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Water Quality Program
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Attn: Marla Koberstein

RE: Aquatic Life Toxics Criteria, Chapter 173-201A WAC, Water Quality Standards for Surface Waters of the State of Washington

The Aluminum Association appreciates the opportunity to provide comment on the State of Washington Department of Ecology's (DOE) recent proposed rulemaking "Aquatic Life Toxics Criteria, Chapter 173-201A WAC, Water Quality Standards for Surface Waters of the State of Washington" and "WAC 173-201A-240, Aquatic Life Toxics Criteria Rulemaking Technical Support Document" as noticed on February 15, 2024.

The Aluminum Association (the "Association"), based in Arlington, VA, is the voice of the aluminum industry in the United States, representing aluminum producing companies and their employees that span the entire aluminum value chain from primary production to fabricated aluminum products to aluminum recyclers, as well as industry suppliers. The Association is charged with developing global standards, business intelligence, sustainability research, policy positions, and industry expertise for its member companies, policymakers, and the public. Altogether, Association member companies produce over 70 percent of the aluminum and aluminum products shipped in North America. The U.S. aluminum industry across the value chain directly employs more than 164,000 union and non-union workers and indirectly supports an additional 535,000 workers. Through its activity, the economic impact of the U.S. aluminum industry adds $228 billion to the economy annually.

Member companies own and operate over 200 manufacturing facilities located throughout the United States and multiple member companies operate major aluminum manufacturing facilities in Washington. The Washington aluminum industry is directly responsible for 3,108 jobs, and another 9,858 supplier and induced jobs. In total, the industry contributes $5.01 billion in economic impact to the state. These facilities and their contributions would be directly affected by the revision of the Washington State Aquatic Life Water Quality Criteria. As such, the Association's Water Workgroup has significant interest in the revision of Washington's water quality standards and is providing the comments below for DOE's consideration in finalizing them.

The Association's Water Workgroup has had significant involvement with EPA on its revision of the aluminum water quality criteria, its related implementation guidance development, and consideration of a bioavailable aluminum test method that more accurately represents aluminum toxicity in natural waters. From that background, the Association has the following input on the draft methodology.

Aluminum Water Quality Criteria Revisions [Amendments to WAC 173-201A-240, Table 240]

The Washington proposed rule revises Table 240, the Toxics Substances Criteria. For the first time, DOE is proposing acute and chronic freshwater aquatic life criteria for aluminum as a new toxic. The acute standards are 510 µg/L for the West region and 820 µg/L for the East region and the chronic standards are 270 µg/L for the West and 480 µg/L for the East region. DOE used EPA's 2018 final aluminum water quality criteria standards and the ensuing Aluminum Criteria Calculator V.2.0 to calculate the default criteria. EPA uses a Multi-Linear Regression (MLR) approach that was developed using the most recent science on aluminum toxicity in water. DOE calculated the default criteria using state-specific data from Washington's Environmental Information Management database and the Federal Water Quality Portal and used the 5th percentile of individual model outputs to set the proposed standards. This methodology is consistent with one of the approaches that the EPA outlined for states to use in implementation of the 2018 aluminum criteria.

The Association supports the proposed water quality criteria for aluminum and is happy to see that Washington is taking a leading role among the states in implementing the new criteria in this manner. Furthermore, the Association supports DOE's proposal to allow permittees to gather their site's water chemistry data to calculate site-specific default criteria that may supersede the proposed 5th percentile regional acute and chronic default criteria.

Bioavailability

Aluminum chemistry in surface waters makes it uniquely complex to measure compared to other metals. EPA's criteria were developed using laboratory diluted water that does not contain suspended solids, clays, or particulate matter that aluminum is bound to in natural waters. Thus, in lab water, the amount of aluminum present measured as total recoverable aluminum is essentially the same as the bioavailable fraction. However, natural waters contain a particulate matter fraction measured as total suspended solids (TSS) that do not generally contribute to aluminum toxicity.

The analytical procedure for total recoverable metals involves lowering the pH of the water sample to 2 in nitric or hydrochloric acid, heating and stirring for upwards to 8 hours, and then filtering the sample for final analysis. This processing step dissolves all silicate and organo-metallic aluminum, thus far overpredicting the amount of aluminum that is actually bioavailable under ambient conditions and making the test method unrepresentative for use in assessment of natural waters against water quality criteria.

