

## Suggested Approach for Formulation of CALFED Hg Control Strategy

- Conduct Program to Determine the Current Concentrations of Hg in Delta and Upper San Francisco Bay Fish, Benthic Organisms, Water and Sediments at Various Times of the Year for Several Years

Determine Concentrations of Inorganic and Methyl Hg in Various Locations in the Delta, Yolo Bypass, and Upper San Francisco Bay

Determine the Distribution of Hg as a Function of Particle Size in Cache Creek High Flow

Determine Where the Fine and Course-Grain Cache Creek Particulate Hg Primarily Settles in the Delta and Bay

Do Those Areas Have Higher Methyl Hg Generation Rates?

Determine the Leaching Characteristics of the Hg Found on the Cache Creek High Flow Particles

### Suggested Hg Source/Uptake Studies:

- Take Samples of Bypass, Delta, and Bay Sediments to the Lab and Measure Methyl Hg Generation Rate Based on Chemical and Bio-Uptake Approaches
- Collect Samples of Cache Creek High-Flow Hg
  - Fractionate by Particle Size/Density by Gravity Settling without Dispersant
  - Add Cache Creek High-Flow Hg to Delta and Bay Sediments to Determine if Additional Hg Stimulates Methyl Hg Formation
- Evaluate Hg Stable Isotope Ratios in Cache Creek High-Flow Particles and within the Delta and Bay Sediments, Water, and Fish Tissue

From the Information Gained on the Forms of Hg That Lead to Methyl Hg Formation in Delta and Bay Sediments and Excessive Bioaccumulation in Fish, Determine the Sources of Hg within Cache Creek That Lead to Excessive Bioaccumulation of Hg in Delta and Bay Fish

### Conclusions

- Delta and San Francisco Bay Fish Contain Excessive Hg That Is a Threat to the Health of Those Who Eat the Fish
- CALFED Potentially Has Some Funds to Control Part of the Hg Input to the Delta
- Cache Creek High Flow Is an Important Source of Total Hg for the Delta and Upper Bay -- Unknown What Part of That Hg Is Bioavailable
- Need to Evaluate Whether Cache Creek High-Flow Hg Is a Significant Factor in Causing Excessive Bioaccumulation of Hg in Delta and/or Bay Fish
- Integrated Lab and Field Studies Need to Be Conducted to Define the Role of Cache Creek High-Flow Hg in Excessive Bioaccumulation of Hg in Delta and Upper San Francisco Bay

## Water Quality and Solid & Hazardous Waste Landfills Evaluation and Management

Dr. G. Fred Lee and Dr. Anne Jones-Lee have prepared a set of professional papers and reports, present lectures and short-courses and serve as consultants on various public health and environmental quality aspects of domestic water supply water quality, water and wastewater treatment, water pollution control, and the evaluation and management of impacts of solid and hazardous waste. Publications are available from Dr. G. Fred Lee in the following areas:

- Landfills - Solid and Hazardous Waste Impact Evaluation and Development
- Water Quality Evaluation & Management for Wastewater Discharges and Stormwater Runoff
- Hazardous Chemical Impact - Superfund - Evaluation and Remediation/Management Davis South Campus Superfund Oversight Committee Activities
- Contaminated Sediments - Aquafund - Water Quality Impact Evaluation and Management
- Domestic Water Supply Water Quality- Watershed Management
- Reuse of Reclaimed Wastewaters for Groundwater Recharge and Shrubbery Irrigation
- Excessive Fertilization/Eutrophication of Lakes, Reservoirs, Estuaries, and Marine Waters
- Watershed Based Water Quality Management Sacramento River and Delta Water Quality Issues Upper Newport Bay, California Water Quality Issues
- Information on G. Fred Lee & Associates

## Evaluation and Remediation/Management of Impacts of Hazardous Chemicals

There are some areas of industrial, municipal, and agricultural properties, and waterbodies, including groundwaters, that contain significantly elevated concentrations of potentially hazardous and otherwise deleterious chemicals. Such chemicals pose real or potential threats to public health, surface and groundwater resources, the environment, and/or the interest of those who own or use properties in the areas under the influence of the chemicals. Drs. Lee and Jones-Lee have developed several papers and reports that discuss important issues for investigating and remediating areas that contain hazardous or otherwise deleterious chemicals. Information is provided on evaluating the adequacy of site investigation and remediation relative to the long-term threats that hazardous and otherwise deleterious chemicals may represent to public health, groundwater resources, and the environment. A list of recent publications and further information on their activities on this topic are available.

