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Dr. Val Connor
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Dear Val:

I wish to follow up on the discussions at a recent Sacramento River Watershed Toxics Control Toxics Subcommittee meeting in which it was advocated by one of the committee members that it is possible to identify the constituent responsible for aquatic life toxicity through the use of exceedance of a US EPA water quality criterion for that constituent. I have subsequently found upon review of the Department of Fish and Game studies in the upper Sacramento River system associated with acid mine drainage from Iron Mountain Mine that this approach has been used by this group to assert that zinc was the chemical responsible for the toxicity found in the sediment elutriates.

I have worked throughout most of my over-36 year professional career in the area of aquatic life toxicity in which I have examined the relationship between chemical concentrations of constituents in water and/or sediments and their toxicity as measured in a laboratory toxicity test. I have a strong academic and professional background in aquatic chemistry and analytical chemistry. I taught graduate-level courses in both of these areas for over 30 years at several major US universities. Further, I have published extensively on this topic in the refereed literature and have been invited to present papers at symposia specifically dealing with the relationship between chemical concentrations of constituents and aquatic life toxicity. Further, I was involved as a peer reviewer for the US EPA water quality criteria development approach and a number of the criteria that are in the current "Gold Book" of water quality criteria released by the Agency in 1987.

In addition, I have discussed in some detail in previous correspondence associated with the development of the Sacramento River Watershed Toxics Control Program subcommittee activities various issues pertinent to the importance of developing this program based on measured aquatic life toxicity rather than chemical concentration-based approaches. I can unequivocally state, and this can be substantiated from the vast literature that exists on this topic, that the constituents responsible for toxicity in a laboratory-based toxicity test cannot necessarily be correctly identified based on the concentrations of constituents that exceed the US EPA water quality criteria. While this approach might work on some rare conditions, it is dangerous to follow and can readily lead to incorrect conclusions.

The unreliability of this approach was recognized many years ago by the US EPA and serves as one of the primary bases for the development of the Toxicity Investigation Evaluation approach (TIE). I have been working on TIE issues since the 1960s, long before they were formally

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recognized as a investigative tool to identify the toxicant(s) in a waterbody. Exceedance of a water quality criterion is no substitute for conducting a properly developed and implemented TIE.

The primary reasons that exceedance of a water quality criterion is not reliable as a basis for judging the cause of toxicity include the fact that many chemical constituents exist in aquatic systems in a variety of chemical forms, only some of which are toxic/available. It is well known that, can exceed water quality criterion by orders of magnitude and can be non-toxic.

The fact that there are only a few (100 or so) regulated chemicals compared to the 75,000 chemicals in commerce today, means that there is a wide variety of chemical constituents that can be in water and sediments that can cause aquatic life toxicity that would not be identified by exceedance of a water quality criterion. A prime example is diazinon. Diazinon is one of the most common causes of toxicity in the Sacramento River waters. Where toxicity is found that is due to diazinon, examination of the list of parameters that are present in the water that exceed the US EPA ambient water quality criteria for the cause of the toxicity would lead to a completely erroneous conclusion with respect to the real cause of the toxicity. Diazinon toxicity could readily be present in the sample and not be identified by this approach. It was identified through a proper use of TIE's, however.

In conclusion, it is important that the Sacramento River Watershed Toxics Control Program not rely on exceedance of a water quality criterion for regulating a chemical as a means of determining whether toxicity found in ambient water toxicity testing is caused by a particular constituent. Appropriately developed and implemented TIEs should be used. This does not mean, as I have discussed previously, that a mechanical implementation of the TIE approach should be followed. Instead, individuals who are knowledgeable in aquatic chemistry and toxicology should be involved in developing and implementing the TIE so that it does, in fact, use the funds available wisely to address the cause of the toxicity. It is possible to conduct TIEs which focus on potential toxicants much more rapidly and cost-effectively than the mechanical implementation of the TIE approach developed by the US EPA. That approach was developed as a broad-based guidance of the kinds of testing that can be done to fractionate the toxic components into chemical groups that have certain properties which then can be useful in identifying the cause of the toxicity.

If you have questions on these comments, please contact me. I suggest that you make them available to the Toxics and Monitoring Subcommittee members for their review and comment.

Sincerely yours,

G. Fred Lee, PhD, DEE

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