultants. Identify the specific tasks for which these services would be used. Estimate amount of time required and the hourly or daily rate.

sediment bioaccumulation testing $90,000 sediment toxicity testing $40,000 analysis of sediment & test organisms for OCl & metals $131,900 collection of fish $72,816 analysis for OCl pesticides & PCBs $75,420 analysis for dioxins $37,400 analysis for selenium $2,500 data entry into IEP $2,500 external peer review $70,000

Equipment. Identify non-expendable personal property having a useful life of more than one (1) year and an acquisition cost of more than $5,000 per unit. If fabrication of equipment is proposed, list parts and materials required for each, and show costs separately from the other items.

none

Project Management. Describe the specific costs associated with insuring accomplishment of a specific project, such as inspection of work in progress, validation of costs, report preparation, giving presentatons, reponse to project specific questions and necessary costs directly associated with specific project oversight.

project oversight by G. Fred Lee $75,000

Other Direct Costs. Provide any other direct costs not already covered.

none

Indirect Costs. Explain what is encompassed in the overhead rate (indirect costs). Overhead should include costs associated with general office requirements such as rent, phones, furniture, general office staff, etc., generally distributed by a predetermined percentage (or surcharge) of specific costs.

indirect costs are included in the salary rates

Executive Summary

Assessing the Magnitude of and Developing a Management Program for Excessive Bioaccumulation of Organochlorine Pesticides and PCBs in Delta and Delta Tributary Fish

The San Joaquin/Sacramento River Delta and ten other tributary waterbodies have fish with concentrations of organochlorine pesticides (e.g., DDT, etc.) and/or PCBs (together, referred to as OCls) that are a threat to cause cancer in those who consume the fish. This situation has caused the Central Valley Regional Water Quality Control Board (CVRWQCB) to develop a TMDL to control the excessive bioaccumulation of OCls in fish. The sources of OCls to the Delta are runoff from areas of previous use and waterbody sediments. The PI for the proposed OCl project is under contract with the State Water Resources Control Board (SWRCB) to develop a Technical TMDL to assess the magnitude of the excessive OCl bioaccumulation problem, sources of OCls, and the relationship between OCl concentrations in water and sediments and excessive bioaccumulation in fish. Work done thus far on this Technical TMDL has shown that there is need for information on the magnitude of the problem of excessive bioaccumulation of OCls within the Delta and its tributaries, and the sources of OCls that are bioaccumulating to excessive levels in Delta and tributary fish. The proposed OCl project will provide needed information on the nature and extent of excessive bioaccumulation of organochlorine pesticides and PCBs in Delta and Delta tributary fish, define the sources of OCls in stormwater runoff and irrigation water discharges, and define the role of waterbody sediments in contributing to the excessive OCls in Delta fish tissue. The results of this project will enable the CVRWQCB to expand the Technical TMDL to develop an Implementation Plan and a Basin Plan Amendment to control the excessive bioaccumulation of OCls in the fish of the Delta and its tributaries. This project is designed to address CALFEDs Stage 1 high priority goal of controlling excessive bioaccumulation of OCls in fish.

Proposal

G. Fred Lee & Associates

Assessing the Magnitude of and Developing a Management Program for Excessive Bioaccumulation of Organochlorine Pesticides and PCBs in Delta and Delta Tributary Fish

G. Fred Lee, G. Fred Lee & Associates

Assessing the Magnitude of and Developing a Management Program for Excessive Bioaccumulation of Organochlorine Pesticides and PCBs in Delta and Delta Tributary Fish

A. Project Description: Project Goals and Scope of Work

1. The OCl Bioaccumulation Problem

The Delta, and the Sacramento and San Joaquin Rivers and many of their tributaries have been found to contain fish whose edible tissues contain concentrations of organochlorine pesticides and/or PCBs in levels that are considered by the US EPA and the California Office of Environmental Health Hazard Assessment (OEHHA) to be hazardous to the health of those who consume the fish (WRCB/TSM, 2001; MacCoy and Domagalski, 1999; Davis, 2000; Davis, *et al*., 2000; SRWP, 2000, 2001). What are deemed to be excessive concentrations of OCls in edible fish tissue are defined by the US EPA (1997) and OEHHA based on an increased cancer risk associated with the consumption of a certain amount of the OCl-containing fish over the person's lifetime.

While the focus of this proposed project is bioaccumulation of OCls in edible fish tissue that threatens the health of those people who eat the fish, this project is also important for the protection of aquatic and terrestrial wildlife. Not only are the aquatic organisms at risk of adverse impact of the bioaccumulated OCls, but also, higher trophic level wildlife that use those fish and other aquatic life as food could be adversely impacted. Jarvinen and Ankley (1999) have published an article, "Linkage of Effects to Tissue Residues: Development of a Comprehensive Database for Aquatic Organisms Exposed to Inorganic and Organic Chemicals," that provides information on impacts of chemical tissue residues on the health of the host organism.

Finally, it is well known that GC scans of some fish tissue OCl extracts contain a number of unknown chemicals (peaks) that are potentially hazardous. Therefore, the development of OCl management programs to control excessive bioaccumulation of OCls in fish tissue is in the direction of controlling the adverse impacts of non-regulated bioaccumulatable chemicals that are a threat to the host organism and higher trophic level organisms.

OCls of Concern. The organochlorine pesticides of concern include DDT, aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane (including lindane), endosulfan and toxaphene. These chemicals were banned from further use many years ago because of their persistence in terrestrial and aquatic environments. They are called "legacy" pesticides because they have left a legacy of residues in some soils where they were used, and aquatic sediments in some areas that received runoff from areas of application have accumulated sufficient concentrations of available forms of these OCls to cause fish in the area to bioaccumulate excessive concentrations (based on a human health threat to cause cancer) threatening the health of those who use the fish as food. While not pesticides but rather industrial chemicals, polychlorinated biphenyls (PCBs), are also highly persistent OCls in the environment. Like the legacy OCl pesticides, they are frequently found to have bioaccumulated to excessive levels in fish in areas where they have accumulated in aquatic sediments, posing a cancer risk to those who consume the fish.

Waterbodies of Concern. The excessive bioaccumulation of OCls in edible fish within the San Joaquin/Sacramento River Delta and its tributaries have caused those waterbodies to be listed as Clean Water Act (CWA) 303(d) "impaired" waterbodies (Table 1). In addition to the 1998 303(d)-listed waterbodies for excessive OCls in fish tissue shown in Table 1, there are other waterbodies in the Delta and its tributaries that have also been found to contain excessive concentrations of some OCls, such as the mainstem of the Sacramento River and a number of the tributaries of the San Joaquin River. These waterbodies could be listed in the next round of 303(d) "impaired" waterbodies because of excessive bioaccumulation of OCls. Further, based on USGS studies (see reference list) in the San Joaquin River watershed, some of westside tributary streams have been found to contain concentrations of OCl pesticides that are well above those that have been found to bioaccumulate to excessive levels in edible fish tissue. It is possible that studies of the fish taken from these streams would show that those streams should also be considered CWA 303(d) "impaired." Dr. J. Domagalski (pers. comm., 2001) of the USGS has indicated that, based on USGS studies, elevated concentrations of some OCl pesticides are frequently found in Orestimba Creek and probably Del Puerto, Spanish Grant Drain and Ingram Hospital. Further, the USGS studies, cited in the reference list, provide additional information on waterbodies that should be considered for more intensive study of OCl bioaccumulation in fish from the San Joaquin River watershed.

Table 1
CVRWQCB/SRWB 1998 303(d) Listed Waterbodies for OCl Pesticides and PCBs

American River, Lower	Group A Pesticides
Colusa Drain	Group A Pesticides
Delta Waterways	Group A Pesticides, DDT
Feather River, Lower	Group A Pesticides
Kings River, Lower	Toxaphene
Merced River, Lower	Group A Pesticides
Natomas Main Drain	PCBs
San Joaquin River	Group A Pesticides, DDT
Stanislaus River, Lower	Group A Pesticides
Tuolumne River, Lower	Group A Pesticides
Stockton Deep Water Ship Channel	Dioxins, Furans, PCBs

Additional Waterbodies That Have Been Found to Contain Organochlorines in Fish Tissue above Critical Levels

Sacramento River	Group A Pesticides, DDT and PCBs
Smith Canal (City of Stockton)	PCBs

Group A Pesticides
aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane (including lindane), endosulfan, and toxaphene.

The 303(d)-listing of waterbodies is based primarily on the SWRCB Toxic Substances Monitoring (TSM) Program data. The TSM and 303(d) information are available from the WRCB website (see references). The CVRWQCB is currently reviewing the 303(d) listing of waterbodies for excessive bioaccumulation of OCls and could be adding to or removing waterbodies from the 1998 listing.

Dr. J. Davis of the San Francisco Estuary Institute (SFEI), as well as J. Karkoski and J. Bruns of the CVRWQCB, have contributed updated information which has been included in Table 1.

Recently the WRCB/TSM (2001) has released data covering the year 2000 monitoring of organochlorine pesticides and PCBs in the San Joaquin River. During 2000, fish samples were taken from the San Joaquin River at Vernalis, Crows Landing and Landers Avenue. For the first time, PCBs were found in the San Joaquin River fish sampled at Vernalis above US EPA guideline values. These studies also showed that the previously reported OCls in fish tissue that have been found in the San Joaquin River were found again in 2000.

The CVRWQCB (2001) has recently released its "Draft Staff Report on Recommended Changes to California's Clean Water Act Section 303(d) List." This draft updates the information that the CVRWQCB has on excessive bioaccumulation of OCls in Central Valley fish. There are two major changes from the 1998 listing presented in Table 1. These include a proposed delisting of the American River Lower for Group A pesticides and a new listing of Orestimba Creek in the San Joaquin River watershed for DDE. The CVRWQCB proposes to put the American River Lower on a list of waterbodies for which there is need for additional data to determine its listing status.

