G. Fred Lee, PhD, PE, BCEE
Experience in Fate & Water Quality Impacts of Ammonia

Academic Experience

After earning his PhD degree in Environmental Engineering with emphasis in Aquatic Chemistry at Harvard University in 1960, Dr. Lee spent about 30 years in faculty positions in environmental engineering/environmental science programs at several major US universities. During that time he taught graduate-level courses in environmental chemistry/fate and effects modeling and conducted substantial research in these and related areas. The focus of much of the modeling course work was the prediction of the impacts of oxygen-demanding materials to a stream or river on the oxygen resources of that waterbody. Included were the classical Streeter-Phelps models for describing the oxygen sag downstream of such an input, as well as the US EPA Qual II simulation model which incorporates ammonia nitrification reactions with the oxygen sag component and makes use of the rate constants in the US EPA manual (Bowie et al., 1985). The water quality modeling course taught by Dr. Lee included the use of the US EPA MINTEQ exposure assessment model available at,
http://www.epa.gov/ceampubl/mmedia/minteq/index.htm.

Studies on the Fate and Toxic Impacts of Domestic Wastewater Discharges

While holding the position of Professor of Civil and Environmental Engineering at Colorado State University, Dr. Lee conducted field studies of the fate and water quality impacts of domestic wastewater (publicly owned treatment works - POTW) discharges to several Colorado Front Range streams. Locations included were: were two POTWs in Fort Collins, CO that discharge to Cache la Poudre River; a POTW in Loveland, CO that discharges to Big Thompson River; a POTW in Colorado Springs, CO that discharges to Fountain Creek; and a POTW in Pueblo, CO that discharges to the Arkansas River. At each of those locations, Dr. G. Fred Lee, Dr. Anne Jones, and their graduate students studied the receiving water from just upstream of the discharge of the domestic wastewaters to several miles downstream. The mixing zone of the wastewater effluent with the receiving waters was defined by cross-sectional measurements of specific conductance and temperature; drogues were used to measure stream velocity in the study area. Analyses were made of chlorine, ammonia, electrical conductivity, and temperature. In situ toxicity testing was also conducted using caged fish.

Fish cages, each containing 10 adult fathead minnows, were anchored at selected positions in the stream just upstream of the wastewater discharge, and within and outside of the mixing zone downstream of the discharge. Every few hours the live fish in each cage were counted and water samples from the cage locations were analyzed for total chlorine using amperometric titration. At the same locations and times, light and dark bottle studies were conducted to determine the chlorine-related demand of the river water and the decay of the chlorine due to photolysis. Clear and darkened BOD bottles were filled with site water, sealed, and hung from trapezes placed at selected locations in the river about a half-meter below the surface. Periodically a pair of the bottles was removed and the chlorine was measured in the each. From this monitoring, site-specific rate constants were developed for chlorine demand due associated with its reaction with organics in the water and for the photo-decay of chlorine. This information was compared with the results of the in situ toxicity tests.

It was found that the primary acute toxicant in the POTW effluents was the residual chlorine that had been added to the effluent for disinfection. Ammonia, which was present at several mg/L N in the POTW effluents, did not cause aquatic life toxicity in the receiving waters.

Because of the impact of water temperature on rates of reaction, these studies were conducted under both summer and winter conditions. As expected, the rates of transformation of chlorine summer were considerably higher in the summer than they were in the winter. Similarly, the nitrification of ammonia proceeded at a notably slower rate in the winter than in the summer.

The winter studies of the fate of ammonia in the receiving water for the Colorado Springs POTW discharge showed that the ammonia was converted to nitrite; the nitrite, however, persisted for tens of miles downstream in Fountain Creek. The bacteria responsible for conversion of nitrite to nitrate (*Nitrobacter*) were more temperature-sensitive than the *Nitrosomonas* responsible for the conversion of ammonia to nitrite. This finding is especially important because nitrite is highly toxic to some types of fish. While information in the literature suggests that copper plays a role in affecting the rates of nitrification of ammonia, this question had not been resolved at the time of our studies in the late 1970s and early 1980s.

