

**Use of Unreliable Sediment Quality Evaluation in the LEHR Superfund Site
Ecological Risk Assessment**

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November 29, 2009

**Follow up Discussion on the Unreliability of the LEHR Superfund Site
Ecological Risk Assessment for Sediment Quality Evaluation**

On August 25, 2009 the US EPA Region 9 approved the California State Water Resources Control Board's Sediment Quality Objectives (SQOs) for the state's Enclosed Bay and Estuaries [http://www.swrcb.ca.gov/water_issues/programs/bptcp/docs/sediment/sqo_epa_apprv.pdf].

The development of those SQOs was a 20-year effort under the Bay Protection and Toxics Cleanup Program, costing several million dollars for studies of the relationship between the chemical characteristics of sediments in enclosed bays and estuaries and the potential impacts on aquatic life in the sediments. The initial effort in the late 1980s failed because of inadequacies in the approaches attempted by the SWRCB staff to develop SQOs based on total concentrations of selected chemicals in the sediments and potential impacts of the chemicals on aquatic life. The cornerstone of that effort was co-occurrence-based, so-called "relationships" between the total concentration of a chemical in the sediment and the toxicity of the sediment to aquatic life. However it has long been known in the technical community, based on the thermodynamics, kinetics, and toxicology of chemicals in aquatic systems as well as study data, that there is no reliable cause-and-effect coupling between total concentrations of chemicals in sediment and the impact of those chemicals on water/sediment quality.

This was clearly demonstrated in the late 1970s, in the findings of the approximately \$1-million US Army Corps of Engineers (COE) Dredged Material Research Program's laboratory and field studies conducted by my graduate students and me. We examined the concentrations and behavior of 30 potential pollutants in about 100 sediments taken from numerous waterways across the US and found, as expected based on aqueous environmental chemistry and toxicology, that the total concentration of a chemical in a sediment could not be used to predict the sediment's toxicity. The results of our studies were used by the US EPA and COE to develop their approach for evaluating the potential impact of open (deeper) water disposal of dredged sediments, an approach that is still being used today. As part of their effort to employ sound and reliable technical information in assessing potential impacts of dredged sediment disposal, the US EPA and COE have repeatedly rejected the use of co-occurrence-based sediment quality evaluation procedures in dredged sediment evaluation and management.

In the 2000s, as a result of litigation filed by the DeltaKeeper, the SWRCB attempted again to develop SQOs through a new \$2-million study program. Initially the SWRCB staff indicated

that co-occurrence-based SQOs would be evaluated for those SQOs. It soon became evident, however, that the total concentration, co-occurrence-based, SQOs were not reliable for predicting sediment toxicity. Instead, the SWRCB adopted, and now the US EPA Region 9 has approved, sediment quality evaluation procedures based primarily on measured sediment toxicity and altered benthic organism assemblages. The chemical composition of a sediment is to be used to provide insight into chemicals that may potentially be responsible for the impacts; follow-up toxicity identification evaluation (TIE) studies are to be used to determine whether a particular chemical in a sediment is responsible for observed sediment toxicity and impacts on benthic organism assemblages. Co-occurrence-based sediment quality guidelines are specifically mentioned as being unreliable for evaluating sediment quality. This overall approach for sediment quality evaluation is somewhat similar to that which we have been advocating for more than 30 years. Our writings on this issue are available on our website [www.gfredlee.com] in the "Contaminated Sediment Section" [<http://www.gfredlee.com/psedqual2.htm>].

