

Harvard School of Engineering and Applied Sciences
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In response to the Harvard School of Engineering and Applied Sciences (SEAS) request for information on alumni of the program, I wish to submit the following information.

Overview

G. Fred Lee, PhD, MSPH, PE, AAEES, F.ASCE earned his PhD in Engineering and Applied Chemistry from Harvard in 1960 under the supervision of Dr. J. Carrell Morris. His dissertation research was devoted to understanding the kinetics of the chlorination of phenol as it relates to controlling chlorophenolic tastes and odors in drinking water. Natural and waste-derived phenolic compounds present in domestic water supply waterbodies react with chlorine that is added to the raw water for disinfection; the products of that reaction impart strong medicinal tastes and odors to the finished drinking water. Dr. Lee's research revealed how changes in concentration of the reactants (phenolic compounds and chlorine) and changes in pH affected the chlorophenolic odors produced. The results of his research was published as,

Lee, G. F. and Morris, J. C., "Kinetics of Chlorination of Phenol-Chlorophenolic Tastes and Odors," *Air and Water Pollut.* 6:419-431 (1962).
<http://www.gfredlee.com/WSWQ/KineticsChlorinationLeeMorris.pdf>

Dr. Lee served as a Post Doctoral Fellow at Harvard University for one year working with Dr. W. Stumm to investigate reactions between dissolved oxygen and ferrous iron. The results of that work were published in:

Stumm, W. and Lee, G. F., "The Chemistry of Aqueous Iron," *Schweizerische Zeitschrift fur Hydrology (Swiss Journal of Hydrology)* XXII:295-319 (1960).
www.gfredlee.com/SurfaceWQ/Stumm_Lee_Chemistry_Aqueous_Iron.pdf

Stumm, W., and Lee, G. F., "Oxygenation of Ferrous Iron," *Ind. Eng. Chem.* 53:143-146 (1961).
<http://www.gfredlee.com/SurfaceWQ/StummOxygenFerrous.pdf>

Lee, G. F. and Stumm, W., "Determination of Ferrous Iron in the Presence of Ferric Iron with Bathophenanthroline," *J. Am. Water Works Assoc.* 52:1567-1573 (1960).
http://www.gfredlee.com/SurfaceWQ/Lee_Stumm_JAWWA1960.pdf

The research on the chemistry of aqueous iron provided valuable information on the control of iron as a water pollutant in domestic water supplies and wastewaters.

Additional information on Dr. G. Fred Lee's education background and work at Harvard is provided at:
<http://www.gfredlee.com/Education/GFL-Education.pdf>

In 1962 Dr. Lee joined the faculty of the University of Wisconsin, Madison (UWM) as professor of Water Chemistry. In that position he developed and directed the Water Chemistry Program that specialized in MS and PhD degree education and research focused on the aqueous chemistry

of chemicals in natural and polluted waters. As recounted in the following report, this program was the first of its type and pioneered in the field of water and environmental chemistry.

Lee, G. F., and Jones-Lee, A., "Development of the Water Chemistry Program at the University of Wisconsin Madison & Follow-on Activities of Dr. Lee in Developing the Water Chemistry Field," Report of G. Fred Lee & Associates, El Macero, CA, January 1 (2012).
<http://www.gfredlee.com/Education/WaterChemProgramDevel.pdf>

After serving as Director of the UWM Water Chemistry Program for 13 years Dr. Lee spent the next 16 years serving on the graduate faculties at a number of USA universities developing their environmental engineering/water chemistry programs, and continuing to teach, conduct research, supervise graduate students, and serve the professional community. During his 30-year university graduate program teaching and research career, Dr. Lee conducted over \$8-million in research, published more than 475 professional papers and reports, supervised the thesis and dissertation work of about 90 graduate students, and was active in professional service/education and part-time consulting. Some aspects of those activities are further described subsequently.

Dr. Lee retired from university teaching and research in 1989 and shifted his professional focus to full-time private consulting for governmental agencies and entities, industries, public interest groups, and individuals to address specific issues and concerns about impacts of chemicals in wastewater, municipal and solid waste, hazardous wastes, landfills, surface water, groundwater, Brownfield sites, etc. on public health and environmental quality, and the evaluation and management of those chemicals for the protection of public health and environmental quality. In his consulting he specializes in the development of technically valid water quality investigations, and cost-effective pollutant control programs to protect the designated beneficial uses of waterbodies without significant unnecessary expenditures for constituent control.