These studies are some of the most comprehensive ever conducted on the acute water quality impacts of chlorine and ammonia from domestic wastewater discharges in streams and rivers. The results of the cage fish toxicity tests were in keeping with what was expected based on the US EPA water quality criteria for the acute toxicity of chlorine to fathead minnows provided that the integrated area of the concentration of chlorine versus time over the four-day exposure was used to average the chlorine concentrations found in the streams at the time of measurement.

The results of this these studies have been published in several papers and reports including:

Lee, G. F. and Jones, R. A., “Water Quality Hazard Assessment for Domestic Wastewaters,” *Environmental Hazard Assessment of Effluents*, Pergamon Press, New York, pp.228-246 (1986).
http://www.gfredlee.com/SurfaceWQ/WQHazAssessDWW.pdf

Newbry, B. W., and Lee, G. F., "A Simple Apparatus for Conducting In-Stream Toxicity Tests," *Journ. of Testing and Evaluation*, ASTM **12**:51-53 (1984).
http://www.gfredlee.com/SurfaceWQ/NewbrySimpleApparatus.pdf

Heinemann, T. J., Lee, G. F., Jones, R. A. and Newbry, B. W., "Summary of Studies on Modeling Persistence of Domestic Wastewater Chlorine in Colorado Front Range Rivers," IN: Water Chlorination-Environmental Impact and Health Effects, Vol. 4, Ann Arbor Science, Ann Arbor, MI, pp 97-112 (1983).
http://www.gfredlee.com/SurfaceWQ/Cl-Persist-Heinem.pdf

Newbry, B. W., Lee, G. F., Jones, R. A. and Heinemann, T. J., "Studies on the Water Quality Hazard of Chlorine in Domestic Wastewater Treatment Plant Effluents," In: *Water Chlorination-Environmental Impact and Health Effects*, Vol. 4, Ann Arbor Science, Ann Arbor, MI, pp 1423-1436 (1983).
http://www.gfredlee.com/SurfaceWQ/Cl-WWTPeff-Newbry.pdf

Lee, G. F., Jones, R.A., Newbry, B.W., and Heinemann, T.J., "Use of the Hazard Assessment Approach for Evaluating the Impact of Chlorine and Ammonia in Pueblo, Colorado, Domestic Wastewaters on Water Quality in the Arkansas River," IN: *Aquatic Toxicology and Hazard Assessment: Fifth Conference*, ASTM STP 766, J. G. Pearson, R. B. Foster, and W. E. Bishop, Eds., American Society for Testing and Materials, pp. 356-380 (1982). http://www.gfredlee.com/SurfaceWQ/ClNH3HazAssPueblo.pdf

Fate and Impact of Ammonia in the SJR DWSC

From1999 through the mid-2000s Drs. Lee and Jones-Lee served as the coordinating principal investigators for a $2-million CALFED project devoted to understanding the occurrence of low dissolved oxygen (DO), and sources of oxygen demand, in the San Joaquin River (SJR) Deep Water Ship Channel (DWSC) between the Port Stockton where the SJR enters the DWC and Columbia Cut, about 10 miles downstream from the Port. One of the specific issues of concern was the fate and effects of ammonia and its nitrification reactions that serve as a source of oxygen demand for the DWSC. The ammonia was derived primarily from the city of Stockton domestic wastewater discharges which contained total ammonia in concentrations between 5 mg/L N and nearly 30 mg/L N. Based on a detailed review of the ammonia and other data collected on the DWSC, Drs. Lee and Jones-Lee developed a mass balance model to describe the roles of ammonia and upstream oxygen demand from the decay of algal cells on DO depletion in the DWSC.

Those studies demonstrated that under some SJR flow conditions through the DWSC, only part of the ammonia-associated oxygen demand added to the DWSC by the city of Stockton was exerted in the DWSC before the SJR water in the DWSC was mixed with Sacramento River water at Turner Cut, about seven miles downstream from the Port. Under the typical USBR and DWR export project pumping of around 10,000 to 12,000 cfs at the Jones and Banks pumping stations, all of the water in the SJR DWSC was drawn to Middle River via Turner Cut.

