

## Expertise and Experience in Water Quality Standards and NPDES Permits Development and Implementation into NPDES Permitted Discharges

Drs. G. Fred Lee and Anne Jones-Lee



Dr. G. Fred Lee has over 20 years of experience in developing water quality criteria, state water quality standards and their implementation into NPDES permitted discharge limits. In the 30 years that he held university professorial teaching and research positions, he was highly involved in conducting research for the purpose of determining the impact of chemical constituents on aquatic life and public health. Since the mid-1970's he and Dr. Jones-Lee have worked together as a team in these areas. Her expertise in aquatic biology and aquatic toxicology coupled with his expertise in aquatic chemistry, public health and environmental engineering enable them to undertake work on complex issues associated with evaluating the significance of chemical constituents on the designated beneficial uses of waterbodies and in developing cost effective control programs for those situations where excessive concentrations of constituents are present that impair the designated beneficial uses of the waterbody. Drs. G. F. Lee and A. Jones-Lee have published extensively on water quality criteria and standards development and their implementation into discharge limits. These publications have included invited review articles on the chemical aspects of bioassay procedures and the translation of laboratory toxicity testing results to field situations. A summary of their experience in these various topic areas is presented below.

### Water Quality Research

Beginning in the early 1960's Dr. Lee initiated some of the first work ever done on evaluating the available - toxic forms of chemical constituents in aquatic systems. He pioneered in the combined integrated use of aquatic chemistry and aquatic toxicology in evaluating the water quality significance of chemical constituents. Work of this type is leading to more technically valid criteria and standards which focus on controlling toxic - available forms of contaminants.

### Regulatory Experience

During the mid to late 1960's he served as an advisor to the state of Wisconsin on developing water quality standards that would protect aquatic life without unnecessary expenditures for contaminant control. While teaching at the University of Wisconsin-Madison where he developed and then directed the Water Chemistry graduate degree program, Dr. Lee conducted some of the first work ever done on fate and persistence of a variety of chemical constituents in various types of aquatic systems, including inland lakes, reservoirs, rivers, streams, the Great Lakes and coastal marine waters. During that time, through the mid-1970's he served as an advisor to the International Joint Commission for the US-Canadian Great Lakes in developing water quality objectives for the Great Lakes and their implementation. He was also an advisor to a number of industries, municipalities and various governmental agencies at the federal, state and local levels on water quality criteria and standards development and implementation. His pioneering work on PCB's in the 1960's led to his being selected to head the US Public Health Service committee on developing drinking water standards for PCB's.

### Pesticide Experience

While teaching at the University of Wisconsin-Madison he conducted extensive research on the fate and effects of pesticides. He was appointed secretary for the Technical Committee of the Pesticide Review Board for the state of Wisconsin. That committee was responsible for developing pesticide use regulations in the state which included the banning of DDT. Wisconsin was the first state to pass such a ban. [Additional pesticide experience](#) of Drs. Lee and Jones-Lee is available.

### Consulting Experience with Large Chemical Companies

Beginning in the late 1970's he served as an advisor to a number of chemical companies such as Procter and Gamble Company, Monsanto and FMC in helping them evaluate procedures for determining the potential environmental impact of new or expanded-use chemicals on public health and the environment. This activity led to his serving as an advisor to the President's Council on Environmental Quality which formulated the initial version of the Toxic Substances Control Act.

## Development of Water Quality Criteria

In the early 1970's he was selected as a peer reviewer for the National Academies of Science and Engineering "Blue Book" of Water Quality Criteria. He was asked in the mid-1970's to critique the US EPA's proposed adoption of the "Red Book" national water quality criteria. In the late 1970's he was appointed a member of the American Fisheries Society Water Quality Committee review panel that conducted an in-depth review of the July 1976 US EPA "Red Book" of Water Quality Criteria.

During the 1970's he continued to be active in assisting industry, municipalities and governmental agencies to review the impact of their point and non-point source discharges on domestic water supply and aquatic life-related water quality in specific waterbodies. At that time he held a position as a Professor of Engineering at the University of Texas-Dallas and was the Director of the Institute for Environmental Studies at UTD.

