Cadmium Aquatic Life Ambient Water Quality Criteria
Briefing for Deputy Assistant Administrator
March 23, 2016

Purpose of briefing: Obtain DAA's approval for publication of the final cadmium criteria document in the Federal Register

I. Overview of 2016 Final Cadmium Aquatic Life Criteria Update

- Current criteria update revises 2001 acute and chronic freshwater and estuarine/marine criteria
- Updated criteria added toxicity test data for 75 new species to an already robust data set; there were no major changes in scientific approach
- Timeline consideration: Oregon Toxics Lawsuit brought by Northwest Environmental Advocates
    - OST is working to meet a pending consent decree with NWEA to propose acute cadmium criteria for Oregon by March 31, 2016 and finalize by January 16, 2017
        - The consent decree and criteria revision were driven by a jeopardy call for salmonids by NMFS for acute cadmium in 2012 and subsequent EPA disapproval of the state's criteria in 2013
        - EPA determined new data were available to evaluate acute toxicity of cadmium, which led to this criteria update
    - Plan to issue final cadmium criteria on March 30 in time for the March 31, 2016 rule
- Review of the updated criteria document included:
    - Three rounds of Agency Workgroup review
    - External expert peer review (five reviewers)
        - Positive reception; applicable technical recommendations were integrated
    - Public comment period
        - Ten comment letters received (List of commenters attached)
        - Comments from states, industry, NGOs, and other federal agencies (e.g., USGS)

Table 1. Overview of Milestones

Action	Date
Agency Workgroup Review - Draft	4/20/15 – 5/20/15
External Peer Draft Review	8/22/15-10/2/15
Agency Workgroup Review- Revised Draft	11/2/15 – 11/10/15
60 Day Public Comment Period	12/1/15 – 2/1/16
Agency Workgroup Review - Final	3/1/16 – 3/9/16
FRN Publication	3/30/16

Cadmium Occurrence, Uses and Sources of Contamination

- Occurs naturally in the environment at low concentrations, primarily as mineral deposits (e.g., 0.1-0.2 ppm)
- NiCd batteries account for >80% of global consumption; other common industrial uses include pigments, coatings/platings and stabilizers
- More recently used in manufacture of nanoparticles (quantum dots) for photovoltaic devices (e.g., solar cells and emitters for color displays)
- Primary sources to the environment:

- Anthropogenic sources account for > 90% of environmental release
- Major anthropogenic sources: Fossil fuel combustion, cement manufacturing, metal smelting, and phosphate fertilizer application
- Legacy mining sites (e.g., Colorado) represent localized sources

II. 2016 Cadmium Criteria

- **Acute freshwater and acute and chronic estuarine/marine values decrease slightly, while chronic freshwater value increases slightly from 2001 value**
- The freshwater criteria are represented by hardness equations
  - Equation-based criteria reflect differences in bioavailability, and hence toxicity, of cadmium under different water quality conditions
  - Hardness does not affect cadmium toxicity in salt water
- Acute criteria (CMC)= $e^{(0.9789 \times \ln(\text{hardness}) - 3.866)} \times CF$
  - Where CF =conversion factor from total to dissolved cadmium, which is close to 1 at 100 mg/L hardness (0.944)
- Chronic criteria (CCC) = $e^{(0.7977 \times \ln(\text{hardness}) - 3.909)} \times CF$
  - Where CF= 0.909 at 100 mg/L hardness
- The freshwater criteria are captured in the table at a water hardness of 100 mg/L

Table 2. 2016 updated criteria values compared to 2015 draft and existing 2001 current criteria

	2016 Updated Values		2015 FRN Draft Publication Values		2001 Criteria Update	
	Acute (1-hour, dissolved)	**Chronic** (4-day, dissolved)	**Acute** (1-hour, dissolved)	**Chronic** (4-day, dissolved)	**Acute** (1-day, dissolved)	**Chronic** (4-day, dissolved)
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)	**1.8** µg/L[a]	**0.72** µg/L	2.1 µg/L[a]	0.73 µg/L	2.0 µg/L[a]	0.25 µg/L
Estuarine/marine	**33** µg/L	**7.9** µg/L	35 µg/L	8.3 µg/L	40 µg/L	8.8 µg/L

[a] Lowered to protect the commercially and recreationally important rainbow trout, as per 1985 Guidelines

Table 3. Number of tested aquatic species included in criteria derivation over time

	Freshwater Acute	Freshwater Chronic	Estuarine/Marine Acute	Estuarine/Marine Chronic
1980	29	13	31	1
2001	65	21	61	2
2016	101	27	94	2

III. Key Document Changes Based on Public Comment Period

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- Freshwater acute value decreased from the draft value of 2.1 ug/L to 1.8 ug/L
    - Corrected hardness equation to remove all tests with unmeasured concentrations to ensure validity of results
    - Data for salmonids were revised based mainly on commenter input
        - Insensitive life stages removed
        - High outlier values removed because data outside ten-fold range of acceptability and use of different cadmium salt
        - Low outliers removed due to inappropriate salt used to derive high hardness
- Freshwater chronic value decreased from 0.73 ug/L to 0.72 ug/L due to addition of one test
- Estuarine/marine acute value decreased from 35 ug/L to 33 ug/L due to replacement of nonnative with native test species
- Estuarine/marine chronic value decreased from 8.4 ug/L to 7.9 ug/L based on change in acute test species, and used in the acute-to-chronic criterion calculation

IV. Key Comments/Responses with Limited or No Revisions

- **Comment Topic #1**: Change in acute duration from 24 hours to 1 hour is not adequately justified or supported by new studies and may require additional samples to be collected (Utility Water Act Group)
    - A one-hour duration is consistent with 1985 Guidelines:
      "One hour is probably an appropriate averaging period because high concentrations of some materials can cause death in one to three hours. Even when organisms do not die within the first hour or so, it is not known how many might have died due to delayed effects of this short of an exposure. Thus it is not appropriate to allow concentrations above the CMC to exist for as long as one hour."
    - One hour duration is consistent with all prior cadmium criteria revisions (1996, 1985, 1980), with the draft version of the 2001 cadmium update, and with all 45 of the other acute values except freshwater copper (which we are correcting)
    - States generally take single grab samples, which are appropriate for 1 hour duration, not 24 hours
    - Changing the duration to one hour will not affect the expression of WQBELs; consistent with the NPDES regulations (40 CFR 122.45(d)) and WQBEL derivation procedures (EPA's TSD guidance). WQBELs would continue to be expressed in terms of Maximum Daily and Average Monthly averaging periods
- **Comment Topic #2**: Proposed criteria are based on a flawed toxicity test conducted on the amphipod *Hyalella azteca*; which is the most sensitive organism tested (Illinois EPA)
    - Tests were included based on peer reviewer recommendation
    - Test data quality was reviewed and approved by internationally recognized experts in ORD, USGS, and author of the test method
- **Comment Topic #3**: ESA-related (NOAA/NMFS, Center for Biological

Diversity, California State Water Resources Control Board)

- Specific Comment: Criteria must be fully protective of ESA species and must consult with the Services in its criteria recommendations
  - EPA intends to consult with the Services when approving state standards
- Specific Comment: EPA must develop criteria protective of long-lived or sediment ingesting species
  - Most aquatic organisms are considered to be more susceptible to cadmium from direct aqueous exposure rather than their diet; thus, the criteria are protective of long-lived and sediment ingesting species

V. Protection of Listed Species

- **Background**

  On January 31, 2013, EPA took a formal action under the Clean Water Act to disapprove Oregon's freshwater acute cadmium criterion for which NMFS had provided a 2012 jeopardy opinion regarding endangered salmonids. The Reasonable and Prudent Alternatives (RPAs) in the NMFS Biological Opinion (BiOp) outlined a process for deriving a criterion summarized in the following steps:

  1) Use toxicity data specific to salmonids. If new toxicity data become available for green sturgeon and eulachon, then these data should be used in the analysis.

  2) Toxicity data must be curve-fitted where the literature provides the necessary raw data. Note: in this document the term "curve-fitted" is referred to as "concentration-response curve."

  3) The curve-fitted data, or concentration-response curve must be used to extrapolate a threshold acute effects concentration. For example, if the threshold effect is considered to be at LC_5 the concentration on the curve associated with the LC_5 would be considered the threshold effect. The minimum effects thresholds shall be used to derive the criteria instead of using the EPA acute adjustment factor or the acute-to-chronic ratio to derive criteria.

  4) Derived criteria must be model-adjusted to account for chemical mixtures.

  5) An appropriate population model must be applied to the derived criteria, and must predict no negative change in the intrinsic population growth rate.

Ex. 5 - Deliberative Process

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Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Attachment

Public Comment Period Letters Received

1. Florida Department of Environmental Protection
2. Illinois Environmental Protection Agency
3. Wisconsin Department of Natural Resources
4. Kansas Department of Health and Environment
5. Utility Water Act Group (via Hunton and Williams)
6. Hampton Roads Sanitation District
7. US Geological Survey (Chris Mebane)
8. National Marine Fisheries Service
9. Center for Biological Diversity
10. California State Water Resources Control Board

ED_000992_00000015-00007

To: Gude, Karen[Gude.Karen@epa.gov]
Cc: Southerland, Elizabeth[Southerland.Elizabeth@epa.gov]; Lape, Jeff[lape.jeff@epa.gov]; Behl, Betsy[Behl.Betsy@epa.gov]; Gallagher, Kathryn[Gallagher.Kathryn@epa.gov]; Washington, Evelyn[Washington.Evelyn@epa.gov]; Flaherty, Colleen[Flaherty.Colleen@epa.gov]; Ruf, Christine[Ruf.Christine@epa.gov]
From: Conerly, Octavia
Sent: Thur 3/24/2016 1:26:11 PM
Subject: OST submissions for Joel's weekly email to the Administrator

Karen,

Here are our 2 items for Joel's weekly email.

Cadmium

The EPA is in the process of updating the agency's 304(a) cadmium aquatic life ambient water quality criteria for final publication. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species. We released draft updated cadmium aquatic life criteria for public comment on December 1, 2015. The Cadmium FRN is expected to be signed by March 25, 2016 for publication in the Federal Register by March 31, 2016.

Proposed Rule on Oregon Copper and Cadmium Aquatic Life Criteria

EPA is proposing acute cadmium and acute and chronic copper aquatic life criteria for freshwaters under Oregon's jurisdiction to remedy the disapproval of criteria adopted by Oregon and submitted to EPA in 2004. A consent decree with the Northwest Environmental Advocates (NWEA) is expected to be finalized shortly and will require that this proposed rule be signed by March 31, 2016 (and that a final rule be signed by January 16, 2017). **Ex. 5 - Deliberative Process**

Ex. 5 - Deliberative Process

Octavia Conerly

Special Assistant to the Office Director

Office of Science and Technology

1200 Pennsylvania Ave. NW MC 4304T

Room 5231H

Washington, DC 20460

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PHONE: (202) 566-1094

FAX: (202) 566-0441

Update of: *Recommended Aquatic Life Ambient Water Quality Criteria for Cadmium – 2016*

Substance

The EPA is updating the agency's 304(a) cadmium aquatic life ambient water quality criteria for final publication. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species.

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following the EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. The EPA's disapproval triggered a CWA duty for the EPA to propose a replacement criterion for Oregon. The agency is currently negotiating a settlement with the litigants in which the EPA would commit to propose these new cadmium criteria for Oregon by March 31, 2016, and take final rulemaking action by January 16, 2017.

The basis of the EPA's disapproval of Oregon's cadmium criterion (and the EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effect to salmon species based on the EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standard). The 2016 updated freshwater acute criterion is slightly more stringent than the 2001 value. A draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater acute criterion is expected to provide protection for endangered salmonids, based the minimal acute effects level (5%) specified by the NMFS in their Reasonable and Prudent Alternatives. Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Process

Office of Science and Technology partnered within the agency with Office of Research and Development to develop the criteria. The criteria were reviewed by the Office of Research and Development, Office of Chemical Safety and Pollution Prevention, and the Regions (3, 4, 5, 8, 9, and 10) and Office of Policy. The EPA conducted an external contractor-led letter peer review on the criteria document that was completed in 2015. The document was available for a 60-day public comment period which ended February 1, 2016.

Stakeholder Reaction

Ex. 5 - Deliberative Process

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- **Background**

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  4) Derived criteria must be model-adjusted to account for chemical mixtures.

  5) An appropriate population model must be applied to the derived criteria, and must predict no negative change in the intrinsic population growth rate.

Ex. 5 - Deliberative Process

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Ex. 5 - Deliberative Process

Attachment

Public Comment Period Letters Received

1. Florida Department of Environmental Protection
2. Illinois Environmental Protection Agency
3. Wisconsin Department of Natural Resources
4. Kansas Department of Health and Environment
5. Utility Water Act Group (via Hunton and Williams)
6. Hampton Roads Sanitation District
7. US Geological Survey (Chris Mebane)
8. National Marine Fisheries Service
9. Center for Biological Diversity
10. California State Water Resources Control Board

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MEMORANDUM

SUBJECT: Notice of Availability: Recommended Aquatic Life Ambient Water Quality Criteria for Cadmium – 2016 (Tier 3, SAN 5843) - ACTION MEMORANDUM

FROM: Elizabeth Southerland
Director, Office of Science and Technology

TO: Joel Beauvais
Deputy Assistant Administrator

PURPOSE
Attached for your signature is the *Federal Register* notice announcing the U.S. Environmental Protection Agency's release of the Updated Aquatic Life Criteria for Cadmium. The public will be able to access the criteria document through the EPA docket and website www.regulations.gov.

The EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act (CWA).

DEADLINE
The Updated Aquatic Life Criteria for Cadmium needs to be published by March 30, 2015, in order to maintain a timeline set by a potential lawsuit settlement agreement with Northwest Environmental Advocates.

OVERVIEW
The EPA is in the process of updating the agency's 304(a) cadmium aquatic life ambient water quality criteria. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species.

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following the EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. The EPA's disapproval triggered a CWA duty for the EPA to propose a replacement criterion for Oregon. The EPA intends to use the updated criteria document as the scientific basis for the proposed rule. The agency is currently negotiating a settlement with the litigants in which the EPA would commit to propose cadmium criterion for Oregon by March 31, 2016, and take final rulemaking action by January 16, 2017. We proposed the draft criteria for 60 days of public comment on December 1, 2015. The numbers have changed slightly as a result of adopting changes in response to the the public comments.

The basis of the EPA's disapproval of Oregon's cadmium criterion (and the EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effect to salmon species based on the EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standard). The 2016 updated freshwater acute criterion is slightly more stringent than the 2001 value. A draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater acute criterion is expected to provide protection for endangered salmonids, based the minimal acute effects level (5%) specified by the NMFS in their Reasonable and Prudent Alternatives. Ex. 5 - Deliberative Process

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ANTICIPATED PUBLIC AND STAKEHOLDER RESPONSE

Ex. 5 - Deliberative Process

INTERNAL DEVELOPMENT AND REVIEW PROCESS

Office of Science and Technology partnered within the agency with Office of Research and Development to develop the document. The document was reviewed by the Office of Research and Development, Office of Chemical Safety and Pollution Prevention, and the Regions (3, 4, 5, 8, 9, and 10) and Office of Policy. The EPA conducted an external contractor-led letter peer review on the criteria document that was completed in 2015. The document was available for a 60-day public comment period which ended February 1, 2016.

If you need additional information or have questions regarding this notice, please call Elizabeth Behl at (202) 566-0788.

To: Behl, Betsy[Behl.Betsy@epa.gov]; Gallagher, Kathryn[Gallagher.Kathryn@epa.gov]; Flaherty, Colleen[Flaherty.Colleen@epa.gov]
From: Harper, Ashley
Sent: Thur 3/17/2016 12:28:56 PM
Subject: RE: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon

Kathryn, the first is basically the cadmium memo in a slightly different format. I can update it to follow this format and let you look at it.

I think some of the information will overlap for the Oregon rule, but I will let you take a look at that one since I am not as familiar with it.

From: Behl, Betsy
Sent: Thursday, March 17, 2016 8:22 AM
To: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>; Harper, Ashley <harper.ashley@epa.gov>; Flaherty, Colleen <Flaherty.Colleen@epa.gov>
Subject: FW: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon

Kathryn, can you please pull these two items together? Ashley can help

From: Conerly, Octavia
Sent: Thursday, March 17, 2016 8:04 AM
To: Flaherty, Colleen <Flaherty.Colleen@epa.gov>; Behl, Betsy <Behl.Betsy@epa.gov>; Lape, Jeff <lape.jeff@epa.gov>
Cc: Southerland, Elizabeth <Southerland.Elizabeth@epa.gov>
Subject: RE: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon

Good morning All,

Below are lists of items/topics for Joel's weekly email to Gina or to be submitted as a communique. OST is responsible for 2 communiques and a blurb on the White House Summit for the weekly email.

Communiques:

•□□□□□□□□ **Cadmium ALC:** (OST) DAA signature anticipated 3/24. *Included in Admin weekly email on 3/04.*

•□□□□□□□□ **Oregon ALC:** (OST) Administrator signature anticipated 3/31. *(Consent Decree Deadline)*

Weekly email:

•□□□□□□□□ White House Summit

Although there is no real deadline for the communiques, I would recommend that we prepare them so Betsy can send them to Joel by Monday. (See below for material I received for cadmium from Kathryn; attached is an example communique.)

The weekly email items are due to Karen today by 1pm so please send it to me by 12noon.

Cadmium

- EPA is preparing to announce release of the updated national 304(a) recommended aquatic life water quality criteria for cadmium via a March 30, 2016 Federal Register notice. The acute toxicity database for cadmium increased greatly since 2001; there are 27 additional freshwater species and 33 additional saltwater species included in the 2016 acute test dataset that were not in the 2001 dataset. Six new freshwater species chronic tests are also included in the 2016 criteria dataset. The criteria document underwent vigorous internal and external peer review and was released as draft on November 30, 2015 for a 60-day public comment period. EPA revised the draft criteria considering public comments. Once finalized, EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.
    - The driver for updating EPA's cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following a jeopardy call from the National Marine Fisheries Service in 2012 on EPA's 2001 freshwater acute cadmium criteria. As a result of settlement negotiations EPA plans to propose

updated cadmium criteria in rulemaking for Oregon by March 31, 2016 and finalize by January 16, 2017. EPA's updated 304(a) national criteria will be the basis for this rulemaking and is thus being finalized prior to proposal of criteria for Oregon. Region 10 is leading discussions with the National Marine Fisheries Service on cadmium effects on endangered salmonids. OW is providing technical analyses to support these effort; ORD is also supporting the region with technical assistance on this effort.

Thanks in advance.

Octavia Conerly

Special Assistant to the Office Director

Office of Science and Technology

1200 Pennsylvania Ave. NW MC 4304T

Room 5231H

Washington, DC 20460

EMAIL: conerly.octavia@epa.gov

PHONE: (202) 566-1094

FAX: (202) 566-0441

From: Gude, Karen
Sent: Tuesday, March 15, 2016 11:00 AM
To: Greene, Ashley <Greene.Ashley@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>; Nandi, Romell <Nandi.Romell@epa.gov>; Farris, Erika D. <Farris.Erika@epa.gov>; Klasen, Matthew <Klasen.Matthew@epa.gov>
Cc: Campbell, Ann <Campbell.Ann@epa.gov>; Ruf, Christine <Ruf.Christine@epa.gov>; Lousberg, Macara <Lousberg.Macara@epa.gov>; Loop, Travis <Loop.Travis@epa.gov>; Orvin, Chris <Orvin.Chris@epa.gov>; Evalenko, Sandy <Evalenko.Sandy@epa.gov>
Subject: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon

Dear Special Assistants,

Below please find a list of possible topics for the 3/18 Administrator Weekly Email and communiques list. If you could please send the Administrator Weekly Email write-ups no later than noon on Thursday (3/17).

Possible Topics for 3/18 Administrator Weekly Email:

•□□□□□□□□ **Update on Animas/San Juan** (OWOW – Tom Wall). *This is a request from Joel.*

•□□□□□□□□ **Blending** (Placeholder for Joel)

•□□□□□□□□ **Drinking Water Strategy/White House Announcement** (OGWDW)

•□□□□□□□□ **CWSRF Eligibilities Paper** (OWM)

•□□□□□□□□ **NPDES Updates Rule** (OWM)

•□□□□□□□□ **Something on the White House Water Summit?**

-

Communiques:

•□□□□□□□□ **NPDES Construction General Permit:** (OWM) Anticipate RAs signature 3/29. (Erika – Please provide the communique with the review materials/draft permit for Joel, when they are ready.)

•□□□□□□□□ **Cadmium ALC:** (OST) DAA signature anticipated 3/24. *Included in Admin weekly email on 3/04.*

•□□□□□□□□ **Oregon ALC:** (OST) Administrator signature anticipated 3/31. *(Consent Decree Deadline)*

Thank you,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

3/11 Weekly is below for reference:

Administrator and company – Here's the OW weekly update. As noted below, I'll be out of the office on travel to Gulfport next Tuesday afternoon and Wednesday.

NEJAC: Next week I will travel to Gulfport to attend NEJAC, where I'll be participating in a session on water issues. In addition, I'm hoping to attend the Gulf of Mexico Environmental Justice Community Café event where communities along the Gulf of Mexico to have an opportunity to showcase their efforts around community recovery and revitalization and we will be hosting our own table to bring information to Gulf communities in attendance about the tools available to help achieve their goal.

Blending Discussion at CEQ: **Ex. 5 - Deliberative Process**

Ex. 5 - Deliberative Process

Harmful Algal Blooms and Hypoxia Comprehensive Research Plan and Action Strategy: An Interagency Report: Next week, we expect to release the *Harmful Algal Blooms and Hypoxia Comprehensive Research Plan and Action Strategy*, a report highlighting the progress that federal agencies have made over the past decade, and the current state of the science, on HABs and hypoxia. The report responds to the Harmful Algal Bloom and Hypoxia Research and

Control Act and was written by representatives from a 12-member federal interagency working group. The report details gaps in the detection, assessment and mitigation efforts of HABs and hypoxia, as identified by stakeholders around the country, and includes recommendations to better assess, manage, and communicate the risks of HABs and hypoxia in the United States.

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•□□□□□□□□ 55 percent of the nation's river and stream miles do not support healthy populations of aquatic life, as measured by the condition of aquatic insects, and this can lead to loss of fishing and recreational opportunities.

•□□□□□□□□ Rivers and streams are under significant stress from runoff from urban areas, agricultural practices, and wastewater.

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WaterSense Fix a Leak Week: Next week the WaterSense program and its partners will celebrate the 8th annual "Fix A Leak Week" to remind Americans to find and fix common household leaks. We will kick off the event on March 14th with a Twitter party from 2-3 PM. This year we are encouraging partners to incorporate its "Leak Detective" theme in their communities. Partners will host events across the country, and WaterSense will assist two to three communities to amplify their promotional efforts.

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notifying the public of water quality problems. Predictive tools can help anticipate problems due to changing conditions and enable prompt notification.

To: Flaherty, Colleen[Flaherty.Colleen@epa.gov]; Behl, Betsy[Behl.Betsy@epa.gov]; Lape, Jeff[lape.jeff@epa.gov]
Cc: Southerland, Elizabeth[Southerland.Elizabeth@epa.gov]
From: Conerly, Octavia
Sent: Thur 3/17/2016 12:03:44 PM
Subject: RE: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon
Final 304m Communique 3 3 16.docx

Good morning All,

Below are lists of items/topics for Joel's weekly email to Gina or to be submitted as a communique. OST is responsible for 2 communiques and a blurb on the White House Summit for the weekly email.

Communiques:

•□□□□□□□□ **Cadmium ALC:** (OST) DAA signature anticipated 3/24. *Included in Admin weekly email on 3/04.*

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Weekly email:

•□□□□□□□□ White House Summit

Although there is no real deadline for the communiques, I would recommend that we prepare them so Betsy can send them to Joel by Monday. (See below for material I received for cadmium from Kathryn; attached is an example communique.)

The weekly email items are due to Karen today by 1pm so please send it to me by 12noon.

Cadmium

-
- EPA is preparing to announce release of the updated national 304(a) recommended aquatic life water quality criteria for cadmium via a March 30, 2016 Federal Register notice. The acute toxicity database for cadmium increased greatly since 2001; there are 27 additional freshwater species and 33 additional saltwater species included in the 2016 acute test dataset that were not in the 2001 dataset.

Six new freshwater species chronic tests are also included in the 2016 criteria dataset. The criteria document underwent vigorous internal and external peer review and was released as draft on November 30, 2015 for a 60-day public comment period. EPA revised the draft criteria considering public comments. Once finalized, EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

- The driver for updating EPA's cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following a jeopardy call from the National Marine Fisheries Service in 2012 on EPA's 2001 freshwater acute cadmium criteria. As a result of settlement negotiations EPA plans to propose updated cadmium criteria in rulemaking for Oregon by March 31, 2016 and finalize by January 16, 2017. EPA's updated 304(a) national criteria will be the basis for this rulemaking and is thus being finalized prior to proposal of criteria for Oregon. Region 10 is leading discussions with the National Marine Fisheries Service on cadmium effects on endangered salmonids. OW is providing technical analyses to support these effort; ORD is also supporting the region with technical assistance on this effort.

Thanks in advance.

Octavia Conerly

Special Assistant to the Office Director

Office of Science and Technology

1200 Pennsylvania Ave. NW MC 4304T

Room 5231H

Washington, DC 20460

EMAIL: conerly.octavia@epa.gov

PHONE: (202) 566-1094

FAX: (202) 566-0441

From: Gude, Karen
Sent: Tuesday, March 15, 2016 11:00 AM

To: Greene, Ashley <Greene.Ashley@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>; Nandi, Romell <Nandi.Romell@epa.gov>; Farris, Erika D. <Farris.Erika@epa.gov>; Klasen, Matthew <Klasen.Matthew@epa.gov>
Cc: Campbell, Ann <Campbell.Ann@epa.gov>; Ruf, Christine <Ruf.Christine@epa.gov>; Lousberg, Macara <Lousberg.Macara@epa.gov>; Loop, Travis <Loop.Travis@epa.gov>; Orvin, Chris <Orvin.Chris@epa.gov>; Evalenko, Sandy <Evalenko.Sandy@epa.gov>
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Blending Discussion at CEQ: Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

litigation, and our view that this is not an appropriate moment to push forward a significant new policy effort. We will keep you informed of any further developments on this front.

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Office of Water Communications Strategy

Notice of Availability of Updated Aquatic Life Water Quality Criteria for Cadmium

PUBLIC RELEASE DATE: March 30, 2016

KEY INFORMATION:

- The updated criteria values are very similar to what they were in 2001. EPA used the approach we routinely use in developing aquatic life recommended criteria, and added new toxicity data representing over 75 additional species.

- The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a CWA duty for EPA to propose a replacement criterion for Oregon. The updated criteria document provides the scientific basis for our proposed rule.

- The basis of EPA's disapproval of Oregon's cadmium criterion was a 2012 jeopardy Biological Opinion from the National Marine Fisheries Service (NMFS) for acute effect to salmon species. A draft ESA analysis developed by EPA, indicated that the updated freshwater criteria is expected to provide approximately 95% protection for acute exposure to endangered salmonids, a minimal effects level established in the jeopardy opinion.

- Few regulated entities will be affected by the new criteria; as of 2014 there were three companies that produced refined cadmium in the US: one in Tennessee (as a byproduct of zinc production); and one each in Ohio and Pennsylvania (recovered from scrap metal).

ACTION:
EPA is publishing a Federal Register notice informing the public about the release of the final version of the updated national recommended aquatic life water quality criteria for cadmium.

ANTICIPATED REACTION:

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process while the duration is slightly more protective than established in 2001. The duration of the freshwater acute criterion was reduced from 24 hours in the 2001 criteria to 1 hour, consistent with Agency guidance. The chronic criterion is slightly less stringent (higher) than the previous recommendation. The saltwater cadmium criteria are slightly more stringent (lower) than the previous saltwater criteria.

Ex. 5 - Deliberative Process

MATERIALS:

- Desk Statement
- Stakeholder Notification List
- Water Headlines Entry
- Questions and Answers for the Press Office
- Fact Sheet
- Updated webpage

DESK STATEMENT:

EPA is releasing water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters.

The cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. In addition, the effect of total hardness (the amount of dissolved calcium and magnesium in water) on cadmium toxicity was revised with the newly acquired data. The criteria have undergone an external peer review and a 60 day public comment period. The responses to public comments will be released at the same time as the document.

EPA's water quality criteria for cadmium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

More information: http://www.epa.gov/wqc/aquatic-life-criteria-cadmium

Background:
EPA is obligated to publish final updated cadmium criteria by May 30, 2016 as a result of a settlement agreement with the Northwest Environmental Advocates (NWEA).

A brief history of EPA's development of aquatic life criteria for cadmium:

- 1980- U.S. EPA first published AWQC for cadmium.
- 1985- U.S. EPA updated the AWQC criteria; this update superseded 1980 criteria.
- 1996- U.S. EPA updated the AWQC criteria; this update superseded 1985 criteria.
- 2001- U.S. EPA updated the AWQC criteria; this update superseded the 1996 criteria. This update was based on dissolved cadmium to more accurately account for bioavailability and reflected the latest EPA policy for metals risk assessment.
- 2015- EPA published draft updated cadmium criteria for public comment.
- 2016- (Current Action) EPA Published final updated cadmium criteria, which reflects the latest science.

The updated criteria include data for 75 new species and 49 new genera. The freshwater acute criterion for dissolved cadmium is the same as the 2001 acute. The freshwater chronic criterion is slightly higher (i.e., less stringent) compared to the 2001 criterion for dissolved cadmium; this modest increase is primarily due to the inclusion of four new genera, and the reanalysis of other data. As in the 2001 criteria, the draft freshwater acute criterion was derived to be protective of aquatic species and further lowered to protect the commercially and recreationally important rainbow trout. In addition, the duration of the 2016 acute criteria was changed to one hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The estuarine/marine acute and chronic criteria for dissolved cadmium are slightly more stringent than the 2001 recommended criterion, which is primarily due to the addition of new sensitive genera. Changes in suggested values between 2001 and 2016 can be found in Table 1 below.

Ex. 5 - Deliberative Process

[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).
[c] The duration of the 2016 acute criteria was changed to 1-hour to reflect the 1985 Guidelines-based recommended acute duration.

ROLL OUT SCHEDULE:

3/28/16-3/29/16	Key EPA and stakeholder notifications via phone (list below).
3/30/2016	Other EPA and stakeholder notifications via email (list below). Web content goes live. *(*If FRN will publish on 3/30, we will link to it and the docket materials, and webpost the fact sheet. If the FRN is not projected to publish by then, we will webpost a pre-publication version on 3/30 along with the criteria document, public review comment response and fact sheet.)*

NOTIFICATIONS
Communication by: Betsy Behl, Director, Health and Ecological Criteria Division

Upon Signature (expected 3/24/16):

- Email to EPA Regional Water Division Directors
- Phone calls to key stakeholders:
  - National Mining Association, Amanda E. Aspatore (202)463-2646
  - North American Metals Council, Kathleen M. Roberts (443)964-4653
  - International Zinc Association, Eric Van Genderen (919)287-1880
  - International Cadmium Association, no contact information yet
  - National Association of Manufacturers, Rachel Jones 202-637-3175
  - U.S. Fish and Wildlife Services, Gina Schultz, (703)358-1985
  - National Oceanic and Atmospheric Administration, Cathryn Tortorici, 301-427-8495
  - Copper and Brass Fabricators Council, John Arnett 202-833-8575
  - Natural Resource Defense Council, Jon Devine (202)513-6263

Upon FRN Publication (expected 3/30/16):

- Email to Mary Jo Bragan, Regional Lead for distribution to regional and State/Tribal Water Program
- Emails to other interested stakeholders:
  - Association of Clean Water Administrators (ACWA)
  - National Association of Clean Water Agencies (NACWA)
  - Water Quality Standards Managers Association (WQSMA)
  - Environmental NGO List

WATER HEADLINES:
EPA is releasing final updated water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine

systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters. The cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. The criteria underwent an external peer review that was completed in 2015 and a 60 day public comment period. EPA's criteria for cadmium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act. Learn more

QUESTIONS & ANSWERS:

1) What are National Recommended Aquatic Life Criteria?

Ambient water quality criteria for the protection of aquatic life are numeric concentrations of pollutants, with specific recommendations on the duration and frequency of those concentrations, in surface waters that are protective of aquatic life designated uses. 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 solely 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 a state's water quality standards and approved by EPA.

2) What is Cadmium?

Cadmium is a relatively rare, naturally occurring metal found in mineral deposits and distributed ubiquitously at low concentrations in the environment. Cadmium's primary industrial uses are for the manufacturing of batteries, pigments, plastic stabilizers, metal coatings, alloys and electronics. Recently cadmium has been used in manufacturing nanoparticles (quantum dots) for use in solar cells and color displays.

3) How Does Cadmium Enter Surface Waters?

Cadmium enters the environment by natural and human processes, however, human sources, such as mining and urban processes, are responsible for contributing approximately 90 percent of the cadmium found in surface waters.

4) How Does Cadmium Affect Aquatic Life?

Cadmium is a non-essential metal with no biological function in aquatic life. Chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development and behavior in aquatic organisms.

5) Why are the Final Recommended Water Quality Criteria for Cadmium different from the Draft?

Following the 60-day public comment period EPA considered the comments and revised the draft as necessary; as a result:

Ex. 5 - Deliberative Process

The recommended frequency of exceedance for all the above values is no more than once every three years.

6) How Do the 2016 Criteria Compare to the Previously Recommended 2001 Criteria?

Ex. 5 - Deliberative Process

ED_000992_00000189-00006

Ex. 5 - Deliberative Process

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.
[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).
[c] The duration of the 2016 acute criteria was changed to 1 hour to reflect the 1985 Guidelines-based recommended acute duration.

7) What is EPA doing to help ensure these criteria protect threatened and endangered species?

The criteria document contains an analysis of the protectiveness of the draft criteria for threatened and endangered species using all available quality toxicity test data for species listed under the Endangered Species Act that have been tested for sensitivity to cadmium. EPA is also conducting a detailed analysis of the protectiveness of the draft criteria for endangered salmon to address the National Marine Fisheries Service concerns regarding the protectiveness of the acute cadmium criteria.

8) Is there litigation driving EPA's schedule for this updated criteria? What does the litigation entail?

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a Clean Water Act duty for EPA to propose a replacement criterion for Oregon. EPA intends to use the updated criteria document as the scientific basis for a rulemaking to propose criteria for Oregon.

The basis of EPA's disapproval of Oregon's cadmium criterion (and EPA's resultant duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species based on EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated acute criterion has not changed from 2001, the duration of the acute criterion was made more protective (decreased from 24 to one hour). A draft Endangered Species Act analysis prepared by EPA indicates that the updated freshwater criteria are expected to provide approximately 95 percent protection for acute exposure to endangered salmonids, a minimal effects level associated with the jeopardy opinion.

9) Cadmium is listed as a contaminant from the Animas river spill in Colorado this summer, how will this document effect that?

States affected by the Animas River spill (CO, NM, AZ) will be using their currently adopted criteria that protect the designated uses of the water bodies within their area for the clean-up. States

may have either adopted the 2001 criteria or adopted alternative scientifically defensible criteria for their waters. Water quality criteria are not effective under the Clean Water Act until they have been adopted into a state's water quality standards and approved by EPA.

10) Are regulated entities expected to be affected by EPA's new cadmium criteria?

States are may adopt the new criteria or set new scientifically defensible criteria for cadmium as part of state water quality standards for cadmium. If states adopt the new cadmium 304(a) criteria recommendation we expect that few regulated entities will be affected because EPA's updated criteria values are very similar to what we recommended in 2001 so, we do not expect state adoption of them to significantly affect such companies.

ED_000992_00000189-00008

United States Environmental Protection Agency

Office of Water
EPA 822-F-16-003
March 2016

Aquatic Life Ambient Water Quality Criteria Update for Cadmium - 2016

Summary

EPA is updating its national recommended ambient water quality criteria for cadmium in order to reflect the latest scientific information. The updated criteria reflect the inclusion of many new laboratory aquatic toxicity tests with cadmium published since EPA's 2001 criteria document. In addition, the effect of total hardness on cadmium toxicity was also revised using the newly acquired data. The updated criteria document has undergone an external peer review that was completed in 2015 and a 60 day public comment period.

EPA's water quality criteria for cadmium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

Background

EPA published the original national recommended cadmium aquatic life criteria in 1980 with subsequent revisions in 1985, 1990, 1996 and 2001. In 1985, acute toxicity values were lowered to better protect rainbow trout, the most sensitive species. In 2001, criteria were developed for dissolved cadmium instead of total recoverable cadmium to more accurately account for bioavailability and reflect the latest EPA policy for metals risk assessment. Each update has included updated science and additional aquatic toxicity studies. EPA developed the 2016 national recommended aquatic life criteria for cadmium using the best available science.

What is Cadmium?

Cadmium is a relatively rare, naturally occurring metal found in mineral deposits and distributed ubiquitously at low concentrations in the environment. Cadmium's primary industrial uses are manufacturers of batteries, pigments, plastic stabilizers, metal coatings, alloys and electronics. Recently cadmium has been used in manufacturing nanoparticles for use in solar cells and color displays.

How Does Cadmium Enter Surface Waters?

Cadmium enters the environment by natural and human processes, however, human sources, such as mining and urban processes, are responsible for contributing approximately 90 percent of the cadmium found in surface waters.

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Cadmium is a non-essential metal with no biological function in aquatic life. Acute exposure causes increased mortality in aquatic organisms. Chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development and behavior in aquatic organisms.

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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 solely 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.

What Are the 2016 Recommended Water Quality Criteria for Cadmium?

EPA recommends the:

Ex. 5 - Deliberative Process

The recommended frequency of exceedance for the above is no more than once every three years.

How Do the 2016 Criteria Compare to the Previously Recommended 2001 Criteria?

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

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-2015-0753, accessed at www.regulations.gov. You may also download the document and supporting information from EPA's aquatic life criteria website at: http://www.epa.gov/wqc/aquatic-life-criteria-cadmium

Where can I find more information?

Please contact Mike Elias by email at elias.mike@epa.gov.

United States Environmental Protection Agency

Office of Water
EPA XXX-X-XX-XX
March 2016

Aquatic Life Ambient Water Quality Criteria Update for Cadmium - 2016

Summary

EPA is updating its national recommended ambient water quality criteria for cadmium in order to reflect the latest scientific information. The updated criteria reflect the inclusion of new laboratory aquatic toxicity tests with cadmium published since EPA's 2001 criteria document. In addition, the effect of total hardness on cadmium toxicity was also revised using the newly acquired data. The updated criteria document has undergone an external peer review that was completed in 2015 and a 60 day public comment period.

EPA's water quality criteria for cadmium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

Background

EPA published the original national recommended cadmium aquatic life criteria in 1980 with subsequent revisions in 1985, 1990, 1996 and 2001. In 1985, acute toxicity values were lowered to better protect rainbow trout, the most sensitive species. In 2001, criteria were developed for dissolved cadmium instead of total recoverable cadmium to more accurately account for bioavailability and reflect the latest EPA policy for metals risk assessment. Each update has included updated science and additional aquatic toxicity studies. EPA developed the 2016 national recommended aquatic life criteria for cadmium using the best available science.

What is Cadmium?

Cadmium is a relatively rare, naturally occurring metal found in mineral deposits and distributed ubiquitously at low concentrations in the environment. Cadmium's primary industrial uses are manufacturers of batteries, pigments, plastic stabilizers, metal coatings, alloys and electronics. Recently cadmium has been used in manufacturing nanoparticles for use in solar cells and color displays.

How Does Cadmium Enter Surface Waters?

Cadmium enters the environment by natural and human processes, however, human sources, such as mining and urban processes, are responsible for contributing approximately 90 percent of the cadmium found in surface waters.

How Does Cadmium Affect Aquatic Life?

Cadmium is a non-essential metal with no biological function in aquatic life. Acute exposure causes increased mortality in aquatic organisms. Chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development and behavior in aquatic organisms.

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 solely 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.

What Are the 2016 Recommended Water Quality Criteria for Cadmium?

Ex. 5 - Deliberative Process

How Do the 2016 Criteria Compare to the Previously Recommended 2001 Criteria?

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

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-2015-0753, accessed at www.regulations.gov. You may also download the document and supporting information from EPA's aquatic life criteria website at: http://www.epa.gov/wqc/aquatic-life-criteria-cadmium

Where can I find more information?

Please contact Mike Elias by email at elias.mike@epa.gov.

To: Lousberg, Macara[Lousberg.Macara@epa.gov]; Bethel, Heidi[Bethel.Heidi@epa.gov]
Cc: Southerland, Elizabeth[Southerland.Elizabeth@epa.gov]; Behl, Betsy[Behl.Betsy@epa.gov]; Flaherty, Colleen[Flaherty.Colleen@epa.gov]; Wood, Robert[Wood.Robert@epa.gov]; Zipf, Lynn[Zipf.Lynn@epa.gov]; Lape, Jeff[lape.jeff@epa.gov]; Hisel-Mccoy, Sara[Hisel-McCoy.Sara@epa.gov]; Washington, Evelyn[Washington.Evelyn@epa.gov]
From: Conerly, Octavia
Sent: Fri 3/4/2016 3:49:37 PM
Subject: OST Items for Joel's weekly email to Gina

Good morning Macara,

Here are the items that Joel requested for his weekly email.

Complaint re: Numeric Nutrient Criteria for Missouri Lakes

The Missouri Coalition for the Environment Foundation filed a lawsuit on February 24, 2016 alleging that EPA has a nondiscretionary duty to promulgate new or revised numeric nutrient criteria for Missouri lakes and reservoirs. Under the Clean Water Act, if EPA disapproves a state's water quality standards and the state does not make necessary changes, then EPA must "promptly" publish proposed regulations and promulgate 90 days after proposal unless the state adopts standards in the interim that EPA determines are in accordance with the Act. On August 16, 2011, EPA Region 7 disapproved numeric criteria for total nitrogen, total phosphorus, and chlorophyll *a* for lakes and reservoirs that Missouri Department of Natural Resources (MDNR) submitted to EPA in 2009. Region 7 disapproved the criteria concluding that the methods used and analyses conducted by MDNR to develop the criteria were not based on sound scientific rationale. In addition, Region 7 concluded that MDNR failed to demonstrate that the criteria would protect the designated aquatic life and recreational uses.

Ex. 5 - Deliberative Process

Cadmium

We are updating the 2001 cadmium criteria to reflect substantial new toxicity data. We released draft updated cadmium aquatic life criteria for public comment on December 1, 2015. We are currently reviewing the public comments and revising the document and will publish the final updated cadmium criteria by March 31, 2016.

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TOPIC 6: ESA considerations

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	**Ex. 5 - Deliberative Process**	*None*
EPA-HQ-OW-2015-0753-0014	*To ensure the final cadmium water quality criteria to is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*	Thank you for your comment.	*None*

EPA HQ-OW-2015-0753-0009	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to account for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0009	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*	Please see response to comment above.	

EPA HQ-OW-2015-0753-0015	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a Section 7 Consultation.*	Thank you for your comment.	*None*
EPA HQ-OW-2015-0753-0015	*EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.*	**Ex. 5 - Deliberative Process**	

	Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0015	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0015	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*	**Ex. 5 - Deliberative Process**	

EPA HQ-OW-2015-0753-0015	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*	**Ex. 5 - Deliberative Process**	

OW Responses - Water Utility Meeting
Thursday, December 10, 2015

12:00 p.m. – 1:00 p.m.
Room 3233 EPA East, 1201 Constitution Avenue, N.W.

AGENDA

1. **Introduction and Remarks** from EPA's Office of Water Acting Deputy Assistant Administrator Joel Beauvais

2. **Anticipated Proposed Rules** (between now and the end of year) –

Ex. 5 - Deliberative Process

- Chronic Ambient Water Quality Criteria for Conductivity; SAN 5597 Jan 5 AA signs
- Selenium Ambient Water Quality Criteria for the Protection of Aquatic Life; SAN 5213 AA sign Jan 26

Requested by Claudio Ternieden, Government Affairs, Water Environment Federation - WEF

Comments/Questions:
Aside from the Phase II Stormwater Remand Rule – what other proposals if any – EPA intends to publish this year?

OW Response:
See attachment (Actions likely to be released near the end of 2015)

3. Phase II Stormwater Rule Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

- Following release of the proposed rule, the public will be given 60 days to submit comments and information to EPA on any of the proposed regulatory options.

4. **Update on Criteria Development** (Betsy Southerland)
Requested by Claudio Ternieden, Government Affairs, Water Environment Federation – WEF

Comments/Questions:
What is the status of any criteria EPA is working on including but not limited to, Bacteriophage?

OW Response:

Selenium

- EPA published an "External Peer Review" version of the draft criterion document in May 2014, accepted comments from the public, and submitted the draft to a contractor-led external expert peer review panel to ensure that the Agency was using the best available science.
- EPA incorporated changes reflecting comments from the peer review panel, as well as the public, and released the draft criterion to solicit another round of scientific views from the public on July 27, 2015.
- The extended comment period closed on October 30, 2015.
- EPA is currently reviewing the public comments.

Conductivity

- EPA is developing a draft recommended field-based method for states to develop ambient aquatic life water quality criteria for conductivity.

- The field-based method will allow states to develop science-based conductivity criteria that appropriately reflect ecoregional- or state-specific factors such as background conductivity and ionic and aquatic community composition.
- The draft method underwent two contractor-led, independent external peer reviews in November 2014 and July 2015.
- EPA is planning to release the draft method for public comment in early 2016.

Cadmium

- EPA released draft updated cadmium aquatic life criteria for public comment on December 1, 2015. Comments must be received on or before February 1, 2016.
- EPA updated the 2001 cadmium criteria to reflect the latest scientific information. The update reflects substantial new toxicity data on sensitive species, but maintains hardness-based equation approach.

Aluminum

- EPA is updating the 1988 aluminum criteria to reflect the latest scientific information, including data on the effects of pH on aluminum toxicity.
- The updated aluminum criteria will be equation-based to reflect effect of water chemistry (pH and hardness) on toxicity
- The draft criteria will soon undergo external peer review.
- EPA is aiming to release the draft criteria for 60-day public comment period in early 2016.