It was also found that typically, the rate of nitrification of ammonia in the first seven miles of the DWSC was as it was expected based on the literature for studies conducted at other locations, and considering the temperature of the water. An exception occurred during one winter when Dr. G. Litton of the University of the Pacific (UOP) found an enhanced rate of nitrification under low-SJR-flow through the DWSC. During that period, the ammonia disappeared at a much greater rate than would have been expected based on typical studies conducted elsewhere, although such enhancement of the rate of ammonia nitrification has been reported in the literature for other locations as well.

The results of those studies have been published in several reports including:

Lee. G. F., and Jones-Lee, A., "Synthesis and Discussion of Findings on the Causes and Factors Influencing Low DO in the San Joaquin River Deep Water Ship Channel near Stockton, CA: Including 2002 Data," Report Submitted to SJR DO TMDL Steering Committee/Technical Advisory Committee and CALFED Bay-Delta Program, G. Fred Lee & Associates, El Macero, CA, March (2003).
http://www.gfredlee.com/SJR-Delta/SynthesisRpt3-21-03.pdf

Lee, G. F. and Jones-Lee, A., "Supplement to Synthesis Report on the Low-DO Problem in the SJR DWSC," Report of G. Fred Lee & Associates, El Macero, CA, June (2004).
http://www.gfredlee.com/SJR-Delta/SynthRptSupp.pdf

Lee, G. F., "August and September 2003 SJR DWSC Flow and DO," Report submitted to SJR DO TMDL Steering Committee, by G. Fred Lee & Associates, El Macero, CA, October (2003).
http://www.gfredlee.com/SJR-Delta/Aug-Sept-2003-SJR-DWSC-Flow-DO.pdf

Lee, G. F. and Jones-Lee, A., "SJR DWSC Flow and RRI DO Data for 2003," Report of G. Fred Lee & Associates, El M Lee. G. F., and Jones-Lee, A., "Synthesis and Discussion of Findings on the Causes and Factors Influencing Low DO in the San Joaquin River Deep Water Ship Channel near Stockton, CA: Including 2002 Data," Report Submitted to SJR DO TMDL Steering Committee/Technical Advisory Committee and CALFED Bay-Delta Program, G. Fred Lee & Associates, El Macero, CA, March (2003).
www.gfredlee.com/SJR-Delta/DWSC-Flow-DO-2003.pdf

Lee, G. F., Jones-Lee, A. and Burr, K., "Results of the August 5, 2003,Tour of the South Delta Channels," Report of G. Fred Lee & Associates, El Macero, CA, February (2004).
http://www.gfredlee.com/SJR-Delta/South-Delta-Tour.pdf

These and several other papers and reports on this topic are available from on the Lee and Jones-Lee website, www.gfredlee.com, in the SJR Delta section at,
http://www.gfredlee.com/psjriv2.htm

VAMP Fish Kill

Dr. Lee was asked by representative of the U.S. Fish and Wildlife Service to review the data collected as part of the 2007 VAMP studies when a large salmon smolt kill occurred just downstream the city of Stockton's domestic wastewater discharge. In her presentation entitled, "The 2007 VAMP Salmon Kill near Stockton: What Killed These Fish?" at the October 12, 2007 SJR DO TMDL Technical Working Group meeting, Anke Mueller-Solger of DWR concluded that the ammonia discharged by the city of Stockton was likely responsible for that fish kill. However, from his review of the data, Dr. Lee indicated at the meeting that the ammonia toxicity values that Mueller-Solger had used to conclude that ammonia was likely responsible for the toxicity, were incorrect. A proper review of the toxicity of ammonia to aquatic life shows that the concentrations of ammonia in the SJR near the Stockton POTW discharge would not have been expected to cause toxicity. Lee's conclusion was independently support by a review of the data by the CVRWQCB (Leary, 2007). That finding, however, does not mean that the Stockton POTW discharge was not responsible for the smolt kill, only that the data available does not

support that ammonia was responsible for the kill. It is possible that other constituents, such as chlorine, in the POTW effluent may have been responsible for the smolt kill.