The sediment quality evaluation issue is important to the UCD/DOE LEHR Superfund site since co-occurrence-based sediment quality guidelines were used, with the approval of the RPMs, as part of the ecological risk assessment for the LEHR site. When the matter of using co-occurrence-based approaches in the ecological risk assessment for the LEHR site first arose, I developed several reports, through DSCSOC, discussing the unreliability of co-occurrence-based sediment quality guidelines in the site ecological risk assessment including:

Lee, G. F., "Review of the UCD Ecological Risk Assessment Revised Draft," Comments submitted to DSCSOC by G. Fred Lee & Associates, El Macero, CA, September (2004).
<http://www.gfredlee.com/dcsoc/doc.htm>

Lee, G. F., "Use of Co-occurrence Based "SQGs" in UCD LEHR Ecological Risk Assessment," Comments submitted to DSCSOC by G. Fred Lee & Associates, El Macero, CA, November 7 (2004).
<http://www.gfredlee.com/DSCSOC/2004/RothEcoSed11-07-04.pdf>

The November 2004 report cited above specifically mentioned that the US EPA national Superfund program staff had rejected the use of co-occurrence-based sediment quality guidelines as a basis for assessing sediment quality in Superfund site evaluation. When the LEHR Superfund site RPMs continued to support the use of co-occurrence-based sediment quality guidelines in the LEHR ecological risk assessment, DSCSOC requested that the US EPA Region 9 review this issue. DSCSOC received a response to that request from N. Black, CERCLA Ecologist/Microbiologist for Region 9 Superfund staff, stating that Region 9 had adopted that approach. Black made no attempt to address the large amount of technical information available that showed that that approach is not technically valid. That information is summarized in the following report:

Lee, G. F., "Use of Co-occurrence Based "SQGs" in UCD LEHR Ecological Risk Assessment," Comments submitted to DSCSOC by G. Fred Lee & Associates, El Macero, CA, November 7 (2004).
<http://www.gfredlee.com/DSCSOC/2004/RothEcoSed11-07-04.pdf>

DSCSOC developed the following response to the US EPA Region 9 response:

Lee, G. F., "Comments on US EPA Region 9's Response to DSCSOC's Request for Technical Review of the Reliability of Using Co-Occurrence-Based SQGs in a LEHR Site Ecological Risk Assessment." Report submitted to DSCSOC by G. Fred Lee, G. Fred Lee & Associates, El Macero, CA, February 3 (2005).
<http://www.gfredlee.com/DSCSOC/2005/SQGsResponseRegion9.pdf>

In the DSCSOC response report I again discussed the unreliability of this approach, with references to the technical literature on this topic. I provided quotations from several international experts on this issue including Ed Long, one of the original authors of the "Long and Morgan" co-occurrence approach, who stated, "*The presumption that you can predict benthic impacts with sediment chemistry data alone is very weak.*"

The acceptance of the California sediment quality objective development approach, which includes rejection of the use of co-occurrence approach as a stand-alone sediment quality evaluation approach, affirms DSCSOC's conclusion that the **LEHR Superfund site ecological risk assessment is, in part, technically invalid.**

In addition to the deficiencies in the current ecological risk assessment attributable to the invalid approach used in the sediment quality evaluation, the ecological risk assessment also incorporates an unreliable approach for assessing the impact of the LEHR Superfund site on Putah Creek water quality. With RPM support, the UCD contractor relied on the results of the analysis of two grab samples of Putah Creek water upstream and downstream of the site per year for evaluation of the impact of LEHR site runoff/ discharges on Putah Creek water quality. Such a sampling regimen does not provide an adequate data base upon which to make a reliable assessment of impact. As discussed by DSCSOC, a far-more comprehensive Putah Creek sampling program would need to be made to make a reliable assessment. Unfortunately, ATSDR accepted the inadequate monitoring for evaluating impacts of the LEHR site runoff/discharges as technically valid in its Site Health Assessment. That error in the assessment approach illustrates a gross inadequacy in the surface water sampling program at the LEHR Superfund site.

At this time the technical errors that have been allowed in the LEHR site ecological risk assessment do not appear to be significantly impacting the development of the ROD for the site since sediment quality does not appear to be an issue, and since the impacts of mercury in stormwater on Putah Creek have been more properly assessed separately through information developed by DSCSOC. These errors are significant, nevertheless, since others could be lead to believe that those technically invalid approaches are appropriate for conducting an ecological risk assessment and Site Health Assessment for a Superfund site.

Questions on these comments should be directed to G. Fred Lee at gfredlee@aol.com.