Aluminum exists in several forms within the water column. There are the dissolved, colloidal, silicate, and organo-metallic forms. Not all these forms are "biologically" available to the aquatic life in the receiving streams. The only forms that are bioavailable are the dissolved and colloidal fractions. Most metals are moving towards measuring only dissolved metals for this reason but the colloidal fraction of aluminum, often AlOH3 or Al(OH)–, can cause aquatic toxicity under certain conditions. For this reason, dissolved aluminum testing may not be sufficient to capture all the toxicity within the water column due to aluminum.

In recognition of this situation, a new test method involving lowering of the pH of the water sample to 4 is being developed through ASTM to measure the bioavailable (dissolved and colloidal) fraction of

aluminum most accurately in waters with TSS components. This test method was recognized by EPA within the preamble of the 2018 aluminum criteria as follows:

> *"The validation of the pH 4 extraction method is still on-going, with the expectation that this approach will better estimate the bioavailable fraction of aluminum in natural waters."*

Unfortunately, this bioavailable test method is still in validation through the ASTM test method development process and is not yet available and approved for use. However, the method has been published in the peer reviewed literature (*Rodriguez P, Arbildua J, Villavicencio G, Urrestarazu P, Opazo M, Cardwell A, Stubblefield W, Nordheim E, and Adams W. 2019. Determination of Bioavailable Aluminum in Natural Waters in the Presence of Suspended Solids. Environ Toxicol and Chem. 38 (8): 1668–1681.*)

In response to the 2018 EPA recommended aluminum criteria, multiple states have implemented bioavailability language into their aluminum water quality criteria. In 2021, EPA finalized Oregon's new aluminum criteria. EPA allows the potential use of bioavailable aluminum test methods in footnote two of the final criteria statement:

> *"These criteria are based on aluminum toxicity studies where aluminum was analyzed using total recoverable analytical methods. Oregon may utilize total recoverable analytical methods to implement the criteria. For characterizing ambient waters, Oregon may also utilize, as scientifically appropriate and as allowable by State and Federal regulations, analytical methods that measure the bioavailable fraction of aluminum (* e.g., *utilizing a less aggressive initial acid digestion, such as to a pH of approximately 4 or lower, that includes the measurement of amorphous aluminum hydroxide yet minimizes the measurement of mineralized forms of aluminum such as aluminum silicates associated with suspended sediment particles or clays). Oregon shall use measurements of total recoverable aluminum where required by Federal regulations."*

As such, Oregon DEQ has chosen to adopt the Rodriguez et al. 2019 bioavailable aluminum test method for use in measuring aluminum concentrations in ambient waters even as it is under consideration as an ASTM approved method. Oregon uses the bioavailable aluminum concentration data for implementation of the aluminum water quality criteria in water quality assessments, permitting, total daily maximum loads, and other state water quality programs, excluding measurement of aluminum in wastewater such as effluent discharges.

Iowa DNR also incorporated bioavailable aluminum analytical methods in its 2020 reconsideration of aquatic life water quality criteria for metals. Within the aluminum criteria, footnote (r) was included that expressed the criteria "as the bioavailable portion of aluminum". Their wording differentiates the aluminum criteria from other metals by acknowledging that the dissolved fraction approved by EPA to measure the bioavailability for most metals would be inadequate to measure total aluminum bioavailability including colloidal forms. The criteria's language allows for flexibility in measuring aluminum that contributes to toxicity and for the adoption of new test methods as soon as they are approved, rather than limiting the criteria to total recoverable aluminum that may not be bioavailable in certain conditions.

Given the situation as described above, the Association requests that the final rule add an additional footnote (qq) for the use of the acute and chronic aluminum criteria, as consistent with other federal and state initiatives, that states:

(qq) the criteria are expressed as the bioavailable portion of aluminum consisting of those concentrations of aluminum which may contribute to toxicity as modeled in the "Final Aquatic Life Ambient Water Quality Criteria for Aluminum 2018 (EPA-822-R-18-001), December 2018." Aluminum concentrations identified through an approved test method which do not contribute to aluminum concentrations considered within this model, including sources from particulate matter which lack bioavailability under ambient conditions, shall be excluded from these criteria.

