U.S. EPA's Proposed Rule: Mercury Criterion to Protect Aquatic Life in Idaho

Public Hearing #1

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U.S. Environmental Protection Agency

Office of Water, Water Quality Standards Program

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Proposed Rule

- On April 3, 2024, the EPA Administrator signed a rule proposing a revised water quality criterion to protect aquatic life from the harmful effects of mercury in Idaho water bodies
- The proposed rule was published in the *Federal Register* on April 9, 2024
- The rule proposes to establish mercury levels – which can be measured either as the concentration of mercury in the water column or as the concentration of mercury in fish tissues – that, if not exceeded, will support healthy populations of aquatic organisms in Idaho waters

Background

- Clean Water Act (CWA) section 101(a)(2) establishes a national goal of "water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water," wherever attainable

- To support aquatic life uses, including healthy populations of fish and shellfish, states must establish aquatic life criteria for their surface waters

- States and authorized Tribes must submit any new or revised water quality criteria to the EPA for review, and these water quality criteria must be approved by the EPA before they can be used for CWA purposes such as wastewater discharge permitting (CWA section 303(c)(2)(A) and (c)(3))

Background

- If the EPA disapproves a new or revised water quality criterion because it is inconsistent with the requirements of the CWA, the EPA must notify the state and "specify the changes to meet such requirements;" if the state does not adopt changes to comply with the CWA, the EPA must promptly propose a new or revised water quality criterion (CWA section 303(c)(3) and (4))
- In 2005, Idaho submitted water quality standards (WQS) revisions that removed the state's numeric aquatic life criteria for mercury
  - Idaho stated that the state's existing narrative criteria for toxics (*"[s]urface waters of the state shall be free from toxic substances in concentrations that impair designated beneficial uses…*") would apply instead of the numeric criteria and that the state's existing human health criterion for methylmercury would be protective of aquatic life in most situations
- In 2008, the EPA disapproved these WQS revisions, stating that the previously-approved numeric criteria remained applicable
- As a result of a court order following litigation on that 2008 action, the EPA Administrator was obligated to sign a rule proposing revised aquatic life mercury criteria for Idaho by April 4, 2024

Sources of Mercury

- Mercury is a naturally occurring metal that can be enriched in some mineral deposits and is often present as an impurity in coal
- Mercury can get into water bodies through:
  - deposition of mercury that was released to the air
  - leaching from mercury-containing rocks
  - discharges of wastewater containing mercury
- Human-caused sources of mercury include coal burning, industrial processes, and mining
- Natural sources include volcanoes and hot springs
- Wildfires may also mobilize mercury and result in increased surface water concentrations

Effects of Mercury on Aquatic Life

- Mercury can cause neurological damage in aquatic organisms and has been associated with reduced growth and reproduction
- Aquatic organisms take up mercury more rapidly than they eliminate it, causing mercury to *bioaccumulate* in their tissues
- Mercury also *biomagnifies*, meaning that mercury concentrations in tissues tend to be higher in organisms that are higher on the food chain

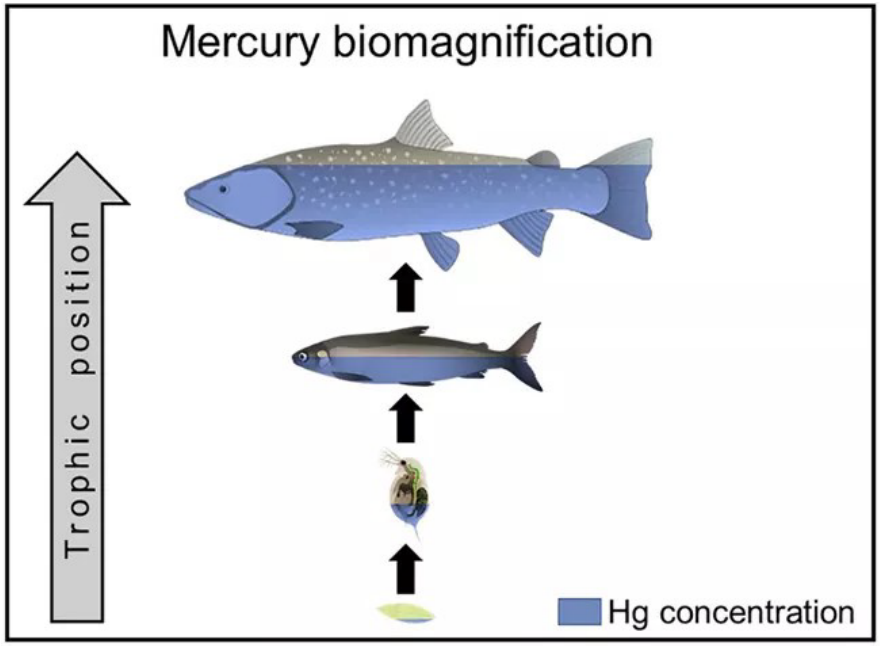

Image source: National Park Service
https://www.nps.gov/articles/000/mercury-lake-trout.htm