Dioxins and Furans. A group of persistent, bioaccumulatable OCls that has not been adequately investigated in the Delta and its tributaries is the dioxins and furans. The dioxins and furans are formed in certain chemical manufacturing processes; they are also products of combustion. Excessive concentrations of these highly hazardous chemicals have been found in some Delta fish. In the early 1990's, fish taken from the Sacramento River below Anderson, CA, contained excessive concentrations of dioxins and furans. These OCls were discharged by the Simpson Paper Company at its Anderson mill. Simpson modified its paper-making processes to eliminate the discharge of dioxins and furans to the River. Within a few years after changing the paper manufacturing process, the concentrations of the dioxins and furans in the fish tissue decreased to acceptable levels. However, there is still a substantial legacy of dioxins and furans in sediments downstream of the reaches of the Sacramento River where excessive bioaccumulation of these chemicals in fish tissue used to occur.

Because of sediment scour that occurs under high-flow conditions with subsequent deposition in slower waters, Sacramento River-derived sediment residues of dioxins and furans are likely to be present in the San Joaquin River Delta and possibly in northern San Francisco Bay. Excessive bioaccumulations of dioxins and furans have been found in some fish in the Delta and in San Francisco Bay (SFBRWQCB, 1997). The role of the Anderson mill dioxin and furan discharges as a source of this excessive bioaccumulation is unknown. Inadequate attention has been given to the excessive bioaccumulation of dioxins and furans in the San Joaquin/Sacramento River Delta and its tributaries. These chemicals are being found in urban area street and highway stormwater runoff (Fisher, *et al*., 1999), and therefore would be expected to be present in water and sediments near urban areas such as Sacramento and Stockton.

Selenium. As part of analyzing the fish from the San Joaquin River watershed for OCls, selected fish will be analyzed for selenium since excessive selenium concentrations have been found in some fish from the San Joaquin River and its tributaries.

2. Justification

Overall Significance. The excessive bioaccumulation of OCls is one of the most important water quality management problems in the San Joaquin/Sacramento River Delta and its tributaries. This justifies CALFED's focusing its resources on developing a management program to control the excessive bioaccumulation of OCls in fish in the Delta and its tributaries. Until such a program is implemented, some of the aquatic life-related beneficial uses of the Delta and its tributaries will continue to be significantly impaired.

Development of a TMDL for Control of Excessive OCl Bioaccumulation. The current 303(d) listing requires that the Central Valley Regional Water Quality Control Board (CVRWQCB) develop total maximum daily loads (TMDLs) to control, to the extent possible, the sources of the OCls that are contributing to excessive bioaccumulation in edible fish tissue. The principal investigator (PI) for this proposed project (Dr. G. Fred Lee) is under contract with the State Water Resources Control Board to develop a Technical TMDL to control excessive bioaccumulation of OCls in Central Valley fish. That contract covers the development of a Problem Statement, Discussion of Numeric Targets, Source Analyses, Linkage Analyses that could lead to a TMDL Allocation, Implementation Plan, Monitoring and Evaluation, and Basin Plan Amendments.

Focus of the CALFED OCl Management Program. Sufficient work has already been done on the OCl management TMDL project to determine that there are several major information gaps on the concentrations of total and available (bioaccumulatable) OCl residues in sediments of selected areas of waterbodies within the Delta and its tributaries in which fish have been found to contain excessive amounts of OCls. There is also inadequate information on the specific agricultural and urban soil areas that are current sources of OCl pesticides potentially contributing to an ongoing accumulation of OCl pesticides in aquatic sediments that, in turn, is contributing to excessive bioaccumulation of OCls in edible fish tissue. Further, there is need for additional fish tissue OCl measurements to more fully define the extent of the current problem of excessive bioaccumulation of OCls in the Delta and its tributaries. This proposed CALFED OCl project is specifically designed to develop a first-round information base on current levels of bioaccumulatable OCl pesticides and PCBs in Delta waterbody sediment, potential current sources of OCls for these waterbodies, and the current concentrations of OCls in tissue of fish from certain insufficiently investigated waterbodies. This proposed project is, therefore, directed toward developing the information that CALFED has delineated in its current PSP that is a priority for funding under the current solicitation.

Environmental Justice. This project addresses a significant environmental justice issue, namely, defining waterbodies in which excessive OCls have bioaccumulated in fish tissue and pose a threat to those who use the fish as food. This threat is the greatest to the economically disadvantaged population that are subsistence fishermen since this is the group of individuals that would be exposed to the greatest concentrations of OCl carcinogens through greater than normal consumption of fish from local waterbodies. The ultimate goal of this project, namely to develop the information base to try to develop control programs for excessive OCl bioaccumulation in edible fish, specifically addresses this major environmental justice issue of concern to CALFED, the regulatory agencies and the public.

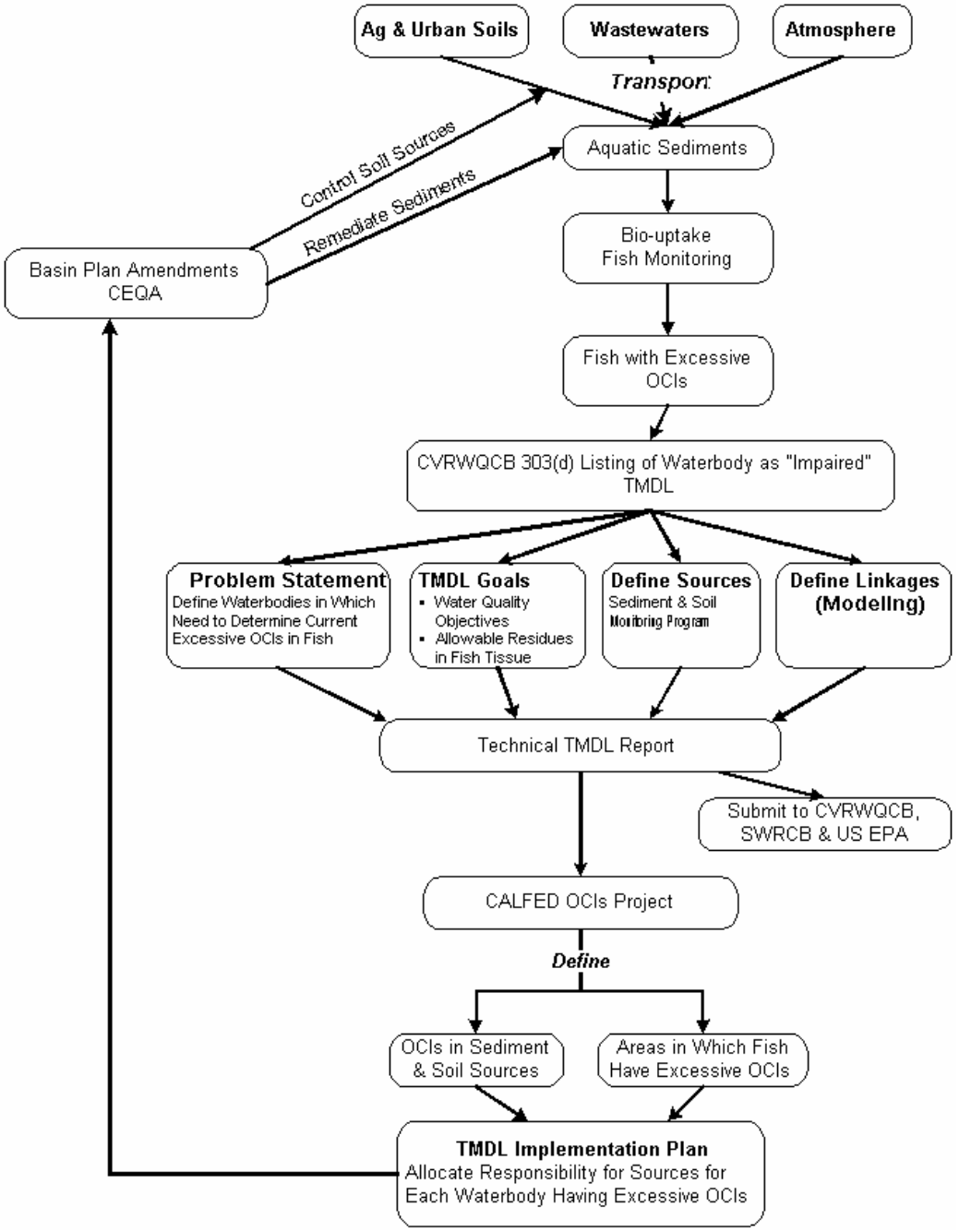
Conceptual Model for Management of Excessive Bioaccumulation of OCls. Figure 1 presents a conceptual model that describes the management of excessive bioaccumulation of OCls in San Joaquin/Sacramento River Delta and Delta tributary fish. The three modes of transport of the OCls (stormwater runoff from agricultural and urban soils, wastewater discharges from municipal and industrial sources, and the atmosphere) all contribute OCls to waterbodies where they become incorporated into the sediments. Through bio-uptake processes, area fish acquire OCls from the sediments; fish tissue monitoring has shown that edible tissues of some fish contain excessive concentrations of OCls. This has caused the CVRWQCB to define waterbodies with fish that have excessive levels of OCls as 303(d)-listed "impaired" waterbodies. This listing sets in motion the Technical TMDL process.

