

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

Summary

EPA published a draft update of aluminum aquatic life ambient water quality criteria for freshwaters under Section 304(a)(1) of the Clean Water Act to reflect the latest scientific knowledge. EPA will accept public comment on the draft criteria for 60 days upon publication of the Federal Register notice. Once final, the criteria will serve as recommendations to states and tribes by defining the concentration of aluminum in water that will protect against harmful effects to aquatic life.

Background

EPA first published criteria for aluminum in 1988 to protect aquatic life from harmful effects of aluminum toxicity in freshwaters. 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. EPA is updating the aluminum criteria to better reflect the latest science. Unfortunately, there are not enough data to support the development of estuarine/marine criteria at this time.

Unlike the fixed acute and chronic values found in the 1988 document, this draft document provides users the flexibility to develop site-specific criteria based on a site's water chemistry using the *Aluminum Criteria Calculator V.1.0.xlsx* or by using the lookup tables provided in the criteria appendix. Studies have shown that three water chemistry parameters, pH, dissolved organic carbon (DOC), and hardness, can affect the toxicity of aluminum by affecting the bioavailability of aluminum in the water to aquatic species.

What is Aluminum and How Does it Enter the Water?

Aluminum is found in most soils and rocks and 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 waste 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 don't 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 Quality Parameter and Why is it Important?

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

- 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.

- DOC: higher dissolved organic carbon reduces the bioavailability of aluminum because it binds to form aluminum complexes.
- Hardness: higher hardness values mean there are more ions present that compete with aluminum. This makes aluminum less bioavailable.

What is the Recommended Level of Aluminum in Freshwater for the Protection of Aquatic Life?

The recommended level of aluminum in freshwater depends on a site's water quality parameters. Unlike the fixed values found in the 1988 criteria document, these criteria use a Multiple Linear Regression (MLR) model to normalize the data, and the criteria are based on a site's pH, DOC, and hardness. See Table 1 for a comparison of existing and draft criteria values.

For freshwater criteria, users can put their site's water quality parameters into the *Aluminum Criteria Calculator V.1.0.xlsx* or use the lookup tables in the document's appendix. The resulting acute criterion would have an appropriate level of protection if the one-hour average concentration is not exceeded more than once every three years on average. If the four-day average concentration is not exceeded more than once every three years on average, the chronic criterion is protective.

Where can I find more information?

For more information please visit EPA's website at www.epa.gov/wqc/aquatic-life-criteria-aluminum or contact Diana Eignor at Eignor.Diana@epa.gov.

Table 1: 2017 Draft Aluminum Aquatic Life Criteria Compared to Current 1988 Criteria^a

Version	Freshwater Acute (1 day, total aluminum)	Freshwater Chronic (4-day, total aluminum)
2017 Draft AWQC Criteria (MLR normalized to pH = 7, hardness = 100 mg/L, DOC = 1 mg/L)	1,400 µg/L	390 µg/L
1988 AWQC Criteria (pH 6.5 – 9.0, across all 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.

Note: Values will be different under differing water chemistry conditions as identified in this document.