Aquatic Life Criteria

- Aquatic life criteria are concentrations of pollutants in surface water (or aquatic life tissues) that are not expected to pose a significant risk to the majority of species in a given environment
- These criteria provide for "the protection and propagation of fish [and] shellfish"
- To develop aquatic life criteria using best available science, the EPA searches for data on a wide variety of aquatic species – including fish, amphibians, and invertebrates – and synthesizes those data according to the EPA's national guidelines for deriving aquatic life criteria
- Generally, aquatic life criteria consist of three components:
  - **Magnitude**: maximum level of the pollutant in the water that will not present a significant risk to aquatic organisms
  - **Duration**: time period over which pollutant levels are averaged before comparison with the magnitude
  - **Exceedance frequency**: how often the magnitude can be exceeded while still ensuring that aquatic life is protected

Idaho Mercury Criterion Development

- The primary route of mercury toxicity to aquatic organisms is via dietary uptake (*i.e.*, consumption of contaminated prey) over time, whereby mercury continues to accumulate in their tissues and can eventually reach levels where it has harmful effects
- The EPA therefore based its mercury criterion on scientific studies in which researchers fed mercury-contaminated food items to aquatic organisms over time and then measured effects related to the organisms' survival, growth, and/or reproduction
- From each study, the EPA recorded the tissue mercury concentration corresponding to a low level of adverse effect that is different from controls but not expected to cause significant effects at the population level
- The EPA then summarized these tissue concentrations by species

Idaho Mercury Criterion Development

- Mercury bioaccumulation varies widely among Idaho species, as expected, in light of mercury's tendency to biomagnify based on the species' diet
- The EPA therefore used a modified method to develop the proposed tissue criterion elements that considered the differences in sensitivity to mercury among species as well as their potential to bioaccumulate mercury
  - First, because the two most sensitive species (amphibians) also had by far the lowest potential to bioaccumulate mercury, the EPA analyzed the effect of removing these two species before calculating the proposed tissue criterion elements; the analysis confirmed that the resulting values were protective of all species, including amphibians
  - Second, the EPA included adjustment factors in the proposed tissue criterion elements to ensure that fish that are higher on the food chain are protected if the only tissue data available are from fish that are lower on the food chain

Idaho Mercury Criterion Development

- Because mercury tends to preferentially accumulate in muscle tissues, fish muscle tissue (fillet) samples are often used to assess tissue mercury levels

- However, only whole-body tissue samples may be available for some fish or other aquatic organisms for which separating out muscle tissue is challenging (*e.g.*, because they are small)

- The EPA therefore developed a muscle – whole body tissue conversion factor from the scientific literature and developed two proposed fish tissue criterion elements (muscle tissue and whole-body tissue), so that either type of sample could be collected and compared to its respective element

Idaho Mercury Criterion Development

- A tissue criterion value can be compared to tissue data collected from organisms in a water body to provide a direct estimate of whether aquatic life in that water body is likely to be experiencing adverse effects; however, tissue data can sometimes be challenging to obtain
- To provide options for implementation, the EPA also developed a proposed water column criterion element using bioaccumulation factors (BAFs) to be used when fish tissue data are unavailable
- BAF = *mercury concentration in tissue / mercury concentration in water*
- The EPA assembled field-collected paired tissue and water mercury data, predominantly from Idaho, and used these data to derive a data set of species-specific mercury BAFs for fish, amphibian, and invertebrate species

Idaho Mercury Criterion Development

- From this BAF data set, the EPA assigned the best-matching BAF (same species if available, taxonomy- or ecology-based match if not) to each species for which tissue-based sensitivity data were available
- The EPA used that BAF to translate the tissue-based sensitivity value to a water column-based sensitivity value, which accounts for both the inherent mercury sensitivity of each species as well as its potential to bioaccumulate mercury
- These water column-based sensitivity values were used to derive the proposed water column criterion element following EPA's national guidelines' calculation method
- If both fish tissue data and water column data are available for the same water body, the EPA is proposing that the fish tissue result take precedence because it is the more direct measure of toxicity