Copper Biotic Ligand Model (BLM)

Freshwater

- EPA has developed a technical support document for the 2007 freshwater copper biotic ligand model (BLM) to estimate model inputs to derive copper criteria when data are lacking.
- The document recently underwent external peer review.
- EPA is aiming to publish the draft for 30-day public comment in early 2016.

Saltwater

- EPA is also developing a draft aquatic life criteria document for saltwater copper.

- The draft criteria will soon undergo external peer review.
- EPA expects to issue a draft in early 2016 for 60-day public comment.

Coliphage

- EPA is planning to have an Experts Workshop on coliphage in February 2016 followed by a fact sheet summarizing the meeting proceedings.
- EPA will continue to do outreach and hold listening sessions in multiple venues, including the Beach Conference.

HABs Recreational Criteria

- EPA is aiming to propose recreational criteria for microcystin and cylindrospermopsin in late 2016. This work builds on EPA's June 2015 health advisories for these two cyanotoxins.

Human Health Criteria Updates

- EPA is updating the remaining human health criteria (~24 chemicals) that were not updated in June 2015. EPA plans to release the drafts for 60-day public comment in spring 2016.

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2. Anticipated Proposed Rules (between now and the end of year)
   Aside from the Phase II Stormwater Remand Rule – what other proposals if any – EPA intends to publish this year?

FYI: Joel/Ellen to lead the discussion. The ODs/office representatives should be prepared to respond to specific questions related to the regs.

The Water Policy Staff created the following chart for Joel/Ellen to lead the discussion.

Rules to release by December, 2015

Ex. 5 - Deliberative Process

Criteria, General Permits or Congressional Reports to be released near the end of 2016

- Clean Watersheds Needs Survey 2012 Report to Congress; SAN 5695 Mid-late Dec, 2016 for AO signature
- National Coastal Condition Assessment Report 2010 DAA signs the week of Dec 21
- Chronic Ambient Water Quality Criteria for Conductivity; SAN 5597 Jan 5 AA signs

- Report on the Allotment of Funds for the Clean Water State Revolving Fund; SAN 5821 Administrator signature Jan 18

- National Pollutant Discharge Elimination System Pesticide General Permit (PGP); SAN 5812 RA sign mid-late Jan, 2016

- Selenium Selenium Ambient Water Quality Criteria for the Protection of Aquatic Life; SAN 5213 AA sign Jan 26

3. Phase II Stormwater Rule

What should we expect EPA's general approach in the rule to be?

4. Update on Criteria Development

What is the status of any criteria EPA is working on including but not limited to, Bacteriophage?

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Human Health Criteria Updates

- EPA is updating the remaining human health criteria (~24 chemicals) that were not updated in June 2015. EPA plans to release the drafts for 60-day public comment in spring 2016.

Draft Aquatic Life Ambient Water Quality Criteria Cadmium -2015

PUBLIC RELEASE DATE: Monday, November 30, 2015*

ACTION: EPA is requesting public comment on a draft version of the updated national recommended aquatic life water quality criteria for cadmium.

ANTICIPATED REACTION:

Ex. 5 - Deliberative Process

MATERIALS:

- Desk Statement
- Stakeholder notification list
- Water Headline entry
- Questions and Answers for Press Office
- Fact Sheet

DESK STATEMENT:

EPA is requesting public comment on draft water quality criteria for aquatic life for the metal cadmium. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters.

The draft cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. The draft criteria has undergone an external peer review that was completed in 2015. EPA will accept public comments on the draft criteria for 60 days after publication in the Federal Register. EPA will consider the comments and revise the criteria. Once finalized, EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act. More information:
http://www.epa.gov/wqc/aquatic-life-criteria-cadmium

ROLL-OUT SCHEDULE

11/24/15 - 11/27/15	Key EPA and stakeholder notifications via phone (list below).
11/30/15 or 12/1/15	Other EPA and stakeholder notifications via email (list below). Web content goes live. *(*If FRN will publish on 11/30 or 12/1, we will link to it and the docket materials, and webpost the fact sheet. If the FRN is not projected to publish by then, we will webpost a pre-publication version on 11/30 along with the criteria document, peer review comments and fact sheet.)*

NOTIFICATIONS

Communication by: Betsy Behl, Director, Health and Ecological Criteria Division

Upon Signature (expected 11/24/15):

- Email to EPA Regional Water Division Directors
- Phone calls to key stakeholders:
  - National Mining Association, Amanda E. Aspatore (202)463-2646
  - North American Metals Council, Kathleen M. Roberts (443)964-4653
  - International Zinc Association, Eric Van Genderen (919)287-1880
  - International Cadmium Association, no contact information yet
  - National Association of Manufacturers, Rachel Jones 202-637-3175
  - U.S. Fish and Wildlife Services, Gina Schultz, (703)358-1985
  - National Oceanic and Atmospheric Administration, Cathryn Tortorici, 301-427-8495
  - Copper and Brass Fabricators Council, John Arnett 202-833-8575
  - Natural Resource Defense Council, Jon Devine (202)513-6263

Upon FRN Publication (expected 11/30/15):

- Email to Mary Jo Bragan, Regional Lead for distribution to regional and State/Tribal Water Program
- Emails to other interested stakeholders:
  - Association of Clean Water Administrators (ACWA)
  - National Association of Clean Water Agencies (NACWA)
  - Water Quality Standards Managers Association (WQSMA)
  - Environmental NGO List

WATER HEADLINES:

EPA is requesting public comment on draft water quality criteria for aquatic life for the metal cadmium. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters. The draft cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. The draft criteria underwent an external peer review that was completed in 2015. EPA will accept public comments on the draft criteria for 60 days after publication in the Federal Register. Once finalized, EPA's criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act. Learn more

QUESTIONS & ANSWERS:

1) What are National Recommended Aquatic Life Criteria?

Ambient water quality criteria for the protection of aquatic life are numeric concentrations of pollutants, with specific recommendations on the duration and frequency of those concentrations, in surface waters that are protective of aquatic life designated uses. 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 solely 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 a state's water quality standards and approved by EPA.

2) What is Cadmium?

Cadmium is a relatively rare, naturally occurring metal found in mineral deposits and distributed ubiquitously at low concentrations in the environment. Cadmium's primary industrial uses are for the manufacturing of batteries, pigments, plastic stabilizers, metal coatings, alloys and electronics. Recently cadmium has been used in manufacturing nanoparticles (quantum dots) for use in solar cells and color displays.

3) How Does Cadmium Enter Surface Waters?

Cadmium enters the environment by natural and human processes, however, human sources, such as mining and urban processes, are responsible for contributing approximately 90 percent of the cadmium found in surface waters.

4) How Does Cadmium Affect Aquatic Life?

Cadmium is a non-essential metal with no biological function in aquatic life. Chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development and behavior in aquatic organisms.

5) What Are the 2015 Draft Recommended Water Quality Criteria for Cadmium?

In the 2015 draft, EPA recommends:

- the one-hour freshwater acute criterion maximum concentration not exceed 2.1 µg/L.
- the four-day average freshwater chronic criterion magnitude not exceed 0.73µg/L.
- the one-hour estuarine/marine acute criterion maximum concentration not exceed 35 µg/L.
- the four-day average estuarine/marine chronic criterion magnitude not exceed 8.3 µg/L.

The recommended frequency of exceedance for the above is no more than once every three years.

6) How Do the Draft 2015 Criteria Compare to the Previously Recommended 2001 Criteria?

The draft 2015 updated criteria reflect data for 70 new species and 49 new genera. The draft 2015 freshwater acute criterion (2.1 micrograms per liter) for dissolved cadmium is approximately the same as the 2001 acute criterion (2.0 micrograms per liter). The draft 2015 freshwater chronic criterion (0.73 micrograms per liter) for dissolved cadmium is slightly higher (less stringent) compared to the 2001 criteria (0.25 micrograms per liter). These modest increases are primarily due to the inclusion of new toxicity studies. As in the 2001 criteria, the draft 2015 freshwater acute criterion was derived to be protective of endangered species and lowered further to protect the commercially and recreationally important rainbow trout. In addition, the duration of the 2015 acute criteria was changed to 1-hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The draft 2015 estuarine/marine acute criterion for dissolved cadmium (35 micrograms per liter) is slightly lower (more stringent) than the 2001 acute criterion (40 micrograms per liter), which is primarily due to the addition of new toxicity studies for sensitive genera. The draft 2015 estuarine/marine chronic criterion (8.3 micrograms per liter) is also slightly more stringent than the 2001 chronic criterion (8.8 micrograms per liter), due the consideration of more species in the chronic criterion development. Changes in suggested values between 2001 and 2015 can be found in Table 1 below.

Table 1. Summary of 2001 and 2015 Draft Aquatic Life AWQC for Cadmium.

	2015 AWQC Update		2001 AWQC	
	Acute (1-hour, dissolved Cd)[c]	Chronic (4-day, dissolved Cd)	Acute (1-day, dissolved Cd)	Chronic (4-day, dissolved Cd)
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)[a]	2.1 µg/L[b]	0.73 µg/L	2.0 µg/L[b]	0.25 µg/L
Estuarine/marine	35 µg/L	8.3 µg/L	40 µg/L	8.8 µg/L

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.
[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).
[c] The duration of the 2015 acute criteria was changed to 1-hour to reflect the 1985 Guidelines-based recommended acute duration.

7) What is EPA doing to help ensure these criteria protect threatened and endangered species?

The draft criteria document contains an analysis of the protectiveness of the draft criteria for threatened and endangered species using all available quality toxicity test data for species listed under the Endangered Species Act that have been tested for sensitivity to cadmium. EPA is also conducting a detailed analysis of the protectiveness of the draft criteria for endangered salmon to address the National Marine Fisheries Service concerns regarding the protectiveness of the acute cadmium criteria.

8) Is there litigation driving EPA's schedule for this updated criteria? What does the litigation entail?

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a Clean Water Act duty for EPA to propose a replacement criterion

for Oregon. EPA intends to use the updated criteria document as the scientific basis for a rulemaking to propose criteria for Oregon.

The basis of EPA's disapproval of Oregon's cadmium criterion (and EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species based on EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

9) Cadmium is listed as a contaminant from the Animas river spill in Colorado this summer, how will this document effect that?

Because this is a draft document states will not be required to adopt the criteria or set new scientifically defensible criteria for cadmium as part of the state's water quality standards until the national ambient water quality update for cadmium is final.

States affected by the Animas river spill (CO, NM, AZ) will be using their currently adopted criteria that protect the designated uses of the water bodies within their area for the clean-up. States may have either adopted the 2001 criteria or adopted alternative scientifically defensible criteria for their waters. Water quality criteria are not effective under the Clean Water Act until they have been adopted into a state's water quality standards and approved by EPA.

10) Are regulated entities expected to be affected by EPA's new cadmium criteria?

EPA is publishing a draft criteria document at this time. States are not required to adopt the criteria or set new scientifically defensible criteria for cadmium as part of state water quality standards until EPA's national ambient water quality update for cadmium is final. Once states adopt their new cadmium criteria we expect that few regulated entities will be affected because, as of 2014, there were only three companies that produced refined cadmium in the United States. In addition, EPA's draft updated criteria values are very similar to what we recommended in 2001 so, once finalized, we do not expect state adoption of them to significantly affect such companies.

Update of: *Recommended Aquatic Life Ambient Water Quality Criteria for Cadmium – 2016*

Substance

The EPA is updating the agency's 304(a) cadmium aquatic life ambient water quality criteria for final publication. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species.

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following the EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. The EPA's disapproval triggered a CWA duty for the EPA to propose a replacement criterion for Oregon. The agency is currently negotiating a settlement with the litigants in which the EPA would commit to propose these new cadmium criteria for Oregon by March 31, 2016, and take final rulemaking action by January 16, 2017.

The basis of the EPA's disapproval of Oregon's cadmium criterion (and the EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effect to salmon species based on the EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standard). The 2016 updated freshwater acute criterion is slightly more stringent than the 2001 value. A draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater acute criterion is expected to provide protection for endangered salmonids, based the minimal acute effects level (5%) specified by the NMFS in their Reasonable and Prudent Alternatives. Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Process

Office of Science and Technology partnered within the agency with Office of Research and Development to develop the criteria. The criteria were reviewed by the Office of Research and Development, Office of Chemical Safety and Pollution Prevention, and the Regions (3, 4, 5, 8, 9, and 10) and Office of Policy. The EPA conducted an external contractor-led letter peer review on the criteria document that was completed in 2015. The document was available for a 60-day public comment period which ended February 1, 2016.

Stakeholder Reaction

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Cadmium Aquatic Life Ambient Water Quality Criteria
Briefing for Deputy Assistant Administrator
March 23, 2016

Purpose of briefing: Obtain DAA's approval for publication of the final cadmium criteria document in the Federal Register

I. Overview of 2016 Final Cadmium Aquatic Life Criteria Update

- Current criteria update revises acute and chronic freshwater and estuarine/marine criteria; values were last updated in 2001
- Updated criteria added toxicity test data for 75 new species to an already robust data set; there were no major changes in scientific approach
- Timeline consideration: Oregon Toxics Lawsuit brought by Northwest Environmental Advocates
    - OST is working to meet a pending consent decree with NWEA to propose acute cadmium criteria for Oregon by March 31, 2016 and finalize by January 16, 2017
        - The consent decree and criteria revision were driven by a jeopardy call for salmonids by NMFS for acute cadmium in 2012 and subsequent EPA disapproval of the state's criteria in 2013
        - EPA determined new data were available to evaluate acute toxicity of cadmium, which led to this criteria update
    - The 304(a) national criteria is the basis for this rulemaking; plan to issue final on March 30, 2016, to support development of the March 31, 2016 rulemaking for the state
- Review of the updated criteria document included:
    - Three rounds of Agency Workgroup review
    - External expert peer review (five reviewers)
        - Positive reception; applicable technical recommendations were integrated
    - Public comment period
        - Ten comment letters received (List of commenters attached)
        - Comments from states, industry, NGOs, and other federal agencies (e.g., USGS)

Table 1. Overview of Milestones

Action	Date
Agency Workgroup Review - Draft	4/20/15 – 5/20/15
External Peer Draft Review	8/22/15-10/2/15
Agency Workgroup Review- Revised Draft	11/2/15 – 11/10/15
60 Day Public Comment Period	12/1/15 – 2/1/16
Agency Workgroup Review - Final	3/1/16 – 3/9/16
FRN Publication	3/30/16

Cadmium Occurrence, Uses and Sources of Contamination

- Occurs naturally in the environment at low concentrations, primarily as mineral deposits (e.g., 0.1-0.2 ppm)
- NiCd batteries account for >80% of global consumption; other common industrial uses include pigments, coatings/platings and stabilizers
- More recently used in manufacture of nanoparticles (quantum dots) for photovoltaic devices

(e.g., solar cells and emitters for color displays)

- Primary sources to the environment:
  - Anthropogenic sources account for > 90% of environmental release
  - Major anthropogenic sources: Fossil fuel combustion, cement manufacturing, metal smelting, and phosphate fertilizer application
  - Legacy mining sites (e.g., Colorado) represent localized sources

II. 2016 Cadmium Criteria

- **Acute freshwater and acute and chronic estuarine/marine values decrease slightly, while chronic freshwater value increases slightly from 2001 value**
- The freshwater criteria are represented by hardness equations
  - Equation-based criteria reflect differences in bioavailability, and hence toxicity, of cadmium under different water quality conditions
  - Hardness does not affect cadmium toxicity in salt water
- Acute criteria (CMC)= $e^{(0.9789 \times \ln(\text{hardness}) - 3.866)} \times CF$
  - Where CF =conversion factor from total to dissolved cadmium, which is close to 1 at 100 mg/L hardness (0.944)
- Chronic criteria (CCC) = $e^{(0.7977 \times \ln(\text{hardness}) - 3.909)} \times CF$
  - Where CF= 0.909 at 100 mg/L hardness
- The freshwater criteria are captured in the table at a water hardness of 100 mg/L

Table 2. 2016 updated criteria values compared to 2015 draft and existing 2001 current criteria

	2016 Updated Values		2015 FRN Draft Publication Values		2001 Criteria Update	
	Acute (1-hour, dissolved)	**Chronic** (4-day, dissolved)	**Acute** (1-hour, dissolved)	**Chronic** (4-day, dissolved)	**Acute** (1-day, dissolved)	**Chronic** (4-day, dissolved)
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)	**1.8** µg/L[a]	**0.72** µg/L	2.1 µg/L[a]	0.73 µg/L	2.0 µg/L[a]	0.25 µg/L
Estuarine/marine	**33** µg/L	**7.9** µg/L	35 µg/L	8.3 µg/L	40 µg/L	8.8 µg/L

[a] Lowered to protect the commercially and recreationally important rainbow trout, as per 1985 Guidelines

Table 3. Number of tested aquatic species included in criteria derivation over time

	Freshwater Acute	Freshwater Chronic	Estuarine/Marine Acute	Estuarine/Marine Chronic
1980	29	13	31	1
2001	65	21	61	2
2016	101	27	94	2

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III. Key Document Changes Based on Public Comment Period

- Freshwater acute value decreased from the draft value of 2.1 ug/L to 1.8 ug/L
  - Corrected hardness equation to remove all tests with unmeasured concentrations to ensure validity of results
  - Data for salmonids were revised based mainly on commenter input
    - Insensitive life stages removed
    - High outlier values removed because data outside ten-fold range of acceptability and use of different cadmium salt
    - Low outliers removed due to inappropriate salt used to derive high hardness
- Freshwater chronic value decreased from 0.73 ug/L to 0.72 ug/L due to addition of one test
- Estuarine/marine acute value decreased from 35 ug/L to 33 ug/L due to replacement of nonnative with native test species
- Estuarine/marine chronic value decreased from 8.4 ug/L to 7.9 ug/L based on change in acute test species, and used in the acute-to-chronic criterion calculation

IV. Key Comments/Responses with Limited or No Revisions

- **Comment Topic #1**: Change in acute duration from 24 hours to 1 hour is not adequately justified or supported by new studies and may require additional samples to be collected (Illinois EPA)
  - A one-hour duration is consistent with 1985 Guidelines:
    "One hour is probably an appropriate averaging period because high concentrations of some materials can cause death in one to three hours. Even when organisms do not die within the first hour or so, it is not known how many might have died due to delayed effects of this short of an exposure. Thus it is not appropriate to allow concentrations above the CMC to exist for as long as one hour."
  - One hour duration is consistent with all prior cadmium criteria revisions (1996, 1985, 1980), with the draft version of the 2001 cadmium update, and with all 45 of the other acute values except freshwater copper (which we are correcting)
  - Changing the duration to one hour will not affect the expression of WQBELs; consistent with the NPDES regulations (40 CFR 122.45(d)) and WQBEL derivation procedures (EPA's TSD guidance). WQBELs would continue to be expressed in terms of Maximum Daily and Average Monthly averaging periods
- **Comment Topic #2**: Proposed criteria are based on a flawed toxicity test conducted on the amphipod *Hyalella azteca*; which is the most sensitive organism tested (FDEP, WDNR)
  - Tests were included based on peer reviewer recommendation
  - Test data quality was reviewed and approved by internationally recognized experts in ORD, USGS, and author of the test method
- **Comment Topic #3**: ESA-related (NOAA/NMFS, Center for Biological Diversity, California State Water Resources Control Board)

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- Specific Comment: Criteria must be fully protective of ESA species and must consult with the Services in its criteria recommendations
  - EPA intends to consult with the Services when approving state standards

- Specific Comment: EPA must develop criteria protective of long-lived or sediment ingesting species
  - Most aquatic organisms are considered to be more susceptible to cadmium from direct aqueous exposure, thus the criteria are protective of long-lived and sediment ingesting species

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Attachment

Public Comment Period Letters Received

1. Florida Department of Environmental Protection
2. Illinois Environmental Protection Agency
3. Wisconsin Department of Natural Resources
4. Kansas Department of Health and Environment
5. Utility Water Act Group (via Hunton and Williams)
6. Hampton Roads Sanitation District
7. US Geological Survey (Chris Mebane)
8. National Marine Fisheries Service
9. Center for Biological Diversity
10. California State Water Resources Control Board

ED_000992_00000669-00006

To: Gallagher, Kathryn[Gallagher.Kathryn@epa.gov]
Cc: Flaherty, Colleen[Flaherty.Colleen@epa.gov]; Harper, Ashley[harper.ashley@epa.gov]; Elias, Mike[Elias.Mike@epa.gov]
From: Behl, Betsy
Sent: Mon 3/21/2016 5:09:52 PM
Subject: FW: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon
Final 304m Communique 3 3 16.docx

The only communique I see related to us below is on the signature of the cadmium criteria. If you are referring to the sub-bullet, I agree, shpd should update it, if there is an update.

From: Conerly, Octavia
Sent: Thursday, March 17, 2016 8:04 AM
To: Flaherty, Colleen <Flaherty.Colleen@epa.gov>; Behl, Betsy <Behl.Betsy@epa.gov>; Lape, Jeff <lape.jeff@epa.gov>
Cc: Southerland, Elizabeth <Southerland.Elizabeth@epa.gov>
Subject: RE: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon

Good morning All,

Below are lists of items/topics for Joel's weekly email to Gina or to be submitted as a communique. OST is responsible for 2 communiques and a blurb on the White House Summit for the weekly email.

Communiques:

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Weekly email:

•□□□□□□□□ White House Summit

Although there is no real deadline for the communiques, I would recommend that we prepare them so Betsy can send them to Joel by Monday. (See below for material I received for cadmium from Kathryn; attached is an example communique.)

The weekly email items are due to Karen today by 1pm so please send it to me by 12noon.

Cadmium

- EPA is preparing to announce release of the updated national 304(a) recommended aquatic life water quality criteria for cadmium via a March 30, 2016 Federal Register notice. The acute toxicity database for cadmium increased greatly since 2001; there are 27 additional freshwater species and 33 additional saltwater species included in the 2016 acute test dataset that were not in the 2001 dataset. Six new freshwater species chronic tests are also included in the 2016 criteria dataset. The criteria document underwent vigorous internal and external peer review and was released as draft on November 30, 2015 for a 60-day public comment period. EPA revised the draft criteria considering public comments. Once finalized, EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.
    - The driver for updating EPA's cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following a jeopardy call from the National Marine Fisheries Service in 2012 on EPA's 2001 freshwater acute cadmium criteria. As a result of settlement negotiations EPA plans to propose updated cadmium criteria in rulemaking for Oregon by March 31, 2016 and finalize by January 16, 2017. EPA's updated 304(a) national criteria will be the basis for this rulemaking and is thus being finalized prior to proposal of criteria for Oregon. Region 10 is leading discussions with the National Marine Fisheries Service on cadmium effects on endangered salmonids. OW is providing technical analyses to support these effort; ORD is also supporting the region with technical assistance on this effort.

Thanks in advance.

Octavia Conerly

Special Assistant to the Office Director

Office of Science and Technology

1200 Pennsylvania Ave. NW MC 4304T

Room 5231H

Washington, DC 20460

EMAIL: conerly.octavia@epa.gov

PHONE: (202) 566-1094

FAX: (202) 566-0441

From: Gude, Karen
Sent: Tuesday, March 15, 2016 11:00 AM
To: Greene, Ashley <Greene.Ashley@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>; Nandi, Romell <Nandi.Romell@epa.gov>; Farris, Erika D. <Farris.Erika@epa.gov>; Klasen, Matthew <Klasen.Matthew@epa.gov>
Cc: Campbell, Ann <Campbell.Ann@epa.gov>; Ruf, Christine <Ruf.Christine@epa.gov>; Lousberg, Macara <Lousberg.Macara@epa.gov>; Loop, Travis <Loop.Travis@epa.gov>; Orvin, Chris <Orvin.Chris@epa.gov>; Evalenko, Sandy <Evalenko.Sandy@epa.gov>
Subject: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon

Dear Special Assistants,

Below please find a list of possible topics for the 3/18 Administrator Weekly Email and communiques list. If you could please send the Administrator Weekly Email write-ups no later than noon on Thursday (3/17).

Possible Topics for 3/18 Administrator Weekly Email:

- **Update on Animas/San Juan** (OWOW – Tom Wall). *This is a request from Joel.*

- **Blending** (Placeholder for Joel)

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-

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Thank you,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

3/11 Weekly is below for reference:

Administrator and company – Here's the OW weekly update. As noted below, I'll be out of the

office on travel to Gulfport next Tuesday afternoon and Wednesday.

NEJAC: Next week I will travel to Gulfport to attend NEJAC, where I'll be participating in a session on water issues. In addition, I'm hoping to attend the Gulf of Mexico Environmental Justice Community Café event where communities along the Gulf of Mexico to have an opportunity to showcase their efforts around community recovery and revitalization and we will be hosting our own table to bring information to Gulf communities in attendance about the tools available to help achieve their goal.

Blending Discussion at CEQ: **Ex. 5 - Deliberative Process**

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Harmful Algal Blooms and Hypoxia Comprehensive Research Plan and Action Strategy: An Interagency Report: Next week, we expect to release the *Harmful Algal Blooms and Hypoxia Comprehensive Research Plan and Action Strategy*, a report highlighting the progress that federal agencies have made over the past decade, and the current state of the science, on HABs and hypoxia. The report responds to the Harmful Algal Bloom and Hypoxia Research and Control Act and was written by representatives from a 12-member federal interagency working group. The report details gaps in the detection, assessment and mitigation efforts of HABs and hypoxia, as identified by stakeholders around the country, and includes recommendations to better assess, manage, and communicate the risks of HABs and hypoxia in the United States.

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WaterSense Fix a Leak Week: Next week the WaterSense program and its partners will celebrate the 8th annual "Fix A Leak Week" to remind Americans to find and fix common household leaks. We will kick off the event on March 14th with a Twitter party from 2-3 PM. This year we are encouraging partners to incorporate its "Leak Detective" theme in their communities. Partners will host events across the country, and WaterSense will assist two to three communities to amplify their promotional efforts.

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To: Gallagher, Kathryn[Gallagher.Kathryn@epa.gov]; Harper, Ashley[harper.ashley@epa.gov]; Flaherty, Colleen[Flaherty.Colleen@epa.gov]
From: Behl, Betsy
Sent: Thur 3/17/2016 12:21:55 PM
Subject: FW: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon
Final 304m Communique 3 3 16.docx

Kathryn, can you please pull these two items together? Ashley can help

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Cadmium Aquatic Life Ambient Water Quality Criteria
Draft Response to Public Comments

TOPIC 1: Duration should be 24 hours, not one hour

Comment Number (Organization)	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0012 (Utility Water Act Group)	*UWAG has concerns with EPA's proposal to change the acute freshwater and estuarine/marine criteria averaging duration from 24 hours to 1 hour. The change is not adequately justified and is not supported by new studies in the Draft. The current 24-hour duration should be retained unless a strong scientific justification is presented.* *Every previous iteration of the cadmium criteria has endorsed a 24-hour duration for the acute criteria. EPA appears to be making a policy decision that the acute criteria should be 1 hour, but does not present the associated science to support the revision which is inconsistent with CWA § 304(a)(1), which mandates EPA establish "criteria for water quality accurately reflecting the latest scientific knowledge."* *EPA compares the acute toxicity to ammonia but fails to provide information that compares the time-dependent toxicity of cadmium with ammonia. Furthermore, assessing the toxicity of cadmium during the first 24 hours of an acute test is problematic because the vast majority of published studies reporting the acute toxicity of cadmium do not report patterns of lethality during the first 24 hours. Several acceptable selected studies (Besser et al. 2007; Buhl 1997; Diamond et al. 1997; Mebane et al. 2012; Nebeker 1986) do not report 24-hour LC50s and the one study with relevant data (Duncan and Klavercamp 1983) had a 12-hour LC50 that was five times greater than the 96-hour LC50 (5.35 vs. 1.11 µg/L, respectively). This value would be expected to be similar if cadmium was a fast-acting pollutant.* *An earlier EPA publication (*Speed of Action of Metals Acute Toxicity to Aquatic Life*; EPA-822-R-95-002) also justifies the 24-hour averaging period. This document estimated a kinetic*	**Ex. 5 - Deliberative Process**	No edits

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	*coefficient (*k*) using a regression of LC50 values versus time, with the averaging period being calculated as the inverse of* k*. The larger the* k *value the faster acting the pollutant. None of the estimated averaging periods in the document for freshwater and saltwater species approached 1-hour. The highest estimated* k *values mentioned, for the freshwater fathead minnow, were 6 and 17 hours, with saltwater species having even larger values. The selection of the 1-hour averaging period is baseless and arbitrary.* *Additionally, the 1985 Guidelines say the duration should be "substantially less than 48 to 96 hours," but do not say that 24 hours is an inappropriate duration and therefore the Guidelines do not support, nor should it be a justification for the proposed revision.*	**Ex. 5 - Deliberative Process**	
EPA-HQ-OW-2015-0753-0012 (Utility Water Act Group)	*Water Quality-Based Effluent Limits (WQBELs) for cadmium are often expressed as a daily (24-hr) maximum value. Changing the WQBEL to a 1-hour averaging duration could require a permittee to collect several compliance samples during a 24-hour period. This additional burden is unnecessary since there is minor variability of the cadmium levels during a typical 24-hour period, and this additional monitoring is unwarranted without sound scientific basis.*	**Ex. 5 - Deliberative Process**	No edits

TOPIC 2: *H. azteca* test by Ingersoll is not acceptable; retest should be done or test should be removed from criteria development

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0007 and EPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*The proposed chronic criterion is based on a flawed toxicity test (Ingersoll and Kemble 2001) conducted on the amphipod Hyalella azteca. The Hyalella test used in the criterion derivation should be repeated using current feeding procedures that are proven to result in better growth and reproduction. While the IEPA acknowledges and commends the improvements USEPA has made in the assessment and analysis of Hyalella sp. data compared to the 2001 cadmium criteria document, specifically in regards to the sensitivity of this organism to the presence/absence of chloride and bromide in culture and test water, the IEPA contends that the feeding regime employed in the 2000 USGS study is deficient by today's standards and likely resulted in malnourished, stressed test organisms.* *Specifically, test organisms in the 2000 USGS study were underfed and/or fed improper diets based on current research. Dr. Soucek, at the Illinois Natural History Survey, conducted new research that focused on determining the appropriate amounts of food for test organisms. His research has led to improved growth of test organisms compared to earlier diet regimes. The diet used in the 2000 USGS study consisted of a ration of 1.0 ml YCT/d, whereas Dr. Soucek's research contends that a diet consisting of Tetramin supplemented with diatoms greatly improves growth and reproduction of Hyalella azteca compared to YCT-only diets (Soucek et al. 2016, in press).* *The diet in the 2000 USGS study restricted growth and fecundity when compared to Tetramin-based diets (Soucek et al. 2016, in press), and brings into question the accuracy of the test results.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0007 andEPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*Test organisms in the 2000 USGS study did not attain minimum growth requirements based on the direct measure of organism weight, with the average dry weight of the controls being 0.27 mg/individual (<0.50 mg/individual). USEPA concluded that the dry weights measured in the test were inaccurate and subsequently used length data to extrapolate to dry weight via a regression equation. However there is no documentation provided for this equation or how it was derived. It is unlikely that the dry weights were underestimated (while an overestimation can be expected due to inadequate drying of test organisms), and it is therefore*	**Ex. 5 - Deliberative Process**	No edits

	considered unlikely that the organisms achieved the minimum weight requirements for this test to be valid.	guidance for conducting tests with *H. azteca*.	
EPA-HQ-OW-2015-0753-0007andEPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*The dilution series (control and 5 treatment concentrations: 0.1, 0.3, 0.5, 2.0 and 3.0 µg/L.) used in the 2000 USGS test did not appropriately bracket the effect concentration. The dilution series was not standard, with a large gap in concentration between the NOEC and LOEC (0.5 and 2.0 µg/L, respectively). While a point estimation technique was used to determine the effect concentration, the lack of a 1.0 µg/L treatment may have changed this estimation. The precision of this estimation is paramount, as the test result was the sole determinant of the GMCV, which is the most sensitive in the chronic dataset, and a small change in the GMCV can therefore have a substantial effect on the final chronic value.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0007 andEPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*At this time, the IEPA is in support of the adoption of the acute cadmium criterion as proposed, but is requesting a one year extension for the adoption of the chronic criterion. A one year extension would allow for a retest on Hyalella azteca using current feeding recommendations and would allow for revisions to be made to the chronic criterion. A round robin approach would ensure that the data are obtained using the appropriate test procedures and would provide additional information regarding the sensitivity of Hyalella azteca to cadmium. If time does not permit a repeat of the test, then the chronic criterion should be recalculated with the Hyalella data removed.*	**Ex. 5 - Deliberative Process**	No edits

TOPIC 3: Dissolved vs total concentration use

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental	*Additional documentation is needed to support the total to dissolved conversion factors. Very little information is provided concerning the derivation of the conversion factors, and more detailed information is needed to fully assess their appropriateness for natural waterbodies.*	**Ex. 5 - Deliberative Process**	Section 2.6

Protection)		Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*It is unknown if the solutions prepared from Cd salts, that were used to develop the conversion factors, adequately represent the forms of Cd found in natural waterbodies.*		Section 2.6
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*An explanation is needed as to why the conversion factors for the acute and chronic criteria are different. It also appears illogical that the constant conversion factor of 0.994 used for marine water is higher than for freshwater, especially because the hardness-dependent conversion factor for freshwater decreases as hardness increases.*		Section 2.6
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*While it is noted in several places in the document, clarify that the recommended criteria values are expressed as dissolved cadmium concentrations (not total). Also clarify if states have the option to adopt total Cd criteria values.*		No edits
EPA HQ-OW-2015-0753-0011	*Kansas has utilized the total recoverable metals criteria and data, and is not set up to sample for total dissolved metals. A conversion factor would be applied to calculate the dissolved concentration and Kansas recommends that EPA retain this flexibility in its final criteria.*		No edits

TOPIC 4: Data quality, use, and availability

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0006 (Kansas Department of Health and Environment)	*Some of the values that are new/revised since the 2001 AWQC document are from studies that were published before 2001. Table 22 has general information describing why GMAVs have changed between the 2001 and 2015 document, but it does not provide details on why these "new" data were now considered acceptable. Include another table that describes why the studies that were excluded previously are now included.*	Ex. 5 - Deliberative Process	No edits
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Should toxicity tests conducted under less-than optimal conditions be discounted? This comment goes beyond just the test results for Hyalella, because while laboratory tests used for criteria development use conditions that are as close to optimal as possible, wild populations in diverse natural conditions are often exposed to conditions that sub-optimal, and therefore laboratory tests may be underprotective in natural conditions (i.e., additional stresses) (see, Holmstrump et al. 2010; Besser et al. 2015).*		No edits
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*"Other data" are not addressed consistent with the Guidelines. While these data are not used in the species sensitivity distribution rankings, they should not be thrown away, discounted, or deemed "unacceptable." "Other Data" can be invoked to lower a criterion (e.g., chronic value in the 1987 selenium criterion). Revaluate Riddel et al. (2005a, b) and include a larger discussion of their effect concentrations/findings and other similar behavioral/ecological studies.*		Sections 5 and 5.2
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*With many organisms, a strong difference in the sensitivity of different life stages makes it inappropriate to roll up data from different developmental stages. Pooling salmonid effects concentrations across developmental stages to obtain a SMAV could produce a misleading result (see, Hansen et al. 2002; Mebane et al. 2012; Chapman 1978; Chapman and Stevens 1978).*		Appendix A Ranked FW Acute Table

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EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*The decision to only use ELS chronic data in which the exposures began in the egg stage, and to exclude long-term data in which the exposures began in the fry stage is non-conservative.*	Ex. 5 - Deliberative Process	No edits
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*SMAV calculations tagged with the footnote "C", indicating that "Data not used to calculate SMAV because more sensitive life stage available, or flow-through measured test available", should be separated into two different footnotes since they are very different reasons.*		Appendix A and Appendix B

EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Address the following Appendix A specific errors/changes:*
	• *Daphnia magna (various)*
	  o *Many "S, U" tests (tests with unmeasured concentrations) are underlined, indicating they are included in the SMAV calculations. These should be excluded per the Guidelines.*
	• *Mayfly (formerly, Ephemerella grandis) Drunella grandis*
	  o *Tested species was listed in the source document as Ephemerella subvaria, which is still a valid species name according to ITIS.gov.*
	• *Rainbow trout (smolt), Chapman 1975 (>2.9 µg/L)*
	  o *Should be excluded from SMAV because it is from a resistant life stage. Also, should be listed as "Rainbow trout (Steelhead smolt)" as Steelhead are not just Rainbow Trout by a different name, but have physiological differences in regard to ion regulation. Chapman (1975) should only be cited when no alternative exists, because it was never formally released by EPA and is not publicly available online.*
			Appendix A Ranked FW Acute Table

	Chapman (1978) reports the same data and is a better citation. • *Rainbow trout (smolt), Chapman 1975 (4.1 µg/L)* o *Suspect value, exclude from SMAV. Chapman (1978) lists the value for the same test as >2.9 µg/L. Chapman (1978) is the peer-reviewed publication of record for these data; Chapman (1975) was an unpublished, work-in-progress progress report that sometimes still gets cited because it includes data never published elsewhere, such as the coho data shown in the figure in this memo. Exclude from SMAV, resistant life stage and re-label as " "Rainbow trout (Steelhead smolt". See Chapman (1978, Table 3).*	**Ex. 5 - Deliberative Process**	
	• *Rainbow trout (299 mg), Stratus (1.29 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with unmanipulated pH of 7.5 were much more sensitive*		

	• *Chinook salmon (parr, 11.58g) (3.5 µg/L)*
	  o *Exclude value from SMAV, based on a resistant life stage being tested. Value is twice as high as the value obtained with swim-up fry in matched tests and confidence limits don't overlap.*
	• *Chinook salmon (smolt, 32.46 g) (>2.9 µg/L)*
	  o *Should be excluded from SMAV, based on a resistant life stage being tested.*		

	• *Bull trout (84.2 mg) (2.89 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with a natural pH of 7.5 were much more sensitive*		
	• *Colorado squawfish* o *Old common name is now considered repugnant. AFS calls it "Colorado pikeminnow". "Pikeminnow" is one word.*		

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EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Address the following Appendix C specific errors/changes:* • *Snail, Aplexa hyporum (Holcombe) (4.0 µg/L)* o *I got an EC20 of about 2.6 µg/L. By excluding the highest treatment with total mortality I could reproduce the 4.0 EC20 value, but it had a poor fit with Y0.*	**Ex. 5 - Deliberative Process**	No edits

EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Add the following additional relevant data:*
	• *Pascoe and Mattey 1977*
	  o *Chronic stickleback exposure*
	• *Wang et al. 2014*
	  o *Chronic fathead full life-cycle test*
	• *Brinkman and Vieira 2008*
	  o *Acute and chronic mountain whitefish*
	• *Mebane et al. 2014 (paper provided)*
	  o *Effects of cadmium on larval aquatic insect communities in 30-day experimental stream tests*
		Ex. 5 - Deliberative Process	Mebane et al. (2014) added to Section 5.2

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*There is concern about the focus on fish in developing the criteria. EPA needs to bring in other species including insects and freshwater mussels into the process when developing criteria for cadmium. This lack of additional species prevents a more holistic picture of the freshwater community, and results in criteria that are not protective of all aquatic-dependent wildlife. EPA has consistently failed to fully consider aquatic-dependent wildlife in the development of national criteria.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0010 (Hampton Roads Sanitation District)	*There is concern with the continued lack of estuarine/marine chronic cadmium toxicity data and that no new chronic toxicity data have been generated since 2001. EPA should conduct additional chronic toxicity studies (particularly with vertebrate species) to expand the estuarine/marine chronic toxicity dataset. More estuarine/marine chronic data are needed to develop a scientifically reliable chronic cadmium criterion.*		No edits
EPA-HQ-OW-2015-0753-0010 (Hampton Roads Sanitation District)	*The mysid Neomysis integer is a new species added to the estuarine/marine acute dataset, but this mysid is potentially non-native to the United States. Since there are available values for two other native mysid species (M. bigelowi and A. bahia), this non-native species should be removed (unless documentation is provided confirming it is naturally occurring within waters of North America).*		Section 3.2.1 and Appendix B

TOPIC 5: ESA considerations

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	**Ex. 5 - Deliberative Process**	No edits

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		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*To ensure the final cadmium water quality criteria is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*		No edits

EPA HQ-OW-2015-0753-0009 (California State Water Resources Control Board)	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to ac7count for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	No edits
EPA HQ-OW-			

2015-0753-0009 (California State Water Resources Control Board)	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*	Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a Section 7 Consultation.*		No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*''EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.* *Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.*		No edits

		Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*		No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and that ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*		No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*		No edits

TOPIC 6: Other

Comment	Public Comment	EPA Response	Revision Location in 2015 Cadmium

Number			Criteria Document
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*In the description of sources of cadmium in the document, EPA overlooked the contribution from coal combustion, coal mining waste, and coal ash ponds spills, seepage, and discharge. These important sources need to be recognized and addressed.*	Ex. 5 - Deliberative Process	Section 2.1

EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Check the document for errors and typos. Specific examples include:*
	• *Pg.27 which is intended to provide an acute criterion protective of nearly all individuals in the distribution (Stephan et al.* ***1985);the*** *FAV/2 approach was developed to estimate minimal effect levels,*
	• *Pg.30 This outcome was based on the poor correlation between hardness and acute toxicity for D. magna and occurred only when tests with* ***less than*** *24-hr old neonates were included in the database. Accordingly, only the five D. magna tests from Chapman et al. (1980} initiated with* ***less than*** *24-hr old neonates were used for the analysis*
	• *Pg.33 Two species of sculpin, Cottus bairdii and Cottus confusus, are used to derive the normalized GMAV of* ***4.962*** *µg Cd/L*
	  o ***Per Appendix A, this value should be 4.926***
	• *Pg.34 The hardness-normalized GMAV of* ***7.911*** *µg/L total cadmium for the genus Oncorhynchus is the fifth lowest in the acute dataset*
	  o ***Per Appendix A, this value should be 7.841 ***
	• *Pg.42 2. Ceriodaphnia, Cladoceran (GMCV=****1.293µg/l*** *total Cd)*
	• *Pg. 74 Acceptable chronic toxicity* ***data*** *are available for 27 freshwater species representing 20 different genera*
	• *Pg. C-8 [d]Not used to calculate* ***SMAV*** *because either a more definitive value available, value is considered an outlier, or preference was given to the more sensitive exposure scenario (LC versus ELS tests).*
			Various locations

EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*While Table 5 summarizes the Phyla, Families, Genera, and Species used to derive the revised criterion, it is unclear which species were used to meet each of the MDRs. Include a table that lists the eight requirements and the species used to fulfill them.*		Table 5
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of	*Verify that the Spehar and Fiandt 1986 data for Pimephales promelas is appropriate to include in the freshwater acute hardness correction.*		Appendix Table A-1, A-2, C-1 and C-2

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Natural Resources)		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Expand Table 6 to include the actual data that were used in the freshwater acute hardness correction for each species.*		Appendix Table A-2
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process.*		Figure 2
EPA-HQ-OW-2015-0753-0006 Wisconsin Department of Natural Resources)	*Indicate how the R^2 value of 0.964 was obtained in the freshwater acute hardness correction. Attempts to replicate the value resulted in a slope of 1.104 and R^2 of 0.698.* *Indicate how the R^2 value of 0.841 was obtained in the freshwater chronic hardness correction. Attempts to replicate the value resulted in a slope of 0.798 and R^2 of 0.632.*		No edits
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*It was not apparent if the MATC or EC_{20} value was used for the freshwater chronic slope derivation. Indicate which of the toxicity values were used in the derivation in Appendix C and Table 8.*		Appendix Table C-2
EPA-HQ-OW-2015-0753-0006			

(Wisconsin Department of Natural Resources)	*Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process.*	**Ex. 5 - Deliberative Process**	
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*The language that describes the computation of the final acute value on pg. 32 is insufficient. Include a reference to section 4.3.1 after the reference to Figure 2 on page 32.*		Section 3.1.1
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*It is unclear how the intercept of the freshwater acute and chronic criterion equations were derived. Add additional language to clarify how these values were derived.*		No edits

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Appendix A
Representative Publications Using H. azteca Length-to-Weight Regression

Besser JM, Brumbaugh WG, Ingersoll CG, Ivey CD, Kunz JL, Kemble NE, Schlekat CE, Garman ER. 2013. Chronic toxicity of nickel‐spiked freshwater sediments: Variation in toxicity among eight invertebrate taxa and eight sediments. Environ Toxicol Chem 32:2495-2506.

Besser JM, Ingersoll CG, Brumbaugh WG, Kemble NE, May TW, Wang N, MacDonald DD, Roberts AD. 2015. Toxicity of sediments from lead-zinc mining areas to juvenile freshwater mussels (*Lampsilis siliquoidea*), compared to standard test organisms. Environ Toxicol Chem 34:626-639.

Besser JM, Ivey CD, Brumbaugh WG, Ingersoll CG. 2015. Effect of Diet Quality on Chronic Toxicity of Aqueous Lead to the Amphipod, *Hyalella azteca*. Environ Toxicol Chem (in press) doi:10.1002/etc.3341

Ivey CD, Ingersoll CG. 2016. Influence of bromide on the performance of the amphipod Hyalella azteca in reconstituted waters. Environ Toxicol Chem: This issue.

Kemble NE, Hardesty DK, Ingersoll CG, Kunz JL, Sibley PK, Calhoun DL, Gilliom RJ, Kuivila KM, Nowell LH, Moran PW. 2013. Contaminants in stream sediments from seven U.S. metropolitan areas: II. Sediment toxicity to the amphipod *Hyalella azteca* and the midge *Chironomus dilutus*. *Arch Environ Contam Toxicol* 64:52-64.

