

## **G. Fred Lee's Experience in Water Quality Issues of Mercury (2008)**

Dr. Lee is nearing his fifth decade in the water quality evaluation and management field, a career that has incorporated university teaching and research, as well as advising and performing investigations for public agencies and private concerns. He has been involved in evaluating the environmental impacts of mercury in terrestrial and aquatic systems since the early 1960s. At that time he held the position of Professor of Water Chemistry and Director of the University of Wisconsin graduate degree program in Water Chemistry. In the 1960s he served as a advisor to the state of Wisconsin on evaluating and managing the mercury pollution of several Wisconsin rivers due to paper mills use of mercury electrode generation of chlorine at chloralkali electrolysis facilities. Those facilities released considerable amounts of mercury to rivers to which they discharged that resulted in the excessive bioaccumulation of mercury in fish. His work on mercury pollution in the 1960s included investigating the use of mercury-based fungicides by paper mills that was leading to mercury pollution of areas near the paper mills where those fungicides were used.

In the 1970s, under a US Army Corps of Engineers Dredged Material Research Program contract, Dr. Lee conducted an approximately \$1-million study of the potential release of mercury and about 30 other potential pollutants associated with dredged sediments during open water disposal of contaminated dredged sediments taken from about 100 waterways located throughout the US. It was found that the mercury in those sediments was not released to the water column during dredged sediment disposal operations. The results of those studies were published in 1978 in several Corps of Engineers DMRP comprehensive reports. A summary of the findings of those studies was published as.

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, New York, NY, pp. 14-1 to 14-42 (2000).

<http://www.gfredlee.com/Sediment/dredging.html>

and in

Jones-Lee, A. and Lee, G. F., "Water Quality Aspects of Dredged Sediment Management," In: Water Encyclopedia: Water Quality and Resource Development, Wiley, Hoboken, NJ, pp 122-127 (2005).

<http://www.gfredlee.com/Sediment/WileyDredging.pdf>

as well in a series of professional papers, some of which are located on, [www.gfredlee.com](http://www.gfredlee.com) in the "contaminated sediment" section (<http://www.gfredlee.com/psedqual2.htm>).

In the mid-1980s Dr. Lee was a consultant to the American Dental Association helping the ADA evaluate the potential water quality impacts of the mercury in dental amalgam discharged by dental offices to municipal sewerage systems. He was involved in studies that demonstrated that dental office disposal of mercury in amalgams to the sanitary sewerage system typically represented a few percent of the total mercury in the domestic wastewater wastewaters. Little of that mercury was present in the POTW treatment plant effluent since it was removed in the treatment process, and did not represent a threat to the environment in the treatment plant sludge.

In the early 2000s Dr. Lee developed an EIR for the Yolo County Department of Public Works covering the water quality impacts of Cache Creek improvement projects that have the potential to impact water quality in the Creek and downstream. Of particular concern were projects that involved the removal of invasive vegetation that is blocking Cache Creek flow, the dredging of sand bars, and creek bank stabilization projects, all of which had the potential to mobilize sediment-associated mercury. The results of Dr. Lee's part of the EIR review are summarized in, Lee, G. F., "Water Quality," Chapter 4.6 of Yolo County's Supplemental Environmental Impact Report for the Cache Creek Resources Management Plan and Cache Creek Improvement Program County of Yolo Planning and Public Works Department, Woodland, CA (2002).

Lee, G. F. and Jones-Lee, A., "Review of Yolo County Lower Cache Creek Water Quality," Report of G. Fred Lee & Associates, El Macero, CA (2002). Available as WQ 003 from gfredlee@aol.com.

Throughout Dr. Lee's professional career he has been involved in the development of water quality criteria/standards and their appropriate use in water quality management. The US EPA's California Toxics Rule (CTR), developed in 2000, contained new criteria for mercury in water. As discussed by Lee (2003), the US EPA's approach to developing

Lee, G. F., "Regulating Mercury in the Water Column and Sediments," Report to Dredge Tailings Workgroup, by G. Fred Lee & Associates, El Macero, CA (2003).

<http://www.gfredlee.com/SurfaceWQ/TotalMercuryandDissolvedMercuryStandardsrev.pdf>

the CTR criterion for mercury is not protective of the public, because it does not adequately consider the excessive bioaccumulation of mercury in edible fish. The adopted CTR criterion for total recoverable mercury of 50 ng/L is about ten times higher than would be necessary to prevent excessive mercury bioaccumulation in some fish in some waters. Since the aquatic chemistry of mercury in aquatic systems is complex and not well understood, Dr. Lee recommended that excessive bioaccumulation of mercury in fish be regulated based on fish tissue concentrations and the use of US EPA proposed fish tissue consumption guidelines, rather than on total recoverable mercury in the water column.

In 1995, Dr. Lee was appointed as the US EPA-supported Technical Assistance Grant advisor to the public through the Davis South Campus Oversight Committee (DSCSOC) in the matter of the adequacy of investigation and remediation of the University of California Davis and US Department of Energy (DOE) LEHR national Superfund site located on the UC Davis campus. As part of that activity he was able to cause the US EPA and the Agency for Toxic Disease Registry (ATSDR) to conduct studies to define whether fish taken from Putah Creek, near the LEHR site, contain excessive concentration of hazardous chemicals including mercury that would be a threat to the health of those who eat Putah Creek fish. Those studies were the first of their type conducted on Putah Creek. They showed that some fish taken from Putah Creek near the LEHR Superfund site contained excessive mercury and that the LEHR site and/or the UCD campus wastewater treatment plant discharges could be source(s) of that mercury.