The Technical TMDL has four major components:

- The **problem statement** defines the waterbodies in which excessive concentrations of OCls have been found in fish tissue, or in which there is need to determine whether fish tissue contains excessive OCls. While the existing database on OCl concentrations in fish tissue is somewhat adequate to indicate whether or not there are excessive bioaccumulations of organochlorines, it does not define the magnitude of this problem. The TMDL problem statement will include a discussion of the monitoring program needed to better define the OCl excessive bioaccumulation problem in fish in the Delta and its tributaries.
- The **TMDL goal** is traditionally the water quality objective. However, because of the unreliability of water quality objectives in predicting bioaccumulation (except under worst-case conditions), increasing emphasis is being placed on using an acceptable fish tissue residue as the TMDL goal.
- **Defining the sources** of sediments and soils that are contributing OCls to waterbodies and their associated fish is the third major component of a Technical TMDL. A monitoring program will need to be established to define whether there are significant sources of terrestrial soils that contribute bioaccumulatable organochlorine pesticides. Further, there is limited information on the amounts of organochlorine pesticides, PCBs, and dioxins in Central Valley sediments, which are the ultimate source of the OCls that bioaccumulate to excessive levels in fish.
- Defining the **linkage (modeling)** or relationship between the concentrations in water, soils and sediments, and the fish tissue residues. This relationship cannot be developed well at this time because of a lack of reliable information on the concentrations of OCls in stormwater runoff, irrigation tailwater, wastewater discharges, and the atmosphere. The technical TMDL will define the program needed to establish linkage between sediments/soil OCl residues and excessive fish tissue residues. The US EPA is developing a new bioaccumulation model (BASS) which will be evaluated with respect to its applicability to Central Valley waterbody situations.

The four major components of the TMDL are integrated into a Technical TMDL, which is to be submitted to the Central Valley Regional Water Quality Control Board, the State Water Resources Control Board, and, ultimately, the US EPA.

Figure 1
Conceptual Model of OCl Management Program



From the information available, it is clear that the Technical TMDL will have major information gaps regarding terrestrial and aquatic sediment sources of OCls that have accumulated to excessive levels in certain Central Valley waterbody fish. For some waterbodies there is need to update the information on OCl levels in fish tissue. There is also need to expand the information base to include measurements from areas that have not been adequately evaluated in the past such as some of the westside tributaries of the San Joaquin River.

The parts of the conceptual model, from defining the sources through the Technical TMDL, will be completed in the spring of 2002 by Dr. G. Fred Lee, under contract with the State Water Resources Control Board, with funds derived through the Central Valley Regional Water Quality Control Board and the US EPA. The information provided in the Technical TMDL can become the foundation of this CALFED OCl management project.

As shown in Figure 1, the conceptual model for the CALFED OCl project has two major components. One is to define the sediment and soil sources of OCls that are leading to excessive OCl residues in tissue of fish in certain Central Valley waterbodies. The other is to define waterbodies with fish that have excessive OCl levels but that have not been adequately sampled thus far. Information developed from these two components will be provided to the TMDL Implementation Plan wherein an allocation of the responsibility for the sources of OCls for each waterbody with excessive OCls in fish tissue is to be defined.

This TMDL Implementation Plan then becomes the basis for the CVRWQCB Basin Plan Amendments in which, through a California Environmental Quality Act (CEQA) process, a program is developed to control the excessive OCls. This program will be directed toward control of the soil sources of OCls that are continuing to contribute OCls that are accumulating in waterbody sediments and fish tissue. It will also focus on remediating OCl "hot spots" in sediments that have been shown to be potentially significant sources of OCls that are accumulating to excessive levels in fish.

The conceptual model shown in Figure 1 represents the first phase of the TMDL process. The waterbodies containing fish with excessive concentrations of OCls and undergoing remediation of sources and/or sediment, will then be monitored through Phase I. This monitoring is to provide information to better define the linkage between the concentrations of OCls in water/sediments and the fish tissue residues. Because of the lack of definitive knowledge in this area, remediation will likely have to be undertaken in a number of steps to eventually control OCl bioaccumulation in fish tissue.

It is important to understand that the OCl pesticides and PCBs may not be derived from "hot spots" of OCls in sediments, but may be released from essentially all of the waterbody sediments. If the latter is the case, it may not be possible to fund remediation technologies either because it would be too expensive to control the runoff of OCl pesticides from agricultural and urban areas where they have previously been used, or because there is such a diffuse, general distribution of available OCl pesticides in waterbody sediments that sediment remediation is not economically feasible.

An important component of the proposed CALFED OCl project is the focus of the project on assessing bioavailable forms of OCls in runoff from agricultural and urban areas through the use of US EPA standard methodology for measuring the ability of organisms to take up bioaccumulatable chemicals from sediments. It has been known for many years that the total concentrations of OCl pesticides, PCBs, or dioxins in sediments or soils is not a reliable measure of the bioavailable forms of those chemicals. This necessitates the use of organisms to determine whether measured OCl residues in sediments or soils are available for bio-uptake.

One of the primary factors controlling the bioavailability of OCls is the total organic carbon (TOC) content of the sediments. In the early 1990s, the US EPA thought that it could relate the bioavailability of certain organochlorine pesticides in sediments to the sediment organic carbon content, and thereby chemically measure directly the fraction of the OCls available for bioaccumulation. However, subsequently it has been established that the process of binding of OCl pesticides, PCBs, and dioxins is far more involved than just generic TOC binding.

It is now understood that equilibrium partitioning with TOC is not the only mechanism controlling PCB release. How this relates to bio-uptake, which is the other important process governing the transfer of PCBs from sediments to aquatic organisms through the food web, is not well understood. This has been a long-standing issue that still has not been adequately addressed. It is of importance in determining the appropriate approach to take for sediment remediation for controlling OCl excessive bioaccumulation.

One of the possible products of this project, which would help advance the science of managing excessive OCl bioaccumulation, is a better understanding of how OCls in sediments are bound to the sediments, and thereby are rendered unavailable for bio-uptake. An important aspect of this study is the investigation of the OCls in sediment, water and fish, and the coupling between the OCls in sediments and water, in a variety of Central Valley waterbodies. This can lead to a better understanding of processes of controlling bio-uptake of OCls than would be gained by investigating one or two waterbodies. During the second and third years of this proposed project, it may be possible to conduct certain laboratory experiments to aid in the fundamental understanding of OCl pesticide and PCB availability from sediments.

Overall, the conceptual model governing this project is based on the hypothesis that in order to develop a control program for excessive bioaccumulation of organochlorine pesticides and PCBs in fish tissue within the Delta and its tributaries, it is necessary to better understand the specific sources of the bioaccumulated OCls in waterbodies in which the fish have excessive tissue concentrations, as well as the potential role of current land-derived inputs of OCls associated with stormwater runoff and irrigation tailwater.

Since this proposed CALFED OCl project is an integral part of an overall CVRWQCB TMDL management plan for control of excessive OCl bioaccumulation in edible fish, it will be an important component of an adaptive management approach for controlling excessive OCl bioaccumulation. The complexity of the processes governing OCl bioaccumulation in fish necessitates that the management plan for their control be conducted in a phased approach. The first phase entails a review of the current information which will be presented in the Technical TMDL that will be available in the spring of 2002. This will lead to defining the studies that need to be conducted to better define the current problem and factors governing excessive OCl bioaccumulation. These studies can be initiated in the summer/fall of 2002 when funding for this proposed OCl project could become available. These studies would then lead to a proposed management plan which would be implemented in Phase 1 of the TMDL control program.

At the end of Phase 1 of the initial control program, an assessment will be made as to the additional control needed to achieve the desired goal, the elimination of excessive OCl bioaccumulation. In a true adaptive management approach, Phase 2 will be formulated for any

additional remediation that is needed to control excessive bioaccumulation at the end of Phase 1. It is anticipated that these phases will take place over at least a five- to ten-year period.

3. Approach

The proposed OCl bioaccumulation project will be patterned after an ongoing pilot study, organized and being supervised by G. F. Lee (PI for the proposed OCl project) on behalf of the DeltaKeeper and the CVRWQCB, of the role of the city of Stockton Smith Canal sediments as a source of the excessive PCBs that have been found in fish taken from Smith Canal. Smith Canal is a dead-end tidal freshwater slough located in the city of Stockton that receives stormwater runoff from the city. It is a tributary of the San Joaquin River Deep Water Ship Channel and the Delta and receives intense recreational use, including sportfishing, by city residents. The Smith Canal study is being funded by a small US EPA 319(h) grant and CVRWQCB funds and involves the cooperative efforts of the DeltaKeeper (William Jennings) for sample collection, Dr. Scott Ogle of Pacific EcoRisk for sediment sample bioaccumulation and toxicity studies and the California Department of Fish and Game (CA DFG) (D. Crane) for sediment, benthic test organism and fish tissue analyses of OCl pesticides and PCBs. Further, while not part of that study, under arrangements made by Debra Denton of the US EPA Region 9, some of the Smith Canal sediments have been sent to the US EPA Duluth, MN National Freshwater Criteria laboratories for work on development of sediment-based TIEs.

In the Smith Canal study, Pacific EcoRisk is using the US EPA standard benthic bioaccumulation test organism, *Lumbriculus variegatus* (an oligochaete) (US EPA, 2000). The uptake of PCBs and other OCls from Smith Canal sediments by this oligochaete is being used to determine the amount of PCBs and some other OCls in the sediments that are bioavailable for bioaccumulation. In addition, the Smith Canal sediments are being tested for aquatic life toxicity using one of the US EPA standard sediment test organisms, *Hyalella azteca* (an amphipod) (US EPA, 1994). While the OCls are not expected to be present in Smith Canal sediments at concentrations that are toxic to *Hyalella*, if sediment toxicity is found, then follow-up studies are contemplated to determine if the benthic organism assemblages are significantly altered/ degraded compared to what would be expected based on habitat characteristics. The Smith Canal sediments with these characteristics would be candidates for work on determining the cause of the toxicity to *Hyalella*.