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Appendix B
Sensitivity of CERC Cd *Hyalella* Study to Concentration Intervals

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HEALTH AND ENVIRONMENTAL EFFECTS
RESEARCH LABORATORY
MID-CONTINENT ECOLOGY DIVISION
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OFFICE OF
RESEARCH AND DEVELOPMENT

February 25, 2016

MEMORANDUM

SUBJECT: Sensitivity of CERC Cd *Hyalella* Study to Concentration Intervals

FROM: David R. Mount and J. Russell Hockett

TO: Mike Elias (OW/OST/HECD)

The purpose of this memo is to provide additional interpretation regarding the robustness of the EC20 estimate previously derived from a cadmium exposure conducted using *Hyalella azteca* conducted by USGS/CERC. OW received comments suggesting that because there was a wide spacing between the exposure concentrations bracketing the reported EC20 that the EC20 was too uncertain to be relied upon.

The data from that study for total young per replicate are as follows:

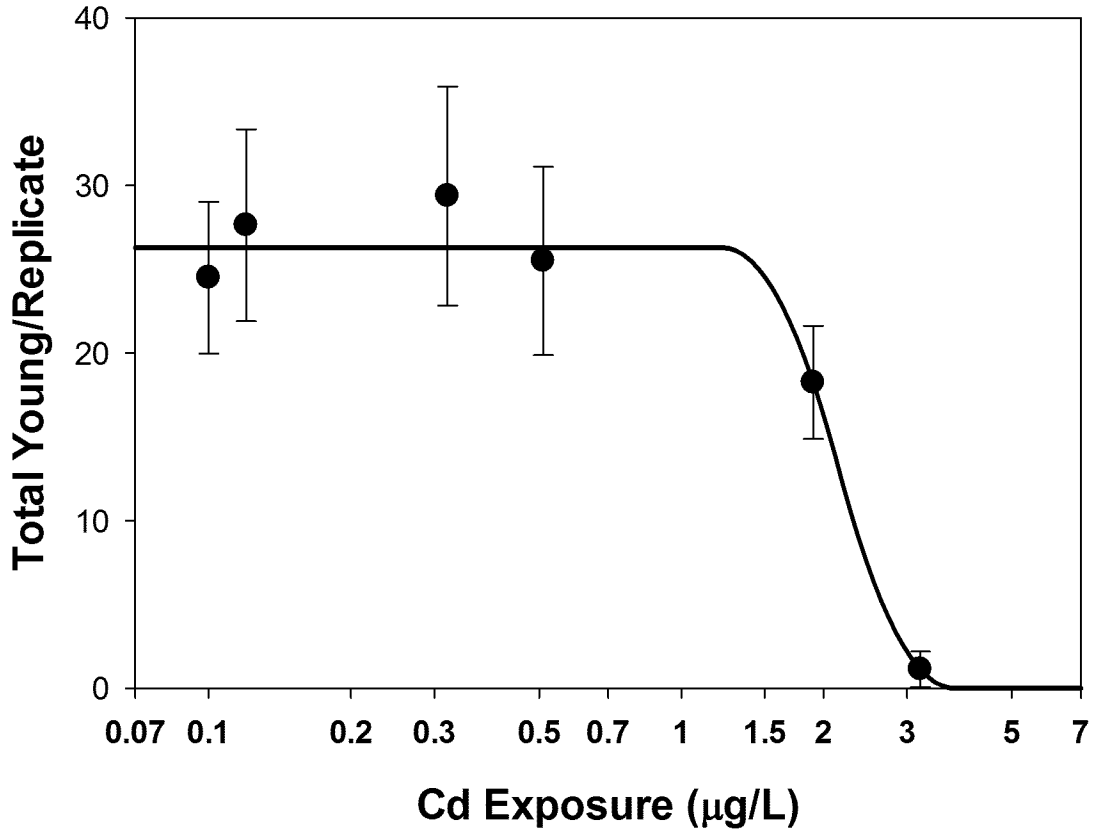
Cd (ug/L)	Mean Total Young
0.10	24.50
0.12	27.63
0.32	29.38
0.51	25.50
1.9	18.25
3.2	1.13

The reported EC20 was 1.695, which lies between the 0.51 and 1.9 ug/L treatments. The commenter is correct that this gap of not quite 4-fold is larger than is used in most toxicity tests.

That said, we have looked carefully at this study and have concluded that this large concentration spacing creates very little uncertainty in the regression estimate of the EC20. This is in large part because the regression curve is firmly anchored near the EC20 by the response in the 1.9 ug/L treatment. The regression estimate of background reproduction is 26.3 young per replicate. The 1.9 ug/L treatment had an average of 18.25 young per replicate, which is a 30.6% reduction from the control estimate. Because this degree of reduction is very close to 20%, and all of the lower concentrations had reproduction very close to control, the EC20 estimate is very heavily influenced by the response at 1.9 ug/L, and very little by the other points in the data set.

This insensitivity is also apparent from looking at the regression itself, shown along with the study data in the figure below:

ED_000992_00000681-00022



As you can see, the modeled response does not decline from control levels until well past 1 ug/L, which would be the geometric mean of 0.51 and 1.9 ug/L and closer to the 0.5x spacing common to aquatic toxicity tests of this type. The regression has a fairly steep slope and a relatively sharp shoulder, so the EC20 remains very close to the 1.9 ug/L treatment.

As further proof of this insensitivity, we modeled additional data sets which assumed that the response observed in the 0.51 ug/L treatment had occurred at higher concentrations; these alternative scenarios are represented by the open symbols in the graph on the following page. We then generated new EC20 estimates under two scenarios. The first was that we left the actual 0.51 ug/L response in the data set and added an additional data point with the same reproduction values at progressively higher concentration. The second involved simply moving the 0.51 ug/L response data to progressively higher Cd concentrations.

The effect of these manipulations showed uniformly that the EC20 estimate was extremely insensitive to the location of the data observed at 0.51 ug/L. Under both scenarios, the EC20 estimate changed very, very little as the presumed exposure concentration was raised. Even when we moved the 0.51 ug/L data all the way up to 1.7 ug/L (extremely close to the 1.9 ug/L treatment), the resulting EC20 estimate increased by a maximum of 2.4%.

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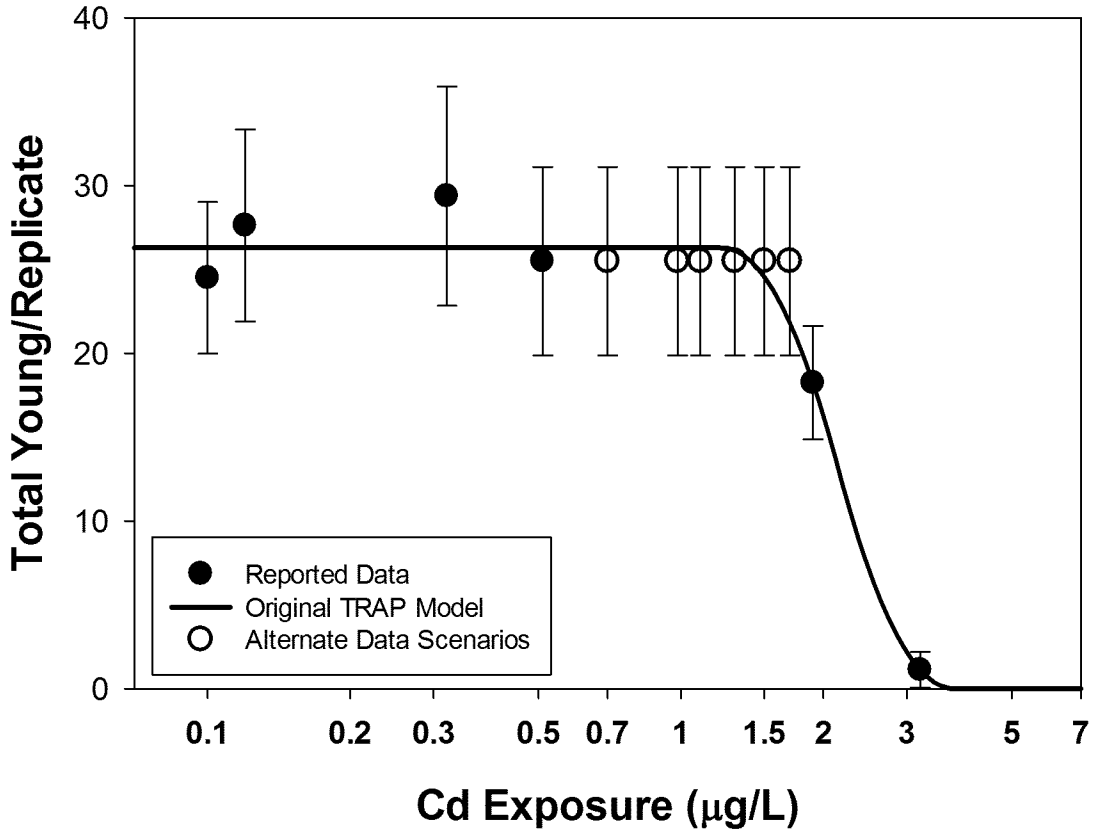

Dataset	EC20 (µg Cd/L)	95% C.I.
Unaltered Original Data	1.6947	1.3560 – 2.1179
Alternative 1: Keep 0.51 data and add additional data		
0.7	1.7077	1.3753 – 2.1236
0.9	1.7077	1.3753 – 2.1236
0.984	1.7077	1.3753 – 2.1236
1.1	1.7077	1.3753 – 2.1236
1.3	1.6903	1.3521 – 2.1132
1.5	1.6971	1.3773 – 2.0910
1.7	1.7360	1.4303 – 2.1071
Alternative 2: Move 0.51 data to higher concentration		
0.7	1.6947	1.3560 – 2.1179
0.9	1.6947	1.3560 – 2.1179
0.984	1.6947	1.3560 – 2.1179
1.1	1.6947	1.3560 – 2.1179
1.3	1.6702	1.3263 – 2.1033
1.5	1.6756	1.3511 – 2.0780
1.7	1.7145	1.4041 – 2.0936

These simulations assumed that the same reproduction observed at 0.51 ug/L was also observed at higher concentrations. If there had been a treatment between 0.51 and 1.9 and reproduction was higher in that treatment than was observed at 0.51 ug/L, the resulting EC20 would be little changed; the background response estimate would increase, but so would the steepness of the curve, and these effects would tend to offset each other. If there was an intermediate treatment that had reproduction between that observed at 0.51 and 1.9 ug/L, the shoulder of the regression curve would be less sharp, and the EC20 concentration would move down some. Hence, there is probably slight larger uncertainty that the EC20 from a more complete concentration series might be lower than the current estimate than there is that it would be higher. But these differences are small; as we said at the outset, the 30% reduction in reproduction in the 1.9 ug/L treatment suggests that the calculated EC20 would not stray far from the original estimate of 1.694 even if additional treatments had been tested.

In summary, while there could be cases were an EC20 value was made uncertain by wide spacing of exposure concentrations, the particular features of the study in question make the EC20 estimate quite robust and unlikely to have been influenced much by the presence of an additional treatment between the 0.51 and 1.9 ug/L treatments, had one been included.

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Cadmium Aquatic Life Ambient Water Quality Criteria
Draft Response to Public Comments

TOPIC 1 Summary: Comments regarding acute criteria duration change from 24 hours to one hour

Comment Number (Organization)	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0012 (Utility Water Act Group)	*UWAG has concerns with EPA's proposal to change the acute freshwater and estuarine/marine criteria averaging duration from 24 hours to 1 hour. The change is not adequately justified and is not supported by new studies in the Draft. The current 24-hour duration should be retained unless a strong scientific justification is presented.* *Every previous iteration of the cadmium criteria has endorsed a 24-hour duration for the acute criteria. EPA appears to be making a policy decision that the acute criteria should be 1 hour, but does not present the associated science to support the revision which is inconsistent with CWA § 304(a)(1), which mandates EPA establish "criteria for water quality accurately reflecting the latest scientific knowledge."* *EPA compares the acute toxicity to ammonia but fails to provide information that compares the time-dependent toxicity of cadmium with ammonia. Furthermore, assessing the toxicity of cadmium during the first 24 hours of an acute test is problematic because the vast majority of published studies reporting the acute toxicity of cadmium do not report patterns of lethality during the first 24 hours. Several acceptable selected studies (Besser et al. 2007; Buhl 1997; Diamond et al. 1997; Mebane et al. 2012; Nebeker 1986) do not report 24-hour LC50s and the one study with relevant data (Duncan and Klavercamp 1983) had a 12-hour LC50 that was five times greater than the 96-hour LC50 (5.35 vs. 1.11 µg/L, respectively). This value would be expected to be similar if cadmium was a*	**Ex. 5 - Deliberative Process**	No edits

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	fast-acting pollutant. *An earlier EPA publication (*Speed of Action of Metals Acute Toxicity to Aquatic Life*; EPA-822-R-95-002) also justifies the 24-hour averaging period. This document estimated a kinetic coefficient (*k*) using a regression of LC50 values versus time, with the averaging period being calculated as the inverse of* k*. The larger the* k *value the faster acting the pollutant. None of the estimated averaging periods in the document for freshwater and saltwater species approached 1-hour. The highest estimated* k *values mentioned, for the freshwater fathead minnow, were 6 and 17 hours, with saltwater species having even larger values. The selection of the 1-hour averaging period is baseless and arbitrary.* *Additionally, the 1985 Guidelines say the duration should be "substantially less than 48 to 96 hours," but do not say that 24 hours is an inappropriate duration and therefore the Guidelines do not support, nor should it be a justification for the proposed revision.*	**Ex. 5 - Deliberative Process**	

		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0012 (Utility Water Act Group)	*Water Quality-Based Effluent Limits (WQBELs) for cadmium are often expressed as a daily (24-hr) maximum value. Changing the WQBEL to a 1-hour averaging duration could require a permittee to collect several compliance samples during a 24-hour period. This additional burden is unnecessary since there is minor variability of the cadmium levels during a typical 24-hour period, and this additional monitoring is unwarranted without sound scientific basis.*		No edits

TOPIC 2: Comments regarding *H. azteca* test by Ingersoll is not acceptable; retest should be done or test should be removed from criteria development

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0007 and EPA	*The proposed chronic criterion is based on a flawed toxicity test (Ingersoll and Kemble 2001) conducted on the amphipod Hyalella azteca. The Hyalella test used in the criterion derivation should be repeated using current feeding procedures that are proven to result in better growth and reproduction. While the IEPA acknowledges and commends the improvements USEPA has made in the assessment and analysis of Hyalella sp. data compared to the 2001 cadmium criteria document, specifically in regards to the sensitivity of this organism to the presence/absence of chloride and bromide in culture and test water, the IEPA contends that the feeding regime employed in the 2000 USGS study is deficient by today's standards and likely resulted in malnourished, stressed test organisms.*	Ex. 5 - Deliberative Process	

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HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*Specifically, test organisms in the 2000 USGS study were underfed and/or fed improper diets based on current research. Dr. Soucek, at the Illinois Natural History Survey, conducted new research that focused on determining the appropriate amounts of food for test organisms. His research has led to improved growth of test organisms compared to earlier diet regimes. The diet used in the 2000 USGS study consisted of a ration of 1.0 ml YCT/d, whereas Dr. Soucek's research contends that a diet consisting of Tetramin supplemented with diatoms greatly improves growth and reproduction of Hyalella azteca compared to YCT-only diets (Soucek et al. 2016, in press).* *The diet in the 2000 USGS study restricted growth and fecundity when compared to Tetramin-based diets (Soucek et al. 2016, in press), and brings into question the accuracy of the test results.*	**Ex. 5 - Deliberative Process**	
EPA-HQ-OW-2015-0753-0007 andEPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*Test organisms in the 2000 USGS study did not attain minimum growth requirements based on the direct measure of organism weight, with the average dry weight of the controls being 0.27 mg/individual (<0.50 mg/individual). USEPA concluded that the dry weights measured in the test were inaccurate and subsequently used length data to extrapolate to dry weight via a regression equation. However there is no documentation provided for this equation or how it was derived. It is unlikely that the dry weights were underestimated (while an overestimation can be expected due to inadequate drying of test organisms), and it is therefore considered unlikely that the organisms achieved the minimum weight requirements for this test to be valid.*		No edits

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		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0007andEPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*The dilution series (control and 5 treatment concentrations: 0.1, 0.3, 0.5, 2.0 and 3.0 µg/L.) used in the 2000 USGS test did not appropriately bracket the effect concentration. The dilution series was not standard, with a large gap in concentration between the NOEC and LOEC (0.5 and 2.0 µg/L, respectively). While a point estimation technique was used to determine the effect concentration, the lack of a 1.0 µg/L treatment may have changed this estimation. The precision of this estimation is paramount, as the test result was the sole determinant of the GMCV, which is the most sensitive in the chronic dataset, and a small change in the GMCV can therefore have a substantial effect on the final chronic value.*		No edits
EPA-HQ-OW-2015-0753-0007 andEPA HQ-OW-2015-0753-0008 (Illinois	*At this time, the IEPA is in support of the adoption of the acute cadmium criterion as proposed, but is requesting a one year extension for the adoption of the chronic criterion. A one year extension would allow for a retest on Hyalella azteca using current feeding recommendations and would allow for revisions to be made to the chronic criterion. A round robin approach would ensure that the data are obtained using the appropriate test procedures and*		No edits

Environmental Protection Agency)	*would provide additional information regarding the sensitivity of Hyalella azteca to cadmium. If time does not permit a repeat of the test, then the chronic criterion should be recalculated with the Hyalella data removed.*		

TOPIC 3: Comments regarding dissolved vs total concentration use

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*Additional documentation is needed to support the total to dissolved conversion factors. Very little information is provided concerning the derivation of the conversion factors, and more detailed information is needed to fully assess their appropriateness for natural waterbodies.*	**Ex. 5 - Deliberative Process**	Section 2.6
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*It is unknown if the solutions prepared from Cd salts, that were used to develop the conversion factors, adequately represent the forms of Cd found in natural waterbodies.*		Section 2.6

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EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*An explanation is needed as to why the conversion factors for the acute and chronic criteria are different. It also appears illogical that the constant conversion factor of 0.994 used for marine water is higher than for freshwater, especially because the hardness-dependent conversion factor for freshwater decreases as hardness increases.*	**Ex. 5 - Deliberative Process**	Section 2.6
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*While it is noted in several places in the document, clarify that the recommended criteria values are expressed as dissolved cadmium concentrations (not total). Also clarify if states have the option to adopt total Cd criteria values.*		No edits
EPA HQ-OW-2015-0753-0011	*Kansas has utilized the total recoverable metals criteria and data, and is not set up to sample for total dissolved metals. A conversion factor would be applied to calculate the dissolved concentration and Kansas recommends that EPA retain this flexibility in its final criteria.*		No edits

TOPIC 4: Comments regarding data quality, use, and availability

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0006 (Kansas Department of Health and Environment)	*Some of the values that are new/revised since the 2001 AWQC document are from studies that were published before 2001. Table 22 has general information describing why GMAVs have changed between the 2001 and 2015 document, but it does not provide details on why these "new" data were now considered acceptable. Include another table that describes why the studies that were excluded previously are now included.*	**Ex. 5 - Deliberative Process**	No edits

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EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Should toxicity tests conducted under less-than optimal conditions be discounted? This comment goes beyond just the test results for Hyalella, because while laboratory tests used for criteria development use conditions that are as close to optimal as possible, wild populations in diverse natural conditions are often exposed to conditions that sub-optimal, and therefore laboratory tests may be underprotective in natural conditions (i.e., additional stresses) (see, Holmstrump et al. 2010; Besser et al. 2015).*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*"Other data" are not addressed consistent with the Guidelines. While these data are not used in the species sensitivity distribution rankings, they should not be thrown away, discounted, or deemed "unacceptable." "Other Data" can be invoked to lower a criterion (e.g., chronic value in the 1987 selenium criterion). Revaluate Riddel et al. (2005a, b) and include a larger discussion of their effect concentrations/findings and other similar behavioral/ecological studies.*		Sections 5 and 5.2
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*With many organisms, a strong difference in the sensitivity of different life stages makes it inappropriate to roll up data from different developmental stages. Pooling salmonid effects concentrations across developmental stages to obtain a SMAV could produce a misleading result (see, Hansen et al. 2002; Mebane et al. 2012; Chapman 1978; Chapman and Stevens 1978).*		Appendix A Ranked FW Acute Table
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological	*The decision to only use ELS chronic data in which the exposures began in the egg stage, and to exclude long-term data in which the exposures began in the fry stage is non-conservative.*		No edits

Survey)			
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*SMAV calculations tagged with the footnote "C", indicating that "Data not used to calculate SMAV because more sensitive life stage available, or flow-through measured test available", should be separated into two different footnotes since they are very different reasons.*		Appendix A and Appendix B
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Address the following Appendix A specific errors/changes:* • *Daphnia magna (various)* o *Many "S, U" tests (tests with unmeasured concentrations) are underlined, indicating they are included in the SMAV calculations. These should be excluded per the Guidelines.*	**Ex. 5 - Deliberative Process**	Appendix A Ranked FW Acute Table
	• *Mayfly (formerly, Ephemerella grandis) Drunella grandis* o *Tested species was listed in the source document as Ephemerella subvaria, which is still a valid species name according to ITIS.gov.*		

	• *Rainbow trout (smolt), Chapman 1975 (>2.9 µg/L)*
	  o *Should be excluded from SMAV because it is from a resistant life stage. Also, should be listed as "Rainbow trout (Steelhead smolt)" as Steelhead are not just Rainbow Trout by a different name, but have physiological differences in regard to ion regulation. Chapman (1975) should only be cited when no alternative exists, because it was never formally released by EPA and is not publicly available online. Chapman (1978) reports the same data and is a better citation.*
	• *Rainbow trout (smolt), Chapman 1975 (4.1 µg/L)*
	  o *Suspect value, exclude from SMAV.*		

	Chapman (1978) lists the value for the same test as >2.9 µg/L. Chapman (1978) is the peer-reviewed publication of record for these data; Chapman (1975) was an unpublished, work-in-progress progress report that sometimes still gets cited because it includes data never published elsewhere, such as the coho data shown in the figure in this memo. Exclude from SMAV, resistant life stage and re-label as ""Rainbow trout (Steelhead smolt". See Chapman (1978, Table 3).		
	• *Rainbow trout (299 mg), Stratus (1.29 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with unmanipulated pH of 7.5 were much more sensitive*	**Ex. 5 - Deliberative Process**	

	• *Chinook salmon (parr, 11.58g) (3.5 µg/L)*
	  o *Exclude value from SMAV, based on a resistant life stage being tested. Value is twice as high as the value obtained with swim-up fry in matched tests and confidence limits don't overlap.*
	• *Chinook salmon (smolt, 32.46 g) (>2.9 µg/L)*
	  o *Should be excluded from SMAV, based on a resistant life stage being tested.*		

	• *Bull trout (84.2 mg) (2.89 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with a natural pH of 7.5 were much more sensitive*		
	• *Colorado squawfish* o *Old common name is now considered repugnant. AFS calls it "Colorado pikeminnow". "Pikeminnow" is one word.*		

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EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Address the following Appendix C specific errors/changes:* • *Snail, Aplexa hyporum (Holcombe) (4.0 µg/L)* o *I got an EC20 of about 2.6 µg/L. By excluding the highest treatment with total mortality I could reproduce the 4.0 EC20 value, but it had a poor fit with Y0.*	**Ex. 5 - Deliberative Process**	No edits

EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Add the following additional relevant data:*
	• *Pascoe and Mattey 1977*
	  o *Chronic stickleback exposure*
	• *Wang et al. 2014*
	  o *Chronic fathead full life-cycle test*
	• *Brinkman and Vieira 2008*
	  o *Acute and chronic mountain whitefish*
	• *Mebane et al. 2014 (paper provided)*
	  o *Effects of cadmium on larval aquatic insect communities in 30-day experimental stream tests*
			Mebane et al. (2014) added to Section 5.2

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		Ex. 5 - Deliberative Process	

Comment Number	Public Comment		Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*There is concern about the focus on fish in developing the criteria. EPA needs to bring in other species including insects and freshwater mussels into the process when developing criteria for cadmium. This lack of additional species prevents a more holistic picture of the freshwater community, and results in criteria that are not protective of all aquatic-dependent wildlife. EPA has consistently failed to fully consider aquatic-dependent wildlife in the development of national criteria.*		No edits
EPA-HQ-OW-2015-0753-0010 (Hampton Roads Sanitation District)	*There is concern with the continued lack of estuarine/marine chronic cadmium toxicity data and that no new chronic toxicity data have been generated since 2001. EPA should conduct additional chronic toxicity studies (particularly with vertebrate species) to expand the estuarine/marine chronic toxicity dataset. More estuarine/marine chronic data are needed to develop a scientifically reliable chronic cadmium criterion.*		No edits

EPA-HQ-OW-2015-0753-0010 (Hampton Roads Sanitation District)	*The mysid Neomysis integer is a new species added to the estuarine/marine acute dataset, but this mysid is potentially non-native to the United States. Since there are available values for two other native mysid species (M. bigelowi and A. bahia), this non-native species should be removed (unless documentation is provided confirming it is naturally occurring within waters of North America).*		Section 3.2.1 and Appendix B

TOPIC 5: Comments regarding ESA considerations

Comment Number	Public Comment		Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	**Ex. 5 - Deliberative Process**	No edits

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		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*To ensure the final cadmium water quality criteria is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*		No edits

EPA HQ-OW-2015-0753-0009 (California State Water Resources Control Board)	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to ac7count for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	No edits

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		Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0009 (California State Water Resources Control Board)	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*		No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a Section 7 Consultation.*		No edits

EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*''EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.* *Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.*	**Ex. 5 - Deliberative Process**	No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US*		No edits

Service)	*waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*		
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and that ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*	Ex. 5 - Deliberative Process	No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*		No edits

TOPIC 6: Other comments

Comment Number	Public Comment		Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*In the description of sources of cadmium in the document, EPA overlooked the contribution from coal combustion, coal mining waste, and coal ash ponds spills, seepage, and discharge. These important sources need to be recognized and addressed.*		Section 2.1

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EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Check the document for errors and typos. Specific examples include:*
	• *Pg.27 which is intended to provide an acute criterion protective of nearly all individuals in the distribution (Stephan et al. **1985);the** FAV/2 approach was developed to estimate minimal effect levels,*
	• *Pg.30 This outcome was based on the poor correlation between hardness and acute toxicity for D. magna and occurred only when tests with **less than** 24-hr old neonates were included in the database. Accordingly, only the five D. magna tests from Chapman et al. (1980} initiated with **less than** 24-hr old neonates were used for the analysis*
	• *Pg.33 Two species of sculpin, Cottus bairdii and Cottus confusus, are used to derive the normalized GMAV of **4.962** µg Cd/L*
	  o ***Per Appendix A, this value should be 4.926***
	• *Pg.34 The hardness-normalized GMAV of **7.911** µg/L total cadmium for the genus Oncorhynchus is the fifth lowest in the acute dataset*
	  o ***Per Appendix A, this value should be 7.841 ***
	• *Pg.42 2. Ceriodaphnia, Cladoceran (GMCV=**1.293µg/l** total Cd)*
	• *Pg. 74 Acceptable chronic toxicity **data** are available for 27 freshwater species representing 20 different genera*
	• *Pg. C-8 [d]Not used to calculate **SMAV** because either a more definitive value available, value is considered an outlier, or preference was given to the more sensitive exposure scenario (LC versus ELS tests).*
		Ex. 5 - Deliberative Process	Various locations

EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*While Table 5 summarizes the Phyla, Families, Genera, and Species used to derive the revised criterion, it is unclear which species were used to meet each of the MDRs. Include a table that lists the eight requirements and the species used to fulfill them.*	**Ex. 5 - Deliberative Process**	Table 5
EPA-HQ-OW-2015-0753-	*Verify that the Spehar and Fiandt 1986 data for Pimephales promelas is appropriate to include in the*		

0006 (Wisconsin Department of Natural Resources)	*freshwater acute hardness correction.*	Ex. 5 - Deliberative Process	Appendix Table A-1, A-2, C-1 and C-2
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Expand Table 6 to include the actual data that were used in the freshwater acute hardness correction for each species.*		Appendix Table A-2
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process.*		Figure 2
EPA-HQ-OW-2015-0753-0006 Wisconsin Department of Natural Resources)	*Indicate how the R^2 value of 0.964 was obtained in the freshwater acute hardness correction. Attempts to replicate the value resulted in a slope of 1.104 and R^2 of 0.698.* *Indicate how the R^2 value of 0.841 was obtained in the freshwater chronic hardness correction. Attempts to replicate the value resulted in a slope of 0.798 and R^2 of 0.632.*		No edits
EPA-HQ-OW-2015-0753-0006 (Wisconsin	*It was not apparent if the MATC or EC_{20} value was used for the freshwater chronic slope derivation.*		Appendix Table C-2

Department of Natural Resources)	*Indicate which of the toxicity values were used in the derivation in Appendix C and Table 8.*	Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process.*		Figure 4
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*The language that describes the computation of the final acute value on pg. 32 is insufficient. Include a reference to section 4.3.1 after the reference to Figure 2 on page 32.*		Section 3.1.1
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*It is unclear how the intercept of the freshwater acute and chronic criterion equations were derived. Add additional language to clarify how these values were derived.*		No edits

ED_000992_00000861-00022

MEMORANDUM

SUBJECT: Notice of Availability: Recommended Aquatic Life Ambient Water Quality Criteria for Cadmium – 2016 (Tier 3, SAN 5843) - ACTION MEMORANDUM

FROM: Elizabeth Southerland
Director, Office of Science and Technology

TO: Joel Beauvais
Deputy Assistant Administrator

PURPOSE
Attached for your signature is the *Federal Register* notice announcing the U.S. Environmental Protection Agency's release of the Updated Aquatic Life Criteria for Cadmium. The public will be able to access the draft criteria document through the EPA docket and website www.regulations.gov.

Following closure of the public comment period, the EPA will consider the public comments and revise the document accordingly. Once finalized, the EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act (CWA).

DEADLINE
The Updated Aquatic Life Criteria for Cadmium needs to be published by March 30, 2015, in order to maintain a timeline set by a potential lawsuit settlement agreement with Northwest Environmental Advocates.

OVERVIEW
The EPA is in the process of updating the agency's 304(a) cadmium aquatic life ambient water quality criteria. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species.

The driver for updating the cadmium criteria was a lawsuit brought on by Northwest Environmental Advocates following the EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. The EPA's disapproval triggered a CWA duty for the EPA to propose a replacement criterion for Oregon. The EPA would intend to use the updated criteria document as the scientific basis for the proposed rule. The agency is currently negotiating a settlement with the litigants in which the EPA would commit to propose cadmium criteria for Oregon by March 31, 2016, and take final rulemaking action by January 16, 2017. The 304(a) criteria being proposed are the basis for the rulemaking and, therefore, the document is time sensitive. We proposed the draft criteria for 60 days of public comment on December 1, 2015. The numbers have changed slightly as a result of adopting changes derived from the public comment period.

The basis of the EPA's disapproval of Oregon's cadmium criterion (and the EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service for acute effect to salmon species based on the EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated freshwater acute criterion is slightly more stringent than the 2001 value, a draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater criterion are expected to provide approximately 95 percent protection for endangered salmonids based on acute effects, a minimal effects level associated with the jeopardy opinion. It is likely, however, that the Services may still question these criteria as they expected our update to result in even more stringent values.

ANTICIPATED PUBLIC AND STAKEHOLDER RESPONSE

Ex. 5 - Deliberative Process

INTERNAL DEVELOPMENT AND REVIEW PROCESS

Office of Science and Technology partnered within the agency with Office of Research and Development to develop the document. The document was reviewed by the Office of Research and Development, Office of Chemical Safety and Pollution Prevention, and the Regions (3, 4, 5, 8, 9, and 10) and Office of Policy. The EPA conducted an external contractor-led letter peer review on the criteria document that was completed in 2015. The document was available for a 60-day public comment period which ended February 1, 2016.

If you need additional information or have questions regarding this notice, please call Elizabeth Behl at (202) 566-0788.

To: Greg Smith[gsmith@glec.com]; Elias, Mike[Elias.Mike@epa.gov]
From: Craig Voros
Sent: Fri 2/26/2016 3:10:31 PM
Subject: Re: Data Request with a bit more info
Cd Public Comments EPA Response_2.26.16_for Mike.docx

;;;;;;Public Comment Response Table for review.

Craig Voros
Great Lakes Environmental Center
1295 King Avenue
Columbus, OH 43212
614-487-1040

On 2/26/2016 9:22 AM, Greg Smith wrote:

Now works

On 2/26/2016 9:21 AM, Elias, Mike wrote:

I can give you a call now if that works.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Friday, February 26, 2016 9:02 AM
To: Elias, Mike
Cc: Craig Voros
Subject: Re: Data Request with a bit more info

Hi Mike

Craig had added your text to the document on H. azteca.

The rest of the changes have been made to the document,

but there is one more issue to discuss if you have time for a call this morning.

And we have made all our changes to the Response Table.

Thanks
Greg

On 2/26/2016 8:40 AM, Elias, Mike wrote:

Greg and Craig,

I am not able to get into Word on the Sharepoint site to make edits to the document. That being said, I only have one minor edit. It is on page 42 of the

document. So, I am attaching the text edit for that paragraph in redline/track change mode for you to insert, as was suggested on the call the other day. Please insert this change in track change mode. Once that is done, I have no other changes to the document text at this point.

Could you please send me a copy with your changes in redline via email, and I will take a quick readthrough (will do immediately), then you should be able to finalize and make it 501 compliant.

In the meantime, I will finalize response to comments and prepare to drop those in. I will try to open that smaller response document, but if I cannot, will ask you to send me the response document, so I can drop my responses in at that time.

Thanks,

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Wednesday, February 24, 2016 11:03 AM
To: Elias, Mike
Cc: Craig Voros
Subject: Re: Data Request with a bit more info

Hey Mike

Would it be possible to have a call sometime today?

Thanks
Greg

On 2/23/2016 4:38 PM, Elias, Mike wrote:

Ex. 5 - Deliberative Process

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 2:44 PM
To: Elias, Mike
Cc: Craig Voros
Subject: Re: Data Request with a bit more info

Mike

One consideration to including graphs showing the linear regression to better illustrate the normalization process.

EPA-HQ-OW-2015-0753-0006: "Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process."

EPA-HQ-OW-2015-0753-0006: "Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process."

Is that it will take Keith approximately 4-8 hours to generate the two graphs (a lot of effort to manually normalize the data).

So just wanted to make sure before starting the effort.

Thanks
Greg

On 2/23/2016 1:38 PM, Elias, Mike wrote:

> Greg, I could not get into Edit in Word, so instead made my comments in italics and highlighted in yellow. Please move forward with changes in the document. I think it is almost all responded to at this point. I need to step out, but will be back in a couple of hours.
>
> **From:** Greg Smith [mailto:gsmith@glec.com]
> **Sent:** Tuesday, February 23, 2016 11:35 AM
> **To:** Elias, Mike
> **Cc:** Craig Voros
> **Subject:** Re: Data Request with a bit more info
>
> Mike
>
> So far we have completed all the responses assigned to us in the response table only.
>
> We have not made all the changes to the document. We have only made changes to the document that aren't dependent on the new (revised) criteria values. So if nothing else will change, we can now begin changing the document to reflect the new criteria values and other comments that were assigned to us (the brunt of the work; tables corrections, graphs, values, etc.).

Thanks
Greg

On 2/23/2016 11:16 AM, Elias, Mike wrote:

I have discussed this with Kathryn. The good news is that we do not need to make any changes to the document before the initiation of the final internal review. However, we will need to review the unmeasured concentrations concurrent with the final Agency review. I can talk with you about a proposed approach to this more tomorrow, but the focus at the moment can be back on finalizing the revisions and comment responses for internal review.

Could you please update me where you are at on your end with revisions?

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 8:39 AM
To: Elias, Mike
Cc: Craig Voros
Subject: Re: Data Request with a bit more info

Yes, your understanding is correct.

On 2/23/2016 8:35 AM, Elias, Mike wrote:

Ex. 5 - Deliberative Process

Is that a correct understanding? I am trying to sort a few things out and then we should talk.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 8:04 AM
To: Elias, Mike
Cc: Craig Voros
Subject: Re: Data Request with a bit more info

Hi Mike

Yes we should discuss asap, since to revise the freshwater and saltwater acute values will take some time.

In my experience, acceptable unmeasured tests have never been excluded from determining the SMAV for a species (except when a flow-through measured test is available).

Examples are acrolein, aluminum, atrazine, carbaryl, chloride, diazinon, manganese, molybdenum, nonylphenol, silver and tributyltin.

Craig and I are in the office all day today for a call.

Thanks
Greg

On 2/23/2016 7:36 AM, Elias, Mike wrote:

> Greg and Craig,
>
> I confirmed with Kathryn that it is acceptable for us to keep the data for salmonids for situations where the pH is 6.5. She is in agreement with our conclusion.
>
> However, a remaining and bigger issue raised by Kathryn is related to the use of data from unmeasured concentrations. There seems to be general agreement that unmeasured concentrations can be used when

Ex. 5 - Deliberative Process

I am working out of the office today, but should be around except for early afternoon.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Friday, February 19, 2016 1:21 PM
To: Elias, Mike
Cc: Craig Voros
Subject: Re: Data Request with a bit more info

Sounds good

On 2/19/2016 1:19 PM, Elias, Mike wrote:

> Sorry, pulled away by calls. I will try to give you a call in about 5 mins
>
> **From:** Greg Smith [mailto:gsmith@glec.com]
> **Sent:** Friday, February 19, 2016 11:23 AM
> **To:** Elias, Mike
> **Cc:** Craig Voros
> **Subject:** Re: Data Request with a bit more info
>
> Mike

Here is a suggested table to fulfill the MDR (this was in the Cd document a couple of years ago before it was removed).

Also need to decide if we want to add tables showing the data used to develop the acute and chronic hardness slopes (current identify them with an * in each appendix).

Thanks
Greg

On 2/19/2016 9:09 AM, Elias, Mike wrote:

Greg and Craig,

Ex. 5 - Deliberative Process

4. Additional items that were not previously discussed.

a. Greg and Craig, please make the following revisions to the document:

i. Add a table summarizing the phyla/family/genera/species used to fulfill the MDRs. The best example of such a table is Table 2 in the ammonia document.

ii. Add tables summarizing the final four species used to develop each criteria value. This is really just repackaging information that is already in the document. Take the list of species at the top of page 42 in the cadmium document, for example, and repackage into a table similar to what is shown in Table 3.6 of the selenium document. Please do that for each of the four criteria values.

Ex. 5 - Deliberative Process

Please let me know when you are available to talk about these items.

Thanks,

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Wednesday, February 17, 2016 3:57 PM
To: Elias, Mike
Cc: Craig Voros

Subject: Data Request with a bit more info

Mike

Here is the reproduction info

Methods for H. azteca testing

Only found methods for sediment testing (nothing available for water only tests):

ASTM (2005) has recommended minimum dry weight of 0.15 mg/individual, **reproduction from day 28 to day 42 of >2 young/female**

OECD (1998) does not have recommendations

Environment Canada (2013) Biological Test Methods for H. azteca recommends minimum dry weight of 0.10 mg/individual. **Nothing on reproduction.**

Title

TOPIC 1: Duration should be 24 hours, not one hour

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0012	*UWAG has concerns with EPA's proposal to change the acute freshwater and estuarine/marine criteria averaging duration from 24 hours to 1 hour. The change is not adequately justified and is not supported by new studies in the Draft. The current 24-hour duration should be retained unless a strong scientific justification is presented.* *Every previous iteration of the cadmium criteria has endorsed a 24-hour duration for the acute criteria. EPA appears to be making a policy decision that the acute criteria should be 1 hour, but does not present the associated science to support the revision which is inconsistent with CWA § 304(a)(1), which mandates EPA establish "criteria for water quality accurately reflecting the latest scientific knowledge."*	*EPA. No change. Response to comment only*	
EPA-HQ-OW-2015-0753-0012	*EPA compares the acute toxicity to ammonia but fails to provide information that compares the time-dependent toxicity of cadmium with ammonia. Furthermore, assessing the toxicity of cadmium during the first 24 hours of an acute test is problematic because the vast majority of published studies reporting the acute toxicity of cadmium do not report patterns of lethality during the first 24 hours. Several acceptable selected studies (Besser et al. 2007; Buhl 1997; Diamond et al. 1997; Mebane et al. 2012; Nebeker 1986) do not report 24-hour LC50s and the one study with relevant data (Duncan and Klavercamp 1983) had a 12-hour LC50 that was five times greater than the 96-hour LC50 (5.35 vs. 1.11 µg/L, respectively). This value would be expected to be similar if cadmium was a fast-acting pollutant.*	*EPA. No change. Response to comment only*	
EPA-HQ-OW-2015-0753-0012	*An earlier EPA publication (*Speed of Action of Metals Acute Toxicity to Aquatic Life*; EPA-822-R-95-002) also justifies the 24-hour averaging period. This document estimated a kinetic coefficient (*k*) using a regression of LC50 values versus time, with the averaging period being calculated as the inverse of* k*. The larger the* k *value the faster acting the pollutant. None of the estimated averaging periods in the document for freshwater and saltwater species approached 1-hour in the document. The highest estimated* k *values mentioned, for the freshwater fathead minnow, were 6 and 17 hours, with saltwater species having even larger values. The selection of the 1-hour averaging period is baseless and arbitrary.*	*EPA. No change. Response to comment only*	

EPA-HQ-OW-2015-0753-0012	*According to EPA, the purpose of the averaging period is to allow the concentration to be above the CMC only if the allowed fluctuating concentrations do not cause more adverse effect than would be caused by a continuous exposure to the CMC, but EPA does not provide explanation, supporting data, or justification why the duration must be changed to 1-hour in order to avoid more adverse effects.* *Additionally, the 1985 Guidelines say the duration should be "substantially less than 48 to 96 hours," but do not say that 24 hours is an inappropriate duration and therefore the Guidelines do not support, nor should it be a justification for the proposed revision.*	*EPA. No change. Response to comment only*	
EPA-HQ-OW-2015-0753-0012	*Similarly the TSD (for ammonia) is used as a justification for the 1-hour averaging period; ammonia's averaging period was derived primarily from data on response time to ammonia, a fast-acting toxicant. However there are differences between the toxic mode of action between ammonia and cadmium. There is more dissimilarity between the modes of toxicity for the two chemicals than similarities. Therefore this document should not be relied upon to prove justification of the new averaging period.*	*EPA. No change. Response to comment only*	
EPA-HQ-OW-2015-0753-0012	*If the averaging period is revised to be shorter, EPA needs to explain why it is not also necessary for a corresponding increase in the cadmium concertation that will cause mortality in the shorter period of time.*	*EPA. No change. Response to comment only*	
EPA-HQ-OW-2015-0753-0012	*Water Quality-Based Effluent Limits (WQBELs) for cadmium are often expressed as a daily (24-hr) maximum value. Changing the WQBEL to a 1-hour averaging duration could require a permittee to collect several compliance samples during a 24-hour period. This additional burden is unnecessary since there is minor variability of the cadmium levels during a typical 24-hour period, and this additional monitoring is unwarranted without sound scientific basis.*	*EPA. No change. Response to comment only*	

TOPIC 2: H. azteca test by Ingersoll is not acceptable; retest should be done or test should be removed from criteria development

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document

ED_000992_00000891-00003

EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*The proposed chronic criterion is based on a flawed toxicity test (Ingersoll and Kemble 2001) conducted on the amphipod Hyalella azteca. The Hyalella test used in the criterion derivation should be repeated using current feeding procedures that are proven to result in better growth and reproduction. While the IEPA acknowledges and commends the improvements USEPA has made in the assessment and analysis of Hyalella sp. data compared to the 2001 cadmium criteria document, specifically in regards to the sensitivity of this organism to the presence/absence of chloride and bromide in culture and test water, the IEPA contends that the feeding regime employed in the 2000 USGS study is deficient by today's standards and likely resulted in malnourished, stressed test organisms.* *Specifically, test organisms in the 2000 USGS study were underfed and/or fed improper diets based on current research. Dr. Soucek, at the Illinois Natural History Survey, conducted new research that focused on determining the appropriate amounts of food for test organisms. His research has led to improved growth of test organisms compared to earlier diet regimes. The diet used in the 2000 USGS study consisted of a ration of 1.0 ml YCT/d, whereas Dr. Soucek's research contends that a diet consisting of Tetramin supplemented with diatoms greatly improves growth and reproduction of Hyalella azteca compared to YCT-only diets (Soucek et al. 2016, in press).* *The diet in the 2000 USGS study restricted growth and fecundity when compared to Tetramin-based diets (Soucek et al. 2016, in press), and brings into question the accuracy of the test results.*	**Ex. 5 - Deliberative Process**	*Self explanatory*
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*Test organisms in the 2000 USGS study did not attain minimum growth requirements based on the direct measure of organism weight, with the average dry weight of the controls being 0.27 mg/individual (<0.50 mg/individual). USEPA concluded that the dry weights measured in the test were inaccurate and subsequently used length data to extrapolate to dry weight via a regression equation. However there is no documentation provided for this equation or how it was derived. It is unlikely that the dry weights were underestimated (while an overestimation can be expected due to inadequate drying of test organisms), and it is therefore considered unlikely that the organisms achieved the minimum weight requirements for this test to be valid.*	**Ex. 5 - Deliberative Process**	

EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*The dilution series (control and 5 treatment concentrations: 0.1, 0.3, 0.5, 2.0 and 3.0 µg/L.) used in the 2000 USGS test did not appropriately bracket the effect concentration. The dilution series was not standard, with a large gap in concentration between the NOEC and LOEC (0.5 and 2.0 µg/L, respectively). While a point estimation technique was used to determine the effect concentration, the lack of a 1.0 µg/L treatment may have changed this estimation. The precision of this estimation is paramount, as the test result was the sole determinant of the GMCV, which is the most sensitive in the chronic dataset, and a small change in the GMCV can therefore have a substantial effect on the final chronic value.*	**Ex. 5 - Deliberative Process**	
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*At this time, the IEPA is in support of the adoption of the acute cadmium criterion as proposed, but is requesting a one year extension for the adoption of the chronic criterion. A one year extension would allow for a retest on Hyalella azteca using current feeding recommendations and would allow for revisions to be made to the chronic criterion. A round robin approach would ensure that the data are obtained using the appropriate test procedures and would provide additional information regarding the sensitivity of Hyalella azteca to cadmium. If time does not permit a repeat of the test, then the chronic criterion should be recalculated with the Hyalella data removed.*	**Ex. 5 - Deliberative Process**	*Self explanatory*