## Development of Water Quality Hazard Assessment Approach

In the late 1970's as part of the work that he did while holding a Professorship in Civil and Environmental Engineering at Colorado State University he and Dr. Jones-Lee, in connection with work that they were doing for several Colorado Front Range cities (Fort Collins, Loveland, Colorado Springs and Pueblo), developed the hazard assessment approach for determining the hazard that a particular POTW discharge containing certain chemical constituents represented to the designated beneficial uses of the receiving waters for that discharge. This hazard assessment work was the first time that such an approach had been applied to complex effluents and was instrumental in causing the state and federal agencies to determine that their proposed discharge limits for several constituents in the POTW permits were excessively restrictive compared to what was needed to protect the designated beneficial uses of the receiving waters for the discharge.

The hazard assessment approach that was developed by Drs. Fred Lee, Anne Jones-Lee and their graduate students has evolved into what is now called ecological risk assessment. It is an integrated, tiered evaluation of the aquatic toxicology and aquatic chemistry for a group of constituents in a wastewater discharge as they may impact the designated beneficial uses of a waterbody. While initially both the Department of Health which regulated water quality in the state of Colorado and the US EPA indicated that they would not approve this approach, eventually when the technical validity and cost-effectiveness of the hazard assessment approach was realized by the state of Colorado, Drs. Lee and Jones-Lee were asked to work with the state in developing this approach as an approach that could be used to develop appropriate discharge limits for all NPDES permit holders in the state. A paper presenting the results of the initial work on aquatic life hazard assessment approaches which focused on the city of Pueblo's POTW discharge was presented in the proceedings of the ASTM Aquatic Toxicology symposium where it tied for first place as the best paper presented at the symposium.

## Contaminated Sediment Issues

During the 1970's Dr. G. F. Lee conducted over \$1 million in research for the US Army Corps of Engineers in developing dredged sediment disposal criteria. Since the late 1970's Drs. G. F. Lee and A. Jones-Lee have been highly active in developing sediment quality criteria and their implementation into programs designed to evaluate the water quality significance of chemical constituents associated with sediments and in developing technically valid, cost-effective approaches for remediation of sediments that contain excessive concentrations of available - toxic forms of chemical constituents.

## Full-Time Consulting

In 1989 Drs. G. F. Lee and A. Jones-Lee terminated their university teaching positions and began to expand the part-time private consulting that they had been doing while they were university professors into a full-time activity. At that time Dr. G. F. Lee held a Distinguished Professorship in Civil and Environmental Engineering at the New Jersey Institute of Technology. Dr. Anne Jones-Lee held the position of Associate Professor of Civil and Environmental Engineering at NJIT. Their consulting activities caused them to move to the Sacramento, CA area in 1989. Shortly after returning to California, they became involved in what ultimately became the April 1991 water quality objectives adopted by the State Board. They submitted extensive comments on the highly significant technical problems and inappropriate

approaches that the State Board staff had proposed at that time for developing water quality objectives, including commenting on the lack of consideration of economic issues in developing these objectives. A copy of the comments provided to the State Board on these problems is available upon request. Many of the issues raised by Drs. G. F. Lee and A. Jones-Lee in 1990 and 1991 are still pertinent to developing technically valid approaches for formulating water quality objectives in the state.

## National Toxics Rule

In November 1990 Drs. G. F. Lee and A. Jones-Lee provided extensive comments on the inappropriate approaches being proposed by the US EPA as part of developing the National Toxics Rule. As part of these comments they reviewed the evolution of national water quality criteria and their implementation into state standards. A copy of their comments on the US EPA's proposed National Toxics Rule is available upon request.