Ultimately, the pilot study on Smith Canal sediments could become the basis for a sediment remediation program in which the Smith Canal sediments that are found to contain bioavailable PCBs at concentrations that could lead to excessive fish tissue residues could be considered for selective dredging or other remediation. The PI for the proposed CALFED OCl project has worked for more than 30 years on water quality aspects of dredging and dredged sediment management. He is well aware of the controversy surrounding dredging of PCB-containing sediments in the Hudson River and Wisconsin's Upper Fox River as a sediment remediation measure. Any dredging for the purpose of sediment remediation will require careful evaluation before this is undertaken.

The proposed CALFED OCl bioaccumulation studies will consist of two major components. One of these will be to determine the locations of sediments and soils within the Central Valley that contain potentially significant sources of bioaccumulatable OCls. The other will be to

expand the current database on OCl concentrations in edible fish tissue. Summary information on both of these areas is provided below.

Bioaccumulation Studies. This proposed CALFED OCl project will utilize the experience gained from the current Smith Canal studies to help formulate the sediment bioaccumulation/ toxicity studies that will be conducted if this CALFED OCl management project is funded. It is anticipated that approximately 50 samples of sediment and soil (i.e., suspended sediment during runoff events) will be collected and processed per year during this study. Dr. Lee will work closely with the CVRWQCB and others such as OEHHA in selecting aquatic sediments and soils (suspended sediment during runoff events) for determining bioavailable OCls and PCBs from the Delta and its tributary waters. It is expected that these studies could lead to defining OCl bioaccumulation "hot spots" which would be examined in more detail in the subsequent years of this three-year project.

With respect to agricultural soil-derived sources of OCls, the previous and ongoing work of the USGS will be used to guide where samples should be collected in order to locate areas from which there is currently high OCl pesticide export. Through forensic studies using a combination of chemical analyses and oligochaete bio-uptake information, it is expected to be possible to identify specific agricultural areas where there may be need to control OCl pesticide transport during stormwater runoff events and in irrigation tailwater discharges. It is anticipated that particular attention will be given to several of the westside tributary streams that J. Domagalski (see above discussion) has indicated should be considered as candidates for the studies on current OCl pesticide export from agricultural lands. Efforts will be made to coordinate these proposed studies with the current USGS NAWQA pesticide studies that are being conducted in the San Joaquin River watershed.

Drs. G. F. Lee and Scott Ogle have worked together over the past three years in Dr. Lee's 205(j) and 319(h) projects devoted to assessing and determining the causes and sources of aquatic life toxicity in tributaries of Upper Newport Bay in Orange County, California.

Expanded OCl Fish Tissue Residue Assessment. Much of the data upon which the current CVRWQCB 303(d) listing of OCl-"impaired" waterbodies is based are from the WRCB/TSM (2001) program results. While this program has provided valuable information on the occurrence of excessive OCl bioaccumulation in edible fish tissue, it is recognized that the current information base is inadequate to define the extent and magnitude of the problem of bioaccumulation of organochlorine pesticides and PCBs in Central Valley edible fish tissue. An important component of the current OCl TMDL efforts being undertaken by Dr. G. F. Lee will be an assessment of the adequacy of the current database as well as defining the areas where there is need for additional fish sampling to bring up to date and expand the current information base on excessive OCl bioaccumulation. This proposed project will include selective sampling of fish from selected waterbodies that have been found by the USGS or others to contain elevated concentrations of OCl pesticides, to assess current levels of OCl residues in fish tissue.

The fish tissue residue part of this proposed CALFED OCl project will be conducted under the supervision of Dr. G. Fred Lee. The methodologies that will be used have been approved by the CVRWQCB and the US EPA in the QAPP for previous and ongoing fish bioaccumulation

studies in the Sacramento River Watershed Program. Dr. G. F. Lee has been a member of the SRWP bioaccumulation team throughout its existence.

It is proposed that during the first year two species of fish be collected from each of 30 to 40 sites in the Sacramento/San Joaquin River watershed and the Delta. The sampling sites will be determined through the TMDL review that Dr. Lee is conducting at this time and in consultation with the CVRWQCB. The edible flesh of these fish will be analyzed for OCl pesticides and PCBs. In addition, 20 fish collected from selected locations will be analyzed for dioxins, furans and selenium. The fish analyzed for selenium will be taken from the San Joaquin River watershed to better define where excessive bioaccumulation of selenium in fish is occurring. The fish taken for dioxin and furan analyses will be from those areas where excessive bioaccumulation of these chemicals could likely occur. Target areas would be near Stockton and in some parts of the Delta where sediments containing dioxins and furans had originated from the Sacramento River below where Simpson Paper Company had discharged those compounds to the river at Anderson, California.

Based on discussions with the CVRWQCB staff (J. Bruns), there is uncertainty as to whether some of the waterbodies on the 303(d) list of OCl-impaired waterbodies, such as the American River, contain fish today with excessive OCls. The original listing was based on limited data that in some instances is 10 or more years old. In order to address this issue, the highest priority during the first year of study will be given to collecting fish from those waterbodies that are currently on the 303(d) list of OCl-impaired waterbodies in order to determine the current status of bioaccumulation of organochlorine pesticides and PCBs in fish taken from these waterbodies. If the initial sampling shows that the fish from any of these waterbodies no longer have excessive OCls, then further sampling of fish from the waterbody and the sampling of sediments from the waterbody will not be conducted.

The first year sediment sampling will focus on those waterbodies where there is recent high quality data such as in the Sacramento River, part of the Delta and in some parts of the San Joaquin River watershed where OCls have bioaccumulated to excessive levels in edible fish. The sediment sampling will be expanded in subsequent years to include waterbodies where excessive OCls have been found based on the first year's sampling.

This proposed CALFED OCl project will be linked to the SFEI CALFED (CVRWQCB) proposed project devoted to collecting fish for mercury analysis. Particular attention will be given to fish taken from the San Joaquin River and its watershed. Since this is the same area where greatly elevated OCl concentrations in water from ag areas have been found, the fish taken from these areas would be analyzed for both the OCls and mercury in the linked projects. Since the OCls tend to accumulate to different degrees in different types of fish than mercury, it will be necessary to collect fish of the type that typically accumulate OCls to the greatest extent at the sampling locations. Normally, those fish with higher body fat content tend to have highest OCl residues.

Coordination of the Proposed CALFED OCl Project with the CVRWQCB OCl TMDL. Drs. G. Fred Lee and Anne Jones-Lee presented a paper, "Developing TMDLs for Organochlorine Pesticides and PCBs," at the Environmental Chemistry Division, American Chemical Society

national meeting, held in San Diego, California, in April (Lee and Jones-Lee, 2001), that discussed the overall approach that should be followed in the development of an OCl TMDL. This is the approach being followed in developing the Technical TMDL for OCl excessive bioaccumulation management. This proposed project is designed to follow up on the CVRWQCB OCl TMDL effort by addressing specific technical issues for which the CVRWQCB needs information to develop an OCl management program for the Delta and its tributaries.

The current contract for the development of the OCl TMDL requires that the draft report be available for final review in the spring of 2002, i.e., just before the time that the CALFED funding of this project would become available if the project is funded. Therefore, the proposed CALFED project is designed to utilize the information developed in the TMDL to specifically address information deficiencies that arise out of the TMDL review/development. It is anticipated that each year of this proposed three-year project would generate additional information that could be used to refine the TMDL so that by the end of the three-year project, a much more focused, technically valid, cost-effective TMDL effort could be initiated, which would not only support the CVRWQCB's TMDL efforts, but also CALFED's Stage 1 efforts to control excessive bioaccumulation of organochlorine pesticides and PCBs.

Complementary Studies. As discussed in the Smith Canal studies, while not essential to addressing bioaccumulation issues, the measurement of sediment toxicity using *Hyalella* provides important information that would be of value to CALFED, the CVRWQCB and others concerned about the health of the Delta and its tributary ecosystems. It is proposed, as auxiliary studies to the bioaccumulation issues, to conduct sediment toxicity studies using *Hyalella* for all sediments for which OCl bioaccumulation is assessed.

The results of the sediment toxicity studies will provide valuable guidance as to locations where CVRWQCB, CALFED and others should do follow-up studies on the cause of the toxicity and its water quality significance. This part of the proposed OCl project will provide important information for the CALFED Stage 1 high priority area devoted to addressing unknown-caused toxicity. If the proposal that is being developed for CALFED funding for work on unknown-caused toxicity is funded, and the proposed OCl project is funded, then the toxicity testing of sediments using *Hyalella* in this project would provide a high value link between the two projects. Dr. Scott Ogle is one of the PIs for the toxicity testing component project of the unknown-caused toxicity project.

The data analysis for the sediment bioaccumulation studies will follow current US EPA (2000) guidance, "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment: Status and Needs," as well as Dr. Lee's over 30 years of experience in conducting sediment bioaccumulation studies and using the results in water quality management programs..

Project Administration. The project administration will be the responsibility Dr. G. Fred Lee with the assistance of Dr. Anne Jones-Lee. G. Fred Lee & Associates will be the contracting entity with the National Fish and Wildlife Foundation, in accord with CALFED current contracting requirements, issuing subcontracts to the participating agencies and firms. Drs. G. Fred Lee and Anne Jones-Lee are familiar with CALFED project administration as a result of

serving as the PI for the current CALFED $2-million, one-year Low-DO project devoted to the San Joaquin River Deep Water Ship Channel. That project will be completed when this proposed OCl project could become active in the spring/summer of 2002.

