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Via email

Julie Roth, Executive Director
DSCSOC

Subject: Regulating Chromium

Julie,

At the last RPM meeting, a representative of a UCD consultant made some incorrect statements about the regulation of chromium in aquatic systems, regarding the impacts of chromium on various forms of aquatic life.

I have been involved in water quality criteria and standards development in various areas since the mid-1960s. These activities included reviewing the McKee and Wolf compilation of the impacts of chemicals on various beneficial uses of water, which led to the Green Book of Water Quality Criteria that was developed by the US Public Health Service.

Further, while teaching at the University of Wisconsin, Madison, where I established and directed the Water Chemistry Program (a graduate degree program in water chemistry), I supervised a graduate student's masters thesis research on chromium chemistry in aquatic systems. In the mid-1970s I was an invited peer reviewer to the National Academies of Science and Engineering Blue Book of Water Quality Criteria.

For a number of years I served as a member of the Water Environment Federation Water Quality Criteria workgroup. This workgroup worked with the US EPA headquarters Criteria and Standards staff in trying to address some of the significant problems that exist in how the US EPA develops and implements water quality criteria into state standards and NPDES permitted discharge limits.

In the early 1980s I was asked by the US EPA to serve as an external peer reviewer for the Agency's Gold Book of Water Quality Criteria development approach and for several criterion documents. This criteria development approach is the same approach that is being used today by the Agency. I am fully aware of how water quality criteria are developed, and, for a number of criteria, such as for chromium, of the inconsistent approach used by the US EPA to develop a criterion that is protective of all forms of aquatic life.

While it was stated by the UCD consultant that the US EPA water quality criteria and state standards based on these criteria consider impacts on fish, zooplankton and aquatic plants, I

pointed out that, in principal, this is true; however, in practice, for some chemicals, it is not true. An example of this is one of the most important chemicals at the LEHR site, chromium-VI.

In the mid-1990s I became involved in reviewing the potential impacts of UCD's proposed approach to discharge chromium-laden groundwater from its Landfill No. 4, located on the western UCD campus. At this landfill, UCD (like it has at the LEHR site) polluted groundwater with chloroform and other VOCs in a plume extending over a mile. UCD was required by the CVRWQCB to initiate a pump-and-treat operation to remove the VOC-polluted groundwaters. I testified before the CVRWQCB that UCD's proposed approach for disposal of chromium present in VOC air-stripped groundwater, which involved discharge to Putah Creek, could readily lead to toxicity in Putah Creek. Ultimately, UCD decided to abandon efforts to discharge the air-stripped polluted groundwaters directly to Putah Creek. Instead it is discharging to a campus wastewater treatment plant, where it is diluted by campus wastewaters, before being discharged to Putah Creek.

As part of my review on the appropriate discharge limits for chromium to Putah Creek, I examined the criterion support documents that were originally developed by the US EPA in the 1980s. I found that the Agency had established the water quality criterion for chromium-VI using a different approach than what it normally does for other potentially toxic constituents. Basically, the Agency chose to ignore the substantial information that exists in the literature and in its chromium criteria support documents, which shows that the 11 µg/L criterion for chromium-VI is not protective of zooplankton. It is well established in the literature and discussed in the criterion documents that chromium-VI at less than 0.5 µg/L was toxic to several forms of zooplankton. As I discussed at the RPM meeting, contrary to the statements made by the UCD consultant, zooplankton are not protected by achieving the US EPA water quality criterion of 11 µg/L.

I checked with US EPA headquarters, Criteria and Standards Branch, to determine why the Agency had not followed the standard procedure of including zooplankton as part of the dataset to establish the extrapolated criterion value. I learned that this was because one of the high-ranking staff in the US EPA Duluth laboratory decided that he did not feel it was appropriate to protect zooplankton. This applies not only to chromium, but to other constituents. However, the Agency, for other chemicals in which he was not involved, does protect zooplankton – e.g., the organophosphate pesticides diazinon and chlorpyrifos, where the focal point of toxicity is zooplankton. This is an example of the inconsistent approach that the Agency uses, in which political and other factors are incorporated into the criteria.

I developed a paper on this topic, which was presented at an American Chemical Society national symposium in San Francisco. An extended abstract of this paper is available from my website as,

> Lee, G. F. and Jones-Lee, A. "Chromium Speciation: Key to Reliable Control of Chromium Toxicity to Aquatic Life," Presented at the American Chemical Society National Meeting poster session, San Francisco, CA, April (1997).

As discussed in the review that I recently developed on mercury, the California Toxics Rule (CTR) criteria have been updated by the November 2002 US EPA Recommended Water Quality Criteria. Those criteria, while not yet officially part of the CVRWQCB Basin Plan, will be, as part of the State Water Board and Regional Board update of the CTR criteria and Basin Plan. The November 2002 criteria represent the Agency's current best estimate of the critical concentrations to protect various forms of aquatic life. Even there, the November 2002 criteria still have biases built into them, such as the zooplankton not being considered as an organism that needs to be protected from chromium-VI toxicity.

The message from this is that, in conducting a LEHR site-wide risk assessment for chromium (and, for that matter, other constituents), where the US EPA water quality criteria or state standards based on these criteria are used, it is important to understand how the water quality criteria were developed with respect to protecting aquatic life from toxicity, excessive bioaccumulation and other factors. Failure to do so could readily lead to an incorrect assessment of the impacts of discharges from the LEHR site.

If there are questions on this matter, please contact me.

G. Fred Lee

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