Copper Development Association Inc.

May 6, 2024

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The Copper Development Association (CDA) wishes to submit some comments regarding the proposed change in the Aquatic Life Criteria for copper. The Copper Development Association Inc. is the market development, engineering and information services arm of the copper industry, chartered to enhance and expand markets for copper and its alloys in North America. We bring the value of copper and its alloys to society.

Over the last twenty-five years, CDA has supported the development of information leading to the development of a substantial data base of aquatic toxicity studies on copper. These studies, together with significant financial support, have formed the basis for the development of the biotic ligand model (BLM). While the efforts and support of CDA and the International Copper Association (ICA) led to the development of the BLM, we recognize this model has only been accepted in a few states due to concerns with the number of parameters required to run the model. Consequently, we have collaborated and supported the development of the multiple linear regression (MLR) model published by Brix et al. (2017). Initial funding for the development of the model came from the copper industry. The copper industry has also supported and is participating in the CRADA with EPAs Office of Water. The generally positive comments provided by the peer review panel support the use of the MLR models.

We are pleased to see that the State of Washington intends to adopt the copper MLR model and to replace the hardness-based approach. We support this approach and encourage the Department of Ecology to update its aquatic life criteria for copper with this state-of-the-science model.

Comments on the Approach to Establishing Water Quality Criteria (WQC) for Copper

1. We support the use of bioavailability-based WQC and acknowledge that the use of MLR models facilitates their development and application of site-specific water chemistry in effluent permits.
2. It is unfortunate that the acute and chronic models have different slopes and cross over at low copper concentrations - the critical zone. We support the use of the chronic model in preference to the acute model as the primary model. This model has had the most use in many risk assessments and gives the best agreement with the BLM.
3. One could argue that the acute values that are predicted to be lower than the predicted chronic values should be used. However, the acute model lacks robustness at low hardness and low pH because the sensitive species (daphnids) driving the model outputs are not well suited to these conditions. We know that *Ceriodaphnia dubia* does not

reproduce well below a pH of 6.3 in the laboratory. This is suggestive that they may also be experiencing stress in laboratory acute studies at low pH and hardness. Frequently, the daphnids are not acclimated to both low pH and low hardness for 2-3 generations before the studies start.

4. The Department of Ecology (DOE) has derived a cross-over fix using a reverse ACR applied to the chronic MLR criteria. This is a bit complicated for industries having to apply the approach. If DOE proceeds with this, it is recommended that several examples be provided in the Appendix describing how this is to be done using several different water chemistries to make the approach transparent.
5. A simplified approach, rather than the reverse ACR, would be to use the chronic MLR model and apply an ACR to the chronic criterion…. And don't use the acute MLR. The merits of this approach are that the model produces the final chronic value and the ACR is a fixed value. The calculation is simple and easy to use. While the ACR approach has been criticized as being too uncertain for many chemicals, this is not the case for copper. The ACRs for copper, at concentrations near the 5th percentile, are typically in the 1-3 range. As a generalization, when the ACR values are larger than 1-3, the studies performed were at concentrations well above the chronic criterion. In support of this statement, we provided a figure from Brix et al. (2001) showing the change in the cumulative frequency distribution using variable ACRs.

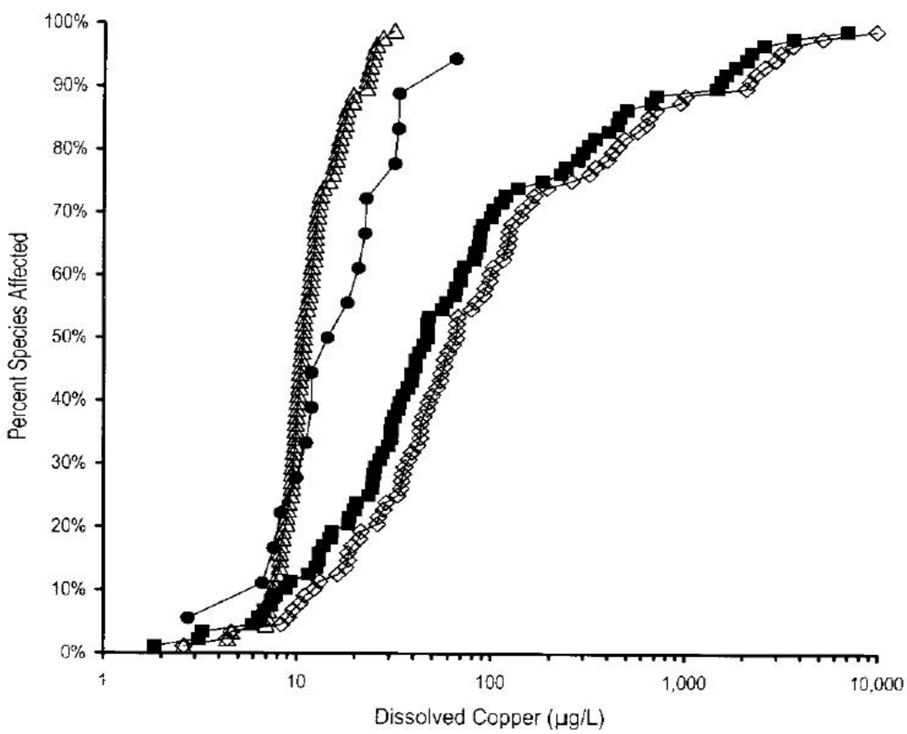

Fig. 5. Empirical cumulative distribution functions based on measured acute and chronic toxicity data compared with estimated chronic cumulative distribution functions using constant and variable ACRs. Acute toxicity (◆), estimated chronic using a constant ACR (■), estimated chronic using adjusted ACR (△), and measured chronic toxicity (●).

6. The proposed approach we suggested may have some consequences in terms of calculating the chronic criterion in the mid-range of pH, and hardness. There is the potential for the estimated chronic values to be somewhat overly conservative. This must be weighed against the complexity of the reverse ACR fix, the degree of conservatism introduced, and the likelihood that the values generated are low enough to be an issue to permits issued in the State of Washington. Will these values be higher than the default values – if so, perhaps they are not an issue for existing permits.

Comments on Document

- Page 77, lines 10-12: Recommended changes are in italics for clarification: "The reverse ACR based equation is calculated by application of the ACR to the chronic criterion followed by division by two to be consistent with *1985 USEPA* methods for CMC calculations *for a final acute value (FAV).*"

Sincerely

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Reference

Brix K, DeForest D, Adams W. 2001. Assessing acute and chronic copper risks to freshwater aquatic life using species sensitivity distributions for different taxonomic groups. Environ. Tox. and Chem., Vol. 20, No. 8, pp. 1846-1856.