TOPIC 3: Dissolved vs total concentration use

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA HQ-OW-2015-0753-0005	*Additional documentation is needed to support the total to dissolved conversion factors. Very little information is provided concerning the derivation of the conversion factors, and more detailed information is needed to fully assess their appropriateness*	Information has been added to better describe the use of derived total to dissolved conversion factors. *Need to describe the derivation, in addition to use of conversion factors.* The acute freshwater conversion factors were determined empirically whereby total and dissolved cadmium concentrations were measured during actual 48- and 96-hour *Daphnia magna* and fathead minnow fed and unfed static toxicity tests conducted at different total hardness (TH) levels (Stephan 1996; University of Wisconsin – Superior 1995). Either cadmium chloride or cadmium sulfate were spiked in Lake Superior water and measured at test initiation and completion. The time weighted averages (TWA) obtained for percent dissolved cadmium for each simulation were used to determine the freshwater acute conversion factors of 0.973 at 50 mg/L TH, 0.944 at 100 mg/L TH and 0.915 at 200 mg/L TH.	Section 2.6

	for natural waterbodies.	Freshwater chronic conversion factors obtained from the same tests and extrapolation procedures were 0.938, 0.909 and 0.880 at 50, 100 and 200 mg/L TH, respectively. The lower chronic conversion factors are due to the longer TWA period employed relative to the acute factors. The acute saltwater conversion factor of 0.99 determined by Lussier et al. (1999) was based on an *Americamysis bahia* 96-hr flow-through exposure and mean weighted total and dissolved cadmium concentrations. Narragansett Bay seawater was spiked with cadmium chloride and exposure concentrations were measured at 1- and 96-hrs.	
EPA HQ-OW-2015-0753-0005	*It is unknown if the solutions prepared from Cd salts, that were used to develop the conversion factors, adequately represent the forms of Cd found in natural waterbodies.*	Cadmium chloride and cadmium sulfate salts were used in the simulation tests, which are the same salts generally used in cadmium toxicity testing and typically found in the environment.	Section 2.6
EPA HQ-OW-2015-0753-0005	*An explanation is needed as to why the conversion factors for the acute and chronic criteria are different. It also appears illogical that the constant conversion factor of 0.994 used for marine water is higher than freshwater, especially because the hardness-dependent conversion factor for freshwater decreases as hardness increases.*	Information has been added to explain the difference between the acute and chronic conversion factors. [The acute and chronic freshwater conversion factors are obtained from the same acute toxicity tests, the only difference being the longer time weighted average (TWA) procedure applied to derive the chronic conversion factors relative to the acute factors]. The freshwater and saltwater conversion factors are each based on dissolved-to-total ratios determined in natural surface water toxicity tests. The only difference between the two is that the freshwater conversion factors were extrapolated using TWA procedures, whereas the saltwater conversion factor is based on mean weighted total and dissolved cadmium concentrations determined at test initiation and completion. **Ex. 5 - Deliberative Process**	Section 2.6
EPA HQ-OW-2015-0753-0005	*While it is noted in several places in the document, clarify that the recommended criteria values are expressed as dissolved cadmium concentrations (not total). Also clarify if states have the option to adopt total Cd criteria values.*	*EPA responding. Minor clarification in document text.*	
EPA HQ-OW-2015-0753-0011	*Kansas has utilized the total recoverable metals criteria and data, and is not set up to sample for total dissolved metals. A conversion factor would be applied to calculate the dissolved concentration and Kansas recommends that EPA retain this flexibility in its final criteria.*	*EPA responding. No change to document text.*	

TOPIC 4: Data inclusion in criteria derivation

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0006	*Some of the values that are new/revised since the 2001 AWQC document are from studies that were published before 2001. Table 22 has general information describing why GMAVs have changed between the 2001 and 2015 document, but it does not provide details on why these "new" data were now considered acceptable. Include another table that describes why the studies that were excluded previously are now included.*	The "new" acceptable data published prior to 2001 were never reviewed during the 2001 document update because the papers/reports were not available at that time. Acquisition of papers/reports during the 1999/2000 time frame was more difficult than currently available procedures, especially with present day enhanced internet capabilities. In some cases, data previously considered acceptable back in 2001 were deemed unacceptable during this update because more stringent acceptability criteria were implemented by EPA. **Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0013	*Should toxicity tests conducted under less-than optimal conditions be discounted? This comment goes beyond just the test results for Hyalella, because while laboratory tests used for criteria development use conditions that are as close to optimal as possible, wild populations in diverse natural conditions are often exposed to conditions that sub-optimal, and therefore laboratory tests may be underproductive in natural conditions (i.e., additional stresses) (see, Holmstrump et al. 2010; Besser et al. 2015).*	*EPA will respond. No change to text anticipated.*	*Self explanatory*
EPA-HQ-OW-2015-0753-0013	*"Other data" are not addressed consistent with the Guidelines. While these data are not used in the species sensitivity distribution rankings, they should not be thrown away, discounted, or deemed "unacceptable." "Other Data" can be invoked to lower a criterion (e.g., chronic value in the 1987 selenium criterion). Revaluate Riddel et al. (2005a, b) and include a larger discussion of their effect concentrations/findings and other similar behavioral/ecological studies.*	**Ex. 5 - Deliberative Process** These "other" data are used qualitatively to support toxicity data compiled for existing species to derive the criteria. Artificial stream study data from Riddel et al. (2005a, b) and Mebane et al. (2014) have been added describing cadmium effect concentrations on behavior and predator-prey interactions.	Section 5 and 5.2
EPA-HQ-OW-	*With many organisms, a strong difference in the sensitivity of different life stages makes it inappropriate to roll up data from different developmental stages. Pooling salmonid effects*	When a strong difference in the sensitivity of species is apparent across life stages then only the data for the most sensitive life stage is used to calculate the SMAV. The data in Appendix A and B was re-evaluated and the SMAV for rainbow trout and Chinook salmon were re-calculated using only the most sensitive lifestages (i.e.,	Appendix A

2015-0753-0013	*concentrations across developmental stages to obtain a SMAV could produce a misleading result (see, Hansen et al. 2002; Mebane et al. 2012; Chapman 1978; Chapman and Stevens 1978).*	smolts were not used in the SMAV calculation). **Ex. 5 - Deliberative Process**	Ranked FW Acute Table
EPA-HQ-OW-2015-0753-0013	*The decision to only use ELS chronic data in which the exposures began in the egg stage, and to exclude long-term data in which the exposures began in the fry stage is non-conservative.*	This decision was based on previous external peer review comments. The use of the life cycle (LC) tests over the early life stage (ELS) tests in the draft reviewed by the external peer reviewers was consistent with the 1985 Guidelines. It was noted that there was no consistent pattern of early life stage tests being more sensitive than life cycle tests for salmonids. Subsequently, based upon peer reviewer comments, use of sensitive salmonid tests was reconsidered and changes in the approach were made for the 2015 draft criteria. Specifically, ELS tests were used to calculate the revised SMCV in instances where they were more sensitive than the LC tests (e.g., *Salmo trutta*). Therefore the most conservative type of test was chosen for each species.	None
EPA-HQ-OW-2015-0753-0013	*SMAV calculations tagged with the footnote "C", indicating that "Data not used to calculate SMAV because more sensitive lifestage available, or flow-through measured test available", should be separated into two different footnotes since they are very different reasons.*	A footnote has been added to separate out "Data not used to calculate SMAV because more sensitive lifestage available" from "flow-through measured test available"	Appendix A and Appendix B
EPA-HQ-OW-2015-0753-0013	*Address the following Appendix A specific errors/changes:* • *Daphnia magna (various)* ○ *Many "S,U" tests (tests with unmeasured concentrations) are underlined, indicating they are included in the SMAV calculations. These should be excluded per the Guidelines.*	• Per the Guidelines (Section IV. I), acceptable static/unmeasured acute tests are only excluded from SMAV calculations when there is an acceptable flow-through/measured test available for the species. In addition, only for certain volatile or easily degraded contaminants (which cadmium is not) would static/unmeasured tests be considered for exclusion. Thus, if an acceptable flow-through/measured test is not available for *Daphnia magna*, then all acceptable acute data are used to calculate the SMAV for this species. *No changes now; we can work through during review.*	Appendix A Ranked FW Acute Table
	• *Mayfly (formerly, Ephemerella grandis) Drunella grandis* ○ *Tested species was listed in the source document as Ephemerella subvaria, which is still a valid species name according to ITIS.gov.*	• Warnick and Bell 1969 did indeed conduct toxicity studies with *Ephemerella subvaria*, but Clubb et al. 1975 conducted tests with *Ephemerella grandis grandis* (now classified as *Drunella grandis grandis*). These two tests will be broken out on Appendix A, with the corrected name changes cited where appropriate.	
	• *Rainbow trout (smolt), Chapman 1975 (>2.9 µg/L)* ○ *Should be excluded from SMAV because it is from a*		

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	resistant life stage. Also, should be listed as "Rainbow trout (Steelhead smolt)" as Steelhead are not just Rainbow Trout by a different name, but have physiological differences in regard to ion regulation. Chapman (1975) should only be cited when no alternative exists, because it was never formally released by EPA and is not publicly available online. Chapman (1978) reports the same data and is a better citation. • *Rainbow trout (smolt), Chapman 1975 (4.1 µg/L)* o *Suspect value, exclude from SMAV. Chapman (1978) lists the value for the same test as >2.9 µg/L. Chapman (1978) is the peer-reviewed publication of record for these data; Chapman (1975) was an unpublished, work-in-progress progress report that sometimes still gets cited because it includes data never published elsewhere, such as the coho data shown in the figure in this memo. Exclude from SMAV, resistant life stage and re-label as " "Rainbow trout (Steelhead smolt". See Chapman (1978, Table 3).*	The Chapman 1975 unpublished report data will be deleted from the appropriate tables, due to the note of the author that the published paper (i.e., Chapman 1978) supersede the report. Furthermore the value for the smolt will not be used in the calculation of the SMAV for rainbow trout because it is a **Ex. 5 - Deliberative Process**
	• *Rainbow trout (299 mg), Stratus (1.29 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with unmanipulated pH of 7.5 were much more sensitive*	• The pH manipulated value from Stratus Consulting (1999) for the rainbow trout is appropriate to use since it is within the pH range of 6.5-9.0 for permitted outfalls and is consistent with the ranges of pH values found in ambient surface waters. Thus the test conducted at pH 6.5 reflects the natural environment and should be included in the database.

	• *Chinook salmon (parr, 11.58g) (3.5 µg/L)*
	  o *Exclude value from SMAV, based on a resistant life stage being tested. Value is twice as high as the value obtained with swim-up fry in matched tests and confidence limits don't overlap.*
	• *Chinook salmon (smolt, 32.46 g) (>2.9 µg/L)*
	  o *Should be excluded from SMAV, based on a resistant life stage being tested .*
		• The Chinook salmon values for the parr and the smolt will not be used in the SMAV calculation because they are from a more resistant life stage.

	• *Bull trout (84.2 mg) (2.89 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with a natural pH of 7.5 were much more sensitive*	• The pH manipulated value from Stratus Consulting (1999) for the bull trout is appropriate to use since it is within the pH range of 6.5-9.0 for permitted outfalls and is consistent with the ranges of pH found in ambient surface waters. Thus the test conducted at pH 6.5 reflects the natural environment and should be included in the database.
	• *Colorado squawfish* o *Old common name is now considered repugnant. AFS calls it "Colorado pikeminnow". "Pikeminnow"*	• The Colorado squawfish common name will be changed to Colorado pikeminnow.

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	is one word.		
EPA-HQ-OW-2015-0753-0013	*Address the following Appendix C specific errors/changes:* • *Snail, Aplexa hyporum (Holcombe) (4.0 µg/L)* o *I got an EC20 of about 2.6 µg/L. By excluding the highest treatment with total mortality I could reproduce the 4.0 EC20 value, but it had a poor fit with Y0.*	Two separate EC_{20}s for Holcombe et al. (1984) were calculated, an un-normalized EC_{20} of 4.002 µg/L based on the number of egg masses per snail for tanks A and B, and an un-normalized EC_{20} of 0.8737 µg/L based on survivors to test end for tanks C and D. The EC_{20} of 4.002 µg/L was calculated using the threshold sigmoid model in TRAP version 1.21 (and was replicated in TRAP version 1.30 with the same result) using the following initial parameters: log X_{50} = 0.7, S=2, y-intercept=90. No treatments were excluded (treatments with 100% mortality were treated as having 0 egg masses/snail). If test data from tanks A and B are combined with data from tanks C and D, the un-normalized EC_{20} for egg-masses per snail was calculated as 2.515 µg/L, using a threshold sigmoid model in TRAP version 1.30. This was the only method where EPA was able to calculate an EC_{20} similar to 2.6 µg/L. The present method of calculation (two EC_{20}s of 4.002 and 0.8737 µg/L, respectively) results in a similar (un-normalized geometric EC_{20} of 1.870 µg/L), but slightly more conservative value for *Aplexa* than the un-normalized 2.515 µg/L one would obtain for number of egg masses per snail by combining data from tanks A-D.	No edits

EPA-HQ-OW-2015-0753-0013	*Add the following additional relevant data:*
	
	• *Pascoe and Mattey 1977*
	  o *Chronic stickleback exposure*
	• *Wang et al. 2014*
	  o *Chronic fathead full life-cycle test*
	• *Brinkman and Vieira 2008*
	  o *Acute and chronic mountain whitefish*
	• *Mebane et al. 2014 (paper provided)*
	  o *Effects of cadmium on larval aquatic insect communities in 30-day experimental stream tests*
		• Pascoe and Mattey 1977
		  o Study deemed unused because of 1) no control information and 2) dilution water not defined (appears to be reconstituted water).
		• Wang et al. 2014
		  o Study deemed unused because of 1) only three exposure concentrations, 2) a static chronic exposure (should be static-renewal or flow-through) and 3) only a 21-day fish test (should be at least 28 days).
		• Brinkman and Vieira 2008
		  o Study deemed unused because scientific name not given (only common name given).
		• Mebane et al. 2014
		  o Initial review of preliminary summary shows 32-day effects levels at 0.1-0.8 µg/L Cd. However the natural river water used for dilution is only partially characterized
			Mebane et al. (2014) added to Section 5.2

TOPIC 5: Species use and availability

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014	*There is concern about the focus on fish in developing the criteria. EPA needs to bring in other species including insects and freshwater mussels into the process when developing criteria for cadmium. This lack of additional species prevents a more holistic picture of the freshwater community, and results in criteria that are not protective of all aquatic-dependent wildlife. EPA has consistently failed to fully consider aquatic-dependent wildlife in the development of national criteria.*	*EPA will respond. No changes to document expected.*	*Self explanatory*
EPA-HQ-OW-2015-0753-0010	*There is concern with the continued lack of estuarine/marine chronic cadmium toxicity data and that no new chronic toxicity data have been generated since 2001. EPA should conduct additional chronic toxicity studies (particularly with vertebrate species) to expand the estuarine/marine chronic toxicity dataset. More estuarine/marine chronic data are needed to develop a scientifically reliable chronic cadmium criterion.*	*EPA will respond. No changes to document expected.*	*Self explanatory*
EPA-HQ-OW-2015-0753-0010	*The mysid Neomysis integer is a new species added to the estuarine/marine acute dataset, but this mysid is potentially non-native to the United States. Since there are available values for two other native mysid species (M. bigelowi and A. bahia), this non-native species should be removed (unless documentation is provided confirming it is naturally occurring within waters of North America).*	*Neomysis integer* has been removed from the database since it is not naturally occurring within waters of North America. In addition, a new North American estuarine/marine species, *Neomysis americana*, has been added to the database after obtaining a new paper (i.e., Roberts et al. 1982) not previously reviewed.	Section 3.2.1 and Appendix B

TOPIC 6: ESA considerations

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the*	*EPA responding. No changes to document expected*	*Self explanatory*

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2015-0753-0014	*hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*		
EPA-HQ-OW-2015-0753-0014	*To ensure the final cadmium water quality criteria to is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*	*EPA responding. No changes to document expected*	*Self explanatory*
EPA HQ-OW-2015-0753-0009	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to account for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	*EPA responding. No changes to document expected*	
EPA HQ-OW-2015-0753-0009	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*	*EPA responding. No changes to document expected*	

EPA HQ-OW-2015-0753-0015	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a Section 7 Consultation.*		*Self explanatory*
EPA HQ-OW-2015-0753-0015	*EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.* *Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.*		
EPA HQ-OW-2015-0753-0015	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For*		

	long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.		
EPA HQ-OW-2015-0753-0015	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*		
EPA HQ-OW-2015-0753-0015	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*		

TOPIC 7: Other

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014	*In the description of sources of cadmium in the document, EPA overlooked the contribution from coal combustion, coal mining waste, and coal ash ponds spills, seepage, and discharge. These important sources need to be recognized and addressed.*	Additional information will be added to the document detailing the anthropogenic sources of cadmium from coal ash ponds/pits.	Section 2.1
EPA-HQ-OW-2015-0753-0006	*Check the document for errors and typos. Specific examples include:* • *Pg.27 which is intended to provide an acute criterion protective of nearly all individuals in the distribution (Stephan et al. **1985);the** FAV/2 approach was developed to estimate minimal effect levels,* • *Pg.30 This outcome was based on the poor correlation between hardness and acute toxicity for D. magna and occurred only when tests with **less than** 24-hr old neonates were included in the database. Accordingly, only the five D. magna tests from Chapman et al. (1980} initiated with **less than** 24-hr old neonates were used for the analysis* • *Pg.33 Two species of sculpin, Cottus bairdii and Cottus confusus, are used to derive the normalized GMAV of **4.962** µg Cd/L*	Document will be thoroughly reviewed prior to Federal Register publication. Typos, grammatical errors and suggestions highlighted in your comments have be changed.	*Various locations*

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	Per Appendix A, this value should be 4.926 • *Pg.34 The hardness-normalized GMAV of **7.911** µg/L total cadmium for the genus Oncorhynchus is the fifth lowest in the acute dataset* o ***Per Appendix A, this value should be 7.841 *** • *Pg.42 2. Ceriodaphnia, Cladoceran (GMCV=**1.293µg/l** total Cd)* • *Pg. 74 Acceptable chronic toxicity **data** are available for 27 freshwater species representing 20 different genera* • *Pg. C-8 [d] Not used to calculate **SMAV** because either a more definitive value available, value is considered an outlier, or preference was given to the more sensitive exposure scenario (LC versus ELS tests).*		
EPA-HQ-OW-2015-0753-0006	*While Table 5 summarizes the Phyla, Families, Genera, and Species used to derive the revised criterion, it is unclear which species were used to meet each of the MDRs. Include a table that lists the eight requirements and the species used to fulfill them.*	Table 5 has been modified to include the genus used to fulfill each of the family minimum data requirements.	Table 5
EPA-HQ-OW-2015-0753-0006	*Verify that the Spehar and Fiandt 1986 data for Pimephales promelas is appropriate to include in the freshwater acute hardness correction.*	The Spehar and Fiandt (1986) data for *Pimephales promelas* satisfy the requirements for use in the freshwater acute slope derivation, and although the acute value for this study is lower than the other data evaluated at a similar hardness level, there is no justification for exclusion. Furthermore, additional tables were added to Appendices A and C to list which studies and values were used in the respective hardness normalization analysis.	Appendix Table A-1, A-2, C-1 and C-2
EPA-HQ-OW-2015-0753-0006	*Expand Table 6 to include the actual data that were used in the freshwater acute hardness correction for each species.*	An additional table was added to Appendix A to list which studies and values were used in the hardness normalization analysis.	Appendix Table A-2
EPA-HQ-OW-2015-0753-0006	*Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process.*	A graph has been added showing the freshwater acute hardness linear regression to better illustrate the normalization process.	Figure 2
EPA-HQ-OW-2015-0753-0006	*Indicate how the R^2 value of 0.964 was obtained in the freshwater acute hardness correction. Attempts to replicate the value resulted in a slope of 1.104 and R^2 of 0.698.* *Indicate how the R^2 value of 0.841 was obtained in the freshwater chronic hardness correction. Attempts to replicate the value resulted in a slope of 0.798 and R^2 of 0.632.*	The differences in r^2 for both the acute and chronic hardness correction slopes represents differences in the models used to calculate these slopes. While the commenter manually normalized log transformed hardness and toxicity values by species prior to the regression (inferred from Figure 1 and 2), the draft document did not manually normalize to species, but rather used the following multiple linear regression model: lnToxicity = Species + lnHardness; Where "lnToxicity" represents either ln transformed acute or chronic toxicity values, as applicable. The inclusion of a "Species" term in a multiple regression model	No edits

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EPA-HQ-OW-2015-0753-0006	*It was not apparent if the MATC or EC_{20} value was used for the freshwater chronic slope derivation. Indicate which of the toxicity values were used in the derivation in Appendix C and Table 8.*	prior to the lnHardness term returns a normalized hardness slope without having to manually normalize data to species, as shown by the equivalent hardness slopes calculated using the two approaches. The higher r^2 in the multiple regression model is due to the inclusion of the species term, as the effects of species are also accounted for in the model, but the hardness slopes are equivalent. This is the same approach used in the previous (2001) cadmium criteria document. An additional table was added to Appendix C to list which studies, effect measurement and values were used in the hardness normalization analysis.	Appendix Table C-2
EPA-HQ-OW-2015-0753-0006	*Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process.*	A graph has been added showing the freshwater chronic hardness linear regression to better illustrate the normalization process.	Figure 4
EPA-HQ-OW-2015-0753-0006	*The language that describes the computation of the final acute value on pg. 32 is insufficient. Include a reference to section 4.3.1 after the reference to Figure 2 on page 32.*	Reference to Section 4.3.1 has been added.	Section 3.1.1
EPA-HQ-OW-2015-0753-0006	*It is unclear how the intercept of the freshwater acute and chronic criterion equations were derived. Add additional language to clarify how these values were derived.*	The intercept of the freshwater acute and chronic criterion equations can be calculated by rearranging the criterion equations for total cadmium and solving for the intercept. The constants/intercept in the equations for the CMC and CCC were derived as follows: The CMC=$e^{(1.103 \text{ x } \ln(\text{hardness})-4.291)}$ Where, 1.103 is the acute pooled slope and; -4.291 is calculated as =ln(CMC at 100 hardness) - (Pooled Acute Slope x (ln(100))) =ln(2.2)-(1.103 x 4.605) Similarly, the CCC=$e^{(0.7977 \text{ x } \ln(\text{hardness})-3.897)}$ Where, 0.7977 is the chronic pooled slope and; -3.897 is calculated as =ln(CCC at 100 hardness) - (Pooled Chronic Slope x (ln(100))) =ln(0.80)-(0.7977 x 4.605)	No edits

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To: Greg Smith[gsmith@glec.com]; Elias, Mike[Elias.Mike@epa.gov]
From: Craig Voros
Sent: Fri 2/26/2016 2:38:05 PM
Subject: Re: Data Request with a bit more info
Draft Cadmium Aquatic Life Ambient Water Quality Criteria 2.26.16_for Mike.docx

;;;;;;Red-lined cadmium draft for review. Please confirm receipt.

Craig Voros
Great Lakes Environmental Center
1295 King Avenue
Columbus, OH 43212
614-487-1040

On 2/26/2016 9:22 AM, Greg Smith wrote:

Now works

On 2/26/2016 9:21 AM, Elias, Mike wrote:

I can give you a call now if that works.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Friday, February 26, 2016 9:02 AM
To: Elias, Mike
Cc: Craig Voros
Subject: Re: Data Request with a bit more info

Hi Mike

Craig had added your text to the document on H. azteca.

The rest of the changes have been made to the document,

but there is one more issue to discuss if you have time for a call this morning.

And we have made all our changes to the Response Table.

Thanks
Greg

On 2/26/2016 8:40 AM, Elias, Mike wrote:

Greg and Craig,

I am not able to get into Word on the Sharepoint site to make edits to the document. That being said, I only have one minor edit. It is on page 42 of the

document. So, I am attaching the text edit for that paragraph in redline/track change mode for you to insert, as was suggested on the call the other day. Please insert this change in track change mode. Once that is done, I have no other changes to the document text at this point.

Could you please send me a copy with your changes in redline via email, and I will take a quick readthrough (will do immediately), then you should be able to finalize and make it 501 compliant.

In the meantime, I will finalize response to comments and prepare to drop those in. I will try to open that smaller response document, but if I cannot, will ask you to send me the response document, so I can drop my responses in at that time.

Thanks,

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Wednesday, February 24, 2016 11:03 AM
To: Elias, Mike
Cc: Craig Voros
Subject: Re: Data Request with a bit more info

Hey Mike

Would it be possible to have a call sometime today?

Thanks
Greg

On 2/23/2016 4:38 PM, Elias, Mike wrote:

> Thanks for pointing this out Greg. Is there any lower LOE alternative to illustrating the data w/o just having to say we are not doing something to be responsive? I understand that there may not be.
>
> **From:** Greg Smith [mailto:gsmith@glec.com]
> **Sent:** Tuesday, February 23, 2016 2:44 PM
> **To:** Elias, Mike
> **Cc:** Craig Voros
> **Subject:** Re: Data Request with a bit more info
>
> Mike
>
> One consideration to including graphs showing the linear regression to better illustrate the normalization process.

EPA-HQ-OW-2015-0753-0006: "Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process."

EPA-HQ-OW-2015-0753-0006: "Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process."

Is that it will take Keith approximately 4-8 hours to generate the two graphs (a lot of effort to manually normalize the data).

So just wanted to make sure before starting the effort.

Thanks
Greg

On 2/23/2016 1:38 PM, Elias, Mike wrote:

> Greg, I could not get into Edit in Word, so instead made my comments in italics and highlighted in yellow. Please move forward with changes in the document. I think it is almost all responded to at this point. I need to step out, but will be back in a couple of hours.
>
> **From:** Greg Smith [mailto:gsmith@glec.com]
> **Sent:** Tuesday, February 23, 2016 11:35 AM
> **To:** Elias, Mike
> **Cc:** Craig Voros
> **Subject:** Re: Data Request with a bit more info
>
> Mike
>
> So far we have completed all the responses assigned to us in the response table only.
>
> We have not made all the changes to the document. We have only made changes to the document that aren't dependent on the new (revised) criteria values. So if nothing else will change, we can now begin changing the document to reflect the new criteria values and other comments that were assigned to us (the brunt of the work; tables corrections, graphs, values, etc.).

Thanks
Greg

On 2/23/2016 11:16 AM, Elias, Mike wrote:

Ex. 5 - Deliberative Process

Could you please update me where you are at on your end with revisions?

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 8:39 AM
To: Elias, Mike
Cc: Craig Voros
Subject: Re: Data Request with a bit more info

Yes, your understanding is correct.

On 2/23/2016 8:35 AM, Elias, Mike wrote:

Ex. 5 - Deliberative Process

Is that a correct understanding? I am trying to sort a few things out and then we should talk.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 8:04 AM
To: Elias, Mike
Cc: Craig Voros
Subject: Re: Data Request with a bit more info

Hi Mike

Yes we should discuss asap, since to revise the freshwater and saltwater acute values will take some time.

In my experience, acceptable unmeasured tests have never been excluded from determining the SMAV for a species (except when a flow-through measured test is available).

Examples are acrolein, aluminum, atrazine, carbaryl, chloride, diazinon, manganese, molybdenum, nonylphenol, silver and tributyltin.

Craig and I are in the office all day today for a call.

Thanks
Greg

On 2/23/2016 7:36 AM, Elias, Mike wrote:

Greg and Craig,

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

I am working out of the office today, but should be around except for early afternoon.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Friday, February 19, 2016 1:21 PM
To: Elias, Mike
Cc: Craig Voros
Subject: Re: Data Request with a bit more info

Sounds good

On 2/19/2016 1:19 PM, Elias, Mike wrote:

> Sorry, pulled away by calls. I will try to give you a call in about 5 mins
>
> **From:** Greg Smith [mailto:gsmith@glec.com]
> **Sent:** Friday, February 19, 2016 11:23 AM
> **To:** Elias, Mike
> **Cc:** Craig Voros
> **Subject:** Re: Data Request with a bit more info
>
> Mike

Here is a suggested table to fulfill the MDR (this was in the Cd document a couple of years ago before it was removed).

Also need to decide if we want to add tables showing the data used to develop the acute and chronic hardness slopes (current identify them with an * in each appendix).

Thanks
Greg

On 2/19/2016 9:09 AM, Elias, Mike wrote:

Greg and Craig,

Ex. 5 - Deliberative Process

4. Additional items that were not previously discussed.

a. Greg and Craig, please make the following revisions to the document:

i. Add a table summarizing the phyla/family/genera/species used to fulfill the MDRs. The best example of such a table is Table 2 in the ammonia document.

ii. Add tables summarizing the final four species used to develop each criteria value. This is really just repackaging information that is already in the document. Take the list of species at the top of page 42 in the cadmium document, for example, and repackage into a table similar to what is shown in Table 3.6 of the selenium document. Please do that for each of the four criteria values.

Ex. 5 - Deliberative Process

Please let me know when you are available to talk about these items.

Thanks,

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Wednesday, February 17, 2016 3:57 PM
To: Elias, Mike
Cc: Craig Voros

Subject: Data Request with a bit more info

Mike

Here is the reproduction info

Methods for H. azteca testing

Only found methods for sediment testing (nothing available for water only tests):

ASTM (2005) has recommended minimum dry weight of 0.15 mg/individual, **reproduction from day 28 to day 42 of >2 young/female**

OECD (1998) does not have recommendations

Environment Canada (2013) Biological Test Methods for H. azteca recommends minimum dry weight of 0.10 mg/individual. **Nothing on reproduction.**

To: Elias, Mike[Elias.Mike@epa.gov]
Cc: Craig Voros[cvoros@glec.com]
From: Greg Smith
Sent: Wed 2/17/2016 8:36:54 PM
Subject: Data request
Cadmium NODA tables_02.16.16.xlsx
ASTM Bioassay Protocols E1706.pdf
Canada - Hyalella Sediment Test Methods.pdf
OECD Test Procedures.pdf

;;Mike:

Here is the info you requested.

Greg

H. azteca and the FW chronic criterion

Ex. 5 - Deliberative Process

Changes to the FW acute criterion due to life stage issue with salmonids

Ex. 5 - Deliberative Process

See the attached spreadsheet with changes highlighted in yellow.

Methods for H. azteca testing

Only found methods for sediment testing (nothing available for water only tests):

ASTM (2005) has recommended minimum dry weight of 0.15 mg/individual

OECD (1998) does not have recommendations

Environment Canada (2013) Biological Test Methods for *H. azteca* recommends minimum dry weight of 0.10 mg/individual.

To: Gallagher, Kathryn[Gallagher.Kathryn@epa.gov]
From: Elias, Mike
Sent: Mon 4/4/2016 5:51:43 PM
Subject: RE: MEDIA INQUIRY: GREENWIRE; Cadmium criteria
Response to Questions (Redlines Accepted).docx
Response to Questions.docx

Here are the edited responses for your review, both in redline and change accepted mode.

-----Original Message-----
From: Gallagher, Kathryn
Sent: Monday, April 04, 2016 12:33 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Subject: FW: MEDIA INQUIRY: GREENWIRE; Cadmium criteria
Importance: High

Can you draft response and send to me?

Kathryn Gallagher, Ph.D. | Branch Chief, Ecological Risk Assessment Branch | Health and Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

-----Original Message-----
From: Lalley, Cara
Sent: Monday, April 04, 2016 11:21 AM
To: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>
Cc: Harper, Ashley <harper.ashley@epa.gov>
Subject: FW: MEDIA INQUIRY: GREENWIRE; Cadmium criteria
Importance: High

Kathryn,

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

-----Original Message-----
From: Schollhamer, Mary
Sent: Friday, April 01, 2016 2:35 PM
To: Lalley, Cara <Lalley.Cara@epa.gov>
Cc: Loop, Travis <Loop.Travis@epa.gov>
Subject: MEDIA INQUIRY: EE GREENWIRE; Cadmium [DDL Flex.]

Ex. 5 - Deliberative Process

Mary G Schollhamer
Acting Deputy Director of Communications Office of Water U.S. Environmental Protection Agency
Office: 202-564-5759
Mobile: 202-853-5317
schollhamer.mary@epa.gov

-----Original Message-----
From: Daguillard, Robert
Sent: Friday, April 01, 2016 2:29 PM
To: Schollhamer, Mary <Schollhamer.Mary@epa.gov>
Subject: RE: MARY ACTION: EE GREENWIRE; NEGOT. DEADLINE; CADMIUM

Follow-up:

Ex. 5 - Deliberative Process

Thanks, R.

-----Original Message-----
From: Daguillard, Robert
Sent: Friday, April 01, 2016 1:47 PM
To: Schollhamer, Mary <Schollhamer.Mary@epa.gov>
Subject: MARY ACTION: EE GREENWIRE; NEGOT. DEADLINE; CADMIUM

Mary, EE Greenwire is asking us to react to the Center for Biological Diversity's release below. Please note, they're referring to the national cadmium announcement we issued two days ago, not to today's proposed criteria for Oregon.

Ex. 5 - Deliberative Process

-----Original Message-----
From: Corbin Hiar
Sent: Friday, April 01, 2016 1:38 PM
To: Daguillard, Robert <Daguillard.Robert@epa.gov>
Subject: FW: EPA Approves Dangerous Water Quality Standard for Cadmium

Hi Robert,

I'm pinch hitting for our water reporter Tiffany, who's on vacation today. Does EPA have any comment on CBD's claims? Did the agency put out any PR about this new standard?

I plan to file by 3 p.m.

Thanks.

Corbin Hiar
E&E Reporter

http://www.biologicaldiversity.org/news/press_releases/2016/cadmium-04-01-2016.html

For Immediate Release, April 1, 2016

Contact: Brett Hartl, (202) 817-8121, Bhartl@biologicaldiversity.org

EPA Approves Dangerous Water Quality Standard for Cadmium

Endangered Salmon, Sturgeon, Sea Turtles, Corals, Freshwater Animals Will Continue to Be Harmed After EPA Ignores Comments From Experts

WASHINGTON- The Environmental Protection Agency today finalized a new, nationwide water-quality criterion for cadmium that is nearly 40 percent higher than the standard the National Marine Fisheries Service concluded would be safe for endangered salmon in Idaho. Used in the manufacturing of batteries, plastics and electronics, cadmium is toxic to people and wildlife and regulated under the Clean Water Act. But despite the recommendation from the Fisheries Service that the EPA consult with it, as required by the Endangered Species Act, the EPA refused.

"It is beyond disappointing that the EPA continues to turn a blind eye to our nation's most endangered species," said Brett Hartl, endangered species policy director at the Center for Biological Diversity. "Freshwater animals like sturgeon, crayfish and mussels are some of the fastest-declining species in the United States in large part because toxic metals like cadmium continue to be poorly regulated by the EPA."

The new acute water quality criteria of 1.8 micrograms/liter is nearly 40 percent higher than the standard of 1.3 micrograms/liter, which the National Marine Fisheries Service concluded would be safe for endangered salmon in Idaho. Although naturally occurring in extremely low levels, cadmium is a known human carcinogen and is acutely toxic. Chronic exposure to cadmium causes negative impacts on reproduction, immune and endocrine system response, and development for aquatic species.

Despite the Endangered Species Act requirement that the EPA consult with the expert wildlife agencies on any action they take that could harm endangered species, the EPA failed to do so. As a result, the U.S. Fish and Wildlife Service did not even submit comments to EPA on the proposed cadmium standard, leaving the fate of more than 200 species of endangered fish and mussels completely unaccounted for in EPA's decision-making. The National Marine Fisheries Service provided detailed comments noting that the impacts from cadmium on sea turtles and corals had not been assessed leaving these animals vulnerable. The Fisheries Service also noted that EPA's 30-year-old protocols for assessing ecological impacts was completely out of date.

"The EPA needs to stop its head-in-the-sand approach to toxic pollutants, and instead start listening to the best scientific experts about the real-world impacts of these harmful chemicals on endangered species," said Hartl. "If EPA had set a standard that protected the most sensitive endangered species, it would have also set a standard that fully protects our own health and well-being."

The Center for Biological Diversity is a national, nonprofit conservation organization with more than

990,000 members and online activists dedicated to the protection of endangered species and wild places.

To unsubscribe reply with "unsubscribe" in subject line

To: Gallagher, Kathryn[Gallagher.Kathryn@epa.gov]
From: Elias, Mike
Sent: Mon 4/4/2016 4:34:55 PM
Subject: RE: MEDIA INQUIRY: GREENWIRE; Cadmium criteria

Yes.

-----Original Message-----
From: Gallagher, Kathryn
Sent: Monday, April 04, 2016 12:33 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Subject: FW: MEDIA INQUIRY: GREENWIRE; Cadmium criteria
Importance: High

Can you draft response and send to me?

Kathryn Gallagher, Ph.D. | Branch Chief, Ecological Risk Assessment Branch | Health and Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

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Cc: Harper, Ashley <harper.ashley@epa.gov>
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Importance: High

Kathryn,

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

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From: Schollhamer, Mary
Sent: Friday, April 01, 2016 2:35 PM
To: Lalley, Cara <Lalley.Cara@epa.gov>
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Subject: MEDIA INQUIRY: EE GREENWIRE; Cadmium [DDL Flex.]

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Mary G Schollhamer
Acting Deputy Director of Communications Office of Water U.S. Environmental Protection Agency
Office: 202-564-5759
Mobile: 202-853-5317
schollhamer.mary@epa.gov

-----Original Message-----
From: Daguillard, Robert
Sent: Friday, April 01, 2016 2:29 PM
To: Schollhamer, Mary <Schollhamer.Mary@epa.gov>
Subject: RE: MARY ACTION: EE GREENWIRE; NEGOT. DEADLINE; CADMIUM

Follow-up:

Ex. 5 - Deliberative Process

Thanks, R.

-----Original Message-----
From: Daguillard, Robert
Sent: Friday, April 01, 2016 1:47 PM
To: Schollhamer, Mary <Schollhamer.Mary@epa.gov>
Subject: MARY ACTION: EE GREENWIRE; NEGOT. DEADLINE; CADMIUM

Mary, EE Greenwire is asking us to react to the Center for Biological Diversity's release below. Please note, they're referring to the national cadmium announcement we issued two days ago, not to today's proposed criteria for Oregon.

Ex. 5 - Deliberative Process

-----Original Message-----
From: Corbin Hiar
Sent: Friday, April 01, 2016 1:38 PM
To: Daguillard, Robert <Daguillard.Robert@epa.gov>
Subject: FW: EPA Approves Dangerous Water Quality Standard for Cadmium

Hi Robert,

I'm pinch hitting for our water reporter Tiffany, who's on vacation today. Does EPA have any comment on CBD's claims? Did the agency put out any PR about this new standard?

I plan to file by 3 p.m.

Thanks.

Corbin Hiar
E&E Reporter

http://www.biologicaldiversity.org/news/press_releases/2016/cadmium-04-01-2016.html

For Immediate Release, April 1, 2016

Contact: Brett Hartl, (202) 817-8121, Bhartl@biologicaldiversity.org

EPA Approves Dangerous Water Quality Standard for Cadmium

Endangered Salmon, Sturgeon, Sea Turtles, Corals, Freshwater Animals Will Continue to Be Harmed After EPA Ignores Comments From Experts

WASHINGTON- The Environmental Protection Agency today finalized a new, nationwide water-quality criterion for cadmium that is nearly 40 percent higher than the standard the National Marine Fisheries Service concluded would be safe for endangered salmon in Idaho. Used in the manufacturing of batteries, plastics and electronics, cadmium is toxic to people and wildlife and regulated under the Clean Water Act. But despite the recommendation from the Fisheries Service that the EPA consult with it, as required by the Endangered Species Act, the EPA refused.

"It is beyond disappointing that the EPA continues to turn a blind eye to our nation's most endangered species," said Brett Hartl, endangered species policy director at the Center for Biological Diversity. "Freshwater animals like sturgeon, crayfish and mussels are some of the fastest-declining species in the United States in large part because toxic metals like cadmium continue to be poorly regulated by the EPA."

The new acute water quality criteria of 1.8 micrograms/liter is nearly 40 percent higher than the standard of 1.3 micrograms/liter, which the National Marine Fisheries Service concluded would be safe for endangered salmon in Idaho. Although naturally occurring in extremely low levels, cadmium is a known human carcinogen and is acutely toxic. Chronic exposure to cadmium causes negative impacts on reproduction, immune and endocrine system response, and development for aquatic species.

Despite the Endangered Species Act requirement that the EPA consult with the expert wildlife agencies on any action they take that could harm endangered species, the EPA failed to do so. As a result, the U.S. Fish and Wildlife Service did not even submit comments to EPA on the proposed cadmium standard, leaving the fate of more than 200 species of endangered fish and mussels completely unaccounted for in EPA's decision-making. The National Marine Fisheries Service provided detailed comments noting that the impacts from cadmium on sea turtles and corals had not been assessed leaving these animals vulnerable. The Fisheries Service also noted that EPA's 30-year-old protocols for assessing ecological impacts was completely out of date.

"The EPA needs to stop its head-in-the-sand approach to toxic pollutants, and instead start listening to the best scientific experts about the real-world impacts of these harmful chemicals on endangered species," said Hartl. "If EPA had set a standard that protected the most sensitive endangered species, it would have also set a standard that fully protects our own health and well-being."

The Center for Biological Diversity is a national, nonprofit conservation organization with more than 990,000 members and online activists dedicated to the protection of endangered species and wild places.

To unsubscribe reply with "unsubscribe" in subject line

Rollout

Final Updated Aquatic Life Water Quality Criteria for Cadmium

PUBLIC RELEASE DATE: March 30, 2016

KEY INFORMATION:

- The updated criteria values are very similar to the criteria we issued in 2001. EPA used the approach we routinely use in developing aquatic life recommended criteria, and added new toxicity data representing over 75 additional species.

- The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a CWA duty for EPA to propose a replacement criterion for Oregon. The updated criteria document provides the scientific basis for our proposed rule.

- The basis of EPA's disapproval of Oregon's cadmium criterion was a 2012 jeopardy Biological Opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species. A draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater acute criterion is expected to provide protection for endangered salmonids, based the minimal acute effects level (5%) specified by the NMFS in their Reasonable and Prudent Alternatives Ex. 5 - Deliberative Process as of 2014 there were three companies that produced refined cadmium in the U.S.: one in Tennessee (as a byproduct of zinc production) and one each in Ohio and Pennsylvania (recovered from scrap metal).

ACTION:
EPA is publishing a Federal Register notice informing the public about the release of the final version of the updated national recommended aquatic life water quality criteria for cadmium.

ANTICIPATED REACTION:

Ex. 5 - Deliberative Process

ED_000992_00001162-00001

Ex. 5 - Deliberative Process

MATERIALS:

- Desk Statement
- Stakeholder Notification List
- Water Headlines Entry
- Questions and Answers for the Press Office
- Fact Sheet
- Updated webpage

DESK STATEMENT:
EPA has published updated water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters.

The 2016 cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. In addition, the effect of total hardness (the amount of dissolved calcium and magnesium in water) on cadmium toxicity was revised with the newly acquired data. The criteria have undergone an external peer review and a 60 day public comment period.

EPA's water quality criteria for cadmium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

More information: http://www.epa.gov/wqc/aquatic-life-criteria-cadmium

BACKGROUND:
EPA is obligated to publish final updated cadmium criteria by May 30, 2016 as a result of a settlement agreement with the Northwest Environmental Advocates (NWEA). EPA intends to use the updated criteria document as the scientific basis for a rulemaking to propose criteria for Oregon, which we plan to publish at the beginning of April 2016.

ED_000992_00001162-00002

A brief history of EPA's development of ambient water quality criteria (AWQC) for cadmium for the protection of aquatic life:

- 1980- EPA first published AWQC for cadmium.
- 1985- EPA updated the AWQC criteria; this update superseded 1980 criteria.
- 1996- EPA updated the AWQC criteria; this update superseded 1985 criteria.
- 2001- EPA updated the AWQC criteria; this update superseded the 1996 criteria. This update was based on dissolved cadmium to more accurately account for bioavailability and reflected the latest EPA policy for metals risk assessment.
- 2015- EPA published draft updated cadmium criteria for public comment.

The updated criteria include data for 75 new species and 49 new genera. The freshwater acute criterion for dissolved cadmium is slightly lower (i.e. more stringent) than the 2001 acute. The freshwater chronic criterion is slightly higher (i.e., less stringent) compared to the 2001 criterion for dissolved cadmium; this modest increase is primarily due to the inclusion of four new genera, and the reanalysis of other data. As in the 2001 criteria, the draft freshwater acute criterion was derived to be protective of aquatic species and further lowered to protect the commercially and recreationally important rainbow trout. Rainbow trout are sensitive salmonids which were the focus of the jeopardy opinion for NMFS. In addition, the duration of the 2016 acute criteria was changed to one hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The estuarine/marine acute and chronic criteria for dissolved cadmium are more stringent than the 2001 recommended criterion, which is primarily due to the addition of new sensitive genera. Changes in suggested values between 2001 and 2016 can be found in Table 1 below.

Table 1. Summary of 2001 and 2016 Aquatic Life AWQC for Cadmium.

	2016 AWQC Update		**2001 AWQC**	
	Acute (1-hour, dissolved Cd)[c]	**Chronic (4-day, dissolved Cd)**	**Acute (1-day, dissolved Cd)**	**Chronic (4-day, dissolved Cd)**
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)[a]	1.8 µg/L[b]	0.72 µg/L	2.0 µg/L[b]	0.25 µg/L
Estuarine/marine	33 µg/L	7.9 µg/L	40 µg/L	8.8 µg/L

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.

[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).

[c] The duration of the 2016 acute criteria was changed to 1-hour to reflect the 1985 Guidelines-based recommended acute duration.