Water Quality Criteria for Ammonia

Throughout Dr. Lee's nearly five-decade-long professional career he has been involved in reviewing, helping to establish, and providing guidance on, the appropriate use of water quality criteria and standards. The served as an invited peer reviewer for the National Academies of Science and Engineering (NAS/NAE) "Water Quality Criteria – 1972" (Blue Book), and the American Fisheries Society's Water Quality Panel that reviewed US EPA "Water Quality Criteria – 1976" ("Red Book"). In the early 1980s he was a US EPA invited peer-reviewer for the water quality criteria development approach that became incorporated into the "Water Quality Criteria" of 1986 ("Gold Book"). In addition, he was a US EPA peer-reviewer for the criteria and supporting documents for several constituents, including ammonia. Since that time he has continued to follow ammonia criteria updates, including those released in 1999 when the US EPA significantly changed the criteria for toxicity of ammonia to fish. The current criteria for ammonia, based on a 30-day average exposure, are less stringent than those used prior to 1999, and reflect the fact that there can be significant short-term excursions in ammonia concentration above the criterion value without significant toxicity to aquatic life. The current criteria are available at:
http://www.epa.gov/waterscience/criteria/ammonia/99update.pdf

Sacramento Regional Ammonia Discharge

Dr. Lee reviewed the data on ammonia concentrations in the Delta relative to the city of Sacramento's wastewater discharges; it was his finding that that discharge of ammonia would not be expected to cause toxicity to fish in the Delta. That conclusion is supported by the results of toxicity testing of Sacramento Regional Wastewater Treatment Plant effluent conducted by Werner et al. (2009). She reported that the Sacramento POTW effluent did not cause acute toxicity to Delta Smelt larvae. Based on acute:chronic toxicity ratios and the concentrations of ammonia in the Delta, it is also unlikely that ammonia is causing chronic toxicity to Delta Smelt in the Delta.

Role of Sediments as a Source of Ammonia

Beginning in the early 1960s, Dr. Lee has conducted numerous investigations on the role of aquatic sediments in influencing waterbodies' water quality; many of those studies focused attention on sediments as a potential source of ammonia. During the 1970s he conducted about $1-million in laboratory and field research toward the development of dredged sediment disposal criteria, as part of the Corps of Engineers' Dredge Material Research Program (DMRP). In that work, sediments from about 100 US waterways were examined for about 30 chemical parameters including ammonia, toxicity, tendency to release or sorb chemicals during suspension in a watercolumn, and behavior under field conditions during open water disposal operations of various sorts. Dr. Lee and his graduate students also developed sediment toxicity tests procedures included as part of the DMRP by which the potential availability and toxicity of sediment-associated chemicals could be assessed. It was found that of all the heavy metals, chlorinated hydrocarbon pesticides, PCBs, and nutrients evaluated, only ammonia and manganese were released to the water column during sediment suspension. A summary of those studies was published as:

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

Lee, G. F. and Jones-Lee, A., "Water Quality Aspects of Dredging and Dredged Sediment Disposal," IN: Handbook of Dredging Engineering, Second Edition, McGraw Hill, pp. 14-1 to 14-42 (2000). http://www.gfredlee.com/Sediment/dredging.html

Other papers and reports on those studies are available at www.gfredlee.com in the Contaminated Sediment section [http://www.gfredlee.com/psedqual2.htm].

In the 1980s Dr. Anne Jones (now Jones-Lee) and Dr. Lee investigated New York/New Jersey harbor sediment further and found that the unexplained toxicity in those and other sediments was in fact caused by ammonia. Those results were published as:

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

The studies of the New York harbor sediments showed that the origin of the unusually high ammonia toxicity was the large amounts of untreated domestic wastewaters that were being discharged to the harbor. Those discharges contained particulate organic nitrogen that was being converted to ammonia in the sediment, where it accumulated.

Ammonia and Bluegreen Algae

There has been considerable discussion about the role of ammonia in influencing the growth bluegreen algae in the Delta. From about 1960 to the mid-1980s Dr. Lee was involved in investigations into the causes, control, and water quality implications of bluegreen algal blooms. It has been well-established in the literature, and through his experience, that the transition from spring diatom blooms to summer bluegreen algal blooms is not driven by ammonia. That transition is commonplace even in waterbodies in containing low concentrations of ammonia. The bluegreen algal blooms that occur in the Delta during the summer are not atypical of those found in myriad waterbodies; there is no indication or reason to expect that they are controlled by ammonia-inhibition of the growth of diatoms.

