United States Environmental Protection Agency

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Aquatic Life Ambient Water Quality Criterion for Selenium in Freshwater 2016 – Fact Sheet

Summary

EPA has published the final national chronic aquatic life criterion for the pollutant selenium in fresh water. The 2016 criterion document is the final update of EPA's 1999 recommended national chronic aquatic life criterion for selenium, developed per Clean Water Act section 304(a). The 2016 criterion reflects the latest scientific knowledge, which indicates that selenium toxicity to aquatic life is primarily based on organisms consuming selenium-contaminated food rather than by being exposed only to selenium dissolved in water. The final criterion is expressed both in terms of fish tissue concentration (egg/ovary, whole body, muscle) and water concentration (lentic, lotic).

EPA's water quality criterion for selenium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act. The revised criteria document includes information to help states to develop site specific criteria that account for differing local conditions. In addition, later this year EPA intends to release for public comment draft technical support materials to assist states in addressing implementation questions such as fish tissue monitoring.

Background

EPA developed the 2016 national recommended aquatic life criterion for selenium using the best available science. In 2004, EPA published the first draft of the updated selenium criterion using fish-tissue concentrations. In 2009, EPA participated in an expert workshop on selenium and in 2010 collaborated with the U.S. Geological Survey to develop a selenium bioaccumulation model. As a result, EPA then revised the 2004 draft criterion to include egg-ovary tissue and water column concentrations. In 2014, EPA released the draft criterion for public comment and external peer review. EPA revised the draft criterion accordingly and in 2015 released the draft for a second round of public comment. EPA has considered all public comments and peer reviewer comments in the development of the 2016 final criterion document.

What is Selenium?

Selenium is a naturally occurring element present in sedimentary rocks, shales, coal and phosphate deposits and soils. There are around 40 known selenium-containing minerals but all are rare and generally occur together with sulfides of metals such as copper, zinc and lead.

How Does Selenium Enter Surface Waters?

Selenium can be released into water resources by natural sources via weathering and by anthropogenic sources, such as surface mining, coal-fired power plants, and irrigated agriculture.

How Does Selenium Affect Aquatic Life?

Selenium is a nutritionally essential element for animals in small amounts, but toxic at higher concentrations. Selenium bioaccumulates in the aquatic food chain and chronic exposure in fish and aquatic invertebrates can cause reproductive impairments (e.g., larval deformity or mortality).

Selenium can also adversely affect juvenile growth and mortality.

What are National Recommended Aquatic Life Criteria?

Ambient water quality criteria for the protection of aquatic life are numeric concentrations of pollutants in surface waters that are protective of aquatic life designated uses, with specific recommendations on the duration and frequency of those concentrations. Under Clean Water Act section 304(a), EPA is directed to develop and publish water quality criteria that reflect the latest scientific knowledge. Water quality criteria are based on data and scientific judgments about the relationship between pollutant concentrations and potential environmental and human health effects. EPA's recommended water quality criteria are not rules, nor do they automatically become part of a state's water quality standards. States must adopt into their standards water quality criteria that protect the designated uses of the water bodies within their area. These can include scientifically defensible site-specific criteria that are different from EPA's national recommended criteria, as long as the site-specific criteria are protective of the designated use. Water quality criteria are not effective under the Clean Water Act until they have been adopted into state water quality standards and approved by EPA.

How does the 2016 Criterion compare to the 1999 criteria?

The 2016 selenium criterion document recommends that states and authorized tribes adopt a multi-media criterion into their water quality standards. The criterion has four elements and EPA recommends that states includes all four elements in their standards. The table below compares the 2016 criterion with the 1999 criteria.

Comparison of 2016 Selenium Criterion to 1999 Criteria.

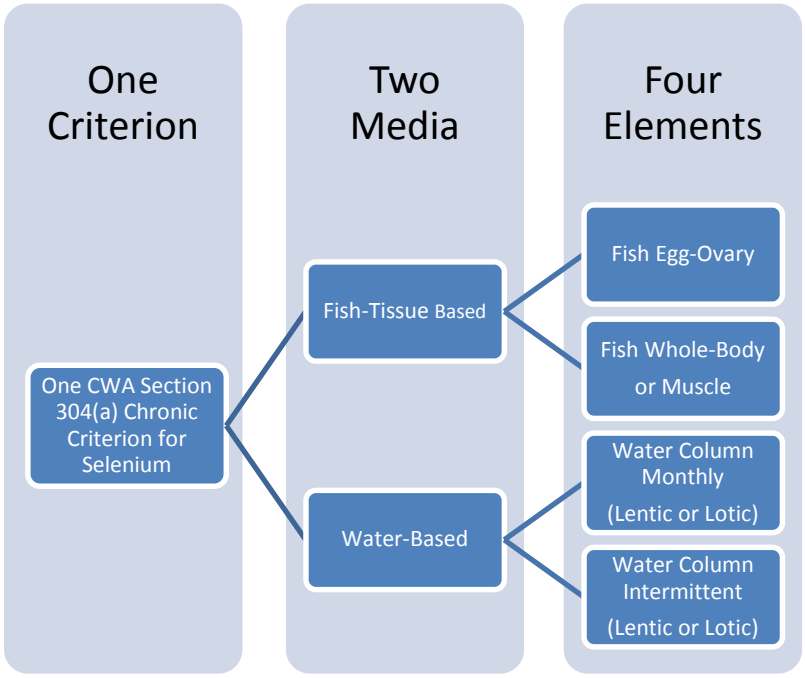
	Chronic					Short-term
Criterion Version	**Egg-Ovary[1]** [mg/kg dw]	**Whole Body[1]** [mg/kg dw]	**Muscle[1]** [mg/kg dw]	**Water Lentic[1]** [µg/L]	**Water Lotic[1]** [µg/L]	**Water[1]** [µg/L]
2016 Selenium Criterion	15.1	8.5	11.3	1.5 (30 day)	3.1 (30 day)	Intermittent exposure equation
1999 Selenium Criteria	N/A	N/A	N/A	5 (4 day)	5 (4 day)	Acute Equation based on water column concentration

1 A note on hierarchy of table: when fish egg/ovary concentrations are measured, the values supersede any whole-body, muscle, or water column elements except in certain situations. Whole body or muscle measurements supersede any water column element when both fish tissue and water concentrations are measured, except in certain situations. Water column values are derived from the egg & ovary concentrations via bioaccumulation modeling. Water column values are the applicable criterion element in the absence of fish tissue measurements, such as waters where fish have been extirpated or where physical habitat and/or flow regime cannot sustain fish populations, or in waters with new discharges of selenium where steady state has not been achieved between water and fish tissue at the site.

2016 Criterion expression:

EPA is recommending a national selenium criterion expressed as four elements (Figure 1). EPA recommends that when implementing the criterion, the fish tissue elements take precedence over the water column elements, except in certain circumstances. All elements are protective against chronic selenium effects, and account for both short term and longer term exposure to selenium. Two elements are based on the concentration of selenium in fish tissue (eggs and ovaries, and whole-body or muscle) and two elements are based on the concentration of selenium in the water-column (two 30-day chronic values and an intermittent value). Aquatic communities are expected to be protected by this chronic criterion from any potential acute effects of selenium.

Figure 1



How to View the Criteria Document and Supporting Information

EPA has established an official public docket for this action under Docket ID No. EPA-HQ-OW-2004-0019, accessed at www.regulations.gov. You may also download the document and supporting information from EPA's aquatic life criteria website at: www.epa.gov/wqc/aquatic-life-criterion-selenium

For more information, please contact Joe Beaman by email at beaman.joe@epa.gov