ROLL OUT SCHEDULE:

Week of 3/21/16	Expected AA signature for FRN
3/28/16-3/29/16	Key EPA and stakeholder notifications via phone (list below).
3/30/2016	Other EPA and stakeholder notifications via email (list below). Web content goes live. *(*If FRN will publish on 3/30, we will link to it and the docket materials, and webpost the fact sheet. If the FRN is not projected to publish by then, we will webpost a pre-publication version on 3/30 along with the criteria document, public review comment response and fact sheet.)*

NOTIFICATIONS

Communication by: Betsy Behl, Director, Health and Ecological Criteria Division

Upon Signature (expected the week of 3/21/16):

- Email to EPA Regional Water Division Directors
- Phone calls to key stakeholders:
  - National Mining Association, Amanda E. Aspatore (202)463-2646
  - North American Metals Council, Kathleen M. Roberts (443)964-4653
  - International Zinc Association, Eric Van Genderen (919)287-1880
  - International Cadmium Association, no contact information yet
  - National Association of Manufacturers, Rachel Jones 202-637-3175
  - U.S. Fish and Wildlife Services, Gina Schultz, (703)358-1985
  - National Oceanic and Atmospheric Administration, Cathryn Tortorici, 301-427-8495
  - Copper and Brass Fabricators Council, John Arnett 202-833-8575
  - Natural Resource Defense Council, Jon Devine (202)513-6263

Upon FRN Publication (expected 3/30/16):

- Email to Mary Jo Bragan, Regional Lead for distribution to regional and State/Tribal Water Program
- Emails to other interested stakeholders:
  - Association of Clean Water Administrators (ACWA)
  - National Association of Clean Water Agencies (NACWA)
  - Water Quality Standards Managers Association (WQSMA)
  - Environmental NGO List

WATER HEADLINES:

EPA is releasing final updated water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters. The 2016 cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. The criteria underwent an external peer review that was completed in 2015 and a 60 day public comment period. EPA's criteria for cadmium provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act. Learn more

QUESTIONS & ANSWERS FOR PRESS OFFICE:

1) What are National Recommended Aquatic Life Criteria?

Ambient water quality criteria for the protection of aquatic life are numeric concentrations of pollutants, with specific recommendations on the duration and frequency of those concentrations, in surface waters that are protective of aquatic life designated uses. 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 solely 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 a state's water quality standards and approved by EPA.

2) What is Cadmium?

Cadmium is a naturally occurring metal found in mineral deposits at low concentrations in the environment. Cadmium's primary industrial uses are for the manufacturing of batteries, pigments, plastic stabilizers, metal coatings, alloys and electronics. Recently, cadmium has been used in manufacturing nanoparticles (quantum dots) for use in solar cells and color displays.

3) How Does Cadmium Enter Surface Waters?

Cadmium enters the environment by natural and human processes. However, human sources, such as mining and urban processes, are responsible for contributing approximately 90 percent of the cadmium found in surface waters.

4) How Does Cadmium Affect Aquatic Life?

Cadmium is a non-essential metal with no biological function in aquatic life. Acute exposure cause mortality. Chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development and behavior in aquatic organisms.

5) Why are the Final Recommended Water Quality Criteria for Cadmium different from the Draft?

Following the 60-day public comment period, EPA considered the comments and revised the draft as necessary; as a result:

- The draft one-hour freshwater acute criterion maximum concentration was lowered from 2.1 µg/L to 1.8 µg/L. This decrease resulted from the removal of a limited number of data outliers and elevated data points from tests with insensitive salmonid life stages.
- The draft four-day average freshwater chronic criterion was slightly lowered from 0.73 µg/L in the draft to 0.72 µg/in the final criteria document.
- The draft one-hour estuarine/marine acute criterion maximum concentration of 35 µg/L was lowered slightly to 33 µg/L. The draft document used a shrimp species not found in North America to calculate the criterion. EPA removed this non-native species and replaced it with data recently found for a shrimp species native to North American waters.
- The draft four-day average estuarine/marine chronic criterion magnitude of 8.3 µg/L was lowered to 7.9 µg/L.

The recommended frequency of exceedance for all the above values is no more than once every three years.

6) How Do the 2016 Criteria Compare to the Previously Recommended 2001 Criteria?

The 2016 criteria reflect data for 75 new species and 49 new genera. The 2016 freshwater acute criterion (1.8 µg/L) for dissolved cadmium is slightly lower (i.e. more stringent) than the 2001 acute criterion. The 2016 freshwater chronic criterion (0.72 micrograms per liter) for dissolved cadmium is slightly higher (less stringent) compared to the 2001 criteria (0.25 micrograms per liter). These modest increases are primarily due to the inclusion of new toxicity studies. As in the 2001 criteria, the 2016 freshwater acute criterion was derived to be protective of aquatic species and lowered further to protect the commercially and recreationally important rainbow trout. In addition, the duration of the 2016 acute criteria was changed to one hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The 2016 estuarine/marine acute criterion for dissolved cadmium (33 µg/L) is slightly lower (more stringent) than the 2001 acute criterion (40 µg/L), which is primarily due to the addition of new toxicity studies for sensitive genera. The 2016 estuarine/marine chronic criterion (7.9 µg/L) is also slightly more stringent than the 2001 chronic criterion (8.8 micrograms per liter) due the consideration of more species in the chronic criterion development. Changes in suggested values between 2001 and 2016 can be found in Table 1 below.

Table 1. Summary of 2001 and 2016 Draft Aquatic Life AWQC for Cadmium.

	2016 AWQC Update		**2001 AWQC**	
	Acute (1-hour, dissolved Cd)[c]	**Chronic (4-day, dissolved Cd)**	**Acute (1-day, dissolved Cd)**	**Chronic (4-day, dissolved Cd)**
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[b] Lowered to protect a commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).

[c] The duration of the 2016 acute criteria was changed to 1 hour to reflect the 1985 Guidelines-based recommended acute duration.

7) What is EPA doing to help ensure these criteria protect threatened and endangered species?

The criteria document contains an analysis of the protectiveness of the draft criteria for threatened and endangered species using all available quality toxicity test data for species listed under the Endangered Species Act that have been tested for sensitivity to cadmium. EPA is also conducting a detailed analysis of the protectiveness of the draft criteria for endangered salmon to address the National Marine Fisheries Service concerns regarding the protectiveness of the acute cadmium criteria.

8) Is there litigation driving EPA's schedule for this updated criteria? What does the litigation entail?

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a Clean Water Act duty for EPA to propose a replacement criterion for Oregon. EPA intends to use the updated criteria document as the scientific basis for a rulemaking to propose criteria for Oregon.

The basis of EPA's disapproval of Oregon's cadmium criterion (and EPA's resultant duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species based on EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated acute criterion has changed only slightly from 2001, the duration of the acute criterion was made more protective (decreased from 24 to one hour). A draft Endangered Species Act analysis prepared by EPA indicates that the updated freshwater criteria are expected to provide approximately 95 percent protection for acute exposure to endangered salmonids, a minimal effects level associated with the jeopardy opinion.

9) Cadmium is listed as a contaminant from the Animas river spill in Colorado this summer, how will this document effect that?

States affected by the Animas River spill (CO, NM, AZ) will be using their currently adopted criteria that protect the designated uses of the water bodies within their area for the clean-up. States may have either adopted the 2001 criteria or adopted alternative scientifically defensible criteria for their waters. Water quality criteria are not effective under the Clean Water Act until they have been adopted into a state's water quality standards and approved by EPA.

10) Are regulated entities expected to be affected by EPA's new cadmium criteria?

States may adopt the new criteria or set new scientifically defensible criteria for cadmium as part of state water quality standards for cadmium. If states adopt the new cadmium 304(a) criteria recommendation, we expect that few regulated entities will be affected because EPA's updated criteria values are very similar to what we recommended in 2001.

Rollout

Final Updated Aquatic Life Water Quality Criteria for Cadmium

PUBLIC RELEASE DATE: March 30, 2016

KEY INFORMATION:

- The updated criteria values are very similar to the criteria we issued in 2001. EPA used the approach we routinely use in developing aquatic life recommended criteria, and added new toxicity data representing over 75 additional species.

- The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a CWA duty for EPA to propose a replacement criterion for Oregon. The updated criteria document provides the scientific basis for our proposed rule.

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ACTION:
EPA is publishing a Federal Register notice informing the public about the release of the final version of the updated national recommended aquatic life water quality criteria for cadmium.

ANTICIPATED REACTION:

Ex. 5 - Deliberative Process

ED_000992_00001168-00001

Ex. 5 - Deliberative Process

MATERIALS:

- Desk Statement
- Stakeholder Notification List
- Water Headlines Entry
- Questions and Answers for the Press Office
- Fact Sheet
- Updated webpage

DESK STATEMENT:
EPA has published updated water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters.

The 2016 cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. In addition, the effect of total hardness (the amount of dissolved calcium and magnesium in water) on cadmium toxicity was revised with the newly acquired data. The criteria have undergone an external peer review and a 60 day public comment period.

EPA's water quality criteria for cadmium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

More information: http://www.epa.gov/wqc/aquatic-life-criteria-cadmium

BACKGROUND:
EPA is obligated to publish final updated cadmium criteria by May 30, 2016 as a result of a settlement agreement with the Northwest Environmental Advocates (NWEA). EPA intends to use the updated criteria document as the scientific basis for a rulemaking to propose criteria for Oregon, which we plan to publish at the beginning of April 2016.

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A brief history of EPA's development of ambient water quality criteria (AWQC) for cadmium for the protection of aquatic life:

- 1980- EPA first published AWQC for cadmium.
- 1985- EPA updated the AWQC criteria; this update superseded 1980 criteria.
- 1996- EPA updated the AWQC criteria; this update superseded 1985 criteria.
- 2001- EPA updated the AWQC criteria; this update superseded the 1996 criteria. This update was based on dissolved cadmium to more accurately account for bioavailability and reflected the latest EPA policy for metals risk assessment.
- 2015- EPA published draft updated cadmium criteria for public comment.

The updated criteria include data for 75 new species and 49 new genera. The freshwater acute criterion for dissolved cadmium is slightly lower (i.e. more stringent) than the 2001 acute. The freshwater chronic criterion is slightly higher (i.e., less stringent) compared to the 2001 criterion for dissolved cadmium; this modest increase is primarily due to the inclusion of four new genera, and the reanalysis of other data. As in the 2001 criteria, the draft freshwater acute criterion was derived to be protective of aquatic species and further lowered to protect the commercially and recreationally important rainbow trout. Rainbow trout are sensitive salmonids which were the focus of the jeopardy opinion for NMFS. In addition, the duration of the 2016 acute criteria was changed to one hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The estuarine/marine acute and chronic criteria for dissolved cadmium are more stringent than the 2001 recommended criterion, which is primarily due to the addition of new sensitive genera. Changes in suggested values between 2001 and 2016 can be found in Table 1 below.

Table 1. Summary of 2001 and 2016 Aquatic Life AWQC for Cadmium.

	2016 AWQC Update		**2001 AWQC**	
	Acute (1-hour, dissolved Cd)[c]	**Chronic (4-day, dissolved Cd)**	**Acute (1-day, dissolved Cd)**	**Chronic (4-day, dissolved Cd)**
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)[a]	1.8 µg/L[b]	0.72 µg/L	2.0 µg/L[b]	0.25 µg/L
Estuarine/marine	33 µg/L	7.9 µg/L	40 µg/L	8.8 µg/L

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.

[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).

[c] The duration of the 2016 acute criteria was changed to 1-hour to reflect the 1985 Guidelines-based recommended acute duration.

ROLL OUT SCHEDULE:

Week of 3/21/16	Expected AA signature for FRN
3/28/16-3/29/16	Key EPA and stakeholder notifications via phone (list below).
3/30/2016	Other EPA and stakeholder notifications via email (list below). Web content goes live. *(*If FRN will publish on 3/30, we will link to it and the docket materials, and webpost the fact sheet. If the FRN is not projected to publish by then, we will webpost a pre-publication version on 3/30 along with the criteria document, public review comment response and fact sheet.)*

NOTIFICATIONS

Communication by: Betsy Behl, Director, Health and Ecological Criteria Division

Upon Signature (expected the week of 3/21/16):

- Email to EPA Regional Water Division Directors
- Phone calls to key stakeholders:
  - National Mining Association, Amanda E. Aspatore (202)463-2646
  - North American Metals Council, Kathleen M. Roberts (443)964-4653
  - International Zinc Association, Eric Van Genderen (919)287-1880
  - International Cadmium Association, no contact information yet
  - National Association of Manufacturers, Rachel Jones 202-637-3175
  - U.S. Fish and Wildlife Services, Gina Schultz, (703)358-1985
  - National Oceanic and Atmospheric Administration, Cathryn Tortorici, 301-427-8495
  - Copper and Brass Fabricators Council, John Arnett 202-833-8575
  - Natural Resource Defense Council, Jon Devine (202)513-6263

Upon FRN Publication (expected 3/30/16):

- Email to Mary Jo Bragan, Regional Lead for distribution to regional and State/Tribal Water Program
- Emails to other interested stakeholders:
  - Association of Clean Water Administrators (ACWA)
  - National Association of Clean Water Agencies (NACWA)
  - Water Quality Standards Managers Association (WQSMA)
  - Environmental NGO List

WATER HEADLINES:

EPA is releasing final updated water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters. The 2016 cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. The criteria underwent an external peer review that was completed in 2015 and a 60 day public comment period. EPA's criteria for cadmium provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act. Learn more

QUESTIONS & ANSWERS FOR PRESS OFFICE:

1) What are National Recommended Aquatic Life Criteria?

Ambient water quality criteria for the protection of aquatic life are numeric concentrations of pollutants, with specific recommendations on the duration and frequency of those concentrations, in surface waters that are protective of aquatic life designated uses. 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 solely 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 a state's water quality standards and approved by EPA.

2) What is Cadmium?

Cadmium is a relatively rare, naturally occurring metal found in mineral deposits and distributed ubiquitously at low concentrations in the environment. Cadmium's primary industrial uses are for the manufacturing of batteries, pigments, plastic stabilizers, metal coatings, alloys and electronics. Recently cadmium has been used in manufacturing nanoparticles (quantum dots) for use in solar cells and color displays.

3) How Does Cadmium Enter Surface Waters?

Cadmium enters the environment by natural and human processes. However, human sources, such as mining and urban processes, are responsible for contributing approximately 90 percent of the cadmium found in surface waters.

4) How Does Cadmium Affect Aquatic Life?

Cadmium is a non-essential metal with no biological function in aquatic life. Acute exposure cause mortality. Chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development and behavior in aquatic organisms.

5) Why are the Final Recommended Water Quality Criteria for Cadmium different from the Draft?

Following the 60-day public comment period, EPA considered the comments and revised the draft as necessary; as a result:

- The draft one-hour freshwater acute criterion maximum concentration was lowered from 2.1 µg/L to 1.8 µg/L. This decrease resulted from the removal of two elevated data points from tests with insensitive salmonid life stages.
- The draft four-day average freshwater chronic criterion was slightly lowered from 0.73 µg/L in the draft to 0.72 µg/in the final criteria document.
- The draft one-hour estuarine/marine acute criterion maximum concentration of 35 µg/L was lowered slightly to 33 µg/L. The draft document used a shrimp species not found in North America to calculate the criterion. EPA removed this non-native species and replaced it with data recently found for a shrimp species native to North American waters.
- The draft four-day average estuarine/marine chronic criterion magnitude of 8.3 µg/L was lowered to 7.9 µg/L.

The recommended frequency of exceedance for all the above values is no more than once every three years.

6) How Do the 2016 Criteria Compare to the Previously Recommended 2001 Criteria?

The 2016 criteria reflect data for 75 new species and 49 new genera. The 2016 freshwater acute criterion (1.8 µg/L) for dissolved cadmium is slightly lower (i.e. more stringent) than the 2001 acute criterion. The 2016 freshwater chronic criterion (0.72 micrograms per liter) for dissolved cadmium is slightly higher (less stringent) compared to the 2001 criteria (0.25 micrograms per liter). These modest increases are primarily due to the inclusion of new toxicity studies. As in the 2001 criteria, the 2016 freshwater acute criterion was derived to be protective of aquatic species and lowered further to protect the commercially and recreationally important rainbow trout. In addition, the duration of the 2016 acute criteria was changed to one hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The 2016 estuarine/marine acute criterion for dissolved cadmium (33 µg/L) is slightly lower (more stringent) than the 2001 acute criterion (40 µg/L), which is primarily due to the addition of new toxicity studies for sensitive genera. The 2016 estuarine/marine chronic criterion (7.9 µg/L) is also slightly more stringent than the 2001 chronic criterion (8.8 micrograms per liter) due the consideration of more species in the chronic criterion development. Changes in suggested values between 2001 and 2016 can be found in Table 1 below.

Table 1. Summary of 2001 and 2016 Draft Aquatic Life AWQC for Cadmium.

	2016 AWQC Update		2001 AWQC	
	Acute (1-hour, dissolved Cd)[c]	**Chronic (4-day, dissolved Cd)**	**Acute (1-day, dissolved Cd)**	**Chronic (4-day, dissolved Cd)**
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)[a]	1.8 µg/L[b]	0.72 µg/L	2.0 µg/L[b]	0.25 µg/L
Estuarine/marine	33 µg/L	7.9 µg/L	40 µg/L	8.8 µg/L

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.

[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).

[c] The duration of the 2016 acute criteria was changed to 1 hour to reflect the 1985 Guidelines-based recommended acute duration.

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7) What is EPA doing to help ensure these criteria protect threatened and endangered species?

The criteria document contains an analysis of the protectiveness of the draft criteria for threatened and endangered species using all available quality toxicity test data for species listed under the Endangered Species Act that have been tested for sensitivity to cadmium. EPA is also conducting a detailed analysis of the protectiveness of the draft criteria for endangered salmon to address the National Marine Fisheries Service concerns regarding the protectiveness of the acute cadmium criteria.

8) Is there litigation driving EPA's schedule for this updated criteria? What does the litigation entail?

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a Clean Water Act duty for EPA to propose a replacement criterion for Oregon. EPA intends to use the updated criteria document as the scientific basis for a rulemaking to propose criteria for Oregon.

The basis of EPA's disapproval of Oregon's cadmium criterion (and EPA's resultant duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species based on EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated acute criterion has changed only slightly from 2001, the duration of the acute criterion was made more protective (decreased from 24 to one hour). A draft Endangered Species Act analysis prepared by EPA indicates that the updated freshwater criteria are expected to provide approximately 95 percent protection for acute exposure to endangered salmonids, a minimal effects level associated with the jeopardy opinion.

9) Cadmium is listed as a contaminant from the Animas river spill in Colorado this summer, how will this document effect that?

States affected by the Animas River spill (CO, NM, AZ) will be using their currently adopted criteria that protect the designated uses of the water bodies within their area for the clean-up. States may have either adopted the 2001 criteria or adopted alternative scientifically defensible criteria for their waters. Water quality criteria are not effective under the Clean Water Act until they have been adopted into a state's water quality standards and approved by EPA.

10) Are regulated entities expected to be affected by EPA's new cadmium criteria?

States may adopt the new criteria or set new scientifically defensible criteria for cadmium as part of state water quality standards for cadmium. If states adopt the new cadmium 304(a) criteria recommendation, we expect that few regulated entities will be affected because EPA's updated criteria values are very similar to what we recommended in 2001.

To: Elias, Mike[Elias.Mike@epa.gov]
Cc: Craig Voros[cvoros@glec.com]
From: Greg Smith
Sent: Mon 3/14/2016 4:52:21 PM
Subject: Re: FW: Cd GLEC tasks/discussion
Response to Agency Comments on Cd Document.docx

Mike

Here is the file containing our responses to the Agency comments (that you highlighted in yellow for us to address).

Just call if you have any questions.

Thanks
Greg

On 3/14/2016 11:26 AM, Elias, Mike wrote:

> Greg, Kathryn and I are talking, so I will be delayed for a few mins, but will give you a call after.

> **From:** Greg Smith [mailto:gsmith@glec.com]
> **Sent:** Monday, March 14, 2016 11:05 AM
> **To:** Elias, Mike <Elias.Mike@epa.gov>
> **Subject:** Re: FW: Cd GLEC tasks/discussion

> Yes

> On 3/14/2016 11:02 AM, Elias, Mike wrote:

> > Greg, Are you available for a 5 min touching base?

> > **From:** Greg Smith [mailto:gsmith@glec.com]
> > **Sent:** Sunday, March 13, 2016 4:36 PM
> > **To:** Elias, Mike <Elias.Mike@epa.gov>

Cc: Craig Voros <cvoros@glec.com>
Subject: Re: FW: Cd GLEC tasks/discussion

Hi Mike

Yes, Hollis et al. (2000a) was not used in the rainbow trout SMAV, and the numbers below reflect this.

Greg

On 3/13/2016 2:16 PM, Elias, Mike wrote:

> Thanks. I am using these numbers as the most updated for my briefing. Please let me know if there are any changes. I saw the messages from Kathryn and confirmation from Luis about removing Hollis 2000a from the SMAV. Based on the time stamps of the messages, I assume the numbers below reflect this correctly, but just wanted to confirm.
>
> **From:** Greg Smith [mailto:gsmith@glec.com]
> **Sent:** Friday, March 11, 2016 3:20 PM
> **To:** Elias, Mike <Elias.Mike@epa.gov>
> **Cc:** Craig Voros <cvoros@glec.com>
> **Subject:** Re: FW: Cd GLEC tasks/discussion
>
> Mike
>
> We have finished revising the acute data (using the new acute slope of 0.9789), and have also updated the chronic database (now includes the Cottus 21-day study).
>
> So here are the criteria (please pass this onto the others):
>
> **Ex. 5 - Deliberative Process**
>
> Equation: CMC = e^(0.9789*ln(hardness)-3.866)

Ex. 5 - Deliberative Process

And just to verify,
the version on SharePoint that we will update (make changes) is in the:
"GLEC/Final Document" folder
and the file is called "Draft Cadmium Aquatic Life Ambient Water Quality Criteria 2 26 16-(REDLINE)"

Thanks
Greg

On 3/11/2016 10:48 AM, Elias, Mike wrote:

> Greg, I am briefing the division director Monday morning. Could you please let me know how the chronic value changes once the cottus 21 day study is put back in before that time? I just need the number. Thanks.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Friday, March 11, 2016 9:41 AM
To: Cruz, Luis <Cruz.Luis@epa.gov>; Craig Voros <cvoros@glec.com>; Doug Endicott <dendicott@glec.com>

Cc: Elias, Mike <Elias.Mike@epa.gov>; Justice, JamesR <Justice.JamesR@epa.gov>; Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>
Subject: Re: FW: Cd GLEC tasks/discussion

Hi all

Ex. 5 - Deliberative Process

So was a justification found to exclude the RBT studies that used cadmium nitrate? Or do we now include it in the SMAV calculation for RBT, pending we have some justification that it was not used in the acute hardness dataset?

Thanks
Greg

On 3/10/2016 4:33 PM, Cruz, Luis wrote:

Hi,

After the initial slope analysis please continue as follows

Ex. 5 - Deliberative Process

- Report data and criteria normalized to hardness of 100.
- Send the results to EPA WAM by Monday morning

Then,

•□□□□□□□□ Correct the criteria document values

•□□□□□□□□ Correct the chronic by adding back in the 21-day Cottus study.

Thanks

From: Cruz, Luis
Sent: Thursday, March 10, 2016 3:27 PM
To: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>
Subject: FW: Cd GLEC tasks/discussion

Kathryn,

After removing the data the pooled slope changed from 1.103 to 0 0.9789. But still around 1. If this change enough to go ahead and redo data normalization?

From: Craig Voros [mailto:cvoros@glec.com]
Sent: Thursday, March 10, 2016 2:31 PM
To: Cruz, Luis <Cruz.Luis@epa.gov>; Doug Endicott <dendicott@glec.com>; Greg Smith <gsmith@glec.com>
Cc: Elias, Mike <Elias.Mike@epa.gov>; Justice, JamesR <Justice.JamesR@epa.gov>; Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>
Subject: Re: Cd GLEC tasks/discussion

Okay, Keith ran the acute hardness slope analysis you requested.

The original acute pooled slope is 1.103.
Removing the 4 values from RBT, the acute pooled slope is 1.088. (n=111, for 20 species)
Removing the 4 values from RBT and all the unmeasured studies, the acute pooled slope is 0.9789. (n=80, for 13 species)

There is no significant species interaction term in the new models.

Please give us a call when you get a chance to discuss how to proceed.
Thanks,

Craig Voros Great Lakes Environmental Center 1295 King Avenue Columbus, OH 43212 614-487-1040

On 3/10/2016 1:11 PM, Cruz, Luis wrote:

Hello,

Doug is GLEC Work Assignment Leader. As per our phone conversation this morning these are the tasks we talked about regarding Task 3 (Updating Cd criteria) of WA 1-05 and they constitute technical directives.

1) For the criteria driver rainbow trout data:

a. Please exclude the data point "greater than" 6.X value from the calculation, since it will bias the value high.

Ex. 5 - Deliberative Process

2) For the hardness equation.

Ex. 5 - Deliberative Process

We need to have the new criteria values (acute and chronic) and hardness equation in hand by Monday. Then, the other non-criteria-driving values in the document can be corrected by next Thursday afternoon.

Agency Comments

Acute and chronic hardness slopes were updated with data for several new species. The updated acute cadmium hardness slope incorporates data for 20 species (12 species used in the 2001 draft criteria and eight new species) (see **Table 6**). The updated chronic slope incorporates data for four species (two species used in the 2001 draft criteria and two new species) (see **Table 8**). The new chronic slope uses EC_{20} estimates for three of the four species, instead of only Maximum Acceptable Toxicant Concentrations (MATCs) used for the 2001 chronic slope (MATCs were used only for *Daphnia magna* in the 2016 slope to retain the invertebrate species).

We don't think additional text needed in Executive Summary (would be too much), but this is explained in detail on page 22 of the document.

We did not explore other ECx levels

Currently in document (page 22):

Chronic measures of effect

The endpoint for chronic exposure is the EC20, which represents a 20 percent effect/inhibition concentration. This is in contrast to a concentration that causes a low level of reduction in response, such as an EC5 or EC10, which is rarely statistically significantly different from the control treatment. EPA selected EC20 values to be used to estimate a low level of effect that would be statistically different from control effects, yet not so severe as to be expected to cause chronic impacts at the population level (see U.S. EPA 1999). For calculation of the chronic criterion, the EC20 point estimate was selected for use over a NOEC or LOEC as the measure of effect to use, as NOECs and LOECs are highly dependent on test concentrations selected. Furthermore, point estimates provide additional information that is difficult to determine using NOEC and LOEC effect measures, such as a measure of effect level across the range of tested concentrations, and the confidence intervals around those measures of effect.

In addition to hardness, other water quality characteristics have been shown to influence the toxicity of cadmium to aquatic species. Increased levels of dissolved organic carbon, for example, have been shown to reduce the toxicity of cadmium to daphnids by reducing the bioavailability of cadmium through complexation (Clifford and McGeer 2010; Giesy et al. 1977; Niyogi et al. 2008). Conversely, other water chemistry variables, including magnesium, pH and alkalinity have been shown to have little or no effect on cadmium toxicity (Clifford and McGeer 2010; Niyogi et al. 2008). The relationship between salinity and temperature and cadmium effects could not be quantitatively established. These analyses are described in detail in **Section 5.4.1**.

Mike: GLEC. Anything to add here?

No, we don't think magnesium-dominated waters are very common. So no need to highlight these waters. In those limited situations, site-specific criteria can be implemented.

Page 20 of document:

Conversely, other water chemistry variables, including magnesium, pH and alkalinity have been shown to have little or no effect on cadmium toxicity (Clifford and McGeer 2010; Niyogi et al. 2008). The relationship between salinity and temperature and cadmium effects could not be quantitatively established. These analyses are described in detail in Section 5.4.1.

Mike: Please state clearly in text that the same tests were used.

This was fixed on the 2-29-16 version.

Page 21:

Acute toxicity data on freshwater mussel glochidia life stage

Glochidia are an early parasitic life stage of unionid freshwater mussels, which are free living in the water column prior to finding an appropriate fish host. Based on their unique life history compared to most aquatic life, glochidia toxicity tests were carefully examined to determine if they provided ecologically relevant toxicological information for the derivation of aquatic life criteria. Glochidia may be present in the water column for a period of time ranging from seconds to days, depending on the species, and they have potential to be exposed to contaminants in surface water during that time. U.S. EPA determined it was important to consider the potential for adverse effects to glochidia in the development of water quality criteria for cadmium because adverse effects on this sensitive early life stage could have implications on the viability of unionid mussel populations. The potential for adverse effects to glochidia was also considered in the development of ammonia criteria (U.S. EPA 2013).

In order for the toxicity test results with glochidia to be ecologically relevant, the duration of the acute toxicity test must be comparable to the duration of the free-living stage of glochidia prior to attaching to a host. Research conducted by Fritts et al. (2014) supports the recommendation of a maximum test duration of 24 hours for glochidia, corresponding with the ecologically relevant period of host infectivity of this parasitic life stage. Survival of glochidia at the end of 24 hours should be at least 90% in the laboratory control and if the viability is less than 90% at 24 hours in the control, then the next longest duration less than 24 hours that had at least 90% survival in the control is considered acceptable for use. These requirements for the acceptance of glochidia tests were put forward in the 2013 ammonia criteria document and were peer reviewed at that time (U.S. EPA 2013). Acceptable cadmium exposed glochidia data were available only for the fatmucket (*Lampsilis siliquoidea*), but this life stage was less sensitive than juveniles and therefore not used to calculate the SMAV for this species.

We can add above text in red

Page 51:

All other glochidia test results were considered unacceptable and were not included in the acute dataset (see Section 2.6). These included results from tests conducted by Black (2001), who exposed *Fusconia masoni* and *Utterbackia imbecillis* glochidia to cadmium for 24 hours but did not report the control mortality adequately for the data to be used quantitatively.

The Black (2001) studies were the only 2 studies found unacceptable and are described here.

So just add the "see Section 2.6" as requested.

Section 5.1.4

Acute criteria duration

Ex. 5 - Deliberative Process

hour.

Section 5.8.1 (add text in red)

One endangered freshwater mussel, Neosho mucket (*Lampsilis rafinesqueana*), has a normalized SMAV of 49.46 µg/L total cadmium, indicating a sensitivity that falls within the range of three other freshwater mussel species within the genus, with normalized SMAVs ranging from 104.4 (*Lampsilis straminea claibornensis*) to 39.56 (*Lampsilis siliquoidea*) µg/L total cadmium (**Appendix A**). All of these SMAVs are an order of magnitude higher than the freshwater acute cadmium criteria value.

Cadmium Aquatic Life Ambient Water Quality Criteria
Draft Response to Public Comments

TOPIC 1: Duration should be 24 hours, not one hour

Comment Number (Organization)	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0012 (Utility Water Act Group)	*UWAG has concerns with EPA's proposal to change the acute freshwater and estuarine/marine criteria averaging duration from 24 hours to 1 hour. The change is not adequately justified and is not supported by new studies in the Draft. The current 24-hour duration should be retained unless a strong scientific justification is presented.* *Every previous iteration of the cadmium criteria has endorsed a 24-hour duration for the acute criteria. EPA appears to be making a policy decision that the acute criteria should be 1 hour, but does not present the associated science to support the revision which is inconsistent with CWA § 304(a)(1), which mandates EPA establish "criteria for water quality accurately reflecting the latest scientific knowledge."* *EPA compares the acute toxicity to ammonia but fails to provide information that compares the time-dependent toxicity of cadmium with ammonia. Furthermore, assessing the toxicity of cadmium during the first 24 hours of an acute test is problematic because the vast majority of published studies reporting the acute toxicity of cadmium do not report patterns of lethality during the first 24 hours. Several acceptable selected studies (Besser et al. 2007; Buhl 1997; Diamond et al. 1997; Mebane et al. 2012; Nebeker 1986) do not report 24-hour LC50s and the one study with relevant data (Duncan and Klavercamp 1983) had a 12-hour LC50 that was five times greater than the 96-hour LC50 (5.35 vs. 1.11 µg/L, respectively). This value would be expected to be similar if cadmium was a fast-acting pollutant.* *An earlier EPA publication (*Speed of Action of Metals Acute Toxicity to Aquatic Life*; EPA-822-R-95-002) also justifies the 24-hour averaging period. This document estimated a kinetic*	**Ex. 5 - Deliberative Process**	No edits

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	*coefficient (*k*) using a regression of LC50 values versus time, with the averaging period being calculated as the inverse of* k*. The larger the* k *value the faster acting the pollutant. None of the estimated averaging periods in the document for freshwater and saltwater species approached 1-hour. The highest estimated* k *values mentioned, for the freshwater fathead minnow, were 6 and 17 hours, with saltwater species having even larger values. The selection of the 1-hour averaging period is baseless and arbitrary.* *Additionally, the 1985 Guidelines say the duration should be "substantially less than 48 to 96 hours," but do not say that 24 hours is an inappropriate duration and therefore the Guidelines do not support, nor should it be a justification for the proposed revision.*	**Ex. 5 - Deliberative Process**	
EPA-HQ-OW-2015-0753-0012 (Utility Water Act Group)	*Water Quality-Based Effluent Limits (WQBELs) for cadmium are often expressed as a daily (24-hr) maximum value. Changing the WQBEL to a 1-hour averaging duration could require a permittee to collect several compliance samples during a 24-hour period. This additional burden is unnecessary since there is minor variability of the cadmium levels during a typical 24-hour period, and this additional monitoring is unwarranted without sound scientific basis.*		No edits

TOPIC 2: *H. azteca* test by Ingersoll is not acceptable; retest should be done or test should be removed from criteria development

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0007 and EPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*The proposed chronic criterion is based on a flawed toxicity test (Ingersoll and Kemble 2001) conducted on the amphipod Hyalella azteca. The Hyalella test used in the criterion derivation should be repeated using current feeding procedures that are proven to result in better growth and reproduction. While the IEPA acknowledges and commends the improvements USEPA has made in the assessment and analysis of Hyalella sp. data compared to the 2001 cadmium criteria document, specifically in regards to the sensitivity of this organism to the presence/absence of chloride and bromide in culture and test water, the IEPA contends that the feeding regime employed in the 2000 USGS study is deficient by today's standards and likely resulted in malnourished, stressed test organisms.* *Specifically, test organisms in the 2000 USGS study were underfed and/or fed improper diets based on current research. Dr. Soucek, at the Illinois Natural History Survey, conducted new research that focused on determining the appropriate amounts of food for test organisms. His research has led to improved growth of test organisms compared to earlier diet regimes. The diet used in the 2000 USGS study consisted of a ration of 1.0 ml YCT/d, whereas Dr. Soucek's research contends that a diet consisting of Tetramin supplemented with diatoms greatly improves growth and reproduction of Hyalella azteca compared to YCT-only diets (Soucek et al. 2016, in press).* *The diet in the 2000 USGS study restricted growth and fecundity when compared to Tetramin-based diets (Soucek et al. 2016, in press), and brings into question the accuracy of the test results.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0007 andEPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*Test organisms in the 2000 USGS study did not attain minimum growth requirements based on the direct measure of organism weight, with the average dry weight of the controls being 0.27 mg/individual (<0.50 mg/individual). USEPA concluded that the dry weights measured in the test were inaccurate and subsequently used length data to extrapolate to dry weight via a regression equation. However there is no documentation provided for this equation or how it was derived. It is unlikely that the dry weights were underestimated (while an overestimation can be expected due to inadequate drying of test organisms), and it is therefore*		No edits

	considered unlikely that the organisms achieved the minimum weight requirements for this test to be valid.		
EPA-HQ-OW-2015-0753-0007andEPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*The dilution series (control and 5 treatment concentrations: 0.1, 0.3, 0.5, 2.0 and 3.0 µg/L.) used in the 2000 USGS test did not appropriately bracket the effect concentration. The dilution series was not standard, with a large gap in concentration between the NOEC and LOEC (0.5 and 2.0 µg/L, respectively). While a point estimation technique was used to determine the effect concentration, the lack of a 1.0 µg/L treatment may have changed this estimation. The precision of this estimation is paramount, as the test result was the sole determinant of the GMCV, which is the most sensitive in the chronic dataset, and a small change in the GMCV can therefore have a substantial effect on the final chronic value.*		No edits
EPA-HQ-OW-2015-0753-0007 andEPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*At this time, the IEPA is in support of the adoption of the acute cadmium criterion as proposed, but is requesting a one year extension for the adoption of the chronic criterion. A one year extension would allow for a retest on Hyalella azteca using current feeding recommendations and would allow for revisions to be made to the chronic criterion. A round robin approach would ensure that the data are obtained using the appropriate test procedures and would provide additional information regarding the sensitivity of Hyalella azteca to cadmium. If time does not permit a repeat of the test, then the chronic criterion should be recalculated with the Hyalella data removed.*		No edits

Ex. 5 - Deliberative Process

TOPIC 3: Dissolved vs total concentration use

Comment Number	Public Comment		Revision Location in 2015 Cadmium Criteria Document
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental	*Additional documentation is needed to support the total to dissolved conversion factors. Very little information is provided concerning the derivation of the conversion factors, and more detailed information is needed to fully assess their appropriateness for natural waterbodies.*		Section 2.6

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Protection)		Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*It is unknown if the solutions prepared from Cd salts, that were used to develop the conversion factors, adequately represent the forms of Cd found in natural waterbodies.*		Section 2.6
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*An explanation is needed as to why the conversion factors for the acute and chronic criteria are different. It also appears illogical that the constant conversion factor of 0.994 used for marine water is higher than for freshwater, especially because the hardness-dependent conversion factor for freshwater decreases as hardness increases.*		Section 2.6
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*While it is noted in several places in the document, clarify that the recommended criteria values are expressed as dissolved cadmium concentrations (not total). Also clarify if states have the option to adopt total Cd criteria values.*		No edits
EPA HQ-OW-2015-0753-0011	*Kansas has utilized the total recoverable metals criteria and data, and is not set up to sample for total dissolved metals. A conversion factor would be applied to calculate the dissolved concentration and Kansas recommends that EPA retain this flexibility in its final criteria.*		No edits

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TOPIC 4: Data quality, use, and availability

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0006 (Kansas Department of Health and Environment)	*Some of the values that are new/revised since the 2001 AWQC document are from studies that were published before 2001. Table 22 has general information describing why GMAVs have changed between the 2001 and 2015 document, but it does not provide details on why these "new" data were now considered acceptable. Include another table that describes why the studies that were excluded previously are now included.*	Ex. 5 - Deliberative Process	No edits
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Should toxicity tests conducted under less-than optimal conditions be discounted? This comment goes beyond just the test results for Hyalella, because while laboratory tests used for criteria development use conditions that are as close to optimal as possible, wild populations in diverse natural conditions are often exposed to conditions that sub-optimal, and therefore laboratory tests may be underprotective in natural conditions (i.e., additional stresses) (see, Holmstrump et al. 2010; Besser et al. 2015).*		No edits
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*"Other data" are not addressed consistent with the Guidelines. While these data are not used in the species sensitivity distribution rankings, they should not be thrown away, discounted, or deemed "unacceptable." "Other Data" can be invoked to lower a criterion (e.g., chronic value in the 1987 selenium criterion). Revaluate Riddel et al. (2005a, b) and include a larger discussion of their effect concentrations/findings and other similar behavioral/ecological studies.*		Sections 5 and 5.2
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*With many organisms, a strong difference in the sensitivity of different life stages makes it inappropriate to roll up data from different developmental stages. Pooling salmonid effects concentrations across developmental stages to obtain a SMAV could produce a misleading result (see, Hansen et al. 2002; Mebane et al. 2012; Chapman 1978; Chapman and Stevens 1978).*		Appendix A Ranked FW Acute Table

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EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*The decision to only use ELS chronic data in which the exposures began in the egg stage, and to exclude long-term data in which the exposures began in the fry stage is non-conservative.*	Ex. 5 - Deliberative Process	No edits
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*SMAV calculations tagged with the footnote "C", indicating that "Data not used to calculate SMAV because more sensitive life stage available, or flow-through measured test available", should be separated into two different footnotes since they are very different reasons.*		Appendix A and Appendix B
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Address the following Appendix A specific errors/changes:* • *Daphnia magna (various)* o *Many "S, U" tests (tests with unmeasured concentrations) are underlined, indicating they are included in the SMAV calculations. These should be excluded per the Guidelines.*		Appendix A Ranked FW Acute Table
	• *Mayfly (formerly, Ephemerella grandis) Drunella grandis* o *Tested species was listed in the source document as Ephemerella subvaria, which is still a valid species name according to ITIS.gov.*		
	• *Rainbow trout (smolt), Chapman 1975 (>2.9 µg/L)* o *Should be excluded from SMAV because it is from a resistant life stage. Also, should be listed as "Rainbow trout (Steelhead smolt)" as Steelhead are not just Rainbow Trout by a different name, but have physiological differences in regard to ion regulation. Chapman (1975) should only be cited when no alternative exists, because it was never formally released by EPA and is not publicly available online.*		

	Chapman (1978) reports the same data and is a better citation. • *Rainbow trout (smolt), Chapman 1975 (4.1 µg/L)* o *Suspect value, exclude from SMAV. Chapman (1978) lists the value for the same test as >2.9 µg/L. Chapman (1978) is the peer-reviewed publication of record for these data; Chapman (1975) was an unpublished, work-in-progress progress report that sometimes still gets cited because it includes data never published elsewhere, such as the coho data shown in the figure in this memo. Exclude from SMAV, resistant life stage and re-label as " "Rainbow trout (Steelhead smolt". See Chapman (1978, Table 3).*		
	• *Rainbow trout (299 mg), Stratus (1.29 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with unmanipulated pH of 7.5 were much more sensitive*		

	• *Chinook salmon (parr, 11.58g) (3.5 µg/L)*
	  o *Exclude value from SMAV, based on a resistant life stage being tested. Value is twice as high as the value obtained with swim-up fry in matched tests and confidence limits don't overlap.*
	• *Chinook salmon (smolt, 32.46 g) (>2.9 µg/L)*
	  o *Should be excluded from SMAV, based on a resistant life stage being tested.*
		Ex. 5 - Deliberative Process	

	• *Bull trout (84.2 mg) (2.89 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with a natural pH of 7.5 were much more sensitive*		
	• *Colorado squawfish* o *Old common name is now considered repugnant. AFS calls it "Colorado pikeminnow". "Pikeminnow" is one word.*		

EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Address the following Appendix C specific errors/changes:* • *Snail, Aplexa hyporum (Holcombe) (4.0 µg/L)* o *I got an EC20 of about 2.6 µg/L. By excluding the highest treatment with total mortality I could reproduce the 4.0 EC20 value, but it had a poor fit with Y0.*	**Ex. 5 - Deliberative Process**	No edits

EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Add the following additional relevant data:*
	• *Pascoe and Mattey 1977*
	  o *Chronic stickleback exposure*
	• *Wang et al. 2014*
	  o *Chronic fathead full life-cycle test*
	• *Brinkman and Vieira 2008*
	  o *Acute and chronic mountain whitefish*
	• *Mebane et al. 2014 (paper provided)*
	  o *Effects of cadmium on larval aquatic insect communities in 30-day experimental stream tests*
			Mebane et al. (2014) added to Section 5.2

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Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*There is concern about the focus on fish in developing the criteria. EPA needs to bring in other species including insects and freshwater mussels into the process when developing criteria for cadmium. This lack of additional species prevents a more holistic picture of the freshwater community, and results in criteria that are not protective of all aquatic-dependent wildlife. EPA has consistently failed to fully consider aquatic-dependent wildlife in the development of national criteria.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0010 (Hampton Roads Sanitation District)	*There is concern with the continued lack of estuarine/marine chronic cadmium toxicity data and that no new chronic toxicity data have been generated since 2001. EPA should conduct additional chronic toxicity studies (particularly with vertebrate species) to expand the estuarine/marine chronic toxicity dataset. More estuarine/marine chronic data are needed to develop a scientifically reliable chronic cadmium criterion.*		No edits
EPA-HQ-OW-2015-0753-0010 (Hampton Roads Sanitation District)	*The mysid Neomysis integer is a new species added to the estuarine/marine acute dataset, but this mysid is potentially non-native to the United States. Since there are available values for two other native mysid species (M. bigelowi and A. bahia), this non-native species should be removed (unless documentation is provided confirming it is naturally occurring within waters of North America).*		Section 3.2.1 and Appendix B

TOPIC 5: ESA considerations

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	**Ex. 5 - Deliberative Process**	No edits

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		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*To ensure the final cadmium water quality criteria is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*		No edits

EPA HQ-OW-2015-0753-0009 (California State Water Resources Control Board)	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to ac7count for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	No edits
EPA HQ-OW-			

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2015-0753-0009 (California State Water Resources Control Board)	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*	Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a Section 7 Consultation.*		No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*''EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.* *Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.*		No edits

		Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*		No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and that ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*		No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*		No edits

TOPIC 6: Other

Comment	Public Comment	EPA Response	Revision Location in 2015 Cadmium

Number			Criteria Document
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*In the description of sources of cadmium in the document, EPA overlooked the contribution from coal combustion, coal mining waste, and coal ash ponds spills, seepage, and discharge. These important sources need to be recognized and addressed.*	Ex. 5 - Deliberative Process	Section 2.1

EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Check the document for errors and typos. Specific examples include:*
	• *Pg.27 which is intended to provide an acute criterion protective of nearly all individuals in the distribution (Stephan et al. **1985);the** FAV/2 approach was developed to estimate minimal effect levels,*
	• *Pg.30 This outcome was based on the poor correlation between hardness and acute toxicity for D. magna and occurred only when tests with **less than** 24-hr old neonates were included in the database. Accordingly, only the five D. magna tests from Chapman et al. (1980} initiated with **less than** 24-hr old neonates were used for the analysis*
	• *Pg.33 Two species of sculpin, Cottus bairdii and Cottus confusus, are used to derive the normalized GMAV of **4.962** µg Cd/L*
	  o ***Per Appendix A, this value should be 4.926***
	• *Pg.34 The hardness-normalized GMAV of **7.911** µg/L total cadmium for the genus Oncorhynchus is the fifth lowest in the acute dataset*
	  o ***Per Appendix A, this value should be 7.841 ***
	• *Pg.42 2. Ceriodaphnia, Cladoceran (GMCV=**1.293µg/l** total Cd)*
	• *Pg. 74 Acceptable chronic toxicity **data** are available for 27 freshwater species representing 20 different genera*
	• *Pg. C-8 [d] Not used to calculate **SMAV** because either a more definitive value available, value is considered an outlier, or preference was given to the more sensitive exposure scenario (LC versus ELS tests).*
			Various locations

EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*While Table 5 summarizes the Phyla, Families, Genera, and Species used to derive the revised criterion, it is unclear which species were used to meet each of the MDRs. Include a table that lists the eight requirements and the species used to fulfill them.*		Table 5
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of	*Verify that the Spehar and Fiandt 1986 data for Pimephales promelas is appropriate to include in the freshwater acute hardness correction.*		Appendix Table A-1, A-2, C-1 and C-2

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Natural Resources)			
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Expand Table 6 to include the actual data that were used in the freshwater acute hardness correction for each species.*		Appendix Table A-2
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process.*		Figure 2
EPA-HQ-OW-2015-0753-0006 Wisconsin Department of Natural Resources)	*Indicate how the R^2 value of 0.964 was obtained in the freshwater acute hardness correction. Attempts to replicate the value resulted in a slope of 1.104 and R^2 of 0.698.* *Indicate how the R^2 value of 0.841 was obtained in the freshwater chronic hardness correction. Attempts to replicate the value resulted in a slope of 0.798 and R^2 of 0.632.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*It was not apparent if the MATC or EC_{20} value was used for the freshwater chronic slope derivation. Indicate which of the toxicity values were used in the derivation in Appendix C and Table 8.*		Appendix Table C-2
EPA-HQ-OW-2015-0753-0006			

(Wisconsin Department of Natural Resources)	*Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process.*	Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*The language that describes the computation of the final acute value on pg. 32 is insufficient. Include a reference to section 4.3.1 after the reference to Figure 2 on page 32.*		Section 3.1.1
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*It is unclear how the intercept of the freshwater acute and chronic criterion equations were derived. Add additional language to clarify how these values were derived.*		No edits

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Appendix A
Representative Publications Using H. azteca Length-to-Weight Regression

Besser JM, Brumbaugh WG, Ingersoll CG, Ivey CD, Kunz JL, Kemble NE, Schlekat CE, Garman ER. 2013. Chronic toxicity of nickel‐spiked freshwater sediments: Variation in toxicity among eight invertebrate taxa and eight sediments. Environ Toxicol Chem 32:2495-2506.

