International Zinc Association

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International Zinc Association
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September 16, 2021

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Subject: Comments on Triennial Review of Washington Surface Water Quality Standards, Chapter 173-201A WAC

Dear Department of Ecology:

Thank you for the opportunity to provide input to the Department of Ecology (hereinafter, Ecology) on the Triennial Review of Washington Surface Water Quality Standards, Chapter 173-201A WAC. The International Zinc Association (IZA) is a non-profit industry association dedicated to supporting the global market for zinc and the role of zinc in sustainable development. IZA actively supports research programs on the fate and effects of zinc in the environment and supports the adoption of regulatory standards for zinc that reflect the current state-of-the science.

This submittal provides recommendations for the 2021 Triennial Review of Water Quality Standards (WQS) for Washington. Specifically, the recommendations provided here are related to revision of the numeric zinc criteria for protection of freshwater aquatic life to more accurately incorporate bioavailability. The biotic ligand model (BLM) allows for derivation of freshwater criteria based on the toxicity modifying effects of site-specific water chemistry conditions. Given the general recognition of the effectiveness of the BLM as a tool to address the site-specific bioavailability of metals, our recommendations below are succinct and include relevant information for the triennial review process.

The basis for the current hardness-based zinc WQC for protection of freshwater aquatic life in Washington is the U.S. EPA (1987) ambient WQC for zinc. These WQC are no longer consistent with U.S. EPA's nationally recommended WQC for zinc, which were last updated in 1995 (U.S. EPA 1996). Since 1995, a substantial amount of data on the toxicity of zinc to several freshwater species has overwhelmingly demonstrated that multiple water chemistry characteristics, in addition to hardness, influence the bioavailability and toxicity of zinc. Therefore, zinc WQC should be updated to more accurately reflect zinc bioavailability in freshwaters.

As recognized by U.S. EPA (2007), the BLM is an effective framework for incorporating bioavailability into freshwater WQC.

Currently, the BLM is the state-of-the-science tool for understanding zinc bioavailability in freshwaters. Further, the zinc BLM has been applied in a manner consistent with U.S. EPA (1985) guidelines for WQC development (DeForest and Van Genderen 2012), and the outcome of that application represents a technically robust alternative to hardness-based zinc WQC. Additionally, the zinc BLM continues to be validated with toxicity tests conducted in natural waters with unique chemistries[1].

In Ecology's responses to the 2010 triennial review, it was stated that "[b]ecause EPA has worked on the BLM for development of national recommended criteria we suggest that parties interested in offering expertise or advice on how this model should be included in criteria for other metals contact the EPA and become involved at the national level." We therefore would like to take this opportunity to promote awareness of a collaborative research and development agreement (CRADA[2]) between several metals associations and the U.S. EPA to develop simplified bioavailability-based models for use as nationally recommended water quality criteria (WQC) for metals. This agreement was signed in 2017. The types of models being considered as part of the CRADA include BLMs and multiple linear regression (MLR) models. Given the objectives described in the CRADA workplan[3], we anticipate that revised nationally recommended Clean Water Act section 304(a) WQC for zinc will be available within the next 3-5 years. The revised WQC will likely incorporate several toxicity modifying factors (e.g., pH, dissolved organic carbon [DOC], hardness, and/or major ions). Therefore, as a proactive measure, we strongly urge Ecology to encourage measurement of relevant water chemistry characteristics in addition to dissolved metal concentrations and hardness.

As mentioned, the current CRADA efforts[4] are aimed at developing simplified bioavailability-based models for several metals that can be used as WQC. The fact that zinc is being considered in the CRADA efforts is an acknowledgement that bioavailability is viewed as important and that the U.S. EPA is actively exploring options for updating metals WQC to consider bioavailability. For zinc, a BLM already exists, and based on the WQC assessment conducted by DeForest and Van Genderen (2012), a BLM application for zinc WQC is immediately available. However, one

[1] A current collaborative effort with the U.S. Geological Survey, Illinois Natural History Survey, and U.S. Environmental Protection Agency (Region 5) is evaluating the capability of the zinc BLM to predict toxicity to a cladoceran (*Ceriodaphnia dubia*) and a mayfly (*Neocloeon triangulifer*) in natural waters with unique combinations of pH, DOC, and hardness (i.e., https://www.usgs.gov/centers/cerc/science/validation-zinc-and-nickel-biotic-ligand-models-based-toxicity-testing-natural?qt-science_center_objects=0#qt-science_center_objects).

