Development of a CALFED Remediation Program for Potentially Toxic Heavy Metals

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via e-mail

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Dear Paul:

During yesterday's telephone conference call on metals there were discussions about several areas where I have developed materials pertinent to developing technically valid, cost-effective management programs that focus public resources on solving real water quality use impairments associated with heavy metals. I have been working on heavy metal water quality issues since the early 1960s and have published extensively on this topic. My work over the last half a dozen years has focused primarily on urban area and highway stormwater runoff-associated metals as they may impact receiving water beneficial uses. Further, over the past two years, I have followed closely the information available on heavy metal impacts on water quality in the Sacramento River system, Delta and San Francisco Bay.

Proper Definition of Heavy Metal Water Quality Problems

Following the CALFED April 15, 1998 meeting, I sent you a note concerning some of the issues that should be addressed by the Metals Workgroup in formulating CALFED remediation approaches. Subsequently, I have expanded on my note to you to develop a statement of these issues, "Recommended Approach for Development of CALFED Funded Remediation Program to Control Heavy Metal Water Quality Use Impairments Associated with Exceedance of Quality Standards." This statement summarizes some of the comments that I have made over the past year a half to CALFED on developing a more appropriate approach for formulating a remediation program for heavy metals than that proposed in the December 1997 WQTG plan as well as the January 1998 draft EIS/EIR. I have attached as a WordPerfect 6/7/8 file this statement. This write-up addresses the bioavailability issue that should be a key part of any credible CALFED heavy metals remediation program for the potentially toxic metals, such as copper zinc, cadmium, nickel and lead.

As I discussed during our telephone conference, the bottom-line issue with respect to regulating these metals is a proper assessment of whether they are toxic. It has been known since the early 1970s that measurements of heavy metals as is frequently done provides essentially no useful information on whether there is a real water quality problem associated with heavy metals. It is not possible to estimate toxicity based on chemical measurements in water or sediments.

Toxicity tests and TIE techniques are readily available to determine whether potentially toxic heavy metals in any particular chemical form are, in fact, toxic and therefore determine whether there is need for CALFED to consider developing a remediation program for heavy metal input control to the Delta and its tributaries.

Chromium

During our discussions I mentioned that the CALFED Parameter Assessment Team had supported my proposal to include chromium VI as a potentially significant parameter of concern that could be of significance in causing aquatic life toxicity. I presented a poster session paper on this topic entitled "Chromium Speciation: Key to Reliable Control of Chromium Toxicity to Aquatic Life" at the American Chemical Society national meeting that was held a year ago in San Francisco. The poster items which summarize the key issues are available on my web site (http://home.pacbell.net/gfredlee/index.html) under the water quality section. The abstract of this poster summarizes the key issues that should be included in a CALFED statement on the importance of incorporating chromium VI monitoring down to about 1 µg/L reliable detection limit. While the USGS and many other agencies do not determine total chromium or chromium VI at these levels, there are standard methods available that can be used for this purpose, such as in the "Standard Methods for the Examination of Water and Wastewater."

I have also developed a Society for Environmental Toxicology and Chemistry Learned Discourse, "Under-Regulation of Chromium in Ambient Waters," which is in press which summarizes the chromium VI toxicity issues. This is also on my web site and attached to these comments. Those writing up the heavy metals section should feel free to use any aspect of this discussion in their write-up. If there are questions about it, please contact me.

Lead

During our discussions, I pointed out that lead should be added to the list of heavy metals which are parameters of concern in urban area stormwater runoff. As I have commented in my comments on the original approach that was used by the CALFED Water Quality Technical Group, the original list of parameters of concern did not reflect what is well-known in the field for a number of constituents. Lead is an example of this situation. Those familiar with urban stormwater runoff know that all runoff waters contain lead above water quality standards. Therefore, urban stormwater runoff is responsible for causing a violation of water quality standards in ambient waters at the point of urban area and highway runoff discharge. While the lead concentrations in gasoline have decreased significantly, they are still sufficient to cause elevated concentrations of lead in stormwater runoff that lead to exceedances of US EPA worst-case water quality standards for protection of aquatic life. My graduate students and I have been involved in investigating lead in urban area and highway stormwater runoff as a cause of water pollution since the 1960s. In June 1997, as part of my work with the State Water Resources Control Board's Stormwater Quality Task Force, I developed a review, "Lead as a Stormwater Runoff Pollutant," which is available from my web site. This write-up summarizes the key issues of concern with respect to lead. The situation with urban area and highway stormwater runoff lead is that it has been repeatedly found to be inert, i.e. in a non-toxic, non-available form, as it