### San Francisco Bay Copper Objectives

During the past couple of years, Drs. G. F. Lee and A. Jones-Lee have become highly active in San Francisco Bay water quality issues where they have conducted reviews of the approaches that were used to develop the site-specific water quality objectives for copper in San Francisco Bay and have commented on the inappropriateness of some of the approaches that were used. Today those associated with San Francisco Bay copper issues are trying to use the development of site-specific objectives for copper in New York Harbor as an example of what should be done in San Francisco Bay. As some of the few, if not the only, individuals who have worked on copper in both New York Harbor and San Francisco Bay, they are well aware of the significant differences that exist between the two systems. The attempts to translate the New York Harbor experience to San Francisco Bay will prove to be unsuccessful and will lead to massive waste of public and private funds in controlling copper in San Francisco Bay inputs which are not having an adverse impact on the designated beneficial uses of the Bay waters.

## Mining Wastes

Dr. Lee has worked on evaluating the water quality impact of mining wastes and their management since the late 1960's. Extensive work has been done on mine waste tailings including acid production from sulfide-containing ores. Recently he and Dr. Jones-Lee worked for the Port of San Diego in conducting a water quality and public health risk assessment for a copper ore concentrate spill in San Diego Bay. They demonstrated that the copper ore concentrate was inert in San Diego Bay sediments. Additional information on Drs. Lee and Jones-Lee's experience in environmental aspects of mining and mineral processing is available.

## Stormwater Quality Management

Dr. G. Fred Lee conducted one of the first studies on water quality impacts of urban stormwater runoff as part of the work that he did at the University of Wisconsin-Madison in the 1960's in the International Biological Program. In that Program he and his graduate students found that urban stormwater runoff contained high concentrations of a variety of constituents which have the potential to adversely impact designated beneficial uses of waters. However, substantial parts of these constituents were in forms that were non-toxic, non-available.

As part of the National Urban Runoff Program (NURP) studies conducted by the US EPA in the early 1980's, Drs. G. F. Lee and A. Jones-Lee conducted a number of studies on behalf of Fort Collins, Colorado and the City and County of Denver, Colorado in evaluating the impact of urban stormwater runoff on water quality in specific waterbodies of interest to them. It was at that time that Drs. Lee and Jones-Lee suggested that these cities should be conducting instream bioassays to determine what, if any, toxicity was associated with urban stormwater runoff derived from the Denver,

Colorado area. The US EPA, Washington, D.C. managers of NURP however determined that it was inappropriate for cities to use funds derived from NURP in evaluating the impact of the urban stormwater-associated contaminants on receiving water quality. This eventually led to Drs. Lee and Jones-Lee publishing a paper in *Civil Engineering* questioning whether NURP would provide the information needed by water quality managers to determine how best to proceed to address real water quality problems associated with stormwater runoff. That discussion of these issues has proven to be correct in that NURP failed to provide the kind of information needed to evaluate the water quality significance of chemical constituents in urban stormwater runoff.

Over the past several years, Drs. Lee and Jones-Lee have published extensively on the problems with the way in which federal and state regulatory agencies are developing programs for evaluating the water quality impacts of urban stormwater-associated contaminants. Copies of their papers on these topics are available. Although the focus of this work is on urban stormwater runoff, they have direct applicability to industrial stormwater runoff as well as agricultural and rural non-point source runoff. A listing of their papers and reports pertinent to evaluating non-point source-associated contaminant impacts is available upon request.

During the past several years, Dr. G. F. Lee has been an active member of the California Stormwater Quality Task Force. They have also been active as advisors to industrial groups, Caltrans, and municipalities on stormwater runoff quality evaluation and management issues. Of particular importance in these activities is the development of appropriate criteria - standards for evaluating the water quality significance of chemical constituents in point and non-point source discharges.

Drs. Lee and Jones-Lee have assisted several clients in the Midwest on water quality issues, including a city in Indiana which was being sued by the US EPA for combined sewer overflow stormwater and wastewater discharges. As part of this work on behalf of clients in the Midwest he attended the US EPA workshop devoted to the Agency's new proposed approaches for developing water quality criteria and implementation into state standards and permitted discharge limits.