Idaho Mercury Criterion Development

- **Fish tissue criterion elements:** Duration and Frequency
  - **Duration:** *instantaneous measurement,* because a fish tissue sample that is collected at a specific point in time (instantaneous) integrates and represents mercury bioaccumulation over several years
  - **Frequency:** *not to exceed,* because fish tissue mercury concentrations are relatively slow to respond to any decrease in mercury inputs

- **Water column criterion element:** Duration and Frequency
  - **Duration:** *30 days*, considering observed durations of mercury methylation processes affecting trophic transfer and of mercury bioaccumulation and elimination processes in aquatic organisms
  - **Frequency:** *not more than once in three years on average*, based on the ability of an aquatic ecosystem to recover from stress caused by a toxic pollutant such as mercury

Proposed Criterion

Media Type	Fish Muscle Tissue [1, 2, 3] Total Mercury (ng THg/g wet weight)	Fish Whole Body Tissue [1, 2] Total Mercury (ng THg/g wet weight)	Water Column [1,4] Total Mercury (ng/L) in whole water
Magnitude	**225**	**162**	**2.1**
Duration	Instantaneous measurement [5]		30 day average
Frequency	The average tissue concentration must not be exceeded		Not more than once in three years on average

[1] The proposed criterion elements are hierarchical, with both tissue elements superseding the water column element. The fish muscle tissue and fish whole body tissue criterion elements are independently applicable.

[2] Tissue sample measurements must be based on measurement(s) of the total mercury concentration (in a composited tissue sample from each fish species or a central tendency estimate of individual tissue samples from each fish species) collected from a given site or waterbody in a discrete sampling period. These criterion elements support Idaho's aquatic life uses. Only samples of adult life stage trophic level (TL) 4 fish can be directly compared to the muscle or whole-body criterion elements.

[3] If adult life stage TL2 or TL3 fish are sampled, a Bioaccumulation Trophic Adjustment Factor (BTAF) must be applied to the muscle concentrations of those fish. If whole-body tissue from TL2 or TL3 fish is sampled, the fish whole body – muscle conversion factor of 0.72 must be applied to generate a translated muscle value before a BTAF is applied to the sample concentration. A TL2 sampled fish concentration must be multiplied by the TL2 BTAF of 5.6 and the resultant value compared to the muscle tissue criterion element. A TL3 sampled fish concentration must be multiplied by the TL3 BTAF of 3.5 and the resultant value compared to the muscle tissue criterion element. If multiple adults of different TLs are sampled, the TL4 fish result would supersede TL3 BTAF-applied or TL2 BTAF-applied value outcomes. If TL3 and TL2 fish are sampled, the TL3 BTAF-applied values supersede the TL2 BTAF-applied values.

[4] Water column values are based on total mercury in unfiltered or "whole water" samples. Total mercury includes all inorganic and organic species of mercury in the water column. Water samples collected during baseflow conditions would be most representative of the data used to derive this criterion element. This criterion element supports Idaho's aquatic life uses.

[5] Fish tissue data provide integrative measurements that reflect accumulation of mercury over time and space in aquatic organisms from a given site or waterbody in a discrete sampling period.

Next Steps

- For more information on the proposal, please visit the EPA's website: https://www.epa.gov/wqs-tech/mercury-criterion-protect-aquatic-life-idaho
- The EPA will hold a second public hearing on Wednesday, May 29, 2024, 4-6 pm Mountain Time
- The public comment period closes on Monday, June 10, 2024

To Make a Written Comment

You may send comments, identified by Docket ID No. EPA-HQ-OW-2023-0325, by any of the following methods:

- **Online:** https://www.regulations.gov (*our preferred method*). Follow the online instructions for submitting comments.
- **Mail:** U.S. Environmental Protection Agency, EPA Docket Center, Office of Water Docket, Mail Code 28221T, 1200 Pennsylvania Avenue NW, Washington, DC 20460.
- **Hand Delivery or Courier:** EPA Docket Center, WJC West Building, Room 3334, 1301 Constitution Avenue NW, Washington, DC 20004. The Docket Center's hours of operation are 8:30 am to 4:30 pm, Monday through Friday (except Federal Holidays).

All submissions received must include the Docket ID No. EPA-HQ-OW-2023-0325 for this rulemaking. Comments received may be posted without change to www.regulations.gov, including any personal information provided. Once submitted, comments cannot be edited or removed from the docket.