

Fact Sheet: Final 2018 Aquatic Life Ambient Water Quality Criteria for Aluminum in Freshwaters

Summary

The EPA has published final updated aquatic life ambient water quality criteria recommendations for aluminum in freshwater under Section 304(a)(1) of the Clean Water Act to reflect the latest scientific knowledge. There are not enough data to support the development of estuarine/marine aluminum criteria at this time. Aluminum can inhibit an aquatic organism's ability to regulate salt concentrations and clog fish gills, potentially resulting in death or affecting growth and reproduction.

States and authorized tribes can adopt these criteria into their water quality standards or can adopt other aluminum criteria that is scientifically defensible based on local or site-specific conditions. These final criteria are not a regulation, nor do they impose a legally-binding requirement. These criteria provide information for states to develop science-based standards that reflect site-specific factors and are protective against the effects of aluminum on aquatic life.

Background

The EPA first published criteria for aluminum in 1988. The updated aluminum criteria better reflect the latest science. Studies have shown that three water chemistry parameters – pH, total hardness, and dissolved organic carbon (DOC) – can affect the toxicity of aluminum by affecting the bioavailability of aluminum in the water to aquatic species. Unlike the fixed acute and chronic values found in the 1988 criteria recommendation, these final 2018 recommended criteria provide users the flexibility to develop site-specific criteria based on local water chemistry.

The EPA released a draft of this criteria in 2017 for public comment and has reviewed the comments and updated the document.

What is Aluminum and How Does It Enter the Water?

Aluminum is found in most soils and rocks. It is the third most abundant element and the most common metal in the earth's crust. Aluminum can enter the water via natural processes, like weathering of rocks. Aluminum is also released to water by mining, industrial processes using aluminum, and in waste water and drinking water treated with alum, an aluminum compound.

How Does Aluminum Affect Aquatic Life?

Aluminum is considered a non-essential metal because fish and other aquatic life do not need it to function. Elevated levels of aluminum can affect some species' ability to regulate ions, like salts, and inhibit respiratory functions, like breathing. Aluminum can accumulate on the surface of a fish's gill, leading to respiratory dysfunction, and possibly death. Aquatic plants are generally less sensitive to aluminum than fish and other aquatic life.

What is a Water Chemistry Parameter and Why is it Important?

Bioavailability is the measure of whether a substance in the environment is available to affect living organisms, like fish. The bioavailability of aluminum is dependent on the chemistry of the water. The more bioavailable the aluminum is, the more likely it is to cause a toxic effect. The water chemistry parameters that have the greatest impact on aluminum's bioavailability are pH, total hardness, and DOC.

- pH: a low pH generally makes it easier for aluminum to be dissolved, and therefore more bioavailable. At higher pH, aluminum speciation changes make it more bioavailable.
- Hardness: generally, higher hardness values mean there are more ions present. These ions

compete with aluminum and make aluminum less bioavailable.

- DOC: higher dissolved organic carbon reduces bioavailability. Aluminum is bound to DOC, making the aluminum less bioavailable to aquatic organisms.

What are the Recommended Criteria for Aluminum in Freshwater for the Protection of Aquatic Life?

The recommended aquatic life criteria for aluminum in freshwater depend on a site's water chemistry parameters. Unlike the fixed values found in the 1988 criteria document, these criteria use Multiple Linear Regression (MLR) models to normalize the toxicity data and provide a range of acceptable values. The criteria are calculated based on a site's pH, total hardness, and DOC. See Table 1 for a comparison of 2018 and 1988 criteria values.

For freshwater criteria, users can enter their site's water quality parameters into the *Aluminum Criteria Calculator V.2.0.xlsm* or use the lookup tables in the criteria document's appendix. The resulting acute criterion indicates that freshwater organisms would be protected if the one-hour average concentration is not exceeded more than once every three years on average. The chronic criterion indicates that freshwater organisms would be protected if the four-day average concentration is not exceeded more than once every three years on average.

Where can I find more information?

For more information and to view the aluminum criteria document and the criteria calculator, please visit EPA's website at www.epa.gov/wqc/aquatic-life-criteria-aluminum or email Diana Eignor at eignor.diana@epa.gov.

Table 1: Comparison of the EPA's 2018 and 1988 National Recommended Aquatic Life Criteria for Aluminum

Version	Freshwater Acute ^a (1 hour, total recoverable aluminum)	Freshwater Chronic ^a (4-day, total recoverable aluminum)
2018 Criteria (vary as a function of a site's pH, total hardness, and DOC)	1 - 4,800 µg/L ^b	0.63 - 3,200 µg/L ^b
1988 Criteria (pH 6.5 – 9.0, across all total hardness and DOC ranges)	750 µg/L	87 µg/L

^a Values are recommended not to be exceeded more than once every three years on average.

^b Values will be different under differing water chemistry conditions.