Since the late-1970s he has worked as a team with Dr. Anne Jones-Lee. They have published or issued about 600 professional papers and technical reports since leaving academia. Drs. Lee and Jones-Lee's website, www.gfredlee.com, describes their expertise and experience and makes available many of their reports and publications.

Dr. Lee is a registered professional engineer in the state of Texas and an American Academy of Environmental Engineers (AAEES) board certified Environmental Engineers and Scientists. The latter recognizes his leadership roles in the environmental engineering field. He served as the chief examiner for the AAEE in New Jersey during the 1980s, and in north-central California during 1990-2010. In that capacity he was responsible for administering examinations for professional engineers with extensive experience and expertise in various aspects of environmental engineering, including solid and hazardous waste management to become recognized by the AAEEES.

In November 2009 Dr. Lee was elected Fellow of the American Society of Civil Engineers. This election recognized Dr. Lee's then five decades of leadership in the environmental quality management field on the national and international levels as a university graduate-level educator, researcher, and environmental consultant. In September 2010 the Sacramento Section of the American Society of Civil Engineers named Dr. Lee the Outstanding ASCE Life Member.

Dr. Lee served as an advisor to the states of California, Michigan, New Jersey and Texas on solid and hazardous waste regulations and management.

Aspects of Dr. Lee's Professional Work by Topic

Research and Consulting

The bulk of the university and private consulting research that Dr. Lee has undertaken has been oriented to problem identification and problem solving in areas of sources, significance, fate, impact, and control of chemical contaminants in surface, ground, estuarine, and marine waters, and solid and hazardous waste landfills and management areas including Brownfield sites. His university contract and grant research was directed in such a way as to provide meaningful research topics for the education and training of graduate students. Some of the topic areas in which he has conducted research and private consulting are described below.

Sources, Significance, Fate & Control of Chemicals in the Environment

Beginning in the late 1960s, Dr. Lee pioneered in the development of approaches for evaluating the water quality/environmental impacts of chemicals in environmental systems. The focus of his work has been on the integration of aquatic chemistry and toxicology in evaluating the impact of chemicals on water quality/beneficial uses. He has been involved in the development, evaluation, and implementation of water quality criteria and state water quality standards since the early 1960s. A summary of his experience is provided at <http://www.gfredlee.com/exp/wqexp.html>.

During the 1960s while he held the position of Professor of Water Chemistry and Director of the Water Chemistry Program at the University of Wisconsin, Madison Dr. Lee served as an advisor to the Wisconsin Department of Natural Resources on the development and implementation of water quality criteria and standards. During that time and subsequently he has served as an advisor to numerous governmental agencies including municipalities, industry, and environmental/citizen groups on water quality criteria issues.

In the early 1970s Dr. Lee served as an invited peer-reviewer for the National Academies of Science and Engineering's "Blue Book" Water Quality Criteria - 1972. In the late 1970s, he served as an invited member of the American Fisheries Society Water Quality Panel that conducted a review of the US EPA's 1976 "Red Book" Quality Criteria for Water. In the early to mid-1980s he served as a US EPA invited peer-reviewer for the development approach and for several of the specific chemical criteria in the 1986 "Gold Book" Water Quality Criteria. During the 1960's 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. Drs. Lee and Jones-Lee have published extensively on the development of water quality criteria and their implementation into state standards to appropriately regulate water quality impacts without significant over-regulation of wastewater and other discharges. Many of those publications are available on their website, www.gfredlee.com in the Surface Water section, <http://www.gfredlee.com/pwwqual2.html#criteria>.

Dr. Lee has also served as technical consultant to several chemical companies including Procter & Gamble, FMC, and Monsanto providing guidance in the evaluation of potential impacts of new or expanded-use chemicals. His work with Monsanto included reviewing the environmental fate and impacts of PCBs in aquatic systems and evaluating the environmental impacts of phosphorus used in detergent formulations. For FMC he helped evaluate the fate and effects of a spill of carbon tetrachloride on Ohio River water quality. For about 10 years Dr. Lee served as a reviewer for evaluating potential water quality impacts of new products developed by Procter & Gamble.