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## Water Quality Evaluation and Management Wastewater Discharges and Stormwater Runoff

The typical regulatory approach used today tends to significantly over-regulate regulated chemicals in point-source domestic and industrial wastewater discharges and non-point source runoff from agricultural, forested, and mining areas. This is due to inadequate consideration being given to the aquatic chemistry of chemical constituents which affects their impact on the beneficial uses of waterbodies. Dr. Lee has worked on the development of water quality criteria and their implementation into water quality standards and discharge limits since the mid-1960's. He and Dr. Jones-Lee have published extensively on this topic area. Particular attention in their publications has been given to residual chemicals in municipal and industrial wastewater discharges, urban and highway stormwater runoff, and non-point-source stormwater runoff from agricultural, range and forested lands. Drs. Lee and Jones-Lee have developed a water quality-based hazard assessment approach for the evaluation of the impact of chemical constituents in a waterbody or tributary to it, on the beneficial uses of the waterbody.

An area of emphasis in their work has been the impacts of chemical constituents in urban area and highway stormwater runoff on water quality/use-impairment of receiving waters. Included in their publications is information on an Evaluation Monitoring approach for the identification of real water quality problems caused by stormwater runoff. That approach is a suggested alternative to the traditional, mechanical monitoring of stormwater runoff. The Evaluation Monitoring they describe provides a technically valid, cost-effective approach for developing reliable BMPs for stormwater runoff. Further information on their work in this topic area, as well as information on obtaining copies of their publications in the area of wastewater quality impact evaluation and management and stormwater quality impact evaluation and management and the short-courses they have developed on this topic area is available upon request. A summary of the author's expertise and experience in pesticide impact and management, water quality standards and NPDES permits is provided as is a summary of his experience in stormwater quality evaluation and management.

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## Contaminated Sediments - Aquafund

Aquatic sediments tend to accumulate a variety of chemical constituents that represent potential threats to water quality. The issue of contaminants in sediment is of sufficient concern to potentially lead to a new national Superfund-like program - "Aquafund" - in which large amounts of money would be spent to investigate and remediate contaminated sediments. Drs. Lee and Jones-Lee have worked for many years in the evaluation of the water quality significance of contaminants in harbor and waterway sediments, including conducting more than \$1 million in research on the significance of contaminants in waterway sediments associated with dredging projects.

There is considerable interest today in developing sediment quality criteria for regulating contaminants in sediments. Several approaches have been proposed for the evaluation of the water quality significance of chemical constituents in aquatic sediments. While chemical-concentration-based approaches, such as equilibrium partitioning and co-occurrence, are being used, such approaches tend to be unreliable in their assessment of the water quality significance of chemicals in aquatic sediments. Drs. Lee and Jones-Lee have published considerably on the technical issues of impacts of sediment-associated contaminants including factors that affect the availability of such contaminants. Their writings discuss many of the reasons that chemical-concentration-based approaches are not reliable for estimating sediment toxicity or bioaccumulation of sediment-associated chemicals into aquatic life. They recommend that biological effects-based approaches (sediment toxicity and actual bioaccumulation) be used. Dr. Lee presents a several-day short-course on sediment quality issues. He and Dr. Jones-Lee have an extensive set of publications on this topic. Further information on their activities in this area and on obtaining copies of their publications is available upon request.