Besser JM, Ingersoll CG, Brumbaugh WG, Kemble NE, May TW, Wang N, MacDonald DD, Roberts AD. 2015. Toxicity of sediments from lead-zinc mining areas to juvenile freshwater mussels (*Lampsilis siliquoidea*), compared to standard test organisms. Environ Toxicol Chem 34:626-639.

Besser JM, Ivey CD, Brumbaugh WG, Ingersoll CG. 2015. Effect of Diet Quality on Chronic Toxicity of Aqueous Lead to the Amphipod, *Hyalella azteca*. Environ Toxicol Chem (in press) doi:10.1002/etc.3341

Ivey CD, Ingersoll CG. 2016. Influence of bromide on the performance of the amphipod Hyalella azteca in reconstituted waters. Environ Toxicol Chem: This issue.

Kemble NE, Hardesty DK, Ingersoll CG, Kunz JL, Sibley PK, Calhoun DL, Gilliom RJ, Kuivila KM, Nowell LH, Moran PW. 2013. Contaminants in stream sediments from seven U.S. metropolitan areas: II. Sediment toxicity to the amphipod *Hyalella azteca* and the midge *Chironomus dilutus*. *Arch Environ Contam Toxicol* 64:52-64.

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Appendix B
Sensitivity of CERC Cd *Hyalella* Study to Concentration Intervals

ED_000992_00001268-00021

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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MID-CONTINENT ECOLOGY DIVISION
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OFFICE OF
RESEARCH AND DEVELOPMENT

February 25, 2016

MEMORANDUM

SUBJECT: Sensitivity of CERC Cd *Hyalella* Study to Concentration Intervals

FROM: David R. Mount and J. Russell Hockett

TO: Mike Elias (OW/OST/HECD)

The purpose of this memo is to provide additional interpretation regarding the robustness of the EC20 estimate previously derived from a cadmium exposure conducted using *Hyalella azteca* conducted by USGS/CERC. OW received comments suggesting that because there was a wide spacing between the exposure concentrations bracketing the reported EC20 that the EC20 was too uncertain to be relied upon.

The data from that study for total young per replicate are as follows:

Cd (ug/L)	Mean Total Young
0.10	24.50
0.12	27.63
0.32	29.38
0.51	25.50
1.9	18.25
3.2	1.13

The reported EC20 was 1.695, which lies between the 0.51 and 1.9 ug/L treatments. The commenter is correct that this gap of not quite 4-fold is larger than is used in most toxicity tests.

That said, we have looked carefully at this study and have concluded that this large concentration spacing creates very little uncertainty in the regression estimate of the EC20. This is in large part because the regression curve is firmly anchored near the EC20 by the response in the 1.9 ug/L treatment. The regression estimate of background reproduction is 26.3 young per replicate. The 1.9 ug/L treatment had an average of 18.25 young per replicate, which is a 30.6% reduction from the control estimate. Because this degree of reduction is very close to 20%, and all of the lower concentrations had reproduction very close to control, the EC20 estimate is very heavily influenced by the response at 1.9 ug/L, and very little by the other points in the data set.

This insensitivity is also apparent from looking at the regression itself, shown along with the study data in the figure below:

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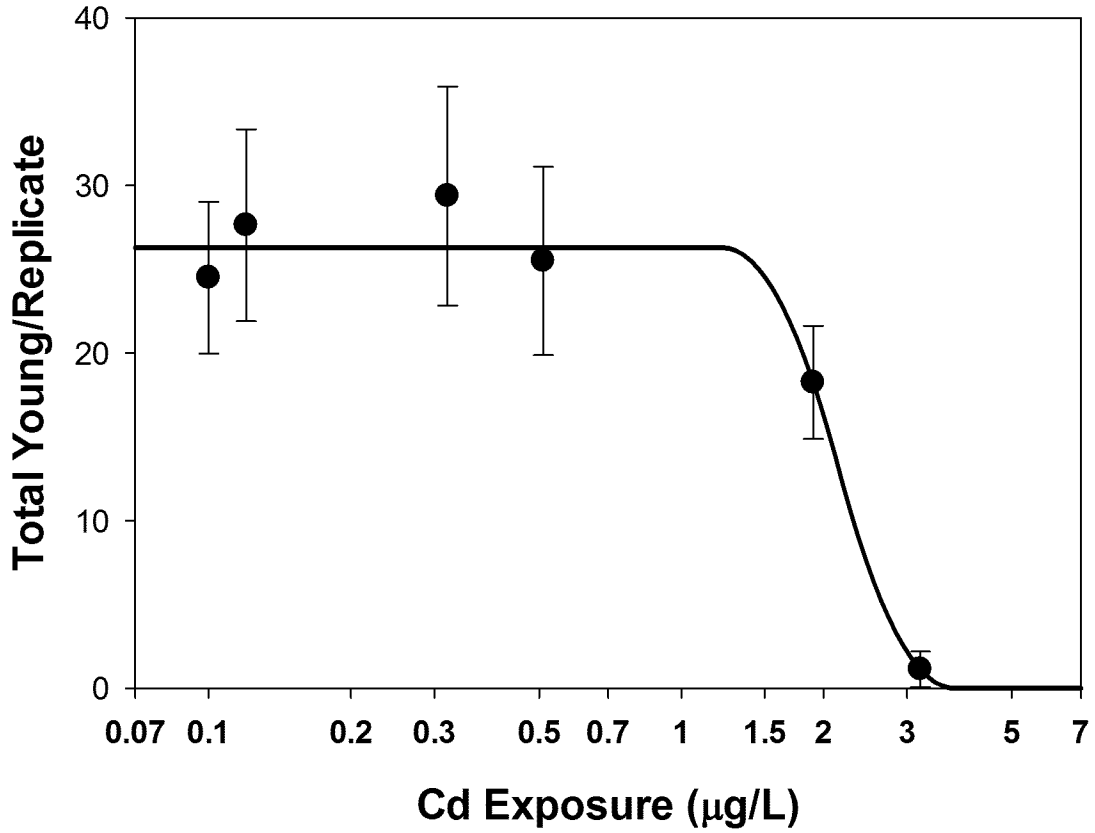

As you can see, the modeled response does not decline from control levels until well past 1 ug/L, which would be the geometric mean of 0.51 and 1.9 ug/L and closer to the 0.5x spacing common to aquatic toxicity tests of this type. The regression has a fairly steep slope and a relatively sharp shoulder, so the EC20 remains very close to the 1.9 ug/L treatment.

As further proof of this insensitivity, we modeled additional data sets which assumed that the response observed in the 0.51 ug/L treatment had occurred at higher concentrations; these alternative scenarios are represented by the open symbols in the graph on the following page. We then generated new EC20 estimates under two scenarios. The first was that we left the actual 0.51 ug/L response in the data set and added an additional data point with the same reproduction values at progressively higher concentration. The second involved simply moving the 0.51 ug/L response data to progressively higher Cd concentrations.

The effect of these manipulations showed uniformly that the EC20 estimate was extremely insensitive to the location of the data observed at 0.51 ug/L. Under both scenarios, the EC20 estimate changed very, very little as the presumed exposure concentration was raised. Even when we moved the 0.51 ug/L data all the way up to 1.7 ug/L (extremely close to the 1.9 ug/L treatment), the resulting EC20 estimate increased by a maximum of 2.4%.

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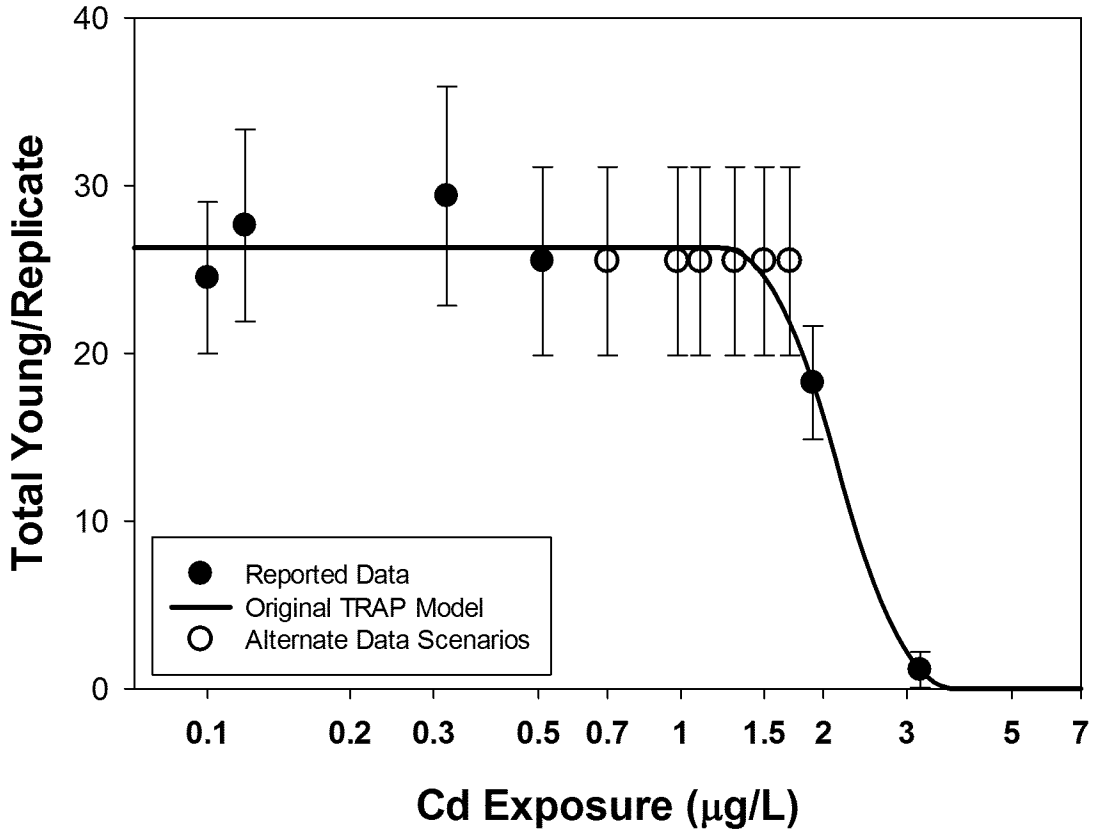

Dataset	EC20 (µg Cd/L)	95% C.I.
Unaltered Original Data	1.6947	1.3560 – 2.1179
Alternative 1: Keep 0.51 data and add additional data		
0.7	1.7077	1.3753 – 2.1236
0.9	1.7077	1.3753 – 2.1236
0.984	1.7077	1.3753 – 2.1236
1.1	1.7077	1.3753 – 2.1236
1.3	1.6903	1.3521 – 2.1132
1.5	1.6971	1.3773 – 2.0910
1.7	1.7360	1.4303 – 2.1071
Alternative 2: Move 0.51 data to higher concentration		
0.7	1.6947	1.3560 – 2.1179
0.9	1.6947	1.3560 – 2.1179
0.984	1.6947	1.3560 – 2.1179
1.1	1.6947	1.3560 – 2.1179
1.3	1.6702	1.3263 – 2.1033
1.5	1.6756	1.3511 – 2.0780
1.7	1.7145	1.4041 – 2.0936

These simulations assumed that the same reproduction observed at 0.51 ug/L was also observed at higher concentrations. If there had been a treatment between 0.51 and 1.9 and reproduction was higher in that treatment than was observed at 0.51 ug/L, the resulting EC20 would be little changed; the background response estimate would increase, but so would the steepness of the curve, and these effects would tend to offset each other. If there was an intermediate treatment that had reproduction between that observed at 0.51 and 1.9 ug/L, the shoulder of the regression curve would be less sharp, and the EC20 concentration would move down some. Hence, there is probably slight larger uncertainty that the EC20 from a more complete concentration series might be lower than the current estimate than there is that it would be higher. But these differences are small; as we said at the outset, the 30% reduction in reproduction in the 1.9 ug/L treatment suggests that the calculated EC20 would not stray far from the original estimate of 1.694 even if additional treatments had been tested.

In summary, while there could be cases were an EC20 value was made uncertain by wide spacing of exposure concentrations, the particular features of the study in question make the EC20 estimate quite robust and unlikely to have been influenced much by the presence of an additional treatment between the 0.51 and 1.9 ug/L treatments, had one been included.

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Title

TOPIC 1: Duration should be 24 hours, not one hour

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docur
EPA-HQ-OW-2015-0753-0012	*UWAG has concerns with EPA's proposal to change the acute freshwater and estuarine/marine criteria averaging duration from 24 hours to 1 hour. The change is not adequately justified and is not supported by new studies in the Draft. The current 24-hour duration should be retained unless a strong scientific justification is presented.* *Every previous iteration of the cadmium criteria has endorsed a 24-hour duration for the acute criteria. EPA appears to be making a policy decision that the acute criteria should be 1 hour, but does not present the associated science to support the revision which is inconsistent with CWA § 304(a)(1), which mandates EPA establish "criteria for water quality accurately reflecting the latest scientific knowledge."* *EPA compares the acute toxicity to ammonia but fails to provide information that compares the time-dependent toxicity of cadmium with ammonia. Furthermore, assessing the toxicity of cadmium during the first 24 hours of an acute test is problematic because the vast majority of published studies reporting the acute toxicity of cadmium do not report patterns of lethality during the first 24 hours. Several acceptable selected studies (Besser et al. 2007; Buhl 1997; Diamond et al. 1997; Mebane et al. 2012; Nebeker 1986) do not report 24-hour LC50s and the one study with relevant data (Duncan and Klavercamp 1983) had a 12-hour LC50 that was five times greater than the 96-hour LC50 (5.35 vs. 1.11 µg/L, respectively). This value would be expected to be similar if cadmium was a fast-acting pollutant.* *An earlier EPA publication (*Speed of Action of Metals Acute Toxicity to Aquatic Life*; EPA-822-R-95-002) also justifies the 24-hour averaging period. This document estimated a kinetic coefficient (*k*) using a regression of LC50 values versus time, with*	**Ex. 5 - Deliberative Process**	No edits

	the averaging period being calculated as the inverse of k. *The larger the* k *value the faster acting the pollutant. None of the estimated averaging periods in the document for freshwater and saltwater species approached 1-hour. The highest estimated* k *values mentioned, for the freshwater fathead minnow, were 6 and 17 hours, with saltwater species having even larger values. The selection of the 1-hour averaging period is baseless and arbitrary.* *Additionally, the 1985 Guidelines say the duration should be "substantially less than 48 to 96 hours," but do not say that 24 hours is an inappropriate duration and therefore the Guidelines do not support, nor should it be a justification for the proposed revision.*	**Ex. 5 - Deliberative Process**	
EPA-HQ-OW-2015-0753-0012	*Water Quality-Based Effluent Limits (WQBELs) for cadmium are often expressed as a daily (24-hr) maximum value. Changing the WQBEL to a 1-hour averaging duration could require a permittee to collect several compliance samples during a 24-hour period. This additional burden is unnecessary since there is minor variability of the cadmium levels during a typical 24-hour period, and this additional monitoring is unwarranted without sound scientific basis.*		No edits

TOPIC 2: *H. azteca* test by Ingersoll is not acceptable; retest should be done or test should be removed from criteria development

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docu

ED_000992_00001482-00003

EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*The proposed chronic criterion is based on a flawed toxicity test (Ingersoll and Kemble 2001) conducted on the amphipod Hyalella azteca. The Hyalella test used in the criterion derivation should be repeated using current feeding procedures that are proven to result in better growth and reproduction. While the IEPA acknowledges and commends the improvements USEPA has made in the assessment and analysis of Hyalella sp. data compared to the 2001 cadmium criteria document, specifically in regards to the sensitivity of this organism to the presence/absence of chloride and bromide in culture and test water, the IEPA contends that the feeding regime employed in the 2000 USGS study is deficient by today's standards and likely resulted in malnourished, stressed test organisms.* *Specifically, test organisms in the 2000 USGS study were underfed and/or fed improper diets based on current research. Dr. Soucek, at the Illinois Natural History Survey, conducted new research that focused on determining the appropriate amounts of food for test organisms. His research has led to improved growth of test organisms compared to earlier diet regimes. The diet used in the 2000 USGS study consisted of a ration of 1.0 ml YCT/d, whereas Dr. Soucek's research contends that a diet consisting of Tetramin supplemented with diatoms greatly improves growth and reproduction of Hyalella azteca compared to YCT-only diets (Soucek et al. 2016, in press).* *The diet in the 2000 USGS study restricted growth and fecundity when compared to Tetramin-based diets (Soucek et al. 2016, in press), and brings into question the accuracy of the test results.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*Test organisms in the 2000 USGS study did not attain minimum growth requirements based on the direct measure of organism weight, with the average dry weight of the controls being 0.27 mg/individual (<0.50 mg/individual). USEPA concluded that the dry weights measured in the test were inaccurate and subsequently used length data to extrapolate to dry weight via a regression equation. However there is no documentation provided for this equation or how it was derived. It is unlikely that the dry weights were underestimated (while an overestimation can be expected due to inadequate drying of test organisms), and it is therefore considered unlikely that the organisms achieved the minimum*		No edits

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	weight requirements for this test to be valid.		
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*The dilution series (control and 5 treatment concentrations: 0.1, 0.3, 0.5, 2.0 and 3.0 µg/L.) used in the 2000 USGS test did not appropriately bracket the effect concentration. The dilution series was not standard, with a large gap in concentration between the NOEC and LOEC (0.5 and 2.0 µg/L, respectively). While a point estimation technique was used to determine the effect concentration, the lack of a 1.0 µg/L treatment may have changed this estimation. The precision of this estimation is paramount, as the test result was the sole determinant of the GMCV, which is the most sensitive in the chronic dataset, and a small change in the GMCV can therefore have a substantial effect on the final chronic value.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*At this time, the IEPA is in support of the adoption of the acute cadmium criterion as proposed, but is requesting a one year extension for the adoption of the chronic criterion. A one year extension would allow for a retest on Hyalella azteca using current feeding recommendations and would allow for revisions to be made to the chronic criterion. A round robin approach would ensure that the data are obtained using the appropriate test procedures and would provide additional information regarding the sensitivity of Hyalella azteca to cadmium. If time does not permit a repeat of the test, then the chronic criterion should be recalculated with the Hyalella data removed.*		No edits

TOPIC 3: Dissolved vs total concentration use

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docur

EPA HQ-OW-2015-0753-0005	*Additional documentation is needed to support the total to dissolved conversion factors. Very little information is provided concerning the derivation of the conversion factors, and more detailed information is needed to fully assess their appropriateness for natural waterbodies.*	**Ex. 5 - Deliberative Process**	Section 2.6
EPA HQ-OW-2015-0753-0005	*It is unknown if the solutions prepared from Cd salts, that were used to develop the conversion factors, adequately represent the forms of Cd found in natural waterbodies.*		Section 2.6
EPA HQ-OW-2015-0753-0005	*An explanation is needed as to why the conversion factors for the acute and chronic criteria are different. It also appears illogical that the constant conversion factor of 0.994 used for marine water is higher than for freshwater, especially because the hardness-dependent conversion factor for freshwater decreases as hardness increases.*		Section 2.6

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EPA HQ-OW-2015-0753-0005	*While it is noted in several places in the document, clarify that the recommended criteria values are expressed as dissolved cadmium concentrations (not total). Also clarify if states have the option to adopt total Cd criteria values.*		No edits
EPA HQ-OW-2015-0753-0011	*Kansas has utilized the total recoverable metals criteria and data, and is not set up to sample for total dissolved metals. A conversion factor would be applied to calculate the dissolved concentration and Kansas recommends that EPA retain this flexibility in its final criteria.*		No edits

TOPIC 4: Data quality, use, and availability

Comment Number	Public Comment		Revision Locat in 2015 Cadmi Criteria Docu
EPA-HQ-OW-2015-0753-0006	*Some of the values that are new/revised since the 2001 AWQC document are from studies that were published before 2001. Table 22 has general information describing why GMAVs have changed between the 2001 and 2015 document, but it does not provide details on why these "new" data were now considered acceptable. Include another table that describes why the studies that were excluded previously are now included.*		No edits
EPA-HQ-OW-2015-0753-0013	*Should toxicity tests conducted under less-than optimal conditions be discounted? This comment goes beyond just the test results for Hyalella, because while laboratory tests used for criteria development use conditions that are as close to optimal as possible, wild populations in diverse natural conditions are often exposed to conditions that sub-optimal, and therefore laboratory tests may be underprotective in natural conditions (i.e., additional stresses) (see, Holmstrump et al. 2010; Besser et al. 2015).*		No edits

Ex. 5 - Deliberative Process

		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0013	*"Other data" are not addressed consistent with the Guidelines. While these data are not used in the species sensitivity distribution rankings, they should not be thrown away, discounted, or deemed "unacceptable." "Other Data" can be invoked to lower a criterion (e.g., chronic value in the 1987 selenium criterion). Revaluate Riddel et al. (2005a, b) and include a larger discussion of their effect concentrations/findings and other similar behavioral/ecological studies.*		Sections 5 and 5.
EPA-HQ-OW-2015-0753-0013	*With many organisms, a strong difference in the sensitivity of different life stages makes it inappropriate to roll up data from different developmental stages. Pooling salmonid effects concentrations across developmental stages to obtain a SMAV could produce a misleading result (see, Hansen et al. 2002; Mebane et al. 2012; Chapman 1978; Chapman and Stevens 1978).*		Appendix A Ranked FW Acut Table
EPA-HQ-OW-2015-0753-0013	*The decision to only use ELS chronic data in which the exposures began in the egg stage, and to exclude long-term data in which the exposures began in the fry stage is non-conservative.*		No edits
EPA-HQ-OW-2015-0753-0013	*SMAV calculations tagged with the footnote "C", indicating that "Data not used to calculate SMAV because more sensitive life stage available, or flow-through measured test available", should be separated into two different footnotes since they are very different reasons.*		Appendix A and Appendix B
EPA-HQ-OW-2015-0753-0013	*Address the following Appendix A specific errors/changes:* • *Daphnia magna (various)* ○ *Many "S, U" tests (tests with unmeasured*		Appendix A Ranked FW Acut Table

	concentrations) are underlined, indicating they are included in the SMAV calculations. These should be excluded per the Guidelines.	**Ex. 5 - Deliberative Process**	
	• *Mayfly (formerly, Ephemerella grandis) Drunella grandis* o *Tested species was listed in the source document as Ephemerella subvaria, which is still a valid species name according to ITIS.gov.*		

	• *Rainbow trout (smolt), Chapman 1975 (>2.9 µg/L)*
	  o *Should be excluded from SMAV because it is from a resistant life stage. Also, should be listed as "Rainbow trout (Steelhead smolt)" as Steelhead are not just Rainbow Trout by a different name, but have physiological differences in regard to ion regulation. Chapman (1975) should only be cited when no alternative exists, because it was never formally released by EPA and is not publicly available online. Chapman (1978) reports the same data and is a better citation.*
	• *Rainbow trout (smolt), Chapman 1975 (4.1 µg/L)*
	  o *Suspect value, exclude from SMAV. Chapman (1978) lists the value for the same test as >2.9 µg/L. Chapman (1978) is the peer-reviewed publication of record for these data; Chapman (1975) was an unpublished, work-in-progress progress report that sometimes still gets cited because it includes data never published elsewhere, such as the coho data shown in the figure in this memo. Exclude from SMAV, resistant life stage and re-label as " "Rainbow trout (Steelhead smolt". See Chapman (1978, Table 3).*		

	• *Rainbow trout (299 mg), Stratus (1.29 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with unmanipulated pH of*		

	7.5 were much more sensitive
	• *Chinook salmon (parr, 11.58g) (3.5 µg/L)*
	  o *Exclude value from SMAV, based on a resistant life stage being tested. Value is twice as high as the value obtained with swim-up fry in matched tests and confidence limits don't overlap.*
	• *Chinook salmon (smolt, 32.46 g) (>2.9 µg/L)*
	  o *Should be excluded from SMAV, based on a resistant life stage being tested.*
	• *Bull trout (84.2 mg) (2.89 µg/L)*
	  o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with a natural pH of 7.5 were much more sensitive*
	• *Colorado squawfish*
	  o *Old common name is now considered repugnant. AFS calls it "Colorado pikeminnow". "Pikeminnow" is one word.*
		Ex. 5 - Deliberative Process	

EPA-HQ-OW-2015-0753-0013	*Address the following Appendix C specific errors/changes:* • *Snail, Aplexa hyporum (Holcombe) (4.0 µg/L)* o *I got an EC20 of about 2.6 µg/L. By excluding the highest treatment with total mortality I could reproduce the 4.0 EC20 value, but it had a poor fit with Y0.*		No edits

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		Ex. 5 - Deliberative Process	

EPA-HQ-OW-2015-0753-0013	*Add the following additional relevant data:*
	• *Pascoe and Mattey 1977*
	  o *Chronic stickleback exposure*
	• *Wang et al. 2014*
	  o *Chronic fathead full life-cycle test*
	• *Brinkman and Vieira 2008*
	  o *Acute and chronic mountain whitefish*
	• *Mebane et al. 2014 (paper provided)*
	  o *Effects of cadmium on larval aquatic insect communities in 30-day experimental stream tests*
			Mebane et al. (20
			added to Section

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docu

EPA-HQ-OW-2015-0753-0014	*There is concern about the focus on fish in developing the criteria. EPA needs to bring in other species including insects and freshwater mussels into the process when developing criteria for cadmium. This lack of additional species prevents a more holistic picture of the freshwater community, and results in criteria that are not protective of all aquatic-dependent wildlife. EPA has consistently failed to fully consider aquatic-dependent wildlife in the development of national criteria.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0010	*There is concern with the continued lack of estuarine/marine chronic cadmium toxicity data and that no new chronic toxicity data have been generated since 2001. EPA should conduct additional chronic toxicity studies (particularly with vertebrate species) to expand the estuarine/marine chronic toxicity dataset. More estuarine/marine chronic data are needed to develop a scientifically reliable chronic cadmium criterion.*		No edits
EPA-HQ-OW-2015-0753-0010	*The mysid Neomysis integer is a new species added to the estuarine/marine acute dataset, but this mysid is potentially non-native to the United States. Since there are available values for two other native mysid species (M. bigelowi and A. bahia), this non-native species should be removed (unless documentation is provided confirming it is naturally occurring within waters of North America).*		Section 3.2.1 and Appendix B

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TOPIC 5: ESA considerations

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docu
EPA-HQ-OW-2015-0753-0014	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0014	*To ensure the final cadmium water quality criteria is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*	Thank you for your comment.	No edits

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EPA HQ-OW-2015-0753-0009	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to account for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	No edits
EPA HQ-OW-2015-0753-0009	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*	Please see response to the above comment.	No edits
EPA HQ-OW-2015-0753-0015	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a*	Thank you for your comment.	No edits

	Section 7 Consultation.		
EPA HQ-OW-2015-0753-0015	*''EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.* *Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.*	**Ex. 5 - Deliberative Process**	No edits

		Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0015	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*		No edits
EPA HQ-OW-2015-0753-0015	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and that ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*		No edits
EPA HQ-OW-2015-0753-0015	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*		No edits

TOPIC 6: Other

Comment	Public Comment	EPA Response	Revision Locat in 2015 Cadmi

Number			Criteria Docum
EPA-HQ-OW-2015-0753-0014	*In the description of sources of cadmium in the document, EPA overlooked the contribution from coal combustion, coal mining waste, and coal ash ponds spills, seepage, and discharge. These important sources need to be recognized and addressed.*	Ex. 5 - Deliberative Process	Section 2.1

EPA-HQ-OW-2015-0753-0006	*Check the document for errors and typos. Specific examples include:*
	• *Pg.27 which is intended to provide an acute criterion protective of nearly all individuals in the distribution (Stephan et al. **1985);the** FAV/2 approach was developed to estimate minimal effect levels,*
	• *Pg.30 This outcome was based on the poor correlation between hardness and acute toxicity for D. magna and occurred only when tests with **less than** 24-hr old neonates were included in the database. Accordingly, only the five D. magna tests from Chapman et al. (1980} initiated with **less than** 24-hr old neonates were used for the analysis*
	• *Pg.33 Two species of sculpin, Cottus bairdii and Cottus confusus, are used to derive the normalized GMAV of **4.962** µg Cd/L*
	  o ***Per Appendix A, this value should be 4.926***
	• *Pg.34 The hardness-normalized GMAV of **7.911** µg/L total cadmium for the genus Oncorhynchus is the fifth lowest in the acute dataset*
	  o ***Per Appendix A, this value should be 7.841 ***
	• *Pg.42 2. Ceriodaphnia, Cladoceran (GMCV=**1.293µg/l** total Cd)*
	• *Pg. 74 Acceptable chronic toxicity **data** are available for 27 freshwater species representing 20 different genera*
	• *Pg. C-8 [d]Not used to calculate **SMAV** because either a more definitive value available, value is considered an outlier, or preference was given to the more sensitive exposure scenario (LC versus ELS tests).*
			Various locations

EPA-HQ-OW-2015-0753-0006	*While Table 5 summarizes the Phyla, Families, Genera, and Species used to derive the revised criterion, it is unclear which species were used to meet each of the MDRs. Include a table that lists the eight requirements and the species used to fulfill them.*	Ex. 5 - Deliberative Process	Table 5

EPA-HQ-OW-2015-0753-0006	*Verify that the Spehar and Fiandt 1986 data for Pimephales promelas is appropriate to include in the freshwater acute hardness correction.*	**Ex. 5 - Deliberative Process**	Appendix Table A A-2, C-1 and C-2
EPA-HQ-OW-2015-0753-0006	*Expand Table 6 to include the actual data that were used in the freshwater acute hardness correction for each species.*		Appendix Table A
EPA-HQ-OW-2015-0753-0006	*Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process.*		Figure 2
EPA-HQ-OW-2015-0753-0006	*Indicate how the R^2 value of 0.964 was obtained in the freshwater acute hardness correction. Attempts to replicate the value resulted in a slope of 1.104 and R^2 of 0.698.* *Indicate how the R^2 value of 0.841 was obtained in the freshwater chronic hardness correction. Attempts to replicate the value resulted in a slope of 0.798 and R^2 of 0.632.*		No edits
EPA-HQ-OW-2015-0753-0006	*It was not apparent if the MATC or EC_{20} value was used for the freshwater chronic slope derivation. Indicate which of the toxicity values were used in the derivation in Appendix C and Table 8.*		Appendix Table C
EPA-HQ-OW-2015-0753-0006	*Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process.*		Figure 4
EPA-HQ-OW-	*The language that describes the computation of the final acute*		

2015-0753-0006	*value on pg. 32 is insufficient. Include a reference to section 4.3.1 after the reference to Figure 2 on page 32.*		
EPA-HQ-OW-2015-0753-0006	*It is unclear how the intercept of the freshwater acute and chronic criterion equations were derived. Add additional language to clarify how these values were derived.*	**Ex. 5 - Deliberative Process**	No edits

Appendix A
Representative Publications Using H. azteca Length-to-Weight Regression

Besser JM, Brumbaugh WG, Ingersoll CG, Ivey CD, Kunz JL, Kemble NE, Schlekat CE, Garman ER. 2013. Chronic toxicity of nickel - spiked freshwater sediments: Variation in toxicity among eight invertebrate taxa and eight sediments. Environ Toxicol Chem 32:2495-2506.

Besser JM, Ingersoll CG, Brumbaugh WG, Kemble NE, May TW, Wang N, MacDonald DD, Roberts AD. 2015. Toxicity of sediments from lead-zinc mining areas to juvenile freshwater mussels (*Lampsilis siliquoidea*), compared to standard test organisms. Environ Toxicol Chem 34:626-639.

Besser JM, Ivey CD, Brumbaugh WG, Ingersoll CG. 2015. Effect of Diet Quality on Chronic Toxicity of Aqueous Lead to the Amphipod, Hyalella azteca. Environ Toxicol Chem (in press) doi:10.1002/etc.3341

Ivey CD, Ingersoll CG. 2016. Influence of bromide on the performance of the amphipod Hyalella azteca in reconstituted waters. Environ Toxicol Chem: This issue.

Kemble NE, Hardesty DK, Ingersoll CG, Kunz JL, Sibley PK, Calhoun DL, Gilliom RJ, Kuivila KM, Nowell LH, Moran PW. 2013. Contaminants in stream sediments from seven U.S. metropolitan areas: II. Sediment toxicity to the amphipod *Hyalella azteca* and the midge *Chironomus dilutus*. *Arch Environ Contam Toxicol* 64:52-64.

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Appendix B
Sensitivity of CERC Cd *Hyalella* Study to Concentration Intervals

ED_000992_00001482-00021

Cadmium Aquatic Life Ambient Water Quality Criteria

Agency Workgroup Kickoff Meeting – Final Review

February 29, 2016

1. **OVERVIEW**
   a. **Criteria document revision based on comments received during 60 day public comment period**

   b. **Comment letters received**
      i. Utility Water Act Group (via Hunton and Williams)
      ii. Florida Department of Environmental Protection
      iii. Hampton Roads Sanitation District
      iv. Illinois Environmental Protection Agency
      v. Wisconsin Department of Natural Resources
      vi. Kansas Department of Health and Environment
      vii. US Geological Survey (Chris Mebane)
      viii. National Marine Fisheries Service
      ix. Center for Biological Diversity
      x. California State Water Resources Control Board

   c. **Limited changes in document content occurred as a result of public comments**
      i. Acute freshwater value decreased slightly
      ii. Estuarine/marine acute and chronic values decreased
      iii. Most other revisions involved addition of clarifying tables, figures, or text

Ex. 5 - Deliberative Process

d. **Final review period: March 1 – March 9**

Action	Date
Agency Workgroup Draft Review	4/20/15 – 5/20/15
External Peer Draft Review	8/22/15-10/2/15
Agency Workgroup	11/2/15 – 11/10/15
60 Day Public Comment Period/Revisions	12/1/15 – 2/1/16
Agency Workgroup Review of Final Document	3/1/16 – 3/9/16
FRN Publication	3/30/16

e. **Review materials available on Sharepoint (end of day today)**
   i. Revised criteria document
      - Redline
      - Accepted change version **(Please make comments/changes in accepted change version in track change mode)**
   ii. Draft summarized comments and responses

2. KEY DOCUMENT CHANGES

Ex. 5 - Deliberative Process

b. **Estuarine/marine acute value decreased from 35 ug/L to 33 ug/L**

i. Commenter noted *Neomysis integer* does not occur in North American waters
ii. *Neomysis integer* (65.25 ug/L normalized) was removed from database
iii. *Neomysis Americana* (28.14 ug/L normalized) was added to the database after obtaining an additional paper (Roberts et al. 1982)
iv. CMC decreased from 34.81 ug/L to 33.13 ug/L, total concentration

Revised Cadmium Estuarine/Marine FAV and CMC			FRM Draft Publication Estuarine/Marine FAV and CMC		
Species	**SMAV (µg/L)**	**GMAV [Rank] (µg/L)**	**Species**	**SMAV (µg/L)**	**GMAV [Rank] (µg/L)**
Striped bass, *Morone saxatilis*	75.0	75.0 [5]	Striped bass, *Morone saxatilis*	75.0	75.0 [5]
Mysid, *Americamysis bahia*	41.29	67.39 [4]	Mysid, *Americamysis bahia*	41.29	67.39 [4]
Mysid, *Americamysis bigelowi*	110		Mysid, *Americamysis bigelowi*	110	
Moon jellyfish, *Aurelia aurita*	61.75	61.75 [3]	Mysid, *Neomysis integer*	65.25	65.25 [3]
Harpacticoid copepod, *Tigriopus brevicornis*	29.14	29.14 [2]	Moon jellyfish, *Aurelia aurita*	61.75	61.75 [2]
Mysid, *Neomysis americana*	28.14	28.14 [1]	Harpacticoid copepod, *Tigriopus brevicornis*	29.14	29.14 [1]
FAV (calculated)	66.25		FAV (calculated)	69.62	
CMC	33.13		CMC	34.81	

c. Estuarine/marine chronic value decreased from 8.4 ug/L to 8.0 ug/L total concentration based on decrease in FAV

i. Estuarine/marine chronic value was based on an Acute-to-Chronic Ratio

d. Notable editorial changes/clarifications

i. Information was added clarifying approach and source of data for converting total to dissolved concentrations for fresh and saltwater (Section 2.6) including
- Data sources
- Water and salts used for testing: Natural surface waters and cadmium chloride and cadmium sulfate salts used for simulation

ii. Footnotes edited in Appendix A and B to differentiate "Data not used to calculate SMAV because more sensitive lifestage available" from "Flow-through measured test available"

iii. Table 5 was modified to identify specific genus used to fulfill each of the family MDRs, instead of only numbers of phyla, family, genera, and species used to derive criteria

iv. Additional tables were added identifying which studies and values were used in the acute and chronic hardness normalization analysis (Appendices A-2 and C-2)

v. Graphs were added showing the freshwater acute hardness linear regressions to better illustrate the normalization process (Figures 2 and 4)

3. **KEY COMMENTS/RESPONSES WITH LIMITED OR NO REVISION**

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

To: Gallagher, Kathryn[Gallagher.Kathryn@epa.gov]
From: Elias, Mike
Sent: Fri 2/26/2016 3:18:24 PM
Subject: FW: ESA Public Comment Responses on Cadmium
ESA Comments Summary Responses 2-26-16.docx

FYI. Hit send too quickly….I meant to cc you!

From: Elias, Mike
Sent: Friday, February 26, 2016 10:17 AM
To: Behl, Betsy <Behl.Betsy@epa.gov>
Subject: ESA Public Comment Responses on Cadmium

Betsy,

Ex. 5 - Deliberative Process

I have attached the summarized comments and responses and attached them for your review. Please let me know if you have any questions.

Thanks,

Mike

Mike Elias | Biologist

Ecological Risk Assessment Branch | Health and Ecological Criteria Division

Office of Science and Technology | Office of Water

U.S. Environmental Protection Agency

1200 Pennsylvania Avenue, NW, Washington, DC 20460

(202) 566-0120 | elias.mike@epa.gov

TOPIC 6: ESA considerations

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	**Ex. 5 - Deliberative Process**	*None*
EPA-HQ-OW-2015-0753-0014	*To ensure the final cadmium water quality criteria to is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*	Thank you for your comment.	*None*

EPA HQ-OW-2015-0753-0009	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to account for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0009	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*	Please see response to comment above.	

EPA HQ-OW-2015-0753-0015	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a Section 7 Consultation.*	Thank you for your comment.	*None*
EPA HQ-OW-2015-0753-0015	*EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.*	**Ex. 5 - Deliberative Process**	

	Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0015	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*		
EPA HQ-OW-2015-0753-0015	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*		

EPA HQ-OW-2015-0753-0015	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*	**Ex. 5 - Deliberative Process**	

TOPIC 6: ESA considerations

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	**Ex. 5 - Deliberative Process**	*None*
EPA-HQ-OW-2015-0753-0014	*To ensure the final cadmium water quality criteria to is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*	Thank you for your comment.	*None*

EPA HQ-OW-2015-0753-0009	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to account for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process** Thank you for your comment.	
EPA HQ-OW-2015-0753-0009	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*	Please see comment above. Thank you for your comment..	

EPA HQ-OW-2015-0753-0015	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a Section 7 Consultation.*	Thank you for your comment.	*None*
EPA HQ-OW-2015-0753-0015	*EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected*	**Ex. 5 - Deliberative Process**	

	to result in more severe effects. *Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.*	Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0015	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*		
EPA HQ-OW-2015-0753-0015	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*	Thank you for your comment.	

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TOPIC 6: ESA considerations

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EPA HQ-OW-2015-0753-0009	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to account for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	
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	Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.		
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EPA HQ-OW-	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine*		

2015-0753-0015	*waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*	**Ex. 5 - Deliberative Process** Thank you for your comment.	

To: Mount, Dave[Mount.Dave@epa.gov]
Cc: Hockett, Russ[Hockett.Russ@epa.gov]
From: Elias, Mike
Sent: Wed 2/10/2016 3:55:47 PM
Subject: RE: Cadmium H. azteca
IL EPA DRAFT Comment.pdf
WI DNR Comment DRAFT.pdf

Thank you Dave. I appreciate it.

For your reference, I have attached the comment letter from IEPA, and also one from Wisconsin…who also briefly mentions the H. azteca assay in passing. IEPA, in their comments, requests one of two final actions: that either the H. azteca be removed from the chronic criteria derivation or that the chronic criteria be delayed for a year for retesting to occur.

I am sorting through the comments now, but I will keep you posted but I am guessing we will be talking soon.

Thanks Dave,

Mike

From: Mount, Dave
Sent: Wednesday, February 10, 2016 10:04 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Hockett, Russ <Hockett.Russ@epa.gov>
Subject: RE: Cadmium H. azteca

I would think so. I've already sent a request to CERC for references. I've also cc'd Russ Hockett so he knows what's going on with this.

Dave

From: Elias, Mike
Sent: Wednesday, February 10, 2016 9:01 AM
To: Mount, Dave <Mount.Dave@epa.gov>
Subject: RE: Cadmium H. azteca

Would early to mid next week work for you?

Mike

From: Mount, Dave
Sent: Wednesday, February 10, 2016 9:59 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Subject: RE: Cadmium H. azteca

I'll talk with Columbia. What's your timeline?