In the early 1970s, Dr. Lee became an advisor to the President's Council on Environmental Quality (CEQ) in Washington DC helping to develop programs for screening new or expanded use chemicals for potential environmental impact. This work evolved out of the widespread occurrence of environmental pollution by PCBs, DDT and other organochlorine pesticides and mercury. During the 1970s Dr. Lee was a member of an invited group of professionals – representing chemical companies, regulatory agencies, and universities – who met in annually in Pellston, MI for several years to participate in workshops devoted to developing approaches for screening chemicals for environmental impact. These became known as the “Pellston Workshops” and resulted in publication of workshop proceedings that became classics in the field. In the late 1970s, the efforts of this group led to the development of the environmental hazard assessment approach for evaluating expected toxicological impacts and conducting water quality assessments for new or expanded-use chemicals. These efforts ultimately led to the development of the Toxic Substances Control Act (TSCA). Drs. Lee and Jones together with their graduate students expanded this work to include conducting water quality hazard assessments for domestic wastewaters. That work included development of environmental chemistry-fate models for assessing water quality impacts of domestic wastewater constituents, such as chlorine used for disinfection of domestic wastewaters and ammonia present in the wastewaters, using integrated laboratory and field toxicity testing. Their work on this approach became a foundation for the water quality and public health risk assessment approaches that are widely used today.

PCBs

Dr. Lee and his graduate students at the University of Wisconsin Madison conducted studies on the occurrence, fate, persistence, and bioaccumulation of chlorinated pesticides such as DDT in fish in rivers and lakes. They found that what some other investigators had concluded was DDT in fish was actually not DDT but rather were polychlorinated biphenols (PCBs). This led to the pioneering studies of graduate student G. Veith, working under the supervision of Dr. Lee, on the occurrence of PCBs in water, sediments, and fish in Wisconsin rivers. Several papers were developed on those studies including:

Veith, G., and Lee, G. F., “A Review of Chlorinated Biphenyl Contamination in Natural Waters,” *Water Research* 4:265-269 (1970).

<http://www.gfredlee.com/HazChemSites/Veith-Lee-ReviewPCB.pdf>

Veith, G., and Lee, G. F., “PCBs in Fish from the Milwaukee Region,” *Proc. 14th Conf. Great Lakes Res., Internat. Assoc. Great Lakes Res.* pp. 157-169 (1971).

<http://www.gfredlee.com/HazChemSites/Veith-Lee-PCBFishMKE.pdf>

After completing his PhD in water chemistry Dr. Veith led the US EPA regulatory program for controlling PCBs in the environment.

The widespread occurrence of PCBs in US waterway sediments caused the US Army Corps of Engineers to support Dr. Lee's development of a technical report on the significance of PCBs in dredged sediments:

Lee, G. F., and Jones, A., "Significance of PCB's in Dredged Sediments," Dredged Material Research Program Technical Report, Prepared for Office, Chief of Engineers, US Army, 64pp, August (1979). [Executive Summary]

http://www.gfredlee.com/Sediment/Lee_Jones_PCBs_Dredged_Sediment.pdf

Dr. Lee has continued to be active in research and consulting on the presence, impact, and control of PCBs in the environment. This work is described on Dr. Lee's website at http://www.gfredlee.com/Hazardous_Chemicals_PCBs.html

DDT, Chlorinated Hydrocarbon and Organophosphorus Pesticides

Another area in which Dr. Lee and his graduate students at the University of Wisconsin Madison pioneered was the investigation of the occurrence and impacts of pesticides from agricultural and urban runoff on water quality. They focused on the measurement of chemical concentrations and aquatic life toxicity of DDT and other chlorinated hydrocarbon and organophosphorus pesticides in several waterbodies, as well as the bioaccumulation of pesticides in fish tissue. The toxicity measurements were important for regulating pesticides since there are several chemical factors that cause the pesticides to be non-toxic to aquatic life. Many of their research papers and reports on pesticides are available on their web site www.gfredlee.com in the following sections:

- Hazardous Chemicals & PCBs [http://www.gfredlee.com/Hazardous_Chemicals_PCBs.html]
- Surface Water Quality [<http://gfredlee.com/pwwqual2.html#pest>]
- Stormwater Quality [http://gfredlee.com/Stormwater_Impacts.html#pesticide]

Radioactive Wastes

Dr. Lee and his graduate students have been involved in investigating the occurrence and control of radioactive wastes. One of his first projects in this area was the investigation of the releases and downstream transport of radioactivity from the Shippingport Nuclear Reactor on the Ohio River just south of Pittsburgh. That Reactor was the first facility of its type constructed in the USA.

In addition, the US EPA sponsored research by Dr. Lee and one of his graduate students on the release of radium-226 uranium mill tailings in Colorado Plateau area. They published the results of that work in:

Shearer, S. D. and Lee, G. F., "Leachability of Radium 226 from Uranium Mill Solids and River Sediments," *Health Physics* 10:217-227 (1964).