Studies of the types of algae present in the SJR DWSC downstream of the discharge of the city of Stockton domestic wastewater treatment plant have shown that even though the waters contained high concentrations of ammonia, bluegreen algae were not the dominant algae species. This same situation occurred in the SJR upstream of the city of Stockton POTW discharge where there were typically a few tenths of mg N/L ammonia; bluegreen algae were not the dominant algae there either. However, each summer bluegreen algal scum develops in the city of Stockton channel leading to Weber Point, an area to which there are no domestic wastewater inputs. At this time the specific factors leading to excessive growths of bluegreen algae in the Delta, and indeed in waterbodies throughout the world, are not well understood, except for the observation that these growths tend to occur in nutrient-rich waterbodies during the summer months.

Nonetheless, it is clear that ammonia is not likely a major factor in causing a shift in algal species from diatoms to bluegreens.

OECD Review of Nitrogen Limitation

Throughout his career, Dr. Lee has been involved in the understanding of the causes and management of excessive fertilization of waterbodies. Work in this area that he and his graduate students conducted beginning in the 1960s has focused on bluegreen algae blooms and included MS and PhD thesis and dissertation studies on aquatic chemistry of nutrients, nitrogen cycling as it relates to excessive fertilization of waterbodies, nitrogen fixation by bluegreen algae and bacteria, denitrification in lakes, and nitrogen sources in urban and rural stormwater runoff.

One of the major study areas in Dr. Lee's eutrophication-related work was the relative significance of nitrogen and phosphorus in limiting the magnitude of planktonic algal blooms in lakes and reservoirs. In addition to several individual studies of this issue such as on Lake Ontario, Dr. Lee was highly involved in the international OECD (Organization for Economic Cooperation and Development) eutrophication studies. The OECD eutrophication studies were an approximately $50-million, five-year effort that included lakes and reservoirs in 22 countries in Western Europe, North America, Japan and Australia. Dr. Lee had a US EPA contract to develop a synthesis report for the US part of those studies. Based on the data from about 80 US lakes and reservoirs Dr. Lee and his graduate student (W. Rast) found that while the normalized phosphorus loads to the waterbodies correlated with the waterbodies' planktonic algal chlorophyll, there was no such relationship between the nitrogen load to the waterbodies and planktonic algal chlorophyll. A summary of those results was published as:

> Lee, G. F. Rast, W. and Jones, R. A., "Eutrophication of Water Bodies: Insights for an Age-Old Problem," *Environ. Sci. & Technol.* **12**:900-908 (1978).
> http://www.gfredlee.com/Nutrients/Eutrophication-EST.pdf

Drs. Lee and Jones-Lee have continued investigation of the quantitative relationships between nutrient load and eutrophication-related water quality and further developing the Vollenweider-OECD empirical models; the database describing these relationships now exceeds 750 waterbodies located in most areas of the world, as summarized in:

> Jones-Lee, A., and Lee, G. F., "Eutrophication (Excessive Fertilization)," Water Encyclopedia: Surface and Agricultural Water, Wiley, Hoboken, NJ pp 107-114 (2005).
> http://www.gfredlee.com/Nutrients/WileyEutrophication.pdf

They have also extended the models to the description of the impacts on nutrient loading on fisheries, as discussed in:

> Lee, G. F. and Jones, R. A., "Effects of Eutrophication on Fisheries," *Reviews in Aquatic Sciences*, **5**:287-305, CRC Press, Boca Raton, FL (1991).
> http://www.gfredlee.com/Nutrients/fisheu.html

Additional papers and reports on these issues are available at www.gfredlee.com in the Excessive Fertilization Section at http://www.gfredlee.com/pexfert2.htm.

Lee Publications on Fate/Transformation and Water Quality
Impacts of Ammonia and Other Nitrogen Compounds

Over his five-decade-long professional career, Dr. Lee has developed more than 1100 papers and reports on various aspects of water quality evaluation and management. The sources, significance, fate and control of ammonia and other nitrogen compounds have been the focus of much of his writing. In addition to the papers and reports described above, he has developed the following papers and reports on ammonia and its water quality impacts.

