

Supplement to Stormwater Runoff Water Quality Newsletter NL 11-1 devoted to Development of SQOs for Dredged Sediment

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January 16, 2008

Stormwater Runoff Water Quality Newsletter NL 11-1 presented a condensation of comments on the technical problems with the State Water Resources Control Board Staff's (SWRCB) proposed approach for developing Sediment Quality Objectives (SQOs) for evaluating and ultimately regulating the water quality impacts of chemical contaminants in aquatic sediments. Our original comments,

Lee, G. F., and Jones-Lee, A., "Comments on the SWRCB Staff's Proposed Approach for Developing Sediment Quality Objectives for Enclosed Bays and Estuaries of California," Submitted to State Water Resources Control Board, Sacramento, CA, by G. Fred Lee & Associates, El Macero, CA, November 30 (2007). <http://www.members.aol.com/GFLEnviroQual/SedQualObj11-07.pdf>

included comments on the application of SQOs to dredged sediments, which was not included in Newsletter NL 11-1. This supplement provides that information as well as additional information on the topic of dredged sediment management in the Sacramento San Joaquin Delta.

Background to Comments

Drs. G. Fred Lee and Anne Jones-Lee's work on evaluating the water quality impacts of dredged sediment disposal included about \$1-millions in laboratory and field research for the US Army Corps of Engineers (USACE) Dredged Material Research Program in the development of dredged sediment disposal criteria for managing contaminated sediments. That research, conducted over a five-year period in the 1970s, served as the technical basis for the USACE and USEPA's biological effects-based criteria for evaluation of impacts of contaminated dredged sediment disposed of in open water. Those criteria, developed about 30 years ago, are still in effect today; receiving periodic review, they remain largely unchanged. As part of several of those reviews, attempts have been made to require that the USEPA and USACE incorporate co-occurrence-based sediment quality evaluations of the type proposed by the California SWRCB staff for SQO development, using total concentrations of selected chemicals in sediments.

The USEPA and USACE have conducted detailed reviews of that approach and have repeatedly concluded that it is not a technically valid approach for evaluating and regulating the potential impacts of chemical contaminants in sediments on aquatic life and other beneficial uses of waterbodies. Further information on Drs. Lee and Jones-Lee's qualifications to review the technical validity of the SWRCB staff's proposed approach for SQO development is available at <http://www.gfredlee.com/psedqual.htm>.

Application to Dredged Sediments

The SWRCB staff report Appendix A, in section VII. PROGRAM OF IMPLEMENTATION, states,

“A. Dredge Materials

- 1. This Plan shall not apply to Dredge material suitability determinations. Suitability determinations shall be based upon USACE and U.S. EPA methodologies developed for ocean, inland and upland disposal, and guidance developed by regional dredging teams and approved by the Regional Water Boards.*
- 2. The Regional Water Boards shall not approve a dredging project that involves the dredging of sediment that exceeds the objectives in this plan, unless the Regional Water Boards determine that:*
 - a. The polluted sediment is removed in a manner that prevents or minimizes water quality degradation.*
 - b. The polluted sediment is not deposited in a location that may cause significant adverse effects to aquatic life, fish, shellfish, or wildlife or may harm the beneficial uses of the receiving waters, or does not create maximum benefit to the people of the State.*
 - c. The activity will not cause significant adverse impacts upon a federal sanctuary, recreational area, or other waters of significant national importance.”*

First, it is striking that Item 1 quoted above states that the SQO approach does not apply to dredged material, while the following Item 2 clearly indicates that the SQOs are to be applied. That contradiction notwithstanding, the key concern is that the application of SQOs to dredged sediment disregards, indeed flouts, the substantial technical findings and foundation upon which the referenced USACE and USEPA methodologies were developed. That is, it disregards the aqueous environmental chemistry and toxicology pertinent to assessing the behavior and impact of sediment-associated chemicals while advancing a technically unreliable, co-occurrence-tainted, SQO approach. These fundamental issues were discussed at length in Newsletter 11-1.

Drs. G. F. Lee and Anne Jones-Lee were highly involved in working with the USACE in conducting research to develop regulatory criteria for open-water disposal of dredged sediments. While the focus of that work was open-water disposal, consideration was also given to the environmental quality implications of alternatives to open-water disposal including upland disposal such as is practiced in the Delta. They concluded that upland disposal could, in some situations, have a significant adverse impact on aquatic life and other water quality issues.