[http://www.gfredlee.com/HazChemSites/Shearer_Lee_Radium_Leach.pdf]

Subsequently Dr. Lee became involved on behalf of the public in reviewing a State of New Jersey proposed approach for managing radium-226-containing wastes that had been stored in drums for decades; the source of the radium was its former use for treating watch dials to make them luminesce. The state pollution control agency had proposed to dispose of those wastes into a former sand and gravel pit, and the public was concerned about the potential for radium-226 and other radio-isotopes to become mobile and be transported in groundwater to domestic water supplies. Dr. Lee reviewed the matter and published a paper that addressed his findings:

Lee, G. F. and Jones, R. A., "Assessing the Potential Water Quality Hazards Caused by Disposal of Radium-Containing Waste Solids by Soil Blending," Proc. NWWA Conference - Radon, Radium and Other Radioactivity in Ground Water, Lewis Publishers, Inc., Chelsea, MI, pp 511-520 (1987). [http://www.gfredlee.com/HazChemSites/Radium_Waste_Impacts.pdf].

That paper was entered as evidence in the legal proceedings lodged by the public in opposition to the proposed disposal. The judge in the matter cited this paper as the reason for his judgement in favor of the public and forcing the state to find an alternative approach for managing the waste.

For about 15 years Dr. Lee served as the US EPA-sponsored Technical Assistance Grant advisor to the Davis South Campus Superfund Oversight Committee, a citizens' group concerned with how radioactive and other wastes generated by the University of California, Davis had been managed, investigated, and remediated. Under contract with the DOE the university had undertaken research into the impacts of feeding radium-226 and strontium-90 to dogs. The wastes from that activity were disposed of in unlined pits on university property, a site that was subsequently designated by the US EPA as a significant threat to groundwater quality and was designated a National Superfund Site. The site was in close proximity to residential properties that had relied on well water for their domestic water supply. Information and technical reports on Dr. Lee's findings are available on his website at:
<http://www.gfredlee.com/DSCSOC/dscsoc.htm>

Currently Unregulated, Unrecognized, or Emerging Contaminants

A focal point of Dr. Lee's professional career is the continuing need to investigate the environment for potentially hazardous or otherwise deleterious that are recognized but not regulated, currently unknown/unrecognized, and becoming recognized as potentially hazardous. A review of these issues is presented as:

Lee, G. F., and Jones-Lee, A., "Clean Water Act, Water Quality Criteria/Standards, TMDLs, and Weight-of-Evidence Approach for Regulating Water Quality," Water Encyclopedia: Water Law and Economics, Wiley, Hoboken, NJ, pp 598-604 (2005).
<http://www.gfredlee.com/SurfaceWQ/WileyCleanWaterAct.pdf>

Dr. Lee has been a critic of the US EPA for its failure to conduct comprehensive work to find unknown/ unregulated chemical that could be a threat to human health the environment. Of particular concern is the grossly inadequate approach that it followed to develop the original "Priority Pollutant List" of hazardous chemicals mandated by the Clean Water Act, and still has not corrected. Rather than being a well-considered, peer-reviewed list of chemicals that have been found, or were legitimately suspected to be hazardous in the environment, it was actually a

laundry list of certain types of largely potentially carcinogenic chemicals that could be in the environment, released in response to a law suit filed by an environmental group. Certain types of chemicals were unnecessarily listed, and other chemicals of greater concern were not included. Nonetheless, that list of chemicals was used to direct expenditures for investigation, numeric criteria-setting, and regulation of chemicals throughout the country, without proper evaluation of the need for their evaluation, for the potential of there being other known but inadequately regulated hazardous chemicals, for the anticipated presence of hazardous chemicals that were unrecognized/regulated, or for the presence of chemicals whose adverse impact was not amenable to chemical analytical assessment but rather required toxicity testing for proper evaluation and regulation. Over the years Dr. Lee and others have repeatedly discussed the need for a more technically reliable approach to develop a comprehensive list of potentially hazardous chemicals in the environment. Dr. Lee was a member of a National Oceanic and Atmospheric Administration (NOAA) committee that reviewed the potential hazardous chemicals being transported in the NY/NJ Harbor and the NY Bight that led to selection of the 20 most important chemicals entering the New York Bight.