Dr. Lee developed a series of reports on this situation that may be downloaded from the DSCSOC website, <http://www.gfredlee.com/DSCSOC/DSCSOC.htm>. Those reports served as a part of the technical basis for the Central Valley Regional Water Quality Control Board's

(CVRWQCB) listing of Putah Creek as a 303(d) listed impaired waterbody due to excessive mercury bioaccumulation in some creek fish.

Dr. Lee's review of the stormwater runoff water quality data that UCD and DOE had been collecting on runoff from the LEHR showed that at times the stormwater contained total mercury in concentrations more than 10 times the CTR criterion. It is clear that LEHR site stormwater runoff has contributed to the excessive bioaccumulation of mercury in some Putah Creek fish. It was Dr. Lee's reports on this issue through DSCSOC that caused the CVRWQCB to issue an order to UCD and DOE to implement management practices to prevent discharges of mercury from the LEHR site stormwater runoff above the CTR criterion. That requirement is being implemented at this time.

Dr. Lee was a member of the CALFED dredged tailings review group that reviewed the potential for using dredged tailings from former gold recovery operations as a source of gravel to improve fish spawning habitat. Those dredged tailings contain mercury, which, when dumped into a stream for habitat improvement, could lead to excessive bioaccumulation of mercury in stream fish. Dr. Lee found that the approach being used by California Department of Fish and Game (DFG) to evaluate whether or not the mercury in the dredged tailings were a threat to cause excessive bioaccumulation when reused in this manner, was technically invalid. He developed a report presenting his recommended approach for evaluating this situation as:

Lee, G. F., "Comments on the CA Bay Delta Authority Dredge tailings issue paper: Draft 1/14/05 Mercury in Dredge Tailings: Considerations for Restoration, prepared by D. Podger," Report of G. Fred Lee & Associates, El Macero, CA, January (2005). <http://www.gfredlee.com/Sediment/DredgSedHgcom.pdf>

For the past decade or so, Dr. Lee has been following the CVRWQCB staff's presentations on the ongoing studies of the bioaccumulation of mercury in edible fish in the Delta and its tributaries. He has participated in many of the Delta Mercury Tributaries Council meetings, and served as a member of the CALFED-supported Fish Mercury Project steering committee. Of particular relevance to the Putah Creek/LEHR mercury issues report is Dr. Lee's involvement in Delta water quality issues over the past 20 years. From late-1989 through 2004 he was involved in the CALFED-supported studies of the San Joaquin River (SJR) Deep Water Ship Channel (DWSC) low-dissolved-oxygen problem near the Port of Stockton. He served as coordinating principal investigator for that more than \$2-million project devoted to investigating and defining the nature of, causes for, and potential approaches for developing solutions to, the low dissolved oxygen in the DWSC near the Port of Stockton. Through that work he became familiar with how waters that enter the Delta from the Sacramento and San Joaquin Rivers move through the Delta and transport nutrients, algae, and other potential pollutants including mercury and methyl mercury. He and Dr. Anne Jones-Lee developed a series of reports on that work, including the comprehensive synthesis report:

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 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>

Their papers and reports on Delta water quality issues are available on their website, [www.gfredlee.com](http://www.gfredlee.com) at <http://www.gfredlee.com/psjriv2.htm>.

Following the completion of the SJR DWSC low-DO synthesis report, he and Dr. Jones- Lee conducted several special-purpose studies with the support of the DeltaKeeper (William Jennings). Those studies focused on the flow of the San Joaquin and Sacramento Rivers through the Delta as they enter the Delta and move through the Delta channels to the USBR and DWR water export projects at Tracy and Banks, as well as to San Francisco Bay. Their reports on those studies provide important information on how the water and associated pollutants, including total mercury and methyl mercury, in the SJR are transported through the Delta.

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 (2004).  
<http://www.gfredlee.com/SJR-Delta/South-Delta-Tour.pdf>

Lee, G. F.; Jones-Lee, A. and Burr, K., "Summary of Results from the July 17, 2003, and September 17, 2003, Tours of the Central Delta Channels," Report of G. Fred Lee & Associates, El Macero, CA (2004).  
<http://www.gfredlee.com/SJR-Delta/Central-Delta-Tours.pdf>

Subsequently, Monsen et al. published a report on their investigation into the flow of water through the Delta.

Monsen, N., Cloern, J., and Burau, J., "Effects of Flow Diversions on Water and Habitat Quality: Examples from California's Highly Manipulated Sacramento- San Joaquin Delta," San Francisco Estuary & Watershed Science, Vol. 5, Issue 3, Article 2, July (2007) <http://repositories.cdlib.org/jmie/sfew/vol5/iss3/art2>

Their findings regarding the water flow through the Delta channels were similar to those reported in the Lee et al. (2004) reports. As discussed in these comments, those findings should be considered in OEHHA's development of "Safe Eating Guidelines" for fish consumption in the "Southern Delta."

Additional information on these issues is available upon request from [gfredlee@aol.com](mailto:gfredlee@aol.com).