The proposed project will be conducted in close cooperation with the CVRWQCB staff responsible for TMDLs, where Dr. Lee is already working with the staff on these issues. A key aspect of this project compared to others is that Dr. Lee will work closely with the CVRWQCB staff in developing and conducting this project to ensure that the information developed is what the CVRWQCB needs to begin to manage the OCl excessive bioaccumulation problem in Central Valley fish.

4. Feasibility

The nature of this project is such that all components are feasible and appropriate for the project objectives. The primary participants, Drs. G. F. Lee and Scott Ogle, are both knowledgeable and experienced in conducting studies of this type in the Delta and its tributaries. The methodology that will be used is standard US EPA procedures. Further, the overall approach is recognized as the approach that needs to be followed for managing excessive fish bioaccumulation problems.

There are no environmental compliance permitting issues associated with this project.

5. Performance Measures-Evaluation

The primary basis for evaluating the performance of this project will be the development of information on the sources of OCls from terrestrial soils and aquatic sediments that lead to excessive OCl bioaccumulation in Delta and its tributary fish. This information will be provided to the CVRWQCB as part of expanding the Technical TMDL into an Implementation Plan. The evaluation of the performance of this project will be judged by the amount and quality of the information provided to the CVRWQCB.

Dr. G. F. Lee will organize an external peer review of the project results in the summer of 2003. CALFED Science Program will be invited to participate in this peer review. Dr. Lee is familiar with organizing peer reviews of CALFED-supported projects through his work on the San Joaquin River DO TMDL. This peer review will help evaluate the adequacy of the first year's studies and provide outside guidance on the approach that should be followed in the subsequent years of this project.

6. Data Handling and Storage

All data developed in this project will be provided to the IEP database where Dr Lee will work with Karl Jacobs of DWR to develop the data in a suitable Access database format. Dr. Lee is familiar with this issue through his work on the CALFED-supported San Joaquin River Low-DO project.

7. Expected Products and Outcomes

Dr. Ogle will generate a report covering the sediment accumulation/toxicity testing part of this project. Dr. Lee will generate the report covering the results of the fish tissue testing. Drs. G. F. Lee and Anne Jones-Lee will generate the overall project report which will include a presentation of the key developments of the component parts into a suitable form to support the

CVRWQCB OCl TMDL effort. It is expected that Drs. Ogle and Lee will make presentations of their respective work at a series of seminars, workshops, etc. Both of them have extensive experience in developing and presenting information resulting from their research.

8. Work Schedule

The project will be initiated as soon as funds become available, which is expected to be in the summer 2002.. Figure 2 presents a timeline for each of the components of the project.

B. CALFED, ERP and Science Program Issues

1. ERP Science Program Priorities

The excessive bioaccumulation of OCls in fish in the Delta and its tributaries has caused CALFED to list as one of the Multi-Regional Priorities and Action Areas, MR-4 *"Ensure restoration and water management Stage 1 actions to reduce impacts of pesticides, including organochlorine pesticides*." Stage 1 includes: *"Studies that increase knowledge of occurrence, status, trends, and processes that determine exposure and effects of pesticides are critical to achieving the actions. Sources, effects and trends must be better understood to best implement such actions, or decide where actions are appropriate."* This project is specifically directed to providing the information needed to begin to develop an organochlorine pesticide and PCB (OCl) management program that will potentially reduce the excessive bioaccumulation of OCls in edible fish tissue in the Delta and its tributaries.

2. Relationships to Other Ecosystem Restoration Projects

This proposed OCl project is part of an overall CALFED effort devoted to managing excessive bioaccumulation of hazardous chemicals in edible fish. Thus far, the CALFED effort has focused on mercury with some limited work in support of the DeltaKeeper in defining excessive accumulation of OCls in some Delta fish. This project will be linked with the SFEI proposed project to expand the database on excessive bioaccumulation of mercury in the San Joaquin River watershed. Further, this project would provide useful information to the proposed unknown-caused toxicity project where information on the occurrence of sediment toxicity would be provided to that project.

3. Request for Next Phase Funding

This is a new project and therefore there is no request for "next phase funding" of an existing CALFED project.

4. Previous CALFED Funding

At this time, Dr. G. F. Lee is PI for the $2-million, one-year CALFED Directed Action Low DO project. Dr. Lee's responsibility as this project's PI is primarily that of helping to organize the project, oversee its implementation and most importantly, the individual project component reports and the final overall report. This project will be completed in the spring of 2002.

Dr. Lee has applied for a CALFED Drinking Water project that would be devoted to developing nutrient criteria for managing the water quality impacts of excessive fertilization of the Delta and its tributaries. Information on the award of that project is currently scheduled to be made available in the beginning of 2002. Dr. Lee will be assisted in these projects by Dr. Anne Jones-Lee. They have worked together as a team for 25 years on projects of these types.

Figure 2
Schedule of Activities

	2002*					2003						
Months:	A	S	O	N	D	J	F	M	A	M	J	J
Task 1 - Sediment Bioaccumulation & Toxicity Testing (Pacific EcoRisk)												
Task 1.1 - Sediment Sampling	■	■	■	■								
Task 1.2 - Sediment Bioaccumulation Testing		■	■	■								
Task 1.3 - Sediment Toxicity Testing		■	■	■								
Task 1.4 - Analysis of Sediment & Test Organism Tissue for OCl					■	■	■	■	■			
Task 1.5 - Task Management	■	■	■	■	■	■	■	■	■	■	■	■
Task 1.6 - Task Reports										■	■	■
Task 1.7 - Plan Year 2 Study												■
T***ask 2 - Sportfish Tissue Analysis (G. Fred Lee & Associates)***												
Task 2.1.1 - Develop Sampling Plan	■	■										
Task 2.1.2 - Collection of Fish		■	■									
Task 2.1.3 - Sample Processing				■								
Task 2.2 - Analysis for OCl Pesticides, & PCBs					■	■	■	■				
Task 2.3 - Analysis for Dioxins					■	■	■	■				
Task 2.4 - Analysis for Selenium							■					
Task 2.5.1 - Preliminary Data Report								■				
Task 2.5.2 - Data Report									■			
Task 2.5.3 - Final Annual Data Report										■	■	
Task 2.5.4 - Plan Year 2 Study												■
Task 3 - Project Coordination, Administration & Reporting (G. Fred Lee & Associates)												
Task 3.1 - Overall Project Coordination & Administration	■	■	■	■	■	■	■	■	■	■	■	■
Task 3.2 - Project Reporting				■			■			■		
Task 3.3 - Plan Year 2 Study												■
Task 3.4 - Data Entry in IEP Database										■		
Task 4 - External Peer Review (G. Fred Lee & Associates)												■

* Assumes funding available August 1, 2002.
The details of Year 2 and 3 tasks and sampling will be developed based on the results of the previous year's work and consultation with CVRWQCB. The schedule for these subsequent years will likely be similar to that for Year 1, although the distribution of activities could change.

5. System-Wide Ecosystem Benefits

Currently CALFED is devoting considerable resources to developing improved fisheries within the Delta and its tributaries. However, because of the excessive bioaccumulation problem of the OCls, the utilization of some of these fisheries by the public will be seriously impaired because of the health hazard associated with using the fish as food. It is essential that the excessive bioaccumulation problems of the OCls and mercury be controlled so that the full benefits of CALFED's ecosystem restoration program can be realized.

C. Qualifications - Participating Organizations and Biographical Information

***G. Fred Lee & Associates*: Drs. G. Fred Lee and Anne Jones-Lee**

Dr. G. Fred Lee is President of G. Fred Lee & Associates (EnviroQual) a specialty water quality consulting firm, located in El Macero, CA (next to Davis, CA). He and Dr. Anne Jones-Lee (his wife) are the two principals in the firm. After obtaining a bachelor's degree at San Jose State University in 1955, a Master of Science Degree in Public Health from the University of North Carolina in 1957 and a PhD from Harvard University in 1960 in Environmental Engineering and Environmental Sciences, Dr. Lee taught graduate-level university environmental engineering and environmental science courses for 30 years at several major U.S. universities. During this time, he conducted over $5 million of research and published over 500 papers and reports. One of Dr. Lee's primary areas of emphasis is aquatic chemistry, as it may impact the availability of potential pollutants to cause adverse impacts to aquatic life and human health.

Dr. Anne Jones-Lee was a university professor for a period of 11 years in environmental engineering and environmental sciences. At the New Jersey Institute of Technology she held the position of Associate Professor of Civil and Environmental Engineering with tenure. She has a B.S. degree in biology from Southern Methodist University and a Ph.D in Environmental Sciences from the University of Texas at Dallas, which was obtained in 1978.

Dr G. F. Lee's previous work on pesticides has included driving a spray rig, university research, serving on a state pesticide regulatory board and as an advisor to national committees/ organizations on regulating pesticides. Supplemental information is attached to this proposal on Dr. Lee's OCl pesticide and PCB experience that is available to the reviewers should they wish further information on his experience.

Dr. G. F. Lee has been working on excessive bioaccumulation of OCls in fish tissue for over 30 years. During the 30 years that he held university professorial positions at several major US universities, he conducted research on the transport, fate and effects of bioaccumulatable OCls (organochlorine pesticides such as DDT, aldrin, dieldrin, toxaphene, etc., and PCBs). It was Dr. Lee and his graduate students, at the University of Wisconsin, Madison, that were among the first to identify PCBs as widespread pollutants in water, sediments and fish tissue.