Dave

From: Elias, Mike
Sent: Tuesday, February 09, 2016 1:32 PM
To: Mount, Dave <Mount.Dave@epa.gov>
Subject: RE: Cadmium H. azteca

Hi Dave,

Ex. 5 - Deliberative Process

Thanks,

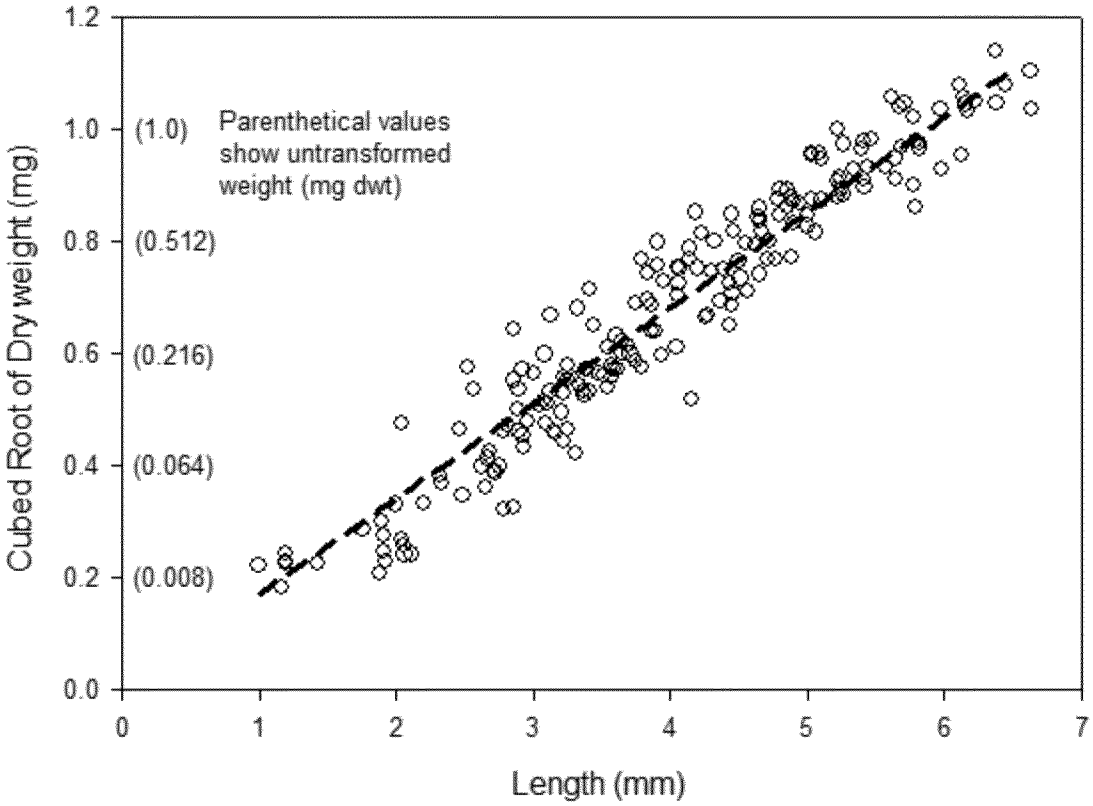
Mike

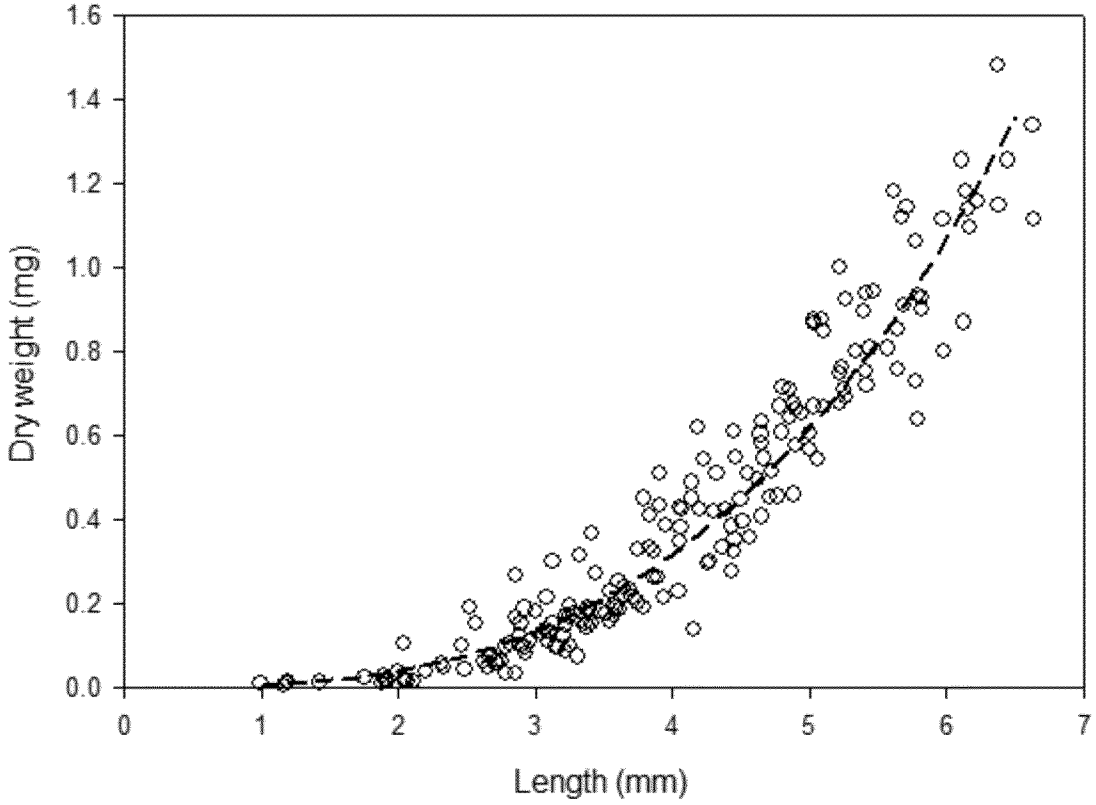
From: Mount, Dave
Sent: Tuesday, January 12, 2016 9:56 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Hockett, Russ <Hockett.Russ@epa.gov>; Hoff, Dale <Hoff.Dale@epa.gov>; Erickson, Russell <Erickson.Russell@epa.gov>
Subject: RE: Cadmium H. azteca

Hi Mike—

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process





From: Elias, Mike
Sent: Tuesday, January 12, 2016 7:12 AM
To: Mount, Dave <Mount.Dave@epa.gov>
Subject: Cadmium H. azteca

Hi Dave,

Hope you are having a good new year so far. I have another favor to ask regarding the H. azteca bioassay work done by Ingersoll, related to the study that we accepted for the cadmium chronic criteria development.

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Thanks Dave,

Mike

Mike Elias | Biologist

Ecological Risk Assessment Branch | Health and Ecological Criteria Division

Office of Science and Technology | Office of Water

U.S. Environmental Protection Agency

1200 Pennsylvania Avenue, NW, Washington, DC 20460

(202) 566-0120 | elias.mike@epa.gov

To: Elias, Mike[Elias.Mike@epa.gov]; Greg Smith[gsmith@glec.com]
Cc: Cruz, Luis[Cruz.Luis@epa.gov]
From: Craig Voros
Sent: Tue 2/9/2016 6:06:32 PM
Subject: Re: Cadmium Call
Cd Public Comments EPA Response_2.9.16.docx

;;;;;;;;Here ya go. I copied and pasted over your edits.

Craig Voros
Great Lakes Environmental Center
1295 King Avenue
Columbus, OH 43212
614-487-1040

On 2/9/2016 1:01 PM, Elias, Mike wrote:

Craig and Greg,

I made some additional edits in track change mode. In general, I slightly truncated some of the comments to get to the final point more quickly. **Ex. 5 - Deliberative Process** getting to the point. I think this may be a reasonable balance that tries to fall between the two verisons.

What I would like to do is to upload the comment/response matrix to the Sharepoint so that we can work on it simultaneously. I will work on the responses and editing the comments, while you work on developing the comments. To that end, could you please send me the most updated version of the comment matrix and I will upload it and send you the link right after?

Additionally, I have some specific areas that we need to investigate further to support our response to comments. I will give you a call Greg about those areas shortly this afternoon to discuss.

Thanks,

Mike

From: Craig Voros [mailto:cvoros@glec.com]
Sent: Monday, February 08, 2016 1:02 PM
To: Elias, Mike ; Greg Smith
Cc: Cruz, Luis
Subject: Re: Cadmium Call

Ok. I made some edits. I agree I will need someone to check my work so it sounds more like a summary and less verbatim (or a mish/mash of the two). I added additional detail and was wondering if this is what you had in mind. Unfortunately since it is not verbatim and is a summary, it will take some time to get it to fit our format. My best guess is early next week

on completion.

Let me know your thoughts.

Craig VorosGreat Lakes Environmental Center1295 King AvenueColumbus, OH 43212614-487-1040
On 2/8/2016 11:02 AM, Elias, Mike wrote:

Thank you Craig for sending this for initial review. Good to make sure we are on the same page from the start.

I have taken a look through and added my thoughts/comments. I think this is very close and my comments are mostly detail-oriented. I had previously and independently gone through and summarized what I saw as the key comments Ex. 5 - Deliberative Process I added a few more detail points based on my analysis. Additionally, I suggested a couple of changes in the ordering of text. My other main comment was to make sure that it is clear we are summarizing the comments. The presentation sometimes sounds like we are summarizing and at other times, to me, sounds like the text was taken verbatim.

Outside of those comments, I think this is looking good in terms of format. Please let me know if you have further questions or want me to take a look at any additional versions. Once you have one, please also let me know when you anticipate having the comments put together.

Thank you Craig,

Mike

From: Craig Voros [mailto:cvoros@glec.com]
Sent: Monday, February 08, 2016 9:37 AM
To: Greg Smith ; Elias, Mike
Cc: Cruz, Luis
Subject: Re: Cadmium Call

Mike,
I distilled Ex. 5 - Deliberative Process comments into the format you suggested (see Topic 2). Is this what you [illegible]? It is very condensed. I want to make sure this is what we were looking for before proceeding with the other comments. Thoughts and suggestions are welcome.

Craig VorosGreat Lakes Environmental Center1295 King AvenueColumbus, OH 43212614-487-1040
On 2/4/2016 4:25 PM, Greg Smith wrote:

Thanks Mike

On 2/4/2016 4:09 PM, Elias, Mike wrote:

Greg and Craig,

I spoke with Kathryn. I have attached an example format that we came to during our discussion. Please refine (and adapt) as appropriate, but this is the basic format that we were thinking would work for cadmium. Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Once you start to develop the framework, I can take a look at it at any time. Please keep me updated on progress and provide me with an estimate of completion date for summarizing the comments once you have taken a closer look at the letter. Please let us know if you have additional questions.

Thank you,

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Thursday, February 04, 2016 12:09 PM
To: Elias, Mike ; Craig Voros
Cc: Cruz, Luis
Subject: Re: Cadmium Call

Thanks Mike

Craig just got back from field sampling, so we are both at the office now.

Thus you can call us direct at Ex. 6 - Personal Privacy (unless there is another person needing the conference line).

Greg

On 2/4/2016 12:02 PM, Elias, Mike wrote:

Gentlemen,

For the call today, we can use the following call in number: Ex. 6 - Personal Privacy
Ex. 6 - Personal Privacy

I have done an initial review of the comments and would like to discuss allocation of the responses/revisions, initial approach, and timeframe. I will send an initial organizational table before the call.

Thanks,

Mike

Mike Elias | Biologist

Ecological Risk Assessment Branch | Health and Ecological Criteria Division

Office of Science and Technology | Office of Water

U.S. Environmental Protection Agency

1200 Pennsylvania Avenue, NW, Washington, DC 20460

(202) 566-0120 | elias.mike@epa.gov

Cadmium Aquatic Life Ambient Water Quality Criteria

Briefing for Betsy Southerland

March 14, 2016

1. **OVERVIEW**
   a. **Criteria document revision based on comments received during 60 day public comment period**

   b. **Comment letters received**
      i. Utility Water Act Group (via Hunton and Williams)
      ii. Florida Department of Environmental Protection
      iii. Hampton Roads Sanitation District
      iv. Illinois Environmental Protection Agency
      v. Wisconsin Department of Natural Resources
      vi. Kansas Department of Health and Environment
      vii. US Geological Survey (Chris Mebane)
      viii. National Marine Fisheries Service
      ix. Center for Biological Diversity
      x. California State Water Resources Control Board

   c. **Limited changes in document content occurred as a result of public comments**
      i. Acute freshwater value decreased slightly
      ii. Estuarine/marine acute and chronic values decreased
      iii. Most other revisions involved addition of clarifying tables, figures, or text

Ex. 5 - Deliberative Process

1985 Guidelines, Stephen et al. (1985).

d. Currently revising based on Agency Workgroup review

Action	Date
Agency Workgroup Draft Review	4/20/15 – 5/20/15
External Peer Draft Review	8/22/15-10/2/15
Agency Workgroup	11/2/15 – 11/10/15
60 Day Public Comment Period/Revisions	12/1/15 – 2/1/16
Agency Workgroup Review of Final Document	3/1/16 – 3/9/16
FRN Publication	3/30/16

2. KEY DOCUMENT CHANGES BASED ON PUBLIC COMMENT PERIOD

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c. **Estuarine/marine acute value decreased from 35 ug/L to 33 ug/L**
   i. Commenter (UWAG) noted *Neomysis integer* does not occur in North American waters
   ii. *Neomysis integer* (65.25 ug/L normalized) was removed from database
   iii. *Neomysis Americana* (28.14 ug/L normalized) was added to the database after obtaining an additional paper (Roberts et al. 1982)
   iv. CMC decreased from 34.81 ug/L to 33.13 ug/L, total concentration

d. **Estuarine/marine chronic value decreased from 8.4 ug/L to 8.0 ug/L total concentration based on decrease in FAV**
   i. Estuarine/marine chronic value was based on an integration of *Neomysis integer* and Acute-to-Chronic Ratio

e. **Notable editorial changes/clarifications**
   i. Information was added clarifying approach and source of data for converting total to dissolved concentrations for fresh and saltwater including
      - Data sources
      - Water and salts used for testing: Natural surface waters and cadmium chloride and cadmium sulfate salts used for simulation
   ii. Footnotes edited in Appendix A and B to differentiate "Data not used to calculate SMAV because more sensitive lifestage available" from "Flow-through measured test available"
   iii. Table 5 was modified to identify specific genus used to fulfill each of the family MDRs, instead of only numbers of phyla, family, genera, and species used to derive criteria
   iv. Additional tables were added identifying which studies and values were used in the acute and chronic hardness normalization analysis (Appendices A-2 and C-2)
   v. Graphs were added showing the freshwater acute hardness linear regressions to better illustrate the normalization process (Figures 2 and 4)

3. **KEY COMMENTS/RESPONSES WITH LIMITED OR NO REVISION**

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Office of Water Communications Strategy

Notice of Availability of Updated Aquatic Life Water Quality Criteria for Cadmium

PUBLIC RELEASE DATE: March 30, 2016

KEY INFORMATION:

- The updated criteria values are very similar to what they were in 2001. EPA used the approach we routinely use in developing aquatic life recommended criteria, and added new toxicity data representing over 70 additional freshwater species.
- The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a CWA duty for EPA to propose a replacement criterion for Oregon. EPA would intend to use the updated criteria document as the scientific basis for our proposed rule.
- The basis of EPA's disapproval of Oregon's cadmium criterion was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effect to salmon species. A draft ESA analysis indicated that the updated freshwater criteria is expected to provide approximately 95% protection for acute exposure to endangered salmonids, a minimal effects level established in the jeopardy opinion.
- Few regulated entities will be affected by the new criteria; as of 2014 there were three companies that produced refined cadmium in the US: one in Tennessee (as a byproduct of zinc production); and one each in Ohio and Pennsylvania (recovered from scrap metal).

ACTION:
EPA is publishing a Federal Register notice informing the public about the release of the final version of the updated national recommended aquatic life water quality criteria for cadmium.

ANTICIPATED REACTION:

Ex. 5 - Deliberative Process

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Ex. 5 - Deliberative Process

MATERIALS:

- Desk Statement
- Stakeholder Notification List
- Water Headlines Entry
- Questions and Answers for the Press Office
- Fact Sheet
- Updated webpage

DESK STATEMENT:
EPA is releasing water quality criteria for aquatic life for the metal cadmium. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters.

The cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. In addition, the effect of total hardness (the amount of dissolved calcium and magnesium in water) on cadmium toxicity was revised with the newly acquired data. The criteria have undergone an external peer review that was completed in 2015 and a public comment period. The responses to public comments will be released at the same time as the document.

EPA's water quality criteria for cadmium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

More information: http://www.epa.gov/wqc/aquatic-life-criteria-cadmium

Background:
EPA is obligated to publish final updated cadmium criteria by May 30, 2016 as a result of a settlement agreement with the Northwest Environmental Advocates (NWEA).

A brief history of EPA's development of aquatic life criteria for cadmium:

- 1980- U.S. EPA first published AWQC for cadmium.

- 1985- U.S. EPA updated the AWQC criteria; this update superseded 1980 criteria.

- 1996- U.S. EPA updated the AWQC criteria; this update superseded 1985 criteria.
- 2001- U.S. EPA updated the AWQC criteria; this update superseded the 1996 criteria. This update was based on dissolved cadmium to more accurately account for bioavailability and reflected the latest EPA policy for metals risk assessment.
- 2015- EPA published draft updated cadmium criteria for public comment.
- 2016- (Current Action) EPA Published final updated cadmium criteria, which reflects the latest science.

The updated criteria include data for 70 new species and 49 new genera. The freshwater acute criterion for dissolved cadmium is the same as the 2001 acute. The freshwater chronic criterion is slightly higher (i.e., less stringent) compared to the 2001 criterion for dissolved cadmium; this modest increase is primarily due to the inclusion of four new genera, and the reanalysis of other data. As in the 2001 criteria, the draft freshwater acute criterion was derived to be protective of endangered species and further lowered to protect the commercially and recreationally important rainbow trout. In addition, the duration of the 2016 acute criteria was changed to one-hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The estuarine/marine acute criterion for dissolved cadmium is slightly more stringent than the 2001 recommended criterion, which is primarily due to the addition of three new sensitive genera. Changes in suggested values between 2001 and 2016 can be found in Table 1 below.

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[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.
[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).
[c] The duration of the 2016 acute criteria was changed to 1-hour to reflect the 1985 Guidelines-based recommended acute duration.

ROLL OUT SCHEDULE:

3/28/16-3/29/16	Key EPA and stakeholder notifications via phone (list below).
3/30/2016	Other EPA and stakeholder notifications via email (list below). Web content goes live. *(*If FRN will publish on 11/30 or 12/1, we will link to it and the docket materials, and webpost the fact sheet. If the FRN is not projected to publish by then, we will webpost a pre-publication version on 11/30 along with the criteria document, peer review comments and fact sheet.)*

NOTIFICATIONS

Communication by: Betsy Behl, Director, Health and Ecological Criteria Division

Upon Signature (expected 11/24/15):

- Email to EPA Regional Water Division Directors
- Phone calls to key stakeholders:
  - National Mining Association, Amanda E. Aspatore (202)463-2646
  - North American Metals Council, Kathleen M. Roberts (443)964-4653
  - International Zinc Association, Eric Van Genderen (919)287-1880
  - International Cadmium Association, no contact information yet
  - National Association of Manufacturers, Rachel Jones 202-637-3175
  - U.S. Fish and Wildlife Services, Gina Schultz, (703)358-1985
  - National Oceanic and Atmospheric Administration, Cathryn Tortorici, 301-427-8495
  - Copper and Brass Fabricators Council, John Arnett 202-833-8575
  - Natural Resource Defense Council, Jon Devine (202)513-6263

Upon FRN Publication (expected 11/30/15):

- Email to Mary Jo Bragan, Regional Lead for distribution to regional and State/Tribal Water Program
- Emails to other interested stakeholders:
  - Association of Clean Water Administrators (ACWA)
  - National Association of Clean Water Agencies (NACWA)
  - Water Quality Standards Managers Association (WQSMA)
  - Environmental NGO List

WATER HEADLINES:

EPA is releasing water quality criteria for aquatic life for the metal cadmium. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters. The cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. The criteria underwent an external peer review that was completed in 2015 and a 60 day public comment period. EPA's criteria for cadmium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act. Learn more

QUESTIONS & ANSWERS:

1) What are National Recommended Aquatic Life Criteria?

Ambient water quality criteria for the protection of aquatic life are numeric concentrations of pollutants, with specific recommendations on the duration and frequency of those concentrations, in surface waters that are protective of aquatic life designated uses. 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 solely 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 a state's water quality standards and approved by EPA.

2) What is Cadmium?

Cadmium is a relatively rare, naturally occurring metal found in mineral deposits and distributed ubiquitously at low concentrations in the environment. Cadmium's primary industrial uses are for the manufacturing of batteries, pigments, plastic stabilizers, metal coatings, alloys and electronics. Recently cadmium has been used in manufacturing nanoparticles (quantum dots) for use in solar cells and color displays.

3) How Does Cadmium Enter Surface Waters?

Cadmium enters the environment by natural and human processes, however, human sources, such as mining and urban processes, are responsible for contributing approximately 90 percent of the cadmium found in surface waters.

4) How Does Cadmium Affect Aquatic Life?

Cadmium is a non-essential metal with no biological function in aquatic life. Chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development and behavior in aquatic organisms.

5) Why are the Final Recommended Water Quality Criteria for Cadmium different from the Draft?

Following the 60-day public comment period EPA considered the comments and revised the draft as necessary; as a result:

Ex. 5 - Deliberative Process

The recommended frequency of exceedance for the above is no more than once every three years.

6) How Do the 2016 Criteria Compare to the Previously Recommended 2001 Criteria?

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Ex. 5 - Deliberative Process

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.
[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).
[c] The duration of the 2016 acute criteria was changed to 1-hour to reflect the 1985 Guidelines-based recommended acute duration.

7) What is EPA doing to help ensure these criteria protect threatened and endangered species?

The criteria document contains an analysis of the protectiveness of the draft criteria for threatened and endangered species using all available quality toxicity test data for species listed under the Endangered Species Act that have been tested for sensitivity to cadmium. EPA is also conducting a detailed analysis of the protectiveness of the draft criteria for endangered salmon to address the National Marine Fisheries Service concerns regarding the protectiveness of the acute cadmium criteria.

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8) Is there litigation driving EPA's schedule for this updated criteria? What does the litigation entail?
The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a Clean Water Act duty for EPA to propose a replacement criterion for Oregon. EPA intends to use the updated criteria document as the scientific basis for a rulemaking to propose criteria for Oregon.

The basis of EPA's disapproval of Oregon's cadmium criterion (and EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species based on EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2015 updated criteria have not changed significantly from 2001, a draft Endangered Species Act analysis prepared by EPA indicates that the updated freshwater criteria are expected to provide approximately 95 percent protection for acute exposure to endangered salmonids, a minimal effects level associated with the jeopardy opinion.

9) Cadmium is listed as a contaminant from the Animas river spill in Colorado this summer, how will this document effect that?

Because this is a draft document states will not be required to adopt the criteria or set new scientifically defensible criteria for cadmium as part of the state's water quality standards until the national ambient water quality update for cadmium is final.

States affected by the Animas river spill (CO, NM, AZ) will be using their currently adopted criteria that protect the designated uses of the water bodies within their area for the clean-up. States may have either adopted the 2001 criteria or adopted alternative scientifically defensible criteria for their waters. Water quality criteria are not effective under the Clean Water Act until they have been adopted into a state's water quality standards and approved by EPA.

10) Are regulated entities expected to be affected by EPA's new cadmium criteria?

States are required to adopt the criteria or set new scientifically defensible criteria for cadmium as part of state water quality standards for cadmium. Once states adopt their new cadmium criteria we expect that few regulated entities will be affected because, as of 2014, there were only three companies that produced refined cadmium in the United States. In addition, EPA's updated criteria values are very similar to what we recommended in 2001 so, we do not expect state adoption of them to significantly affect such companies.

To: Elias, Mike[Elias.Mike@epa.gov]
From: Craig Voros
Sent: Mon 2/8/2016 6:30:10 PM
Subject: Re: Salmonid Study Addition

Lots of changes everywhere, but the two new studies were Wang et al. 2014 and Calfee et al. 2014 that had salmonid data for rainbow trout.

Craig Voros
Great Lakes Environmental Center
1295 King Avenue
Columbus, OH 43212
614-487-1040

On 2/8/2016 1:10 PM, Elias, Mike wrote:

Ex. 5 - Deliberative Process

Mike Elias | Biologist

Ecological Risk Assessment Branch | Health and Ecological Criteria Division

Office of Science and Technology | Office of Water

U.S. Environmental Protection Agency

1200 Pennsylvania Avenue, NW, Washington, DC 20460

(202) 566-0120 | elias.mike@epa.gov

Cadmium Federal Register Notice (Elias)

On December 1, EPA published the draft cadmium criteria document in the *Federal Register*. The 60-day public comment period ends on February 1. The document has undergone two rounds of Agency review and an external peer review. The external peer review report and EPA's response are available on the Agency's website.[1] EPA plans to publish the final criteria in late spring.

EPA last updated the criteria in 2001. The revised criteria include updates to both the acute and chronic freshwater and saltwater values, which are primarily based on new toxicity data. EPA also is incorporating 70 new species and 49 new genera into the document. For the freshwater criteria, hardness remains the primary driver. The proposed values are similar to those adopted in 2001, as shown in the following table.

	2001 Criteria		**2015 Proposed Criteria**	
	Acute	**Chronic**	**Acute**	**Chronic**
Freshwater	2.0 µg/L	0.25 µg/L	2.1 µg/L	0.73 µg/L
Saltwater	40 µg/L	8.3 µg/L	35 µg/L	8.3 µg/L

Ex. 5 - Deliberative Process

[1] See http://www.epa.gov/wqc/aquatic-life-criteria-cadmium.

Cadmium Aquatic Life Ambient Water Quality Criteria
Draft Response to Public Comments

TOPIC 1 Summary: Comments regarding acute criteria duration change from 24 hours to one hour

Comment Number (Organization)	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0012 (Utility Water Act Group)	*UWAG has concerns with EPA's proposal to change the acute freshwater and estuarine/marine criteria averaging duration from 24 hours to 1 hour. The change is not adequately justified and is not supported by new studies in the Draft. The current 24-hour duration should be retained unless a strong scientific justification is presented.* *Every previous iteration of the cadmium criteria has endorsed a 24-hour duration for the acute criteria. EPA appears to be making a policy decision that the acute criteria should be 1 hour, but does not present the associated science to support the revision which is inconsistent with CWA § 304(a)(1), which mandates EPA establish "criteria for water quality accurately reflecting the latest scientific knowledge."* *EPA compares the acute toxicity to ammonia but fails to provide information that compares the time-dependent toxicity of cadmium with ammonia. Furthermore, assessing the toxicity of cadmium during the first 24 hours of an acute test is problematic because the vast majority of published studies reporting the acute toxicity of cadmium do not report patterns of lethality during the first 24 hours. Several acceptable selected studies (Besser et al. 2007; Buhl 1997; Diamond et al. 1997; Mebane et al. 2012; Nebeker 1986) do not report 24-hour LC50s and the one study with relevant data (Duncan and Klavercamp 1983) had a 12-hour LC50 that was five times greater than the 96-hour LC50 (5.35 vs. 1.11 µg/L, respectively). This value would be expected to be similar if cadmium was a*	**Ex. 5 - Deliberative Process**	No edits

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	fast-acting pollutant. *An earlier EPA publication (*Speed of Action of Metals Acute Toxicity to Aquatic Life*; EPA-822-R-95-002) also justifies the 24-hour averaging period. This document estimated a kinetic coefficient (*k*) using a regression of LC50 values versus time, with the averaging period being calculated as the inverse of* k*. The larger the* k *value the faster acting the pollutant. None of the estimated averaging periods in the document for freshwater and saltwater species approached 1-hour. The highest estimated* k *values mentioned, for the freshwater fathead minnow, were 6 and 17 hours, with saltwater species having even larger values. The selection of the 1-hour averaging period is baseless and arbitrary.* *Additionally, the 1985 Guidelines say the duration should be "substantially less than 48 to 96 hours," but do not say that 24 hours is an inappropriate duration and therefore the Guidelines do not support, nor should it be a justification for the proposed revision.*	**Ex. 5 - Deliberative Process**	

		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0012 (Utility Water Act Group)	*Water Quality-Based Effluent Limits (WQBELs) for cadmium are often expressed as a daily (24-hr) maximum value. Changing the WQBEL to a 1-hour averaging duration could require a permittee to collect several compliance samples during a 24-hour period. This additional burden is unnecessary since there is minor variability of the cadmium levels during a typical 24-hour period, and this additional monitoring is unwarranted without sound scientific basis.*		No edits

TOPIC 2: Comments regarding *H. azteca* test by Ingersoll is not acceptable; retest should be done or test should be removed from criteria development

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0007 and EPA	*The proposed chronic criterion is based on a flawed toxicity test (Ingersoll and Kemble 2001) conducted on the amphipod Hyalella azteca. The Hyalella test used in the criterion derivation should be repeated using current feeding procedures that are proven to result in better growth and reproduction. While the IEPA acknowledges and commends the improvements USEPA has made in the assessment and analysis of Hyalella sp. data compared to the 2001 cadmium criteria document, specifically in regards to the sensitivity of this organism to the presence/absence of chloride and bromide in culture and test water, the IEPA contends that the feeding regime employed in the 2000 USGS study is deficient by today's standards and likely resulted in malnourished, stressed test organisms.*	Ex. 5 - Deliberative Process	

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HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*Specifically, test organisms in the 2000 USGS study were underfed and/or fed improper diets based on current research. Dr. Soucek, at the Illinois Natural History Survey, conducted new research that focused on determining the appropriate amounts of food for test organisms. His research has led to improved growth of test organisms compared to earlier diet regimes. The diet used in the 2000 USGS study consisted of a ration of 1.0 ml YCT/d, whereas Dr. Soucek's research contends that a diet consisting of Tetramin supplemented with diatoms greatly improves growth and reproduction of Hyalella azteca compared to YCT-only diets (Soucek et al. 2016, in press).* *The diet in the 2000 USGS study restricted growth and fecundity when compared to Tetramin-based diets (Soucek et al. 2016, in press), and brings into question the accuracy of the test results.*	**Ex. 5 - Deliberative Process**	
EPA-HQ-OW-2015-0753-0007 andEPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*Test organisms in the 2000 USGS study did not attain minimum growth requirements based on the direct measure of organism weight, with the average dry weight of the controls being 0.27 mg/individual (<0.50 mg/individual). USEPA concluded that the dry weights measured in the test were inaccurate and subsequently used length data to extrapolate to dry weight via a regression equation. However there is no documentation provided for this equation or how it was derived. It is unlikely that the dry weights were underestimated (while an overestimation can be expected due to inadequate drying of test organisms), and it is therefore considered unlikely that the organisms achieved the minimum weight requirements for this test to be valid.*		No edits

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		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0007andEPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*The dilution series (control and 5 treatment concentrations: 0.1, 0.3, 0.5, 2.0 and 3.0 µg/L.) used in the 2000 USGS test did not appropriately bracket the effect concentration. The dilution series was not standard, with a large gap in concentration between the NOEC and LOEC (0.5 and 2.0 µg/L, respectively). While a point estimation technique was used to determine the effect concentration, the lack of a 1.0 µg/L treatment may have changed this estimation. The precision of this estimation is paramount, as the test result was the sole determinant of the GMCV, which is the most sensitive in the chronic dataset, and a small change in the GMCV can therefore have a substantial effect on the final chronic value.*		No edits
EPA-HQ-OW-2015-0753-0007 andEPA HQ-OW-2015-0753-0008 (Illinois	*At this time, the IEPA is in support of the adoption of the acute cadmium criterion as proposed, but is requesting a one year extension for the adoption of the chronic criterion. A one year extension would allow for a retest on Hyalella azteca using current feeding recommendations and would allow for revisions to be made to the chronic criterion. A round robin approach would ensure that the data are obtained using the appropriate test procedures and*		No edits

Environmental Protection Agency)	*would provide additional information regarding the sensitivity of Hyalella azteca to cadmium. If time does not permit a repeat of the test, then the chronic criterion should be recalculated with the Hyalella data removed.*		

TOPIC 3: Comments regarding dissolved vs total concentration use

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*Additional documentation is needed to support the total to dissolved conversion factors. Very little information is provided concerning the derivation of the conversion factors, and more detailed information is needed to fully assess their appropriateness for natural waterbodies.*	**Ex. 5 - Deliberative Process**	Section 2.6
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*It is unknown if the solutions prepared from Cd salts, that were used to develop the conversion factors, adequately represent the forms of Cd found in natural waterbodies.*		Section 2.6

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EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*An explanation is needed as to why the conversion factors for the acute and chronic criteria are different. It also appears illogical that the constant conversion factor of 0.994 used for marine water is higher than for freshwater, especially because the hardness-dependent conversion factor for freshwater decreases as hardness increases.*	Ex. 5 - Deliberative Process	Section 2.6
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*While it is noted in several places in the document, clarify that the recommended criteria values are expressed as dissolved cadmium concentrations (not total). Also clarify if states have the option to adopt total Cd criteria values.*		No edits
EPA HQ-OW-2015-0753-0011	*Kansas has utilized the total recoverable metals criteria and data, and is not set up to sample for total dissolved metals. A conversion factor would be applied to calculate the dissolved concentration and Kansas recommends that EPA retain this flexibility in its final criteria.*		No edits

TOPIC 4: Comments regarding data quality, use, an

Comment Number	Public Comment		Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0006 (Kansas Department of Health and Environment)	*Some of the values that are new/revised since the 2001 AWQC document are from studies that were published before 2001. Table 22 has general information describing why GMAVs have changed between the 2001 and 2015 document, but it does not provide details on why these "new" data were now considered acceptable. Include another table that describes why the studies that were excluded previously are now included.*		No edits

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EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Should toxicity tests conducted under less-than optimal conditions be discounted? This comment goes beyond just the test results for Hyalella, because while laboratory tests used for criteria development use conditions that are as close to optimal as possible, wild populations in diverse natural conditions are often exposed to conditions that sub-optimal, and therefore laboratory tests may be underprotective in natural conditions (i.e., additional stresses) (see, Holmstrump et al. 2010; Besser et al. 2015).*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*"Other data" are not addressed consistent with the Guidelines. While these data are not used in the species sensitivity distribution rankings, they should not be thrown away, discounted, or deemed "unacceptable." "Other Data" can be invoked to lower a criterion (e.g., chronic value in the 1987 selenium criterion). Revaluate Riddel et al. (2005a, b) and include a larger discussion of their effect concentrations/findings and other similar behavioral/ecological studies.*		Sections 5 and 5.2
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*With many organisms, a strong difference in the sensitivity of different life stages makes it inappropriate to roll up data from different developmental stages. Pooling salmonid effects concentrations across developmental stages to obtain a SMAV could produce a misleading result (see, Hansen et al. 2002; Mebane et al. 2012; Chapman 1978; Chapman and Stevens 1978).*		Appendix A Ranked FW Acute Table
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological	*The decision to only use ELS chronic data in which the exposures began in the egg stage, and to exclude long-term data in which the exposures began in the fry stage is non-conservative.*		No edits

Survey)			
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*SMAV calculations tagged with the footnote "C", indicating that "Data not used to calculate SMAV because more sensitive life stage available, or flow-through measured test available", should be separated into two different footnotes since they are very different reasons.*		Appendix A and Appendix B
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Address the following Appendix A specific errors/changes:* • *Daphnia magna (various)* o *Many "S, U" tests (tests with unmeasured concentrations) are underlined, indicating they are included in the SMAV calculations. These should be excluded per the Guidelines.*	**Ex. 5 - Deliberative Process**	Appendix A Ranked FW Acute Table
	• *Mayfly (formerly, Ephemerella grandis) Drunella grandis* o *Tested species was listed in the source document as Ephemerella subvaria, which is still a valid species name according to ITIS.gov.*		

	• *Rainbow trout (smolt), Chapman 1975 (>2.9 µg/L)*
	  o *Should be excluded from SMAV because it is from a resistant life stage. Also, should be listed as "Rainbow trout (Steelhead smolt)" as Steelhead are not just Rainbow Trout by a different name, but have physiological differences in regard to ion regulation. Chapman (1975) should only be cited when no alternative exists, because it was never formally released by EPA and is not publicly available online. Chapman (1978) reports the same data and is a better citation.*
	• *Rainbow trout (smolt), Chapman 1975 (4.1 µg/L)*
	  o *Suspect value, exclude from SMAV.*		

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	Chapman (1978) lists the value for the same test as >2.9 µg/L. Chapman (1978) is the peer-reviewed publication of record for these data; Chapman (1975) was an unpublished, work-in-progress progress report that sometimes still gets cited because it includes data never published elsewhere, such as the coho data shown in the figure in this memo. Exclude from SMAV, resistant life stage and re-label as ""Rainbow trout (Steelhead smolt". See Chapman (1978, Table 3).		
	• *Rainbow trout (299 mg), Stratus (1.29 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with unmanipulated pH of 7.5 were much more sensitive*	**Ex. 5 - Deliberative Process**	

	• *Chinook salmon (parr, 11.58g) (3.5 µg/L)*
	  o *Exclude value from SMAV, based on a resistant life stage being tested. Value is twice as high as the value obtained with swim-up fry in matched tests and confidence limits don't overlap.*
	• *Chinook salmon (smolt, 32.46 g) (>2.9 µg/L)*
	  o *Should be excluded from SMAV, based on a resistant life stage being tested.*		

	• *Bull trout (84.2 mg) (2.89 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with a natural pH of 7.5 were much more sensitive*		
	• *Colorado squawfish* o *Old common name is now considered repugnant. AFS calls it "Colorado pikeminnow". "Pikeminnow" is one word.*		

ED_000992_00002191-00010

EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Address the following Appendix C specific errors/changes:* • *Snail, Aplexa hyporum (Holcombe) (4.0 µg/L)* o *I got an EC20 of about 2.6 µg/L. By excluding the highest treatment with total mortality I could reproduce the 4.0 EC20 value, but it had a poor fit with Y0.*	**Ex. 5 - Deliberative Process**	No edits

EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Add the following additional relevant data:*
	• *Pascoe and Mattey 1977*
	  o *Chronic stickleback exposure*
	• *Wang et al. 2014*
	  o *Chronic fathead full life-cycle test*
	• *Brinkman and Vieira 2008*
	  o *Acute and chronic mountain whitefish*
	• *Mebane et al. 2014 (paper provided)*
	  o *Effects of cadmium on larval aquatic insect communities in 30-day experimental stream tests*
			Mebane et al. (2014) added to Section 5.2

ED_000992_00002191-00011

		Ex. 5 - Deliberative Process	

Comment Number	Public Comment		Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*There is concern about the focus on fish in developing the criteria. EPA needs to bring in other species including insects and freshwater mussels into the process when developing criteria for cadmium. This lack of additional species prevents a more holistic picture of the freshwater community, and results in criteria that are not protective of all aquatic-dependent wildlife. EPA has consistently failed to fully consider aquatic-dependent wildlife in the development of national criteria.*		No edits
EPA-HQ-OW-2015-0753-0010 (Hampton Roads Sanitation District)	*There is concern with the continued lack of estuarine/marine chronic cadmium toxicity data and that no new chronic toxicity data have been generated since 2001. EPA should conduct additional chronic toxicity studies (particularly with vertebrate species) to expand the estuarine/marine chronic toxicity dataset. More estuarine/marine chronic data are needed to develop a scientifically reliable chronic cadmium criterion.*		No edits

EPA-HQ-OW-2015-0753-0010 (Hampton Roads Sanitation District)	*The mysid Neomysis integer is a new species added to the estuarine/marine acute dataset, but this mysid is potentially non-native to the United States. Since there are available values for two other native mysid species (M. bigelowi and A. bahia), this non-native species should be removed (unless documentation is provided confirming it is naturally occurring within waters of North America).*	Ex. 5 - Deliberative Process	Section 3.2.1 and Appendix B

TOPIC 5: Comments regarding ESA considerations

Comment Number	Public Comment		Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*		No edits

		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*To ensure the final cadmium water quality criteria is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*		No edits

ED_000992_00002191-00014

EPA HQ-OW-2015-0753-0009 (California State Water Resources Control Board)	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to ac7count for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	No edits

ED_000992_00002191-00015

		Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0009 (California State Water Resources Control Board)	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*		No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a Section 7 Consultation.*		No edits

EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*''EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.* *Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.*	**Ex. 5 - Deliberative Process**	No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US*		No edits

Service)	*waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*		
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and that ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*	es. h e r ugh re fe.	No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*	der. s -- h	No edits

Ex. 5 - Deliberative Process

TOPIC 6: Other comments

Comment Number	Public Comment		Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*In the description of sources of cadmium in the document, EPA overlooked the contribution from coal combustion, coal mining waste, and coal ash ponds spills, seepage, and discharge. These important sources need to be recognized and addressed.*	nt	Section 2.1

EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Check the document for errors and typos. Specific examples include:*
	• *Pg.27 which is intended to provide an acute criterion protective of nearly all individuals in the distribution (Stephan et al. **1985);the** FAV/2 approach was developed to estimate minimal effect levels,*
	• *Pg.30 This outcome was based on the poor correlation between hardness and acute toxicity for D. magna and occurred only when tests with **less than** 24-hr old neonates were included in the database. Accordingly, only the five D. magna tests from Chapman et al. (1980} initiated with **less than** 24-hr old neonates were used for the analysis*
	• *Pg.33 Two species of sculpin, Cottus bairdii and Cottus confusus, are used to derive the normalized GMAV of **4.962** µg Cd/L*
	  o ***Per Appendix A, this value should be 4.926***
	• *Pg.34 The hardness-normalized GMAV of **7.911** µg/L total cadmium for the genus Oncorhynchus is the fifth lowest in the acute dataset*
	  o ***Per Appendix A, this value should be 7.841 ***
	• *Pg.42 2. Ceriodaphnia, Cladoceran (GMCV=**1.293µg/l** total Cd)*
	• *Pg. 74 Acceptable chronic toxicity **data** are available for 27 freshwater species representing 20 different genera*
	• *Pg. C-8 [d]Not used to calculate **SMAV** because either a more definitive value available, value is considered an outlier, or preference was given to the more sensitive exposure scenario (LC versus ELS tests).*
		Ex. 5 - Deliberative Process	Various locations

EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*While Table 5 summarizes the Phyla, Families, Genera, and Species used to derive the revised criterion, it is unclear which species were used to meet each of the MDRs. Include a table that lists the eight requirements and the species used to fulfill them.*	**Ex. 5 - Deliberative Process**	Table 5
EPA-HQ-OW-2015-0753-	*Verify that the Spehar and Fiandt 1986 data for Pimephales promelas is appropriate to include in the*		

0006 (Wisconsin Department of Natural Resources)	*freshwater acute hardness correction.*		Appendix Table A-1, A-2, C-1 and C-2
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Expand Table 6 to include the actual data that were used in the freshwater acute hardness correction for each species.*		Appendix Table A-2
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process.*		Figure 2
EPA-HQ-OW-2015-0753-0006 Wisconsin Department of Natural Resources)	*Indicate how the R^2 value of 0.964 was obtained in the freshwater acute hardness correction. Attempts to replicate the value resulted in a slope of 1.104 and R^2 of 0.698.* *Indicate how the R^2 value of 0.841 was obtained in the freshwater chronic hardness correction. Attempts to replicate the value resulted in a slope of 0.798 and R^2 of 0.632.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0006 (Wisconsin	*It was not apparent if the MATC or EC_{20} value was used for the freshwater chronic slope derivation.*		Appendix Table C-2

Department of Natural Resources)	*Indicate which of the toxicity values were used in the derivation in Appendix C and Table 8.*	Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process.*		Figure 4
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*The language that describes the computation of the final acute value on pg. 32 is insufficient. Include a reference to section 4.3.1 after the reference to Figure 2 on page 32.*		Section 3.1.1
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*It is unclear how the intercept of the freshwater acute and chronic criterion equations were derived. Add additional language to clarify how these values were derived.*		No edits

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ED_000992_00002191-00022

MEMORANDUM

SUBJECT: Notice of Availability: Recommended Aquatic Life Ambient Water Quality Criteria for Cadmium – 2016 (Tier 3, SAN 5843) - ACTION MEMORANDUM

FROM: Elizabeth Southerland
Director, Office of Science and Technology

TO: Joel Beauvais
Deputy Assistant Administrator

PURPOSE
Attached for your signature is the *Federal Register* notice announcing the U.S. Environmental Protection Agency's release of the Updated Aquatic Life Criteria for Cadmium. The public will be able to access the draft criteria document through the EPA docket and website www.regulations.gov.

Following closure of the public comment period, the EPA will consider the public comments and revise the document accordingly. Once finalized, the EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act (CWA).

DEADLINE
The Updated Aquatic Life Criteria for Cadmium needs to be published by March 30, 2015, in order to maintain a timeline set by a potential lawsuit settlement agreement with Northwest Environmental Advocates.

OVERVIEW
The EPA is in the process of updating the agency's 304(a) cadmium aquatic life ambient water quality criteria. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species.

The driver for updating the cadmium criteria was a lawsuit brought on by Northwest Environmental Advocates following the EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. The EPA's disapproval triggered a CWA duty for the EPA to propose a replacement criterion for Oregon. The EPA would intend to use the updated criteria document as the scientific basis for the proposed rule. The agency is currently negotiating a settlement with the litigants in which the EPA would commit to propose cadmium criteria for Oregon by March 31, 2016, and take final rulemaking action by January 16, 2017. The 304(a) criteria being proposed are the basis for the rulemaking and, therefore, the document is time sensitive. We proposed the draft criteria for 60 days of public comment on December 1, 2015. The numbers have changed slightly as a result of adopting changes derived from the public comment period.

The basis of the EPA's disapproval of Oregon's cadmium criterion (and the EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service for acute effect to salmon species based on the EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated freshwater acute criterion is slightly more stringent than the 2001 value, a draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater criterion are expected to provide approximately 95 percent protection for endangered salmonids based on acute effects, a minimal effects level associated with the jeopardy opinion. Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

ANTICIPATED PUBLIC AND STAKEHOLDER RESPONSE

Ex. 5 - Deliberative Process

INTERNAL DEVELOPMENT AND REVIEW PROCESS

Office of Science and Technology partnered within the agency with Office of Research and Development to develop the document. The document was reviewed by the Office of Research and Development, Office of Chemical Safety and Pollution Prevention, and the Regions (3, 4, 5, 8, 9, and 10) and Office of Policy. The EPA conducted an external contractor-led letter peer review on the criteria document that was completed in 2015. The document was available for a 60-day public comment period which ended February 1, 2016.

If you need additional information or have questions regarding this notice, please call Elizabeth Behl at (202) 566-0788.

To: Greg Smith[gsmith@glec.com]; Elias, Mike[Elias.Mike@epa.gov]
From: Craig Voros
Sent: Fri 2/26/2016 3:10:31 PM
Subject: Re: Data Request with a bit more info
Cd Public Comments EPA Response_2.26.16_for Mike.docx

Public Comment Response Table for review.

Craig Voros
Great Lakes Environmental Center
1295 King Avenue
Columbus, OH 43212
614-487-1040

On 2/26/2016 9:22 AM, Greg Smith wrote:

Now works

On 2/26/2016 9:21 AM, Elias, Mike wrote:

I can give you a call now if that works.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Friday, February 26, 2016 9:02 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Hi Mike

Craig had added your text to the document on H. azteca.

The rest of the changes have been made to the document,

but there is one more issue to discuss if you have time for a call this morning.

And we have made all our changes to the Response Table.

Thanks
Greg

On 2/26/2016 8:40 AM, Elias, Mike wrote:

Greg and Craig,

I am not able to get into Word on the Sharepoint site to make edits to the document. That being said, I only have one minor edit. It is on page 42 of the document. So, I am attaching the text edit for that paragraph in redline/track change mode for you to insert, as was suggested on the call the other day. Please insert this change in track change mode. Once that is done, I have no other changes to the document text at this point.

Could you please send me a copy with your changes in redline via email, and I will take a quick readthrough (will do immediately), then you should be able to finalize and make it 501 compliant.

In the meantime, I will finalize response to comments and prepare to drop those in. I will try to open that smaller response document, but if I cannot, will ask you to send me the response document, so I can drop my responses in at that time.