[2] https://www.epa.gov/wqc/cooperative-research-and-development-agreement-aquatic-life-bioavailability-modeling-metals

[3] https://www.epa.gov/sites/production/files/2018-10/documents/metals-crada-workplan-2018.pdf

[4] The CRADA efforts are being driven by input from many technical experts with expertise in metals chemistry, metals toxicology, modeling, statistics, and water quality standards. The technical approach being used in the CRADA efforts is described in a series of publications in *Environmental Toxicology and Chemistry*: Schlekat et al. 2020, Adam et al. 2020, Mebane et al. 2020, Brix et al. 2020, Garman et al. 2020, Van Genderen et al. 2020.

potential outcome of the CRADA effort is that a simplified[5] bioavailability-based model (e.g., MLR model) may become the basis for revised nationally recommended zinc WQC. If Ecology considers use of the copper BLM (U.S. EPA 2007), a simplified bioavailability-based model for zinc may not be necessary. Rather, the regulatory implementation of the zinc BLM, as described by DeForest and Van Genderen (2012) could be the basis for Ecology's revised zinc WQC.

We recognize that one of the primary challenges here will be timing. The CRADA efforts will continue through 2022, and there will likely be some lag time between when the CRADA efforts conclude and nationally recommended freshwater WQC for zinc are updated. In the last responsiveness summary (regarding the comments on the 2010 triennial review), Ecology indicated that their approach for metals WQC "will be to adopt the full suite of updated criteria contained in EPA's list of recommended criteria for aquatic life protection." The only changes U.S. EPA has made within the last 10 years to metals WQC have been for aluminum and cadmium, and that is despite an improved understanding of the role of bioavailability for zinc and several other metals. The public's expectation is that science-based improvements to WQC be made in a timely manner, especially when the tools needed to make those improvements already exist. Therefore, as an interim measure, we recommend that the current state-of-the-science zinc BLM (DeForest and Van Genderen 2012) become the basis for Washington's ambient freshwater zinc WQC. This recommendation is based in part on the uncertainties as to when nationally recommended zinc WQC will be revised and when Ecology will conduct the next triennial review.

Recommendations:

At a minimum, we recommend that Ecology adopt U.S. EPA's current nationally recommended freshwater zinc WQC. However, a more appropriate change would be to move toward bioavailability-based freshwater WQC for zinc. Following are our suggestions for how to revise the freshwater WQC for zinc:

1. Revise the WQS to use the zinc BLM described by DeForest and Van Genderen (2012) as an interim freshwater WQC for zinc.
2. After the CRADA process concludes and the U.S. EPA has revised the nationally recommended freshwater WQC for zinc, revise the WQS to use the U.S. EPA nationally recommended WQC for zinc.

We also recommend that in the near-term, Ecology prepare for bioavailability-based WQC, and as such, Ecology should encourage measurement of dissolved metals and water chemistry characteristics such as pH, DOC, alkalinity, and major ions.

[5] Here, "simplified" indicates that a full chemical speciation approach to bioavailability, as currently implemented in BLMs, would not be used. Rather, a statistical model describing the relationship(s) between toxicity modifying factors and toxicological effect concentrations would be developed.

In summary, the IZA encourages Ecology to adopt bioavailability-based freshwater WQC for zinc. A technically robust BLM-based approach that is consistent with U.S. EPA guidelines for development of WQC is currently available, but based on the current CRADA efforts, we anticipate a revision to the nationally recommended freshwater WQC for zinc within the next 3-5 years. We also anticipate that this revision will be bioavailability-based and therefore implementation will require data for multiple water chemistry characteristics (e.g., pH, DOC, and major ions). We believe that bioavailability-based WQC for zinc represent a fundamental advancement that will serve to achieve appropriate environmental protection and regulation.

Thank you for the opportunity to provide these recommendations for consideration during Ecology's triennial review process. Please let us know if you have any questions or if you would like to discuss these recommendations further.

Sincerely,

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