During the 1970s, Dr. Lee and his graduate students conducted over $1 million in research on developing dredged sediment disposal criteria, which included measuring organochlorine pesticides and PCBs at about 100 sites located across the US, where the Corps of Engineers conducted dredging and open-water disposal of dredged sediments from navigation channels. These studies specifically examined the release of OCls to the water column upon sediment suspension in a dredging operation. Further, during the 1970s, on behalf of the Corps of

Engineers, Dr. Lee developed a comprehensive review of the water quality significance of PCBs in US waterway navigation channels as they might impact dredging and dredged sediment disposal. Subsequently he was asked on two different occasions by the US EPA Region 2 (New York City) for his opinion on the appropriateness of dredging the Hudson River sediments as a means of removing PCBs which were accumulating to excessive levels in striped bass. Dr. Lee's studies of benthic organisms and benthic fish showed that, even though the sediments dredged from New York and New Jersey harbors and dumped at the Mud Dump site in the New York Bight contained elevated concentrations of OCls and PCBs, these OCls were not being transferred to fish to produce excessive concentrations in fish tissue.

More recently, he has been following closely the PCB dredging situation in the Hudson River, where now the US EPA is supporting dredging; however, the General Electric Company and its consultants are justifiably questioning the appropriateness of dredging because of the potential for making available to the water column PCBs that would not ordinarily be there because of their burial in deeper sediments.

Since 1989, when Dr. Lee retired from university teaching and research and moved to El Macero, near Davis, California, he has been active in Central Valley projects involving organochlorine pesticides and PCBs. He is a member of the Sacramento River Watershed Program and was instrumental in having this program include monitoring of fish tissue in the Sacramento River for organochlorines. This led to the finding that some fish in the Sacramento River have excessive concentrations of organochlorine pesticides and PCBs.

Beginning in the mid-1990s, he became involved in a project in Orange County, California, in which there was concern about organochlorine pesticides and PCBs in Upper Newport Bay and its tributaries. As part of US EPA 205(j) and 319(h) projects, he has conducted a comprehensive review of the information available on the OCls in these waters, sediments and aquatic life. He has recommended monitoring programs to the Santa Ana Regional Water Quality Control Board to fill information gaps on the current OCl status of fish and other aquatic life in Upper Newport Bay and its tributaries.

His work on OCl pesticides within the Central Valley has led to the situation where he was asked by the Central Valley Regional Water Quality Control Board staff to undertake the TMDL for control of excessive OCls in Central Valley fish.

In summary, Dr. Lee has a long history of working with the use, fate, transport and impacts of organochlorine pesticides and PCBs. He has published a number of refereed papers and reports devoted to the occurrence, transport, fate and impacts of organochlorines on public health and the environment. He is highly qualified to undertake this proposed project. Additional information on his expertise and experience is available on his web site, www.gfredlee.com.

***Pacific EcoRisk*: Dr. R. Scott Ogle**

For almost 17 years, Dr. Scott Ogle has been directing and/or participating in research in the areas of aquatic ecotoxicology and environmental chemistry. Dr. Ogle's major area of research includes evaluation of the fate and effects of metals, pesticides, and petroleum and petroleum products in aquatic ecosystems and the investigation of contaminants and toxicity in non-point

source and stormwater runoff. Dr. Ogle has directed and participated in numerous projects encompassing all of the standardized US EPA and ASTM test procedures as well as projects involving development of new testing procedures.

Much of Dr. Ogle's recent work has focused upon evaluation of contaminated freshwater, estuarine, and marine sediments, and he and his lab staff have rapidly established a reputation as being one of the best sediment and aquatic testing labs in California. Dr. Ogle's sediment investigations incorporate the latest developments in study design, sample collection, toxicity and bioaccumulation testing and interpretation of data. These sediment evaluations also incorporate the latest regulatory recommendations and are consistent with established guidelines.

Conflicts of Interest – Drs. Lee and Ogle do not have conflicts of interest between this proposed OCl project and other public and private work that they are doing.

D. Cost

The standard CALFED budget is being submitted as part of this proposal. Additional information on the breakdown of the budget is provided in the Supplemental Information appended to this proposal. In accord with the CALFED principles of adaptive research, the second and third years will be expected to have an annual budget of about the same amount as the first year's budget where the emphasis will be on expanding on the results of the first year and filling information gaps. The development of those subsequent year project budgets will be done in close coordination with the CVRWQCB staff.

2. Cost Sharing

Drs. G. F. Lee and Anne Jones-Lee have set their charge rates for their time that they will devote to this project at considerably less than their normal consulting rate. Dr. Lee normally charges $250.00/hr for all time spent on a project. At the CALFED proposed project billing rate of $150.00/hr which includes indirect costs and other costs such as secretarial time, travel, etc., he will be cost-sharing at least $100.00/hr for the time he spends on this project. Similarly Dr. Anne Jones-Lee's normal billing rate is $125.00/hr. She will bill her time on this project at the rate of $100.00/hr, where she will be cost-sharing $25.00/hr for the time spent on this project. Her billing rate also includes indirect costs, etc.

E. Local Involvement

This project involves most of the counties in the Delta's watershed and the Delta. The county planning departments and health departments for the counties that are located within the Delta have received notice of this project, inviting comments or questions about it.

F. Compliance

Drs. Lee and Ogle agree to all of the standard clauses applicable to CALFED projects.

G. Literature Cited

Brown, L. R., "Concentrations of Chlorinated Organic Compounds in Biota and Bed Sediment in Streams of the Lower San Joaquin River Drainage, California.," U. S. Geological Survey, Open-File Report 98-171, Sacramento, California (1998).

CVRWQCB, "Draft Staff Report on Recommended Changes to California's Clean Water Act Section 303(d) List," California Regional Water Quality Control Board, Central Valley Region, Sacramento, California, 27 September (2001).

Davis, J. A, "Chlorinated Hydrocarbons in the San Francisco Estuary and its Watershed," Draft Chapter xx in Spies, R. B. (ed.), Contaminants and Toxicity in the Sacramento-San Joaquin Delta, Its Catchment, and the San Francisco Estuary – A CALFED White Paper, Applied Marine Sciences, Livermore, CA. (2000).

Davis, J., May, M., Ichikawa, G., and Crane, D., "Contaminant Concentrations in Fish from the Sacramento-San Joaquin Delta and Lower San Joaquin River, 1998," San Francisco Estuary Institute, Richmond, CA (2000).

Fisher, T., Hayward, D., Stephens, R., and Stenstrom, M., "Dioxins and Furans Urban Runoff," *Journ. Environ. Engr*. 125(2):185-191, February (1999).

Jarvinen, Alfred W. and Ankley, Gerald T., "Linkage of Effects to Tissue Residues: Development of a Comprehensive Database for Aquatic Organisms Exposed to Inorganic and Organic Chemicals," SETAC Press, Pensacola, FL (1999).

Lee, G. F. and Jones-Lee, A., "Developing TMDLs for Organochlorine Pesticides and PCBs," Environmental Chemistry Division Extended Abstracts, American Chemical Society national meeting, San Diego, California, April (2001). Available from www.gfredlee.com.

MacCoy, D. E., Domagalski, J. L., "Trace Elements and Organic Compounds in Streambed Sediment and Aquatic Biota from the Sacramento River Basin, California, October and November 1995," U. S. Geological Survey, Water-Resources Investigations Report 99-4151 (1999).

SFBRWQCB, "Survey of Storm Water Runoff for Dioxins in the San Francisco Bay Area," Report prepared by California Regional Water Quality Control Board, San Francisco Bay Region, San Francisco, CA, February (1997).

SRWP, "Annual Monitoring Report: 1998-1999," Prepared for the Sacramento River Watershed Program, Larry Walker Associates, Davis, California (2000).

SRWP, "Annual Monitoring Report: 1999-2000;" Draft, Prepared for the Sacramento River Watershed Program, Larry Walker Associates, Davis, California (2001).

US EPA, "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates," US Environmental Protection Agency, EPA/600/R-94/024, Washington, D.C., June (1994).

US EPA, "Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume 2, Risk Assessments and Fish Consumption Limits," Second Edition, U.S. Environmental Protection Agency, EPA 823-B-97-009, Washington D.C. (1997).

US EPA, "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment: Status and Needs," EPA-823-R-00-001, U.S. Environmental Protection Agency, Washington, D.C., February (2000).

WRCB/TSM, "Toxic Substances Monitoring Program," Water Resources Control Board ,Toxic Substances Monitoring Program, databases and annual reports, available from http://www.swrcb.ca.gov/ programs/smw/index.html, Sacramento, CA (2001).

WRCB, "303(d) Listing of Impaired Waterbodies," California Water Resources Control Board. Available from http://www.swrcb.ca.gov/ tmdl/303d_lists.html.

Supplemental Information

Presented in this section are additional materials pertinent to this proposal that are in excess of the 20-page limitation, that CALFED/peer reviewers may wish to review.