As predicted, in recent years the public health and environmental threat posed by a very large group of fluorinated organic chemicals collectively known as PFAS (per- and polyfluoroalkyl substances) that have long been used in commercial products and have recently been found in water supplies, wastes, and in animals and humans. It is now known that PFAS have been in wastes and the environment for more than half a century. The US EPA's discussion of PFAS is available at <https://www.epa.gov/pfas/basic-information-pfas>. Until recently, and even today, PFAS were not monitored for their occurrence in the environment, wastewaters, or landfilled wastes. They are one example of types of environmental pollutants that are not analyzed in studies of pollutants that are associated with landfills, leachate and landfill-polluted groundwaters. The current widespread pollution of the environment with PFAS is a prime example of the grossly inadequate environmental pollution program conducted by the US EPA and state regulatory agencies since the adoption of the Clean Water Act in 1972.

Eutrophication

Since the 1960s Dr. Lee has been involved in pioneering research, graduate university teaching, consulting for governmental agencies and industry, and professional service in issues of excessive fertilization and aquatic plant nutrients (nitrogen and phosphorus compounds) (http://www.gfredlee.com/exp/GFL_Nutrient_Expertise.pdf).

In the 1960s there was considerable controversy about the role of phosphorus and carbon as causes of excessive algal growth in the Great Lakes and other waterbodies. One of the major companies producing phosphorus for laundry detergents was advancing the significance of carbon in controlling algal growth. At that time Dr. Lee and his graduate students at the University of Wisconsin Madison were actively investigating the factors controlling and promoting excessive algal growth in the Great Lakes and other waterbodies, including the role of phosphorus in agricultural and stormwater runoff and wastewaters. The US EPA was aware of Dr. Lee's work on these issues and asked for his assistance in evaluating the relative roles of phosphorus and carbon in promoting excessive algal growth in Lake Erie. Dr. Lee prepared a discussion of these issues and his findings for the US EPA; his work clearly demonstrated that the excessive growth of algae in Lake Erie was not due to carbon discharged in wastewaters and

agricultural runoff, but rather most likely due to phosphorus from domestic wastewaters. Subsequent studies by Dr. Lee and others have confirmed that phosphorus in domestic wastewaters and agricultural runoff was a major factor leading to excessive growths of algae.

One of his major achievements in the area of eutrophication evaluation and management emerged from his service as the US/US EPA member of the International OECD Eutrophication Studies steering committee for the \$50-million, five-year study conducted by 22 countries in western Europe, North America, Japan and Australia to evaluate and model the relationship between N and P loads and planktonic algal growth in lakes and reservoirs. From that and subsequent research he developed, expanded, and documented the predictive capabilities of the US OECD eutrophication modeling approach, an empirical model for predicting eutrophication-related water quality in surface waters. Drs. Lee and Jones have published numerous papers describing the development, application, and predictive capabilities of the US OECD modeling approach including, as well as shortcomings of stochastic models often employed, including the following:

Lee, G. F. and Jones, R. A., "Summary of US OECD Eutrophication Study Results and their Application to Water Quality Management," *Verh. Internat. Verein. Limnol.* 22:261-267 (1984).
http://www.gfredlee.com/Nutrients/US_OECD_Eutrophication_Management.pdf

Lee, G. F., and Jones, A., "Effects of Eutrophication on Fisheries," *Reviews in Aquatic Sciences* 5(3-4):287-305 (1991).
http://www.gfredlee.com/Nutrients/Effects_Eutroph_Fisheries.pdf

Another of the more interesting eutrophication-related research projects that Dr. Lee conducted was on Lake Vanda, an ultra-oligotrophic, permanently ice-covered lake in the Dry Valley of Antarctica. He and his team investigated the relationship between phosphorus load to the lake and the plankton algal growth under the lake's 12 ft of permanent ice. They also documented that the US OECD eutrophication modeling approach applied to that lake as well as the other northern hemisphere lakes. Their work was published as:

Jones-Lee, A. and Lee, G. F., "The Relationship Between Phosphorus Load And Eutrophication Response in Lake Vanda," *Physical and Biogeochemical Processes in Antarctic Lakes*, 59:197-214, American Geophysical Union, Washington, DC, (1993).
<http://www.gfredlee.com/Nutrients/VandaEutrophication.pdf>

Green, W. J., Canfield, D., Lee, G. F. and Jones, R. A., "Mn, Fe, Cu, Cd Distributions and Residence Times in Closed Basin Lake Vanda (Wright Valley, Antarctica)," *Hydrobiologia* 134:237-248 (1986).
http://www.gfredlee.com/SurfaceWQ/Green_et_al_Heavy_Metals_Antarctica.pdf