The open-water disposal activity investigated by Lee and his associates involved dredging shallow-water sediments and transporting them either by a hopper-dredge (boat), clamshell dredge/barge, or pipeline to deeper waters or off-channel for disposal. Dr. Lee and his graduate students conducted more than a million dollars in laboratory and field research devoted to evaluating the water quality impacts of open-water disposal of highly contaminated dredged sediments. That work included laboratory studies of the chemical composition, leaching, and aquatic life toxicity of about 100 sediments from navigation channels across the US. The chemical composition, leaching, toxicity/bioaccumulation evaluations focused on about 30 chemical parameters (heavy metals, nutrients, pesticides, PCBs and selected organics). The work also included comprehensive field studies that were designed to investigate and compare results of laboratory studies with what actually happens under field conditions. At each of the half-dozen disposal sites monitored, about 500 to 1000 samples were taken over the two-day

period just prior to, during and following the open-water disposal operation. This testing/evaluation program established that the elutriate test predicted the direction and approximate magnitude of release of potential pollutant chemicals present in dredged sediments. The elutriate test and toxicity testing became the standard basis for the current US EPA and US ACE evaluation procedure for the potential impacts of chemicals in dredge sediments slated for open water disposal.

The results of the Lee and Jones-Lee dredged sediment evaluation studies were published in two USACE reports,

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 Sediment and Environmental Impact of Open Water Dredged Material Disposal, Vol. I: Discussion," Tech Report D-78-45, US Army Engineer Waterway Experiment Station, Vicksburg, MS, August (1978).

Lee, G. F., Jones, R. A., Saleh, F. Y., Mariani, G. M., Homer, D. H., Butler, J. S. and Bandyopadhyay, P., "Evaluation of the Elutriate Test as a Method of Predicting Contaminant Release during Open Water Disposal of Dredged Sediment and Environmental Impact of Open Water Dredged Materials Disposal, Vol. II: Data Report," Technical Report D-78-45, US Army Engineer Waterway Experiment Station, Vicksburg, MS, 1186 pp., August (1978).

Summaries of those studies were 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/dredging.html>

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.members.aol.com/annejlee/WileyDredging.pdf>

The results of those studies convincingly demonstrated that, as would be expected based on principles of aquatic chemistry, the total concentration of a chemical or group of chemicals in sediments is not a reliable predictor of the water quality impacts of the chemical(s) on aquatic life. They demonstrated the parameters and characteristics that need to be considered and accounted for in assessing the potential leaching and impacts of sediment-associated contaminants. Based on the results of those and other studies, the USEPA and USACE developed a biological effects-based approach for regulating the open-water disposal of dredged sediments. That approach has been reviewed on several occasions since it was first adopted in the late 1970s. Each review has concluded that that approach is technically valid and that co-occurrence-based approaches (such as Long and Morgan, MacDonald, etc.) are not technically

valid for evaluating the potential impacts of contaminants in sediments when either suspended in the water column during disposal or present in bedded sediments after disposal.

The experience in developing national dredged sediment disposal criteria has demonstrated that biological effects-based sediment quality evaluation can be used reliably in a regulatory program to manage highly contaminated sediments to protect aquatic life, public health, and environmental quality. A similar approach should be developed for SQO development and implementation in California.

Regulation of Delta Dredging Activities

In the early 1990s, through discussions with Central Valley Regional Water Quality Control Board (CVRWQCB) staff, Dr. Lee became aware of problems associated with regulating dredged sediment management in the Delta. Then, as well as today, the CVRWQCB was required to assume the US EPA Clean Water Act worst-case-based water quality evaluation approach is applicable for evaluating and regulating dredged sediment disposal, notwithstanding the fact that that approach, as would be expected, tends to significantly overregulate chemicals while ignoring others. This is especially of concern for sediment management because it does not consider the leachability and toxicity/bioavailability of sediment-associated chemicals. In Advisory Committee. Following on his experience in developing criteria for evaluating sediment-associated contaminants in dredged sediment, Lee recommended in a presentation to the committee, the conduct of comprehensive field studies in the Delta to identify and define water quality impacts of dredged sediment and its management in the Delta. The results of those studies could then serve as a more reliable basis for regulation of dredged sediment than the worst-case based approaches in use. That committee obtained substantial funding from CALFED to address this issue. Unfortunately, the management of those funds was such that necessary field studies to examine water quality impacts of dredged sediment management approaches and alternatives were not conducted.

During the past decade, as the issue of dredging and dredged sediment disposal in the Delta has been focused on, Lee has commented on pertinent regulatory issues as they have arisen; those comments are posted on his website, www.gfredlee.com at <http://www.gfredlee.com/psedqual2.htm> and specifically at <http://www.gfredlee.com/psedqual2.htm#dredge>.

The experience, findings, and insight gained from the national dredged sediment disposal criteria work should be put to use in the development of a more appropriate regulatory program for dredging and dredged sediment management in the Delta. As discussed in reports cited above and in keeping with Clean Water Act requirements, in order for the Regional Board to adopt a site-specific approach for regulating dredged sediment management in the Delta, the CVRWCB would need well-documented information on the actual impacts of dredged-sediment-associated chemicals on water quality in the Delta. This, in turn, will require several representative, site-specific studies of dredged sediment management situations in the Delta. Apparently, until such studies are appropriately conducted and reported, the current worst-case-based approach will likely prevail. It will be important that adequate funds be made available for the conduct of such well-planned, focused, conducted and properly reported comprehensive studies in the Delta.