may impact aquatic life. Those writing up the heavy metals section should feel free to use any part of this write-up that they wish.

Nickel

Another metal that should be added to our discussion as a potentially toxic heavy metal parameter of concern is nickel. Nickel is being found at elevated concentrations in water, especially on the western side of the Sacramento Valley. Chris Foe believes that it may be causing some aquatic life toxicity. I know that it is present in San Francisco Bay at levels of concern for aquatic life toxicity. I have not worked on nickel and can add nothing more than noting that it may be an issue that should be considered as part of the CALFED heavy metals group write-up. Chris Foe would be the person I would contact on this for further information.

Copper

During our discussions there was mention of copper in urban stormwater runoff being associated with automobile brake pads. This is a topic that I have been concerned with over the last half a dozen years, especially as it impacts the regulation of copper in San Francisco Bay urban area stormwater runoff. In June 1997, I presented a paper, "Regulating Copper in San Francisco Bay: Importance of Appropriate Use of Aquatic Chemistry and Toxicology," at the Fourth International Conference on the Biogeochemistry of Trace Elements. A copy of the slides used and an extended abstract are present on my web site. This paper summarizes the key issues that need to be addressed in discussing the regulation of copper from any source, and especially auto brake pads. At this time, after extensive study, there has been no discernible problem found due to the copper in San Francisco Bay exceeding the site-specific water quality standard. This is to be expected based on the characteristics of the source of copper and its aqueous environmental chemistry in marine waters and sediments. The same situation will apply to many sources of copper in many, but not all, types of waters. Copper generally is fairly rapidly detoxified in most aquatic systems.

Bioaccumulation of Heavy Metals

There were some discussions during our telephone conference about how certain heavy metals bioaccumulate in aquatic life tissue. This is a topic I have followed closely since the early 1970s as part of my work on regulating contaminated dredged sediments. At this time, the situation is still one of not knowing how to interpret the water quality or ecological significance of accumulating heavy metals within aquatic organism tissue that are not recognized as a threat to human health through consumption of the organism. It is well known, however, that in some environments, some organisms accumulate copper, zinc, cadmium and/or lead in the various organs and/or muscle. A year and a half ago, I attended a US EPA conference devoted to sediments as a source of bioaccumulatable constituents which included a number of speakers reviewing what is known about the relationship between aquatic organism tissue residues and impacts on the organism. The proceedings of that conference are still not yet available. Following that conference, I wrote up a review, "Summary of Issues Pertinent to Regulating Bioaccumulatable Chemicals," which is available from my web site which summarizes the key issues presented at the conference, as well as my own experience. It is important not to assume

that there is a significant water quality problem that needs remediation because an organism accumulates an elevated concentration of a heavy metal or, for that matter, an organic, such as a chlorinated hydrocarbon, due to an adverse impact on the organism which has the elevated body burden. There may be subtle problems that have not been detected. There is need for further research on these issues, however, there are important questions as to whether this type of a search is appropriate for CALFED funding.

I will be contacting you separately on mercury issues. If there are questions about these comments, please contact me. Please send these comments on to the other members of the CALFED Metals Workgroup. The attached files are in WordPerfect6/7/8. If anyone cannot read these files, please contact me and I will send them in another format.

Fred

Reference as: "Lee, G.F., 'Development of a CALFED Remediation Program for Potentially Toxic Heavy Metals,' letter to P. Marshall, CALFED, Sacramento, CA May (1998)."