Dredging/Dredged Sediment Disposal

During the 1970s Dr. Lee and his graduate students at University of Texas Dallas conducted a comprehensive evaluation of potential water quality and public health impacts of open water disposal of chemically-polluted dredged sediments. Traditionally Congress assigned the US Army Corps of Engineers the responsibility for maintaining the navigation depth of US

waterways to support cost-effective commercial transport. In the early 1970s environmental groups and some regulatory agencies proposed that all open deeper-water disposal of contaminated dredged sediments be stopped in favor of on-land disposal in which the contaminated dredged sediment would be piped to a diked disposal area and the water in the dredged sediment allow to flow into nearby water courses. Replacing open-water disposal where used with the on-land approach would greatly increase the cost of maintaining navigation channel depth; furthermore the advocates had not demonstrated public health and environmental quality problems associated with the open-water disposal approaches being used or investigated the additional risks or the real benefits to be accrued by on-land disposal.

In the 1970s the US Congress provided the US Army Water Ways Experiment Station with \$35-million to fund grants to evaluate the environmental impacts of open-water disposal of contaminated dredged sediments. Based on his reputation as a leader in the evaluation of water quality impacts of chemicals associated with aquatic sediments Dr. Lee was awarded more than a million dollars in grants over a five-year period to investigate water quality impacts of open-water disposal dredged sediment and how to reliably assess potential impacts based on laboratory studies. He assembled and directed a team of graduate students to conduct extensive field sampling and monitoring and laboratory analysis and simulation; each graduate student was assigned the responsibility for a group of chemical that were a focus of study including chlorinated pesticides and PCBs, heavy metals, dissolved oxygen demand, nutrients (nitrogen and phosphorous compounds), and toxicity to aquatic life. Working with the Corps of Engineers Districts in various parts of the country Dr. Lee selected more than a dozen contaminated waterway areas for pre-dredging sampling of sediments from areas scheduled to be dredged and intensive monitoring of the disposal site watercolumn before, during, and after dredged sediment disposal. These studies were conducted in Seattle Washington harbor, upper Mississippi River near Minneapolis/St Paul, New York and New Jersey harbors and waterways, several Texas harbors, and several harbors and waterways in the Gulf coast. The samples collected were taken to the university laboratory where they were analyzed for the chemicals of concern. More than 35,000 analyses were conducted and reported in a 1500-page data report submitted to the Corps of Engineers. Those data were summarized and discussed in:

Jones, R. A., and Lee, G. F., "Evaluation of the Elutriate Test as a Method of Predicting Contaminant Release during Open-Water Disposal of Dredged Sediments and Environmental Impact of Open-Water Dredged Material Disposal; Volume I: Discussion," Technical Report D-78-45, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS (1978).
http://www.gfredlee.com/Sediment/DMRP_VolumeI_Discussion.pdf

Numerous papers summarizing various aspects of this study were also published, including:

Lee, G. F., "Dredged Material Research Problems and Progress," Environ. Sci. & Technol. 10(4):334-338 (1976).
www.gfredlee.com/Sediment/Dredged_Material_Research_Program.pdf

Lee, G. F. and Jones-Lee, A., "Contaminated Dredged Sediment Disposal Criteria," Proc. ASCE "Dredged 94" Second International Conference on Dredging and Dredged Materials Placement, Orlando, FL, pp. 121-130 (1994).

http://www.gfredlee.com/Sediment/ASCE_Dredged94.pdf

Jones, R. A., and Lee, G. F., "Toxicity of U.S. Waterway Sediments with Particular Reference to the New York Harbor Area," Chemical and Biological Characterization of Sludges, Sediments, Dredge Spoils, and Drilling Muds, ASTM STP 976, Amer. Soc. Test. Mater., Philadelphia, pp. 403-417 (1988). <http://www.gfredlee.com/Sediment/NYHarborSedimentToxicity.pdf>

Lee, G. F. and Jones-Lee, A., "Water Quality Aspects of Dredging and Dredged Sediment Disposal," Chapter 14 IN: Handbook of Dredging Engineering, Second Edition, McGraw Hill, pp. 14.1 to 14.42 (2000). http://www.gfredlee.com/Sediment/Dredging_Water_Quality.pdf

Jones-Lee, A., and Lee, G. F., "Water Quality Aspects of Dredged Sediment Management," Water Encyclopedia: Water Quality and Resource Development, Wiley, Hoboken, NJ pp 122-127 (2005). <http://www.gfredlee.com/Sediment/WileyDredging.pdf>