This proposed revision addresses the misalignment of laboratory water testing conditions versus ambient natural water conditions and provides for use of the new pH 4 method once it has been validated through the ASTM process. The addition of this footnote is in line with and would assist in the promulgation of Washington DOE *Water Quality Policy 1-11, Chapter 2, Ensuring Credible Data for Water Quality Management*, which directs monitoring entities to use new, accredited methods published by EPA and ASTM, among other groups and laboratories, as soon as is practical.

Water Quality Assessment Methodology

Given the adoption of bioavailability language in EPA-approved state aluminum criteria, the Association asks that Washington include provisions in its water quality assessment methodology that contemplates the availability of the bioavailable aluminum test method and data obtained through its use.

A possible template for how to address this is the water quality assessment methodology available through the work that Oregon DEQ has done in considering this issue. In the Oregon draft methodology, it notes:

"EPA considers the 304(a) criteria protective for both total recoverable and bioavailable aluminum when applied to characterize ambient concentration of receiving waters. In the event the bioavailable method is not available for the 2024 Integrated Report listing cycle, if total recoverable aluminum data indicate a waterbody is impaired, then it will be listed in Category 5. When a bioavailable method becomes available and sufficient bioavailable data are collected, a waterbody may be delisted based on such data.

Only bioavailable aluminum
For water bodies with sufficient bioavailable aluminum results to evaluate the data, DEQ will assess the data according to the aquatic life toxics method.

Only total recoverable aluminum
For water bodies where only total recoverable aluminum data are available, if > 5% of total recoverable samples exceed criteria with 90% confidence according to the exact binomial test, the assessment unit will be placed in Category 3B and DEQ will pursue development of a total recoverable to bioavailable aluminum translator and further study the influence of TSS on instream aluminum concentrations for future assessment cycles.

Both bioavailable and total recoverable aluminum

For water bodies with insufficient bioavailable aluminum results, but where a combination of bioavailable and total recoverable, or only total recoverable data is available and > 5% of the combined samples exceed criteria with 90% confidence according to the exact binomial test, the assessment unit will be placed in Category 3B and DEQ will prioritize collection of bioavailable data."

Iowa DNR has adopted an alternative water quality assessment methodology for its aluminum criteria. Total recoverable aluminum can only be used to delist water bodies from impairment if the aluminum measurement is below the criteria, understanding that total recoverable aluminum will include more aluminum than is bioavailable. Dissolved aluminum is only used to classify impaired water bodies if the sample is greater than the acute or chronic threshold, but it cannot determine that there is no violation. Iowa will use bioavailable aluminum data once a test method is approved, and data is available. The table below from *The Methodology for Iowa's 2024 Water Quality Assessment, Listing, and Reporting* describes Iowa DNR's aluminum water quality criteria violation methodology.

Table 1. Determining violations for metals data with criteria-specified fraction or portion

Data Fraction or Portion	Criteria Fraction or Portion Specified in Iowa WQS	Violation if a Sample Result is Greater than Criterion?	Violation if a Sample Result is Less than Criterion?
Dissolved	Dissolved	Yes	No
Total	Total	Yes	No
Dissolved	Total	Yes	No Determination Possible
Total	Dissolved	No Determination Possible	No
Bioavailable Aluminum	Bioavailable Aluminum	Yes	No
Total Aluminum	Bioavailable Aluminum	No Determination Possible	No
Dissolved Aluminum	Bioavailable Aluminum	Yes	No Determination Possible

The Association recommends that concepts similar to those presented above be considered for integration into the Washington water quality assessment methodology such that bioavailable aluminum data collected using an ASTM method:

- Is available for use in Washington water quality assessments,
- Passes DOE data quality and assurance criteria, and,
- Is considered to be a new condition that corrects a flaw due to analytical limitations from a previous assessment cycle.

Conclusion

In addition to these comments, the Association would like to endorse and direct the WA DOE to the comments submitted by NiPERA Inc. et al. raising concerns about the criteria development methodologies for other metals as well as the development and implementation of bioavailability-based criteria.

The Association again thanks DOE for the opportunity to provide comments on Washington's proposed revisions to their aquatic life water quality criteria. If you have any questions or would like to discuss any of these recommendations in greater detail, please do not hesitate to contact me at 703.358.2985 or asmith@aluminum.org.

Sincerely,

Andrew Smith

Andrew Smith
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The Aluminum Association