Details on Project Proposed Budget

Task 1 -- Sediment Bioaccumulation and Toxicity Testing	
Sediment Sampling (*six 2-day events = 12 days)	
Senior Scientist (12 days*; 12 hrs/day @ $65/hr)	9,360
Field Supervisor (12 days; 12 hrs/day @ $90/hr)	12,960
Per Diem (Lodging & Meals) (12 days @ $140/day)	1,680
Boat Rental (12 days @ $650/day)	7,800
Auto Mileage (6 sampling events; 900 mi/event @ $0.34/mi)	1,836
Mobilization/Demobilization (6 events; 4 hrs/event @ $65/hr)	1,560
Supplies & Equipment	
Miscellaneous Supplies & Equipment	2,500
Sediment Sample Preparation & Shipping	
Senior Scientist (50 samples; 0.5 hrs/sample @ $65/hr)	1,625
Shipping (6 events @ $150/event)	900
Sediment Bioaccumulation Testing with *Lumbriculus variegatus*	
28-day Sediment Bioaccumulation Tests (50 samples @ $1,800/sample test)	90,000
Tissue Sample Preparation & Shipping	
Senior Scientist (50 samples; 0.5 hrs /sample @ $65/hr)	1,625
Shipping (6 events @ $150/event)	900
Sediment Toxicity Testing with *Hyalella azteca*	
10-day Sediment Toxicity Tests (50 samples @ $800/sample test)	40,000
Analysis of Sediment and Fish Tissue for OCl and Metals	
(100 samples @ $1319/sample)	131,900
Project Management	
Field Sampling	
Preparation of Field Sampling Reports (6 events; 4 hrs/event @ $90/hr)	2,160
Supervision of Field Sampling Activities (6 events; 4 hrs/event @ $125/hr)	3,000
Attendance at Monthly Committee Meetings -- S. Ogle	
(12 meetings; 6 hrs/mtg @ $125 hr)	9,000
Review of Reports	
Review of Annual Report (40 hrs @ $125/hr)	5,000
Total Costs Task 1 Sediment Bioaccumulation and Toxicity Testing	**$323,806**
Task 2 -- Additional Fish Tissue Samples	
Collection of Two Species of Fish from 41 Sites* (82 samples @ $800/sample)	$65,600
Dissection and Compositing Fish Samples (82 samples @ $88/sample)	7,216

Analysis for OCl Pesticides and PCBs	
(82 samples + 8 QA samples @ $838/sample)	75,420
Analysis for Dioxins (20 samples + 2 QA samples @ $1700/sample)	37,400
Analysis for Selenium (20 samples $125/sample)	2,500
Labor	
PI** (280 hrs)	30,947
Environmental Analyst (280 hrs)	15,193
Graphics specialist (20 hrs)	1,190
Total Costs Task 2 Additional Fish Tissue Analysis	**$ 235,466**
Task 3 -- Overall Project Coordination and Administration	
Dr. G. Fred Lee, PI (4 hrs/wk @ $150/hr) (includes indirect costs)	31,200
Dr. Anne Jones-Lee (5hrs/wk @ $100/hr) (includes indirect costs)	26,000
Progress and Final Reports	75,000
Work with K. Jacobs of DWR on inputting data into IEP database	2,500
Total Costs Task 3 Project Coordination and Administration	**$ 134,700**
Task 4 -- External Peer Review	**70,000**
TOTAL BUDGET FOR FIRST YEAR	**$ 763,972**

* The number of sites where fish will be collected during the first year will be determined after detailed review of fish tissue OCl data and in consultation with the CVRWQCB.

** Dr. G. F. Lee will be responsible for this activity. He may hire a qualified individual to work under his supervision in carrying out the OCl fish tissue concentration assessment.

The second and third years will be expected to have an annual budget of about the same amount as the first year's budget where the emphasis will be on expanding on the results of the first year and filling information gaps. The development of the subsequent year project budgets will be done in close coordination with the CVRWQCB staff.

Supplemental References

Ankley, G. T., Cook, P. M., Carlson, A. R., Call, D. J., Swenson, J. A., Corcoran, H. F., and Hoke, R. A., "Bioaccumulation of PCBs from Sediments by Oligochaetes and Fishes: Comparison of Laboratory and Field Studies," *Can. J. Fish. Aquat. Sci*. 49:2080-2085 (1992).

Burow, K. R., Stork, S. V., and Dubrovsky, N. M., "Nitrate and Pesticides in Ground Water in the Eastern San Joaquin Valley, California: Occurrence and Trends," U. S. Geological Survey, Water-Resources Investigations Report 98-4040, Sacramento, California (1998).

Davis, J. A., *et al.*, "Persistent Toxic Chemicals of Human Health Concern in Fish from San Francisco Bay and the Sacramento River, CA," available from www.sfei.org (2001).
Domagalski, J. L., *et al.*, "Water Quality in the Sacramento River Basin, California, 1994–98," U. S. Geological Survey, Circular 1215, Sacramento, California (2000).

Domagalski, J. L., "Pesticides in Surface and Ground Water of the San Joaquin-Tulare Basins, California: Analysis of Available Data, 1966 through 1992," U. S. Geological Survey, Water-Supply Paper 2468, Washington, D.C. (1997).

Domagalski, J. L., and Dileanis, P. D., "Water-Quality Assessment of the Sacramento River Basin, California–Water Quality of Fixed Sites, 1996-1998," U. S. Geological Survey, Water-Resources Investigations Report 00-4247, Sacramento, California, (2000).

Domagalski, J. L., "Pesticides in Surface Water Measured at Select Sites in the Sacramento River Basin, California, 1996-1998," U. S. Geological Survey, Water-Resources Investigations Report 00-4203, Sacramento, California (2000).

Kratzer, C. R., "Transport of Sediment-Bound Organochlorine Pesticides to the San Joaquin River, California," U. S. Geological Survey, Open-File Report 97-655, Sacramento, California (1998).

Kratzer, C. R., "Pesticides in Storm Runoff from Agricultural and Urban Areas in the Tuolumne River Basin in the Vicinity of Modesto, California," U. S. Geological Survey, Water-Resources Investigations Report 98-4017, Sacramento, California (1998).

Kratzer, C. R., "Transport of Sediment-Bound Organochlorine Pesticides to the San Joaquin River, California," *Journ. AWRA*, 35(4):957-981 (1999).

Panshin, S. Y., Dubrovsky, N. M., Gronberg, J. M., Domagalski, J. L., "Occurrence and Distribution of Dissolved Pesticides in the San Joaquin River Basin, California," U. S. Geological Survey, Water-Resources Investigations Report 98-4032, Sacramento, California (1998).

Pereira, W., Domagalski, J., Hostettler, F., Brown, L, and Rapp, J., "Occurrence and Accumulation of Pesticides and Organic Contaminants in River Sediment, Water and Clam Tissues from the San Joaquin River and Tributaries, California," *Environ. Tox. & Chem*. 15(2):172-180 (1996).

SFEI, "Contaminant Concentrations in Fish from the Sacramento-San Joaquin Delta and Lower San Joaquin River," San Francisco Estuary Institute, Richmond, California, available from www.sfei.org (2001).

USACE, "The Environmental Residue-Effects Database (ERED)," Home Page <http:// www.wes.army.mil/el/ered/index.html> U.S. Army Corps of Engineers, webdate: November 4 (1997).

US EPA, "Proceedings of the U.S. Environmental Protection Agency's National Technical Workshop 'PCBs in Fish Tissue,'" Washington, D.C., May (1993).

US EPA, "Predicting Bioaccumulation of Sediment Contaminants to Fish," Draft report, US Environmental Protection Agency Region 5 Joint Health Effects Forum/In Place Pollutant Task Force Workgroup on Human Health Risks from Contaminated Sediments, Chicago, Illinois (1994).

US EPA, "Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume 1, Fish Sampling and Analysis," Second Edition, U.S. Environmental Protection Agency, EPA 823-R-93-002, Washington D.C. (1995).

US EPA/USACE, "Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Manual," EPA-503-8-91-001, U.S. Environmental Protection Agency and U.S. Army Corps of Engineers, Washington, D.C. (1991).

US EPA/USACE, "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual: Inland Testing Manual," EPA-823-B-98-004, U.S. Environmental Protection Agency and U.S. Army Corps of Engineers, Washington, D.C. (1998).

Supplemental Information on Dr. Lee's Experience

NAME: G. Fred Lee

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SOCIAL SECURITY:
573-42-8765

DATE & PLACE OF BIRTH:
July 27, 1933
Delano, California, USA

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E-MAIL: gfredlee@aol.com

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http://www.gfredlee.com

EDUCATION

Ph.D.	Environmental Engineering & Environmental Science, Harvard University, Cambridge, MA, 1960
M.S.P.H.	Environmental Science-Environmental Chemistry, School of Public Health, University of North Carolina, Chapel Hill, NC, 1957
B.A.	Environmental Health Science, San Jose State University, 1955

ACADEMIC AND PROFESSIONAL EXPERIENCE

Current Position:
Consultant, President, G. Fred Lee and Associates

Previous Positions:
- Distinguished Professor, Civil and Environmental Engineering, New Jersey Institute of Technology, Newark, NJ 1984-89
- Senior Consulting Engineer, EBASCO-Envirosphere, Lyndhurst, NJ (part-time) 1988-89
- Coordinator, Estuarine and Marine Water Quality Management Program, NJ Marine Sciences Consortium Sea Grant Program 1986-1988
- Director, Site Assessment and Remedial Action Division, Industry Cooperative Center for Research in Hazardous and Toxic Substances, New Jersey Institute of Technology et al., Newark, NJ 1984-1987
- Professor, Department of Civil and Environmental Engineering, Texas Tech University 1982-1984
- Professor, Environmental Engineering, Colorado State University 1978-1982
- Professor, Environmental Engineering & Sciences; Director, Center of Environmental Studies, University of Texas at Dallas 1973-1978
- Professor of Water Chemistry, Department of Civil & Environmental Engineering, University of Wisconsin-Madison 1961-1973

Registered Professional Engineer, State of Texas, Registration No. 39906

Supplemental Discussion of OCl Experience

Dr. Lee's involvement with organochlorine pesticides started in the early 1950s, when, while working on a grape ranch near Delano, California, he drove spray rigs for application of pesticides to grapes. In the mid-1950s, while an intern in the City of San Jose Department of Health, he was involved in a summer project that utilized organochlorine pesticides and other chemicals for mosquito control.