A number of their writings addressed the additional water quality issues and concerns associated with on-land, rather than open-water disposal of contaminated dredged sediment. More recently they discussed this issue in detail in the technical report:

Lee, G. F., and Jones-Lee, A., "Issues in Evaluating Impacts of Dredged Sediment Confined Disposal Facilities," Report of G. Fred Lee & Associates, El Macero, CA, March (2016). http://www.gfredlee.com/Sediment/Dredged_Sediment_CDF_Impacts.pdf

Impacts of Municipal Solid Waste Landfills & Their Redevelopment

One of the areas of Dr. Lee's greatest professional involvement since retiring from his academic career has been in serving as a consultant to governmental agencies and entities, industries, public interest groups, and individuals to address specific issues and concerns about impacts of chemicals in municipal and solid waste, hazardous wastes, landfills, surface water, groundwater, Brownfield sites, etc. on public health and environmental quality, and the evaluation and management of those chemicals for the protection of public health and environmental quality. As discussed above,

Professional Service

Professional Publications and Technical Reports

Throughout Dr. Lee's 30-year university graduate-level teaching and research career and his subsequent 32-year private consulting career, he has been active in developing professional papers and reports to bring the results of his research and consulting experience to the professional community and the public. In all he has published more than 800 professional papers and released more than 800 technical reports on his research and findings. Many of these papers and reports can be downloaded from his website, <http://www.gfredlee.com>. Some of his papers and reports are cited herein associated with various research projects highlighted.

Dr. Lee has also been active in developing comprehensive technical reports designed to provide the technical community, regulatory agencies, and the public with more comprehensive technical information on current and emerging environmental quality management issues. For example, in the 1970s-1980s Drs. Lee and Jones-Lee developed a number of review reports on the

assessment and management of eutrophication/excessive fertilization of waterbodies that can adversely affect the use of waterbodies for water supply, recreation, public health, and aesthetics. Since the 1980s they have developed a number of review reports on issues pertaining to appropriate landfilling of solid wastes and problems with current regulations and their implementation for providing for reliable long-term protection of public health and environmental quality from landfilled wastes for as long as the wastes represent a threat. In the early 1980s while holding a professorship in Civil and Environmental Engineering at Colorado State University, Dr. served as an advisor to the town of Brush, Colorado, on the potential impacts that a proposed hazardous waste landfill could have on the groundwater resources of interest to the community. The paper that Drs. Lee and Jones-Lee published based on that work was among the first to question in the public arena the technical foundations upon which the emerging “dry tomb” landfilling approach (which evolved into the current regulatory approaches) :

Lee, G. F., and Jones, R.A., “Is Hazardous Waste Disposal in Clay Vaults Safe?” Journ. American Water Works Association 76:66-73 (1984).
<http://www.gfredlee.com/HazChemSites/ClayVault.pdf>

The Water Resources Division of American Water Works Association (AWWA) awarded that paper its “Best Paper of the Year” award for papers published in that journal in 1984.

Their most comprehensive review of municipal solid waste landfilling issues was begun in the early 1990s based on their research and consulting experience and findings. As additional information and issues have emerged, they have released updates of this review to keep it current with research, technology, regulation, and implement of regulations. The most recent update of this report was released in January 2021:

Lee, G. F., and Jones-Lee, A., "Evaluating Potential Impacts of Landfills & Landfill Pollution: Flawed Technology of Subtitle D Landfilling of Municipal Solid Waste," Report of G. Fred Lee & Associates, El Macero, CA January (2021).
http://www.gfredlee.com/Landfills/Landfill_Pollution_Impacts.pdf

Lecture Tours and Short Courses

As part of his dedication to professional service, education, and technology transfer, Dr. Lee has served as an invited tour speaker for the American Society of Civil Engineers (ASCE) and the American Chemical Society to address gatherings of engineers and scientists on timely topics of interest to the various groups including eutrophication, water quality assessment and management, solid and hazardous waste assessment and management; he was an ACS tour speaker for 20 years addressing local sections throughout the US.