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# Water Quality Evaluation & Management

## Wastewater Discharges and Stormwater Runoff

Regulatory approaches typically used today tend to significantly over-regulate regulated chemicals in point-source domestic and industrial wastewater discharges and non-point-source runoff from urban, agricultural, rural, forested, and mining areas. This is due to inadequate considerations being given to the aquatic chemistry of chemical constituents that influence their impacts on the beneficial uses of waterbodies. Dr. G. Fred Lee has worked on the development of water quality criteria and their implementation into water quality standards and discharge limits since the mid-1960's. He and Dr. Anne Jones-Lee have published extensively on this topic, with particular attention to residual chemicals in municipal and industrial wastewater discharges, urban and highway stormwater runoff, and non-point-source stormwater runoff from urban, agricultural, range, and forested lands. They have also developed a water quality-based hazard assessment approach for the evaluation of the impact of chemical constituents in a waterbody or tributary to it, on the beneficial uses of the waterbody.

While regulated chemicals tend to be over-regulated by current regulatory approaches, there is a vast arena of unregulated or inadequately regulated chemicals, such as the organophosphorus pesticides, that are adverse to the beneficial uses of waterbodies, which are not being adequately addressed by current regulatory approaches. Urban area and some rural stormwater runoff has been found to be highly toxic to aquatic life due to these and other chemicals.

An area of emphasis of their work has been the impacts of chemical constituents in urban area runoff and in highway stormwater runoff on water quality/use-impairment of receiving waters. They have published information on an Evaluation Monitoring approach for the identification of real water quality problems-use impairments caused by stormwater runoff. That suggested alternative to the traditional mechanical monitoring of stormwater runoff provides a technically valid, cost-effective approach for developing reliable BMPs for managing stormwater runoff water quality impacts.

## Additional Information on Water Quality Evaluation and Management

If you would like additional information on the work of Drs. Lee and Jones-Lee in the area of water quality evaluation and management, including their work on impact and management of pesticides, water quality standards and NPDES permits, and stormwater quality evaluation and management, or would like to access downloadable technical publications on those topics, click on the topic below.

- [Publications on Water Quality Implications of Stormwater Runoff](#)
- [Publications on Water Quality](#)



# Contaminated Sediments - Aquafund

Aquatic sediments tend to accumulate a variety of chemical constituents that represent potential threats to water quality. The issue of pollutants in aquatic sediment is of sufficient concern to potentially lead to a new national Superfund-like program - "Aquafund" - in which large amounts of money could be spent to investigate and remediate contaminated sediments. Further, the US EPA is in the process of developing approaches for placing restrictions on NPDES permitted discharges that are based on the potential of constituents in these discharges to accumulate in aquatic sediments to a sufficient extent to be adverse to the waterbody's beneficial uses.

Drs. G. Fred Lee and Anne Jones-Lee have worked for many years on the evaluation of the water quality significance of contaminants in harbor and waterway sediments. Their work included conducting more than \$1 million in research on the significance of contaminants in waterway sediments associated with navigational dredging projects that are conducted throughout the US. They have published papers and reports on the technical issues of impacts of sediment-associated contaminants, including factors that affect the availability of such contaminants.

There is considerable interest today in developing sediment quality criteria for regulating contaminated sediments. Several approaches have been proposed for the evaluation of the water quality significance of chemical constituents in aquatic sediments. While chemical-concentration-based approaches, such as equilibrium partitioning and co-occurrence, are being used, such approaches tend to be unreliable in their assessment of the water quality significance of chemicals in aquatic sediments. Drs. Lee and Jones-Lee's writings discuss many of the reasons that chemical-concentration-based approaches are not reliable for estimating sediment toxicity or bioaccumulation of sediment-associated chemicals into aquatic life. They recommend that biological-effects-based approaches (sediment toxicity and actual bioaccumulation) be used.

Dr. Lee presents a several-day short-course on sediment quality/water quality issues which can be made available at any location where a local sponsor will make arrangements.

## Additional Information on Contaminated Sediments

If you would like additional technical information on the evaluation and management of sediment-associated contaminants, including deficiencies in some of the current approaches and making more technically reliable assessments and management decisions, or would like to access downloadable technical publications on that topic, click on the link below.

- [Publications on Contaminated Sediments](#)