## Heavy Metal Criteria and Standards

Drs. Lee and Jones-Lee have worked on the fate and effects of a variety of heavy metals in fresh and marine waters. Their work in this topic area resulted in his being an invited participant in the January 1993 heavy metal criteria workshop. It was this workshop that established the approach for establishing dissolved metals as the basis for regulating heavy metals in ambient waters.

## New Water Quality Criteria Development Approaches

As discussed at the Water Resources Control Board water quality objectives meeting held on December 12, 1994, the US EPA is in the process of developing significantly revised approaches for developing and implementing water quality criteria and state standards and permitted discharge limits. Beginning in 1995 and through 1996, the US EPA Washington D.C. staff responsible for criteria development will be releasing a number of proposed revised approaches in the Federal Register for review.

The US EPA will be changing how they develop criteria and implement these criteria into state standards and point-source discharge limits with respect to the averaging period, the frequency and duration of excessive concentrations allowed and the use of risk-based approaches for excessive bioaccumulation of carcinogens and non-carcinogens such as mercury in fish tissue, etc. A key factor that was mentioned at the December 12, 1994 meeting but was not discussed was the potential for the US Fish and Wildlife Service and other fisheries agencies at the state and federal level in implementation of the Endangered Species Act to require states to develop water quality standards that will protect wildlife. Based on the situation that is developing in other parts of the country, water quality criteria considering Endangered Species Act requirements could be highly significant in impacting criteria levels that are allowable, especially for those constituents that may adversely impact wildlife. While the US EPA Region IX may not intend to incorporate wildlife criteria into their current revisions of the state of California water quality objectives, it is highly likely that Department of Interior groups responsible for implementation of the Endangered Species Act will incorporate these into their mandated review of the revised water quality objective developed for California by the US EPA Region IX.

## Groundwater Quality Protection and Management

Drs. G. F. Lee and A. Jones-Lee have many years of experience in evaluating the potential hazard that municipal solid waste and hazardous waste landfills represent to groundwater quality. They have presented over 15 shortcourses on this topic through several University of California Extensions, the American Society of Civil Engineers and the American Water Resources Association.

### **Contaminated Soils**

Drs. Lee and Jones-Lee have extensive experience in Superfund site investigation and remediation. This work includes evaluation of the public health hazard that chemical constituents represent in soil to human health. Particular emphasis has been devoted to the significance of lead residues in soils as they may impact the blood lead concentrations in children who play in the soil.

## Short-Courses, Presentations and Lectures

While Drs. G. F. Lee and A. Jones-Lee are no longer active in teaching in university graduate programs in environmental engineering and environmental science, they continue to be active in professional education activities through presenting short-courses in various areas in which they have expertise. They have developed short-courses in water quality criteria and standards development and implementation, urban stormwater impacts and their management, and sediment quality evaluation and sediment quality criteria development and implementation. These short-courses are made available at any location where a local sponsor will make arrangements for them.

Dr. Lee has been a frequent invited lecturer on water quality and solid and hazardous waste evaluation and management issues. For the past 20 years he has been an American Chemical Society tour speaker in which he lectures on water quality issues to local ACS sections at various locations.

Drs. Lee and Jones-Lee are highly active in developing professional publications that are designed to inform other professionals on the approaches that should be used to develop water quality criteria, state water quality standards, NPDES discharge limits, waste load allocations, total maximum daily loads, watershed approach and pollutant trading. Condensed lists of recent publications in various topic areas is available from [this site](#). A complete list of their papers and reports is available from Dr. Lee upon request.

## Overall Approaches and Further Information

Drs. Anne Jones-Lee and G. Fred Lee are interested in establishing technically valid, cost-effective approaches for evaluating and managing chemical contaminants in aquatic systems. They are available to assist anyone in answering questions or providing guidance on how a particular issue should be addressed. A list of their [past and current clients](#) is available. If it is felt that they can be of assistance in addressing a particular problem, please contact Dr. Lee.

Dr. G. Fred Lee  
G. Fred Lee and Associates  
27298 East El Macero Drive  
El Macero, CA 95618-1005  
E-mail: [gfredlee@aol.com](mailto:gfredlee@aol.com)  
PH: 530-753-9630



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