Lee, G. F. "Evaluating Nitrogen and Phosphorus Control in Nutrient TMDLs," *Stormwater*, 3:10-24, January/February (2002).
http://www.stormh2o.com/January-february-2002/evaluating-nitrogen-phosphorus.aspx

Jones-Lee A., and Lee, G.F., "Evaluation of Inorganic and Organic Nutrient Source Impacts in Nutrient TMDLs," Proceedings of the AWWA/WEF/CWEA Joint Residuals and Biosolids Management Conference San Diego, CA, February (2001).
http://www.gfredlee.com/Nutrients/eval_inorganic_022000.pdf

Lee, G. F. and Jones, R. A., "Role of Vehicular Exhaust NOx and Lawn-Shrubbery Fertilizers as a Cause of Water Quality Deterioration in Lake Tahoe," Report of G. Fred Lee & Associates, El Macero, CA., 15pp, May (1992). http://www.gfredlee.com/Nutrients/TahoeNOX-pap.pdf

Jones, R. A., and Lee, G. F., "The Significance of Dredging and Dredged Material Disposal as a Source of Nitrogen and Phosphorus for Estuarine Waters," IN: Estuaries and Nutrients, Humana Press, Clifton, NJ, pp 517-530 (1981).
http://www.gfredlee.com/Nutrients/DredgingNandP.pdf

Cowen, W. F., Sirisinha, K., and Lee, G. F., "Nitrogen Availability in Urban Runoff," *Journ. Water Pollut. Control Fed.* **48(2)**:339-345 (1976).
http://www.gfredlee.com/Nutrients/NAvailCowenSirisinha.pdf

Torrey, M., and Lee, G. F., "Nitrogen Fixation in Lake Mendota, Madison, Wisconsin," *Limnol. & Oceanogr.* **21(3)**:365-378 (1976).
http://www.gfredlee.com/Nutrients/NitrogenFixationTorrey.pdf

Kluesener, J. W., and Lee, G. F., "Nutrient Loading from a Separate Storm Sewer in Madison, Wisconsin," *Journ. Water Pollut. Control Fed.* **46(5)**:920-936 (1974).
http://www.gfredlee.com/Nutrients/KluesenerLeeNutrLoad.pdf

Brezonik, P. and Lee, G. F., "Denitrification as a Nitrogen Sink in Lake Mendota, Wis.," *Environ. Sci. & Technol.* **2**:120-125 (1968).
http://www.gfredlee.com/Nutrients/DenitrifMendotaBrezonik.pdf

Brezonik, P. L. and Lee, G. F., "Sources of Elemental Nitrogen in Fermentation Gases," Air & Water Pollut. 10:145-160 (1966).

Brezonik, P. L. and Lee, G. F., "Preservation of Water Samples for Inorganic Nitrogen Analysis with Mercuric Chloride," Air & Water Pollut. 10:549-553 (1966).

Kammerer, P. A., Rodel, M. G., Hughes, P. A. and Lee, G. F., "Low Level Kjeldahl Nitrogen Determination by the Technicon AutoAnalyzer," Environ. Sci. & Technol. 1:340-342 (1967).

Brezonik, P. L. and Lee, G. F., "Denitrification as a Nitrogen Sink in Lake Mendota," Environ. Sci. & Technol. 2:120-125 (1968).

Brezonik, P. L., Delfino, J. J. and Lee, G. F., "Chemistry of N and Mn in Cox Hollow Lake, Wisconsin, Following Destratification," J. Sanitary Engr. Div. ISCHIA SA 5:929-940 (1969).

Hall, K. J., Weimer, W. C. and Lee, G. F., "Amino Acids in an Estuarine Environment," Limnol. & Oceanogr. 15:162-164 (1970).

Lee, G. F., "Eutrophication," Transactions of the Northeast Fish and Wildlife Conference, pp 39-60 (1973).

Austin, E. R. and Lee, G. F., "Nitrogen Release from Lake Sediments," Journ. Water Pollut. Control Fed. 45:870-879 (1973).

Sonzogni, W. C. and Lee, G. F., "Nutrient Sources for Lake Mendota-1972," Trans. Wisc. Academy Sciences, Arts, and Letters, LXII:133-164 (1974).

Lee, G. F., Bentley, E. and Amundson, R., "Effect of Marshes on Water Quality," In: Ecological Studies 10, Coupling of Land and Water Systems, Springer-Verlag, New York, pp 105-127 (1975).