Dr. Lee has been invited to present numerous several-day to week-long short-courses to various professional groups in the US and abroad. He presented short-courses on Assessing and Managing the Excessive Fertilization of Waterbodies to:

- South African Department of Environmental Protection
- University of Antioquia, Medellin, Colombia
- University of California, Davis, Extension

- USSR Institute of Ecology for the Volga River
- Argentina Ministry of Public Works
- Spanish Ministry of Public Works
- India Water and Power Research Station
- Hong Kong Public Works impact of storm water runoff on water quality

Through much of the 1980s, Dr. Lee lectured at the annual Texas A&M Ocean Engineering Short Course on Dredging where he was invited to discuss Water Quality Aspects of Dredged Sediment Disposal. Those lectures summarized the findings of his decades-long field and laboratory research on the release of contaminants from dredged sediments that involved analysis of sediments from more than 100 dredging sites and the monitoring of more than a dozen dredged sediment disposal operations as noted in the discussion of research areas herein. Dr. Lee at age 87 is still active in consulting and Jones Lee are active in advising a municipality in the San Francisco Bay area on the potential human health and water quality hazards of constructing residential housing on the surface of old landfill with only a few feet of clean soil covering the hazardous wastes. Regulatory agencies will allow the development of residential housing with only a few feet of clean soil covering the hazardous chemicals which will be threat to public health and the environment forever. Dr Lee discussed that based on chemical migration and human activities could at some time in the future the buried hazardous could become transported to the surface and thereby become a threat public health and the environment. Dr Lee has found that regulatory agencies rarely took the approach of protecting public health and the environment for as long as the hazardous chemical are a potential threat.

Work on Behalf of the Public

Throughout his professional career, Dr. Lee has provided pro-bono or low-cost services to governmental agencies/entities and public interest/advocacy groups as time and commitments have permitted. As part of his consulting career he had several occasions to testify on behalf of public groups on technical issues to regulatory agencies and boards before whom, for example, consulting engineers and scientist would carefully craft discussions of the management of near-term threats to public health and the environment of a proposed landfill but fail to acknowledge, much less address, the full extent of the threats posed by the proposed project over the long-term. Dr. Lee discussed these issues in short-courses presentations; at one such presentation a member of the ethics committee for ASCE encouraged him to write up his experience with “practical environmental ethics” and ways in which these challenges could be addressed by the professional community. That suggestion led to his and Dr. Jones-Lee’s developing:

Lee, G. F., and Jones-Lee, A., "Practical Environmental Ethics: Is There an Obligation to Tell the Whole Truth?" Published in condensed form as "Environmental Ethics: The Whole Truth," Civil Engineering, Forum, 65:6 (1995). <http://www.gfredlee.com/Landfills/ethics.pdf>

Stormwater Quality Newsletter

Over a 14-year period from the late-1990s to 2011 Dr. Lee wrote and published his “Stormwater Runoff Water Quality Newsletter” devoted to stormwater-runoff science and engineering issues of the day. He published more than 90 editions of the newsletter at about monthly to bimonthly intervals and distributed them free of charge by email to over 800 professionals and other subscribers and also made them available on his website where they remain available

[http://www.gfredlee.com/Stormwater_Newsletter.html]. This professional service activity was prompted by the fact that for many years regulatory agencies failed to adequately investigate and control the impacts of chemical pollutants in urban area stormwater. Lee's newsletter was designed to provide guidance on the impact and need to control chemical pollutants in urban runoff. The primary theme of the newsletter was the need for site investigation of the characteristics of urban stormwater runoff and the water quality impacts. Dr Lee pointed out that the conventional approach for regulating water pollution in rivers and lakes was not suitable for stormwater runoff because of the short term nature of exposure of chemical impacts near the point of discharge. Conventional water quality criteria/standards are not appropriate chemicals in urban runoff. Regulatory agencies have not still conducted the site specific studies to adequately regulate urban area runoff without unnecessary expenditure for chemical contaminant control.

Other Examples of Professional Service Activities

For many years Dr. Lee was active in investigating Great Lakes water quality and served as an advisor on Great Lakes water quality management programs. He served on the US-Canada International Joint Commission Research as a Member of its Expert Committee on Engineering and Advisory Board for the Great Lakes Technical Aspects of Great Lakes Water Quality.

Dr. Lee has served on the editorial boards for several professional journals, including Ground Water, Environmental Science and Technology, Environmental Toxicology and Chemistry, Journal of Stormwater, Journal of Remediation.

Acknowledgment

It should be acknowledged that Dr. Anne Jones-Lee has been a key component of Dr. Lees research and consulting since the late-1970s contributing to the quantity and quality of their productivity. She was on university graduate school faculty and conducted research with graduate students for eleven years before becoming a full-time partner with Dr. Lee in his consulting and research.