In the 1960s, Dr. Lee led several research projects devoted to the water quality aspects of organochlorine pesticides. These included working with the Wisconsin Department of Conservation (which is the equivalent of the California Department of Fish and Game) on projects devoted to rough fish control using toxaphene. Toxaphene is a chlorinated hydrocarbon pesticide that is highly toxic to fish. It was used for rough fish control in lakes where excessive numbers of carp had become the dominant fish species in the lake. Dr. Lee and his graduate students followed the fate of the toxaphene as it was applied to several Wisconsin lakes. They found that much of the toxaphene that was added to lakes for rough fish control was partially degraded after its addition to the lake, and, while there was a readily measurable residue in the lake sediments, extraction of this residue and its cleanup using chromatographic procedures, showed that it was far less toxic per unit weight than the parent materials added to the lake.

Dr. Lee and his University of Wisconsin graduate students conducted several projects on organochlorine pesticide (aldrin and dieldrin) transport/fate in surface and ground waters. This was done as part of modeling the fate/transport of OCls in groundwater systems where it had been applied to crops for pest control.

Dr. Lee was an advisor to the Norfolk, Virginia, District of the Corps of Engineers on the dredging of the Intercoastal Waterway in the Virginia/North Carolina border area, where the concern was chlordane accumulation within the waterway sediments. This section of the Intercoastal Waterway had not been dredged for a number of years because of the report of excessive chlordane in the sediments. Dr. Lee showed that the analytical data for chlordane in these sediments were in error, due to improper methodology that was used in analyzing the sediments. Chlordane was not present in the sediments at potentially hazardous levels, which would affect the dredging project.

Also, Dr. Lee was involved as an advisor during the 1970s to the San Francisco District of the Corps on dredging projects within San Francisco Bay, where excessive concentrations of organochlorine pesticides and PCBs were of concern, as they might impact dredging and dredged sediment disposal projects near Treasure Island.

Dr Lee's work on the water quality aspects of OCl pesticides and PCBs has been recognized by several national committees/organizations. In the early 1970s, Dr. Lee was an invited peer reviewer to the National Academies of Science and Engineering for the Blue Book of Water Quality Criteria. As a reviewer, he was responsible for conducting a review of the draft criteria that had been developed by the Academy committees, which included the OCl pesticides.

He was asked by the US Public Health Service to chair a committee devoted to evaluating whether there was need for a PCB drinking water maximum contaminant level, in order to protect the public from PCBs that were being found in domestic water supplies. Dr. Lee served as an advisor to Monsanto Chemical Co. on PCB issues. Further, he was interviewed by Walter Cronkite for CBS evening news on PCB pollution issues.

While teaching at the University of Wisconsin, Madison, Dr. Lee was appointed Secretary for the Technical Advisory Committee for the Pesticide Review Board for the state. This committee advised the Pesticide Review Board on pesticide policy, which included recommending the banning of DDT from its further use in Wisconsin because of the adverse impacts of DDT on some bird populations.

Dr. Lee was a member of the American Society for Testing and Materials Committee E-35, devoted to pesticides. He organized and chaired the Environmental Chemistry Fate Section of this committee for several years.

In the early 1990s, Dr. Lee was part of an OEHHA invited group that conducted the comparative risk project for the state of California. One of the groups of chemicals that were considered in this project was the organochlorines as they may affect human health through consumption of fish that contain excessive concentrations of OCls.

During the late 1990s, Dr. Lee has been an advisor to the DeltaKeeper on pesticide issues within the Delta and its tributaries. This work has included advising on the water quality aspects of the organochlorine pesticides and PCBs.

During the early 1990s, when Dr. Lee served as a consultant to Simpson Paper Company, he was involved in reviewing the dioxin fate, transport and impacts associated with Simpson's Humbolt, California, mill, as well as the Anderson mill, which discharged its wastewaters to the Sacramento River. For a period of time, this mill's wastewater effluent contained dioxins at sufficient concentrations to cause many of the fish in the Sacramento River to contain excessive dioxins and furans.

More recently, Dr. Lee has been involved in litigation in the Salinas Valley concerning DDT transport from areas where strawberries are being grown. It has been found that the concentrations of DDT in stormwater runoff from these areas exceeded drinking water standards, which are well above those that would be expected to bioaccumulate to excessive levels in aquatic life.

For several years, Dr. G. F. Lee was an advisor to the US EPA Region 2 in New York City, regarding the dredging of the Hudson River sediments for the purpose of lowering the PCB content of striped bass in the Hudson River and New York/New Jersey harbors. While there were mathematical models which were claimed by the model developer to link the PCB content of sediments to the PCB content of fish, they were deterministic models, which were not based on an understanding of the mechanism controlling the uptake of PCBs by striped bass from the sediments. It is possible that the sediment "hot

spots," where the total concentrations of PCBs were greatly elevated, may not be the primary transfer point. The PCBs in those sediments are likely tightly bound, and, therefore, not as readily available for bio-uptake as the PCBs associated with sediments with a lower total PCB content and binding affinity for the sediments. These are issues that will be considered in the course of conducting this project, especially during the second and third years when specific studies may be conducted to gain further insight into them.

During the 1970s, under contract with the Corps of Engineers, Dr. G. Fred Lee conducted studies of the release of organochlorine pesticides and PCBs from sediments from about 100 different US waterways. He found that PCBs were most readily released to the water column from sediment suspension when the sediments had a low petroleum hydrocarbon content. This release was not necessarily related to the TOC content of the sediments. Sediments with a low petroleum hydrocarbon content, which are typically sandy type sediments such as obtained several miles out in the Gulf of Mexico near Galveston, Texas, readily released a substantial portion of the PCBs present in the sediments. Sediments with high petroleum hydrocarbon content which had much higher concentrations of PCBs (taken from the Houston Ship Channel) released little of the PCBs upon suspension into the water column.

In the late 1970s, the Corps of Engineers Waterways Experiment Station in Vicksburg, Mississippi, issued a contract to Dr. G. Fred Lee to develop a report addressing the technical issues it was facing in various parts of the US in which elevated levels of PCBs were being found during dredging for navigation channel maintenance. Dr. Lee then raised many of the same issues that are still unknown today with respect to the relationship between the concentrations of PCBs (and, for that matter, other OCls) in sediments and their uptake by fish to excessive levels in edible tissue. The same controversy exists today with respect to dredging of the Hudson River PCB-containing sediments, where the General Electric Company and its consultants have concluded that the current information available on the potential benefits of dredging Hudson River sediments as a means of lowering the PCB content of striped bass in the Hudson River system is not adequate to support the US EPA's position that spending in excess of $30 million dredging selected locations in the Hudson River will significantly impact the PCB content of striped bass in the river.

Supplemental Information on Dr. Ogle's Experience

Dr. Scott Ogle
Lab Director, Pacific Eco-Risk Laboratories

EDUCATION:

Ph.D. Ecology (Aquatic Ecotoxicology)	1996
University of California, Davis, CA	
M.S. Water Science (Water Pollution Biology)	1988
University of California, Davis, CA	
B.S. Fisheries Biology (Water Quality)	1984
Humboldt State University, Arcata, CA	

PROFESSIONAL HISTORY:

PACIFIC ECO-RISK LABS, Martinez, CA	1994-Present
Principal and Laboratory Director	
S.R. HANSEN & ASSOCIATES, Concord, CA	1991-1994
Senior Scientist	
UNIVERSITY OF CALIFORNIA, Davis, CA	1991
Teaching Assistant (Fish Physiology)	
UNIVERSITY OF CALIFORNIA, Davis, CA	1986-1991
Research Assistant	
U.S. FISH & WILDLIFE SERVICE, Dixon, CA	1985
Biological Aide	

SCIENTIFIC/RESEARCH AWARDS:
Pre-Doctoral Fellow, Society of Environmental Toxicology and Chemistry, 1989-1990
Best Student Presentation, SETAC, 9th Annual Meeting, 1988
Jastro-Shields Graduate Research Award, University of California, Davis, 1986

For over ten years, Dr. Scott Ogle has been directing and/or participating in research in the areas of aquatic ecotoxicology and environmental chemistry. A major area of Dr. Ogle's past research efforts has focused on factors affecting toxicity and bioaccumulation of selenium to algae, invertebrates, and fish and has established him as an expert in this field. Current research activities include evaluation of the fate and effects of metals, pesticides, and petroleum and petroleum products in the aquatic environment and the investigation of contaminants and toxicity in non-point source and stormwater runoff. Dr. Ogle has directed and participated in numerous projects encompassing all of the standardized EPA and ASTM test procedures as well as projects involving development of new testing procedures.

After recent competitive evaluations, Dr. Ogle's research team has been selected over other Bay area and West Coast firms to perform dredged sediment sampling and testing services for the Moss Landing Harbor District, the City and County of San Francisco, the

Port of Oakland, and the U.S. Army Corps of Engineers. After similar competitive evaluations (including on-site lab audits), Dr. Ogle's team has also been selected to provide sediment toxicity and bioaccumulation testing for most of the military base re-alignment and closure projects, including the Presidio, the Concord Naval Weapons Facility, the Alameda Naval Air Station, the Pt. Molate Naval Fuel Depot, the Oakland Army Base, McClellan Air Force Base, the US Navy Hunter's Point Annex, as well as the Mare Island Naval Shipyard. Pacific EcoRisk has also provided similar services as part of ongoing Bay Protection and Toxic Cleanup Program evaluations for Zeneca Ag Products, as well as the City & County of San Francisco. Performance of all of these projects has involved a direct management role by Dr. Ogle, from conception and design of experimental approach, through completion of studies and analyses of results, and finally, reporting of the results to the concerned parties.