Gardner, W. S. and Lee, G. F., "The Role of Amino Acids in the Nitrogen Cycle of Lake Mendota," Limnol. & Oceanogr. 20:379-388 (1975).

Cowen, W. F., Sirisinha, K., and Lee, G. F., "Nitrogen Availability in Urban Runoff," Journ. Water Pollut. Control Fed. 48:339-345 (1976).

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Sridharan, N. and Lee, G. F., "Algal Nutrient Limitation in Lake Ontario and Tributary Water," Water Res. 11:849-858 (1977).

Lopez, J. M. and Lee, G. F., "Lake Mendota-Nutrient Loads and Biological Response," In: North American Project -- A Study of US Water Bodies, EPA-600/3-77-086, US EPA, pp 321-335 (1977).

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Piwoni, M. D. and Lee, G. F., "Report on Nutrient Load--Eutrophication Response of Selected South-Central Wisconsin Impoundments," In: North American Project -- A Study of US Water Bodies, EPA-600/3-77-086, US EPA, pp 373-401 (1977).

Piwoni, M. D., Rast, W. and Lee, G. F., "Report on Nutrient Load--Eutrophication Response for the Open Waters of Lake Michigan," In: North American Project -- A Study of US Water Bodies, EPA-600/3-77-086, US EPA, pp 481-498 (1977).

Lee, G. F., "The Effects of Madison Metropolitan Wastewater Effluent on Water Quality in Badfish Creek, Yahara and Rock Rivers," Trans. Wisc. Academy Sciences, Arts and Letters 65:163-179 (1977).

Cowen, W. F., Sirisinha, K. and Lee, G. F., "Nitrogen and Phosphorus in Lake Ontario Tributary Waters," Water, Air, Soil Pollut. 10:343-350 (1978).

Jones, R. A. and Lee, G. F., "Development of Water Quality Management Program for the Rawhide Electric Generating Station Cooling Impoundment: A Domestic Wastewater Reuse Project," In: Water Reuse in the Future, Proc. AWWA Denver, CO, pp 1945-1978 (1982).

Lee, G. F., "Summary of Recent Advances in Managing Water Quality in Reservoirs and Assessing the Water Quality Significance of Chemical Contaminants in Wastewater Effluents," Proc. First World Congress on Engineering and Environment of the World Federation of Engineering Organizations, Buenos Aires, Argentina (1982).

Lee, G. F. and Jones, R. A., "Indirect Reuse of Domestic Wastewater for Recreational Lakes: Evaluation of the Sanitary Quality of the Yellowhouse Canyon Lakes, Lubbock, Texas," In: Proceedings AWRA Symposium, "Water Supply and Water Reuse: 1991 and Beyond," San Diego, CA, pp. 1945-1975, June (1991).

Jones-Lee, A. and Lee, G. F., "Potential Significance of Ammonia as a Toxicant in Aquatic Sediments," In: Proceedings First International Specialized Conference on Contaminated Aquatic Sediments: Historical Records, Environmental Impact, and Remediation, IAWQ, June (1993).

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Lee, G. F. and Jones, R. A., "Application of the Hazard Assessment Approach for Establishing Water Quality Classification for Fountain Creek and Appropriate Water Quality Standards for the River," Testimony before the Colorado Water Quality Control Commission, December (1980).

Lee, G. F., "Application of the Hazard Assessment Approach for Evaluating the Need for Pueblo, CO to Remove Ammonia and Chlorine from Its Domestic Wastewater Discharges to the Arkansas River," Testimony before the Colorado Water Quality Control Commission, December (1980).

Lee, G. F. and Jones, R. A., "An Assessment of the Impact of the Colorado Springs Domestic Wastewater Treatment Plant Discharges on Fountain Creek," Report to Colorado Springs Wastewater Treatment Division, Occasional Paper No. 62, Department of Civil & Environmental Engineering, New Jersey Institute of Technology, Newark, NJ, March (1981).

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Werner, I., Deanovic, L.A., Stillway, M., and Markiewicz, D. "The Effects of Wastewater Treatment Effluent-Associated Contaminants on Delta Smelt" DRAFT FINAL REPORT Aquatic Toxicology Laboratory School of Veterinary Medicine University of California Davis, California January 28, (2009).