Thanks,

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Wednesday, February 24, 2016 11:03 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Hey Mike

Would it be possible to have a call sometime today?

Thanks
Greg

On 2/23/2016 4:38 PM, Elias, Mike wrote:

Thanks for pointing this out Greg. Is there any lower LOE alternative to illustrating the data w/o just having to say we are not doing something to be responsive? I understand that there may not be.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 2:44 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Mike

One consideration to including graphs showing the linear regression to better illustrate the normalization process.

EPA-HQ-OW-2015-0753-0006: "Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process."

EPA-HQ-OW-2015-0753-0006: "Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process."

Is that it will take Keith approximately 4-8 hours to generate the two graphs (a lot of effort to manually normalize the data).

So just wanted to make sure before starting the effort.

Thanks
Greg

On 2/23/2016 1:38 PM, Elias, Mike wrote:

> Greg, I could not get into Edit in Word, so instead made my comments in italics and highlighted in yellow. Please move forward with changes in the document. I think it is almost all responded to at this point. I need to step out, but will be back in a couple of hours.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 11:35 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Mike

So far we have completed all the responses assigned to us in the response table only.

We have not made all the changes to the document. We have only made changes to the document that aren't dependent on the new (revised) criteria values. So if nothing else will change, we can now begin changing the document to reflect the new criteria values and other comments that were assigned to us (the brunt of the work; tables corrections, graphs, values, etc.).

Thanks
Greg

On 2/23/2016 11:16 AM, Elias, Mike wrote:

> I have discussed this with Kathryn. The good news is that we do not need to make any changes to the document before the initiation of the final internal review. However, we will need to review the unmeasured concentrations concurrent with the final Agency review. I can talk with you about a proposed approach to this more tomorrow, but the focus at the moment can be back on finalizing the revisions and comment responses for internal review.
>
> Could you please update me where you are at on your end with revisions?

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 8:39 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Yes, your understanding is correct.

On 2/23/2016 8:35 AM, Elias, Mike wrote:

So to make sure that I am understanding correctly, if flow through data are not available (i.e., for both static and static renewal), we have for the documents noted:

- Used unmeasured concentrations if measured concentrations are not available

- Used unmeasured concentrations along with measured concentrations if both are available….so they are both given the same priority

Is that a correct understanding? I am trying to sort a few things out and then we should talk.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 8:04 AM
To: Elias, Mike <Elias.Mike@epa.gov>

Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Hi Mike

Yes we should discuss asap, since to revise the freshwater and saltwater acute values will take some time.

Ex. 5 - Deliberative Process

Examples are acrolein, aluminum, atrazine, carbaryl, chloride, diazinon, manganese, molybdenum, nonylphenol, silver and tributyltin.

Craig and I are in the office all day today for a call.

Thanks
Greg

On 2/23/2016 7:36 AM, Elias, Mike wrote:

> Greg and Craig,
>
> I confirmed with Kathryn that it is acceptable for us to keep the data for salmonids for situations where the pH is 6.5. She is in agreement with our conclusion.

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

I am working out of the office today, but should be around except for early afternoon.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Friday, February 19, 2016 1:21 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Sounds good

On 2/19/2016 1:19 PM, Elias, Mike wrote:

> Sorry, pulled away by calls. I will try to give you a call in about 5 mins
>
> **From:** Greg Smith [mailto:gsmith@glec.com]

Sent: Friday, February 19, 2016 11:23 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Mike

Here is a suggested table to fulfill the MDR (this was in the Cd document a couple of years ago before it was removed).

Also need to decide if we want to add tables showing the data used to develop the acute and chronic hardness slopes (current identify them with an * in each appendix).

Thanks
Greg

On 2/19/2016 9:09 AM, Elias, Mike wrote:

> Greg and Craig,
>
> I have some answers on the outstanding questions regarding revisions to the cadmium document, along with some additional tasks, based on my meeting with Kathryn late yesterday. I think this addresses most of the outstanding issues for the current time. We should discuss these when you have time. I am open most of the day. Here is the list:
>
> 1. Hyalella azteca inclusion in the chronic value derivation – We are not going to make any changes to calculations for the chronic criterion. I may be adding some additional clarifying text, but that is all in terms of revisions related to this issue.

2. Replacement of N. integer with N. Americana – We should remove N. integer and use N. Americana. Greg and Craig, please make revisions to the tables and text that reflect the additional species that are acceptable in the study from which N. Americana was taken. I will respond to the comment.

3. Please exclude the Chapman 1975 study data for smolt, as per Mebane's comment and revise the tables/text, as appropriate.

We are reviewing some of the other study requests made by Mebane, and should make final conclusions on those shortly

4. Additional items that were not previously discussed.

a. Greg and Craig, please make the following revisions to the document:

i. Add a table summarizing the phyla/family/genera/species used to fulfill the MDRs. The best example of such a table is Table 2 in the ammonia document.

ii. Add tables summarizing the final four species used to develop each criteria value. This is really just repackaging information that is already in the document. Take the list of species at the top of page 42 in the cadmium document, for example, and repackage into a table similar to what is shown in Table 3.6 of the selenium document. Please do that for each of the four criteria values.

b. New issue consideration – Magnesium to calcium ratio/value. Was a magnesium to cadmium ratio or magnesium concentration

value used to screen data usability for the hardness slope or toxicity value usability for acute and chronic? I am just not clear on the specific guideline we are following. However, the reason that I am askign is that it looks like we eliminated data for rainbow trout from Davies et al. (1993) from the hardness adjustment based on differences in toxicity due to different levels of hardness based on magnesium. At the same time, it looks like we used the acute and chronic toxicity data from the higher hardness levels of this study in deriving the criteria. Is this contradictory?

Please let me know when you are available to talk about these items.

Thanks,

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Wednesday, February 17, 2016 3:57 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Data Request with a bit more info

Mike

Here is the reproduction info

Methods for H. azteca testing

Only found methods for sediment testing (nothing available for water only tests):

ASTM (2005) has recommended minimum dry weight of 0.15 mg/individual, **reproduction from day 28 to day 42 of >2 young/female**

OECD (1998) does not have recommendations

Environment Canada (2013) Biological Test Methods for H. azteca recommends minimum dry weight of 0.10 mg/individual. **Nothing on reproduction.**

Title

TOPIC 1: Duration should be 24 hours, not one hour

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0012	*UWAG has concerns with EPA's proposal to change the acute freshwater and estuarine/marine criteria averaging duration from 24 hours to 1 hour. The change is not adequately justified and is not supported by new studies in the Draft. The current 24-hour duration should be retained unless a strong scientific justification is presented.* *Every previous iteration of the cadmium criteria has endorsed a 24-hour duration for the acute criteria. EPA appears to be making a policy decision that the acute criteria should be 1 hour, but does not present the associated science to support the revision which is inconsistent with CWA § 304(a)(1), which mandates EPA establish "criteria for water quality accurately reflecting the latest scientific knowledge."*	*EPA. No change. Response to comment only*	
EPA-HQ-OW-2015-0753-0012	*EPA compares the acute toxicity to ammonia but fails to provide information that compares the time-dependent toxicity of cadmium with ammonia. Furthermore, assessing the toxicity of cadmium during the first 24 hours of an acute test is problematic because the vast majority of published studies reporting the acute toxicity of cadmium do not report patterns of lethality during the first 24 hours. Several acceptable selected studies (Besser et al. 2007; Buhl 1997; Diamond et al. 1997; Mebane et al. 2012; Nebeker 1986) do not report 24-hour LC50s and the one study with relevant data (Duncan and Klavercamp 1983) had a 12-hour LC50 that was five times greater than the 96-hour LC50 (5.35 vs. 1.11 µg/L, respectively). This value would be expected to be similar if cadmium was a fast-acting pollutant.*	*EPA. No change. Response to comment only*	
EPA-HQ-OW-2015-0753-0012	*An earlier EPA publication (*Speed of Action of Metals Acute Toxicity to Aquatic Life*; EPA-822-R-95-002) also justifies the 24-hour averaging period. This document estimated a kinetic coefficient (*k*) using a regression of LC50 values versus time, with the averaging period being calculated as the inverse of* k*. The larger the* k *value the faster acting the pollutant. None of the estimated averaging periods in the document for freshwater and saltwater species approached 1-hour in the document. The highest estimated* k *values mentioned, for the freshwater fathead minnow, were 6 and 17 hours, with saltwater species having even larger values. The selection of the 1-hour averaging period is baseless and arbitrary.*	*EPA. No change. Response to comment only*	

EPA-HQ-OW-2015-0753-0012	*According to EPA, the purpose of the averaging period is to allow the concentration to be above the CMC only if the allowed fluctuating concentrations do not cause more adverse effect than would be caused by a continuous exposure to the CMC, but EPA does not provide explanation, supporting data, or justification why the duration must be changed to 1-hour in order to avoid more adverse effects.* *Additionally, the 1985 Guidelines say the duration should be "substantially less than 48 to 96 hours," but do not say that 24 hours is an inappropriate duration and therefore the Guidelines do not support, nor should it be a justification for the proposed revision.*	*EPA. No change. Response to comment only*	
EPA-HQ-OW-2015-0753-0012	*Similarly the TSD (for ammonia) is used as a justification for the 1-hour averaging period; ammonia's averaging period was derived primarily from data on response time to ammonia, a fast-acting toxicant. However there are differences between the toxic mode of action between ammonia and cadmium. There is more dissimilarity between the modes of toxicity for the two chemicals than similarities. Therefore this document should not be relied upon to prove justification of the new averaging period.*	*EPA. No change. Response to comment only*	
EPA-HQ-OW-2015-0753-0012	*If the averaging period is revised to be shorter, EPA needs to explain why it is not also necessary for a corresponding increase in the cadmium concertation that will cause mortality in the shorter period of time.*	*EPA. No change. Response to comment only*	
EPA-HQ-OW-2015-0753-0012	*Water Quality-Based Effluent Limits (WQBELs) for cadmium are often expressed as a daily (24-hr) maximum value. Changing the WQBEL to a 1-hour averaging duration could require a permittee to collect several compliance samples during a 24-hour period. This additional burden is unnecessary since there is minor variability of the cadmium levels during a typical 24-hour period, and this additional monitoring is unwarranted without sound scientific basis.*	*EPA. No change. Response to comment only*	

TOPIC 2: H. azteca test by Ingersoll is not acceptable; retest should be done or test should be removed from criteria development

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document

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EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*The proposed chronic criterion is based on a flawed toxicity test (Ingersoll and Kemble 2001) conducted on the amphipod Hyalella azteca. The Hyalella test used in the criterion derivation should be repeated using current feeding procedures that are proven to result in better growth and reproduction. While the IEPA acknowledges and commends the improvements USEPA has made in the assessment and analysis of Hyalella sp. data compared to the 2001 cadmium criteria document, specifically in regards to the sensitivity of this organism to the presence/absence of chloride and bromide in culture and test water, the IEPA contends that the feeding regime employed in the 2000 USGS study is deficient by today's standards and likely resulted in malnourished, stressed test organisms.* *Specifically, test organisms in the 2000 USGS study were underfed and/or fed improper diets based on current research. Dr. Soucek, at the Illinois Natural History Survey, conducted new research that focused on determining the appropriate amounts of food for test organisms. His research has led to improved growth of test organisms compared to earlier diet regimes. The diet used in the 2000 USGS study consisted of a ration of 1.0 ml YCT/d, whereas Dr. Soucek's research contends that a diet consisting of Tetramin supplemented with diatoms greatly improves growth and reproduction of Hyalella azteca compared to YCT-only diets (Soucek et al. 2016, in press).* *The diet in the 2000 USGS study restricted growth and fecundity when compared to Tetramin-based diets (Soucek et al. 2016, in press), and brings into question the accuracy of the test results.*	**Ex. 5 - Deliberative Process**	*Self explanatory*
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*Test organisms in the 2000 USGS study did not attain minimum growth requirements based on the direct measure of organism weight, with the average dry weight of the controls being 0.27 mg/individual (<0.50 mg/individual). USEPA concluded that the dry weights measured in the test were inaccurate and subsequently used length data to extrapolate to dry weight via a regression equation. However there is no documentation provided for this equation or how it was derived. It is unlikely that the dry weights were underestimated (while an overestimation can be expected due to inadequate drying of test organisms), and it is therefore considered unlikely that the organisms achieved the minimum weight requirements for this test to be valid.*		

EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*The dilution series (control and 5 treatment concentrations: 0.1, 0.3, 0.5, 2.0 and 3.0 µg/L.) used in the 2000 USGS test did not appropriately bracket the effect concentration. The dilution series was not standard, with a large gap in concentration between the NOEC and LOEC (0.5 and 2.0 µg/L, respectively). While a point estimation technique was used to determine the effect concentration, the lack of a 1.0 µg/L treatment may have changed this estimation. The precision of this estimation is paramount, as the test result was the sole determinant of the GMCV, which is the most sensitive in the chronic dataset, and a small change in the GMCV can therefore have a substantial effect on the final chronic value.*	**Ex. 5 - Deliberative Process**	
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*At this time, the IEPA is in support of the adoption of the acute cadmium criterion as proposed, but is requesting a one year extension for the adoption of the chronic criterion. A one year extension would allow for a retest on Hyalella azteca using current feeding recommendations and would allow for revisions to be made to the chronic criterion. A round robin approach would ensure that the data are obtained using the appropriate test procedures and would provide additional information regarding the sensitivity of Hyalella azteca to cadmium. If time does not permit a repeat of the test, then the chronic criterion should be recalculated with the Hyalella data removed.*		*Self explanatory*

TOPIC 3: Dissolved vs total concentration use

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA HQ-OW-2015-0753-0005	*Additional documentation is needed to support the total to dissolved conversion factors. Very little information is provided concerning the derivation of the conversion factors, and more detailed information is needed to fully assess their appropriateness*	**Ex. 5 - Deliberative Process**	Section 2.6

	for natural waterbodies.	Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0005	*It is unknown if the solutions prepared from Cd salts, that were used to develop the conversion factors, adequately represent the forms of Cd found in natural waterbodies.*		Section 2.6
EPA HQ-OW-2015-0753-0005	*An explanation is needed as to why the conversion factors for the acute and chronic criteria are different. It also appears illogical that the constant conversion factor of 0.994 used for marine water is higher than freshwater, especially because the hardness-dependent conversion factor for freshwater decreases as hardness increases.*		Section 2.6
EPA HQ-OW-2015-0753-0005	*While it is noted in several places in the document, clarify that the recommended criteria values are expressed as dissolved cadmium concentrations (not total). Also clarify if states have the option to adopt total Cd criteria values.*		
EPA HQ-OW-2015-0753-0011	*Kansas has utilized the total recoverable metals criteria and data, and is not set up to sample for total dissolved metals. A conversion factor would be applied to calculate the dissolved concentration and Kansas recommends that EPA retain this flexibility in its final criteria.*		

TOPIC 4: Data inclusion in criteria derivation

ED_000992_00002221-00006

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0006	*Some of the values that are new/revised since the 2001 AWQC document are from studies that were published before 2001. Table 22 has general information describing why GMAVs have changed between the 2001 and 2015 document, but it does not provide details on why these "new" data were now considered acceptable. Include another table that describes why the studies that were excluded previously are now included.*	Ex. 5 - Deliberative Process	No edits
EPA-HQ-OW-2015-0753-0013	*Should toxicity tests conducted under less-than optimal conditions be discounted? This comment goes beyond just the test results for Hyalella, because while laboratory tests used for criteria development use conditions that are as close to optimal as possible, wild populations in diverse natural conditions are often exposed to conditions that sub-optimal, and therefore laboratory tests may be underproductive in natural conditions (i.e., additional stresses) (see, Holmstrump et al. 2010; Besser et al. 2015).*		*Self explanatory*
EPA-HQ-OW-2015-0753-0013	*"Other data" are not addressed consistent with the Guidelines. While these data are not used in the species sensitivity distribution rankings, they should not be thrown away, discounted, or deemed "unacceptable." "Other Data" can be invoked to lower a criterion (e.g., chronic value in the 1987 selenium criterion). Revaluate Riddel et al. (2005a, b) and include a larger discussion of their effect concentrations/findings and other similar behavioral/ecological studies.*		Section 5 and 5.2
EPA-HQ-OW-	*With many organisms, a strong difference in the sensitivity of different life stages makes it inappropriate to roll up data from different developmental stages. Pooling salmonid effects*		Appendix A

2015-0753-0013	*concentrations across developmental stages to obtain a SMAV could produce a misleading result (see, Hansen et al. 2002; Mebane et al. 2012; Chapman 1978; Chapman and Stevens 1978).*	**Ex. 5 - Deliberative Process**	Ranked FW Acute Table
EPA-HQ-OW-2015-0753-0013	*The decision to only use ELS chronic data in which the exposures began in the egg stage, and to exclude long-term data in which the exposures began in the fry stage is non-conservative.*		None
EPA-HQ-OW-2015-0753-0013	*SMAV calculations tagged with the footnote "C", indicating that "Data not used to calculate SMAV because more sensitive lifestage available, or flow-through measured test available", should be separated into two different footnotes since they are very different reasons.*		Appendix A and Appendix B
EPA-HQ-OW-2015-0753-0013	*Address the following Appendix A specific errors/changes:* • *Daphnia magna (various)* o *Many "S,U" tests (tests with unmeasured concentrations) are underlined, indicating they are included in the SMAV calculations. These should be excluded per the Guidelines.*		Appendix A Ranked FW Acute Table
	• *Mayfly (formerly, Ephemerella grandis) Drunella grandis* o *Tested species was listed in the source document as Ephemerella subvaria, which is still a valid species name according to ITIS.gov.*		
	• *Rainbow trout (smolt), Chapman 1975 (>2.9 µg/L)* o *Should be excluded from SMAV because it is from a*		

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	resistant life stage. Also, should be listed as "Rainbow trout (Steelhead smolt)" as Steelhead are not just Rainbow Trout by a different name, but have physiological differences in regard to ion regulation. Chapman (1975) should only be cited when no alternative exists, because it was never formally released by EPA and is not publicly available online. Chapman (1978) reports the same data and is a better citation. • *Rainbow trout (smolt), Chapman 1975 (4.1 µg/L)* o *Suspect value, exclude from SMAV. Chapman (1978) lists the value for the same test as >2.9 µg/L. Chapman (1978) is the peer-reviewed publication of record for these data; Chapman (1975) was an unpublished, work-in-progress progress report that sometimes still gets cited because it includes data never published elsewhere, such as the coho data shown in the figure in this memo. Exclude from SMAV, resistant life stage and re-label as " "Rainbow trout (Steelhead smolt". See Chapman (1978, Table 3).*	**Ex. 5 - Deliberative Process**
	• *Rainbow trout (299 mg), Stratus (1.29 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with unmanipulated pH of 7.5 were much more sensitive*	

	• *Chinook salmon (parr, 11.58g) (3.5 µg/L)*
	  o *Exclude value from SMAV, based on a resistant life stage being tested. Value is twice as high as the value obtained with swim-up fry in matched tests and confidence limits don't overlap.*
	• *Chinook salmon (smolt, 32.46 g) (>2.9 µg/L)*
	  o *Should be excluded from SMAV, based on a resistant life stage being tested .*	

	• *Bull trout (84.2 mg) (2.89 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with a natural pH of 7.5 were much more sensitive*	
	• *Colorado squawfish* o *Old common name is now considered repugnant. AFS calls it "Colorado pikeminnow". "Pikeminnow"*	

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	is one word.		
EPA-HQ-OW-2015-0753-0013	*Address the following Appendix C specific errors/changes:* • *Snail, Aplexa hyporum (Holcombe) (4.0 µg/L)* o *I got an EC20 of about 2.6 µg/L. By excluding the highest treatment with total mortality I could reproduce the 4.0 EC20 value, but it had a poor fit with Y0.*	**Ex. 5 - Deliberative Process**	No edits

EPA-HQ-OW-2015-0753-0013	*Add the following additional relevant data:*
	• *Pascoe and Mattey 1977*
	  o *Chronic stickleback exposure*
	• *Wang et al. 2014*
	  o *Chronic fathead full life-cycle test*
	• *Brinkman and Vieira 2008*
	  o *Acute and chronic mountain whitefish*
	• *Mebane et al. 2014 (paper provided)*
	  o *Effects of cadmium on larval aquatic insect communities in 30-day experimental stream tests*
			Mebane et al. (2014) added to Section 5.2

TOPIC 5: Species use and availability

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014	*There is concern about the focus on fish in developing the criteria. EPA needs to bring in other species including insects and freshwater mussels into the process when developing criteria for cadmium. This lack of additional species prevents a more holistic picture of the freshwater community, and results in criteria that are not protective of all aquatic-dependent wildlife. EPA has consistently failed to fully consider aquatic-dependent wildlife in the development of national criteria.*	*EPA will respond. No changes to document expected.*	*Self explanatory*
EPA-HQ-OW-2015-0753-0010	*There is concern with the continued lack of estuarine/marine chronic cadmium toxicity data and that no new chronic toxicity data have been generated since 2001. EPA should conduct additional chronic toxicity studies (particularly with vertebrate species) to expand the estuarine/marine chronic toxicity dataset. More estuarine/marine chronic data are needed to develop a scientifically reliable chronic cadmium criterion.*	*EPA will respond. No changes to document expected.*	*Self explanatory*
EPA-HQ-OW-2015-0753-0010	*The mysid Neomysis integer is a new species added to the estuarine/marine acute dataset, but this mysid is potentially non-native to the United States. Since there are available values for two other native mysid species (M. bigelowi and A. bahia), this non-native species should be removed (unless documentation is provided confirming it is naturally occurring within waters of North America).*	**Ex. 5 - Deliberative Process**	Section 3.2.1 and Appendix B

TOPIC 6: ESA considerations

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the*	*EPA responding. No changes to document expected*	*Self explanatory*

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2015-0753-0014	*hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*		
EPA-HQ-OW-2015-0753-0014	*To ensure the final cadmium water quality criteria to is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*	*EPA responding. No changes to document expected*	*Self explanatory*
EPA HQ-OW-2015-0753-0009	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to account for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	*EPA responding. No changes to document expected*	
EPA HQ-OW-2015-0753-0009	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*	*EPA responding. No changes to document expected*	

EPA HQ-OW-2015-0753-0015	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a Section 7 Consultation.*		*Self explanatory*
EPA HQ-OW-2015-0753-0015	*EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.* *Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.*		
EPA HQ-OW-2015-0753-0015	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For*		

	long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.		
EPA HQ-OW-2015-0753-0015	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*		
EPA HQ-OW-2015-0753-0015	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*		

TOPIC 7: Other

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014	*In the description of sources of cadmium in the document, EPA overlooked the contribution from coal combustion, coal mining waste, and coal ash ponds spills, seepage, and discharge. These important sources need to be recognized and addressed.*	Ex. 5 - Deliberative Process	Section 2.1
EPA-HQ-OW-2015-0753-0006	*Check the document for errors and typos. Specific examples include:* • *Pg.27 which is intended to provide an acute criterion protective of nearly all individuals in the distribution (Stephan et al. **1985);the** FAV/2 approach was developed to estimate minimal effect levels,* • *Pg.30 This outcome was based on the poor correlation between hardness and acute toxicity for D. magna and occurred only when tests with **less than** 24-hr old neonates were included in the database. Accordingly, only the five D. magna tests from Chapman et al. (1980} initiated with **less than** 24-hr old neonates were used for the analysis* • *Pg.33 Two species of sculpin, Cottus bairdii and Cottus confusus, are used to derive the normalized GMAV of **4.962** µg Cd/L*		*Various locations*

	Per Appendix A, this value should be 4.926 • *Pg.34 The hardness-normalized GMAV of **7.911** µg/L total cadmium for the genus Oncorhynchus is the fifth lowest in the acute dataset* o ***Per Appendix A, this value should be 7.841 *** • *Pg.42 2. Ceriodaphnia, Cladoceran (GMCV=**1.293µg/l** total Cd)* • *Pg. 74 Acceptable chronic toxicity **data** are available for 27 freshwater species representing 20 different genera* • *Pg. C-8 [d] Not used to calculate **SMAV** because either a more definitive value available, value is considered an outlier, or preference was given to the more sensitive exposure scenario (LC versus ELS tests).*		
EPA-HQ-OW-2015-0753-0006	*While Table 5 summarizes the Phyla, Families, Genera, and Species used to derive the revised criterion, it is unclear which species were used to meet each of the MDRs. Include a table that lists the eight requirements and the species used to fulfill them.*	**Ex. 5 - Deliberative Process**	Table 5
EPA-HQ-OW-2015-0753-0006	*Verify that the Spehar and Fiandt 1986 data for Pimephales promelas is appropriate to include in the freshwater acute hardness correction.*		Appendix Table A-1, A-2, C-1 and C-2
EPA-HQ-OW-2015-0753-0006	*Expand Table 6 to include the actual data that were used in the freshwater acute hardness correction for each species.*		Appendix Table A-2
EPA-HQ-OW-2015-0753-0006	*Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process.*		Figure 2
EPA-HQ-OW-2015-0753-0006	*Indicate how the R^2 value of 0.964 was obtained in the freshwater acute hardness correction. Attempts to replicate the value resulted in a slope of 1.104 and R^2 of 0.698.* *Indicate how the R^2 value of 0.841 was obtained in the freshwater chronic hardness correction. Attempts to replicate the value resulted in a slope of 0.798 and R^2 of 0.632.*		No edits

EPA-HQ-OW-2015-0753-0006	*It was not apparent if the MATC or EC_{20} value was used for the freshwater chronic slope derivation. Indicate which of the toxicity values were used in the derivation in Appendix C and Table 8.*	**Ex. 5 - Deliberative Process**	Appendix Table C-2
EPA-HQ-OW-2015-0753-0006	*Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process.*		Figure 4
EPA-HQ-OW-2015-0753-0006	*The language that describes the computation of the final acute value on pg. 32 is insufficient. Include a reference to section 4.3.1 after the reference to Figure 2 on page 32.*		Section 3.1.1
EPA-HQ-OW-2015-0753-0006	*It is unclear how the intercept of the freshwater acute and chronic criterion equations were derived. Add additional language to clarify how these values were derived.*		No edits

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To: Greg Smith[gsmith@glec.com]; Elias, Mike[Elias.Mike@epa.gov]
From: Craig Voros
Sent: Fri 2/26/2016 2:38:05 PM
Subject: Re: Data Request with a bit more info
Draft Cadmium Aquatic Life Ambient Water Quality Criteria 2.26.16_for Mike.docx

Red-lined cadmium draft for review. Please confirm receipt.

Craig Voros
Great Lakes Environmental Center
1295 King Avenue
Columbus, OH 43212
614-487-1040

On 2/26/2016 9:22 AM, Greg Smith wrote:

Now works

On 2/26/2016 9:21 AM, Elias, Mike wrote:

I can give you a call now if that works.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Friday, February 26, 2016 9:02 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Hi Mike

Craig had added your text to the document on H. azteca.

The rest of the changes have been made to the document,

but there is one more issue to discuss if you have time for a call this morning.

And we have made all our changes to the Response Table.

Thanks
Greg

On 2/26/2016 8:40 AM, Elias, Mike wrote:

Greg and Craig,

I am not able to get into Word on the Sharepoint site to make edits to the document. That being said, I only have one minor edit. It is on page 42 of the document. So, I am attaching the text edit for that paragraph in redline/track change mode for you to insert, as was suggested on the call the other day. Please insert this change in track change mode. Once that is done, I have no other changes to the document text at this point.

Could you please send me a copy with your changes in redline via email, and I will take a quick readthrough (will do immediately), then you should be able to finalize and make it 501 compliant.

In the meantime, I will finalize response to comments and prepare to drop those in. I will try to open that smaller response document, but if I cannot, will ask you to send me the response document, so I can drop my responses in at that time.

Thanks,

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Wednesday, February 24, 2016 11:03 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Hey Mike

Would it be possible to have a call sometime today?

Thanks
Greg

On 2/23/2016 4:38 PM, Elias, Mike wrote:

Thanks for pointing this out Greg. Is there any lower LOE alternative to illustrating the data w/o just having to say we are not doing something to be responsive? I understand that there may not be.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 2:44 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Mike

One consideration to including graphs showing the linear regression to better illustrate the normalization process.

EPA-HQ-OW-2015-0753-0006: "Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process."

EPA-HQ-OW-2015-0753-0006: "Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process."

Is that it will take Keith approximately 4-8 hours to generate the two graphs (a lot of effort to manually normalize the data).

So just wanted to make sure before starting the effort.

Thanks
Greg

On 2/23/2016 1:38 PM, Elias, Mike wrote:

> Greg, I could not get into Edit in Word, so instead made my comments in italics and highlighted in yellow. Please move forward with changes in the document. I think it is almost all responded to at this point. I need to step out, but will be back in a couple of hours.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 11:35 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Mike

So far we have completed all the responses assigned to us in the response table only.

We have not made all the changes to the document. We have only made changes to the document that aren't dependent on the new (revised) criteria values. So if nothing else will change, we can now begin changing the document to reflect the new criteria values and other comments that were assigned to us (the brunt of the work; tables corrections, graphs, values, etc.).

Thanks
Greg

On 2/23/2016 11:16 AM, Elias, Mike wrote:

> I have discussed this with Kathryn. The good news is that we do not need to make any changes to the document before the initiation of the final internal review. However, we will need to review the unmeasured concentrations concurrent with the final Agency review. I can talk with you about a proposed approach to this more tomorrow, but the focus at the moment can be back on finalizing the revisions and comment responses for internal review.
>
> Could you please update me where you are at on your end with revisions?

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 8:39 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Yes, your understanding is correct.

On 2/23/2016 8:35 AM, Elias, Mike wrote:

So to make sure that I am understanding correctly, if flow through data are not available (i.e., for both static and static renewal), we have for the documents noted:

- Used unmeasured concentrations if measured concentrations are not available

- Used unmeasured concentrations along with measured concentrations if both are available….so they are both given the same priority

Is that a correct understanding? I am trying to sort a few things out and then we should talk.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 8:04 AM
To: Elias, Mike <Elias.Mike@epa.gov>

Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Hi Mike

Yes we should discuss asap, since to revise the freshwater and saltwater acute values will take some time.

Ex. 5 - Deliberative Process

Examples are acrolein, aluminum, atrazine, carbaryl, chloride, diazinon, manganese, molybdenum, nonylphenol, silver and tributyltin.

Craig and I are in the office all day today for a call.

Thanks
Greg

On 2/23/2016 7:36 AM, Elias, Mike wrote:

> Greg and Craig,
>
> I confirmed with Kathryn that it is acceptable for us to keep the data for salmonids for situations where the pH is 6.5. She is in agreement with our conclusion.

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

I am working out of the office today, but should be around except for early afternoon.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Friday, February 19, 2016 1:21 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Sounds good

On 2/19/2016 1:19 PM, Elias, Mike wrote:

> Sorry, pulled away by calls. I will try to give you a call in about 5 mins
>
> **From:** Greg Smith [mailto:gsmith@glec.com]

Sent: Friday, February 19, 2016 11:23 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Mike

Here is a suggested table to fulfill the MDR (this was in the Cd document a couple of years ago before it was removed).

Also need to decide if we want to add tables showing the data used to develop the acute and chronic hardness slopes (current identify them with an * in each appendix).

Thanks
Greg

On 2/19/2016 9:09 AM, Elias, Mike wrote:

> Greg and Craig,
>
> I have some answers on the outstanding questions regarding revisions to the cadmium document, along with some additional tasks, based on my meeting with Kathryn late yesterday. I think this addresses most of the outstanding issues for the current time. We should discuss these when you have time. I am open most of the day. Here is the list:
>
> 1. Hyalella azteca inclusion in the chronic value derivation – We are not going to make any changes to calculations for the chronic criterion. I may be adding some additional clarifying text, but that is all in terms of revisions related to this issue.

2. Replacement of N. integer with N. Americana – We should remove N. integer and use N. Americana. Greg and Craig, please make revisions to the tables and text that reflect the additional species that are acceptable in the study from which N. Americana was taken. I will respond to the comment.

3. Please exclude the Chapman 1975 study data for smolt, as per Mebane's comment and revise the tables/text, as appropriate.

We are reviewing some of the other study requests made by Mebane, and should make final conclusions on those shortly

4. Additional items that were not previously discussed.

a. Greg and Craig, please make the following revisions to the document:

i. Add a table summarizing the phyla/family/genera/species used to fulfill the MDRs. The best example of such a table is Table 2 in the ammonia document.

ii. Add tables summarizing the final four species used to develop each criteria value. This is really just repackaging information that is already in the document. Take the list of species at the top of page 42 in the cadmium document, for example, and repackage into a table similar to what is shown in Table 3.6 of the selenium document. Please do that for each of the four criteria values.

b. New issue consideration – Magnesium to calcium ratio/value. Was a magnesium to cadmium ratio or magnesium concentration

value used to screen data usability for the hardness slope or toxicity value usability for acute and chronic? I am just not clear on the specific guideline we are following. However, the reason that I am askign is that it looks like we eliminated data for rainbow trout from Davies et al. (1993) from the hardness adjustment based on differences in toxicity due to different levels of hardness based on magnesium. At the same time, it looks like we used the acute and chronic toxicity data from the higher hardness levels of this study in deriving the criteria. Is this contradictory?

Please let me know when you are available to talk about these items.

Thanks,

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Wednesday, February 17, 2016 3:57 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Data Request with a bit more info

Mike

Here is the reproduction info

Methods for H. azteca testing

Only found methods for sediment testing (nothing available for water only tests):

ASTM (2005) has recommended minimum dry weight of 0.15 mg/individual, **reproduction from day 28 to day 42 of >2 young/female**

OECD (1998) does not have recommendations

Environment Canada (2013) Biological Test Methods for H. azteca recommends minimum dry weight of 0.10 mg/individual. **Nothing on reproduction.**

Cadmium Aquatic Life Ambient Water Quality Criteria
Draft Response to Public Comments

TOPIC 1 Summary: Comments regarding acute criteria duration change from 24 hours to one hour

Comment Number (Organization)	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0012 (Utility Water Act Group)	*UWAG has concerns with EPA's proposal to change the acute freshwater and estuarine/marine criteria averaging duration from 24 hours to 1 hour. The change is not adequately justified and is not supported by new studies in the Draft. The current 24-hour duration should be retained unless a strong scientific justification is presented.* *Every previous iteration of the cadmium criteria has endorsed a 24-hour duration for the acute criteria. EPA appears to be making a policy decision that the acute criteria should be 1 hour, but does not present the associated science to support the revision which is inconsistent with CWA § 304(a)(1), which mandates EPA establish "criteria for water quality accurately reflecting the latest scientific knowledge."* *EPA compares the acute toxicity to ammonia but fails to provide information that compares the time-dependent toxicity of cadmium with ammonia. Furthermore, assessing the toxicity of cadmium during the first 24 hours of an acute test is problematic because the vast majority of published studies reporting the acute toxicity of cadmium do not report patterns of lethality during the first 24 hours. Several acceptable selected studies (Besser et al. 2007; Buhl 1997; Diamond et al. 1997; Mebane et al. 2012; Nebeker 1986) do not report 24-hour LC50s and the one study with relevant data (Duncan and Klavercamp 1983) had a 12-hour LC50 that was five times greater than the 96-hour LC50 (5.35 vs. 1.11 µg/L, respectively). This value would be expected to be similar if cadmium was a*	**Ex. 5 - Deliberative Process**	No edits

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	fast-acting pollutant. *An earlier EPA publication (*Speed of Action of Metals Acute Toxicity to Aquatic Life*; EPA-822-R-95-002) also justifies the 24-hour averaging period. This document estimated a kinetic coefficient (*k*) using a regression of LC50 values versus time, with the averaging period being calculated as the inverse of* k*. The larger the* k *value the faster acting the pollutant. None of the estimated averaging periods in the document for freshwater and saltwater species approached 1-hour. The highest estimated* k *values mentioned, for the freshwater fathead minnow, were 6 and 17 hours, with saltwater species having even larger values. The selection of the 1-hour averaging period is baseless and arbitrary.* *Additionally, the 1985 Guidelines say the duration should be "substantially less than 48 to 96 hours," but do not say that 24 hours is an inappropriate duration and therefore the Guidelines do not support, nor should it be a justification for the proposed revision.*	**Ex. 5 - Deliberative Process**	

		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0012 (Utility Water Act Group)	*Water Quality-Based Effluent Limits (WQBELs) for cadmium are often expressed as a daily (24-hr) maximum value. Changing the WQBEL to a 1-hour averaging duration could require a permittee to collect several compliance samples during a 24-hour period. This additional burden is unnecessary since there is minor variability of the cadmium levels during a typical 24-hour period, and this additional monitoring is unwarranted without sound scientific basis.*		No edits

TOPIC 2: Comments regarding *H. azteca* test by Ingersoll is not acceptable; retest should be done or test should be removed from criteria development

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0007 and EPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection	*The proposed chronic criterion is based on a flawed toxicity test (Ingersoll and Kemble 2001) conducted on the amphipod Hyalella azteca. The Hyalella test used in the criterion derivation should be repeated using current feeding procedures that are proven to result in better growth and reproduction. While the IEPA acknowledges and commends the improvements USEPA has made in the assessment and analysis of Hyalella sp. data compared to the 2001 cadmium criteria document, specifically in regards to the sensitivity of this organism to the presence/absence of chloride and bromide in culture and test water, the IEPA contends that the feeding regime employed in the 2000 USGS study is deficient by today's standards and likely resulted in malnourished, stressed test organisms.* *Specifically, test organisms in the 2000 USGS study were underfed and/or fed improper diets based on current research. Dr. Soucek, at the Illinois Natural History Survey, conducted new research that focused*	Ex. 5 - Deliberative Process	No edits

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Agency)	*on determining the appropriate amounts of food for test organisms. His research has led to improved growth of test organisms compared to earlier diet regimes. The diet used in the 2000 USGS study consisted of a ration of 1.0 ml YCT/d, whereas Dr. Soucek's research contends that a diet consisting of Tetramin supplemented with diatoms greatly improves growth and reproduction of Hyalella azteca compared to YCT-only diets (Soucek et al. 2016, in press).* *The diet in the 2000 USGS study restricted growth and fecundity when compared to Tetramin-based diets (Soucek et al. 2016, in press), and brings into question the accuracy of the test results.*	**Ex. 5 - Deliberative Process**	
EPA-HQ-OW-2015-0753-0007 and EPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*Test organisms in the 2000 USGS study did not attain minimum growth requirements based on the direct measure of organism weight, with the average dry weight of the controls being 0.27 mg/individual (<0.50 mg/individual). USEPA concluded that the dry weights measured in the test were inaccurate and subsequently used length data to extrapolate to dry weight via a regression equation. However there is no documentation provided for this equation or how it was derived. It is unlikely that the dry weights were underestimated (while an overestimation can be expected due to inadequate drying of test organisms), and it is therefore considered unlikely that the organisms achieved the minimum weight requirements for this test to be valid.*		No edits

		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0007andEPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*The dilution series (control and 5 treatment concentrations: 0.1, 0.3, 0.5, 2.0 and 3.0 µg/L.) used in the 2000 USGS test did not appropriately bracket the effect concentration. The dilution series was not standard, with a large gap in concentration between the NOEC and LOEC (0.5 and 2.0 µg/L, respectively). While a point estimation technique was used to determine the effect concentration, the lack of a 1.0 µg/L treatment may have changed this estimation. The precision of this estimation is paramount, as the test result was the sole determinant of the GMCV, which is the most sensitive in the chronic dataset, and a small change in the GMCV can therefore have a substantial effect on the final chronic value.*		No edits
EPA-HQ-OW-2015-0753-0007 and EPA HQ-OW-2015-0753-0008 (Illinois Environmental Protection Agency)	*At this time, the IEPA is in support of the adoption of the acute cadmium criterion as proposed, but is requesting a one year extension for the adoption of the chronic criterion. A one year extension would allow for a retest on Hyalella azteca using current feeding recommendations and would allow for revisions to be made to the chronic criterion. A round robin approach would ensure that the data are obtained using the appropriate test procedures and would provide additional information regarding the sensitivity of Hyalella azteca to cadmium. If time does not permit a repeat of the test, then the chronic criterion should be recalculated with the Hyalella data removed.*		No edits

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TOPIC 3: Comments regarding dissolved vs total concentration use

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*Additional documentation is needed to support the total to dissolved conversion factors. Very little information is provided concerning the derivation of the conversion factors, and more detailed information is needed to fully assess their appropriateness for natural waterbodies.*	Ex. 5 - Deliberative Process	Section 2.6
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*It is unknown if the solutions prepared from Cd salts, that were used to develop the conversion factors, adequately represent the forms of Cd found in natural waterbodies.*		Section 2.6
EPA HQ-OW-2015-0753-0005 (Florida Department of	*An explanation is needed as to why the conversion factors for the acute and chronic criteria are different. It also appears illogical that the constant conversion factor of 0.994 used for marine water is higher than for freshwater, especially because the hardness-dependent conversion factor for freshwater decreases as hardness increases.*		Section 2.6

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Environmental Protection)			
EPA HQ-OW-2015-0753-0005 (Florida Department of Environmental Protection)	*While it is noted in several places in the document, clarify that the recommended criteria values are expressed as dissolved cadmium concentrations (not total). Also clarify if states have the option to adopt total Cd criteria values.*		No edits
EPA HQ-OW-2015-0753-0011	*Kansas has utilized the total recoverable metals criteria and data, and is not set up to sample for total dissolved metals. A conversion factor would be applied to calculate the dissolved concentration and Kansas recommends that EPA retain this flexibility in its final criteria.*		No edits

TOPIC 4: Comments regarding data quality, use, ar

Comment Number	Public Comment		Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0006 (Kansas Department of Health and Environment)	*Some of the values that are new/revised since the 2001 AWQC document are from studies that were published before 2001. Table 22 has general information describing why GMAVs have changed between the 2001 and 2015 document, but it does not provide details on why these "new" data were now considered acceptable. Include another table that describes why the studies that were excluded previously are now included.*		No edits
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological	*Should toxicity tests conducted under less-than optimal conditions be discounted? This comment goes beyond just the test results for Hyalella, because while laboratory tests used for criteria development use conditions that are as close to optimal as possible, wild populations in diverse natural conditions are often exposed to conditions that sub-optimal, and therefore laboratory tests may be underprotective in natural conditions (i.e., additional stresses) (see, Holmstrump et al. 2010; Besser et al. 2015).*		No edits

Ex. 5 - Deliberative Process

Survey)		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*"Other data" are not addressed consistent with the Guidelines. While these data are not used in the species sensitivity distribution rankings, they should not be thrown away, discounted, or deemed "unacceptable." "Other Data" can be invoked to lower a criterion (e.g., chronic value in the 1987 selenium criterion). Revaluate Riddel et al. (2005a, b) and include a larger discussion of their effect concentrations/findings and other similar behavioral/ecological studies.*		Sections 5 and 5.2
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*With many organisms, a strong difference in the sensitivity of different life stages makes it inappropriate to roll up data from different developmental stages. Pooling salmonid effects concentrations across developmental stages to obtain a SMAV could produce a misleading result (see, Hansen et al. 2002; Mebane et al. 2012; Chapman 1978; Chapman and Stevens 1978).*		Appendix A Ranked FW Acute Table
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*The decision to only use ELS chronic data in which the exposures began in the egg stage, and to exclude long-term data in which the exposures began in the fry stage is non-conservative.*		No edits
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*SMAV calculations tagged with the footnote "C", indicating that "Data not used to calculate SMAV because more sensitive life stage available, or flow-through measured test available", should be separated into two different footnotes since they are very different reasons.*		Appendix A and Appendix B
EPA-HQ-OW-			Appendix A

2015-0753-0013 (Chris Mebane, US Geological Survey)	*Address the following Appendix A specific errors/changes:* • *Daphnia magna (various)* o *Many "S, U" tests (tests with unmeasured concentrations) are underlined, indicating they are included in the SMAV calculations. These should be excluded per the Guidelines.*	**Ex. 5 - Deliberative Process**	Ranked FW Acute Table
	• *Mayfly (formerly, Ephemerella grandis) Drunella grandis* o *Tested species was listed in the source document as Ephemerella subvaria, which is still a valid species name according to ITIS.gov.*		

	• *Rainbow trout (smolt), Chapman 1975 (>2.9 µg/L)*
	  o *Should be excluded from SMAV because it is from a resistant life stage. Also, should be listed as "Rainbow trout (Steelhead smolt)" as Steelhead are not just Rainbow Trout by a different name, but have physiological differences in regard to ion regulation. Chapman (1975) should only be cited when no alternative exists, because it was never formally released by EPA and is not publicly available online. Chapman (1978) reports the same data and is a better citation.*
	• *Rainbow trout (smolt), Chapman 1975 (4.1 µg/L)*
	  o *Suspect value, exclude from SMAV. Chapman (1978) lists the value for the same test as >2.9 µg/L. Chapman (1978) is the peer-reviewed publication of record for these data; Chapman (1975) was an unpublished, work-in-progress progress report that sometimes still gets cited because it includes data never published elsewhere, such as the coho data shown in the figure in this memo. Exclude from SMAV, resistant life stage and re-label as ""Rainbow trout (Steelhead smolt". See Chapman*		

	(1978, Table 3).		
	• *Rainbow trout (299 mg), Stratus (1.29 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with unmanipulated pH of 7.5 were much more sensitive*	Ex. 5 - Deliberative Process	

	• *Chinook salmon (parr, 11.58g) (3.5 µg/L)*
	  o *Exclude value from SMAV, based on a resistant life stage being tested. Value is twice as high as the value obtained with swim-up fry in matched tests and confidence limits don't overlap.*
	• *Chinook salmon (smolt, 32.46 g) (>2.9 µg/L)*
	  o *Should be excluded from SMAV, based on a resistant life stage being tested.*		

	• *Bull trout (84.2 mg) (2.89 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with a natural pH of 7.5 were much more sensitive*		
	• *Colorado squawfish* o *Old common name is now considered repugnant. AFS calls it "Colorado pikeminnow". "Pikeminnow" is one word.*		
EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Address the following Appendix C specific errors/changes:* • *Snail, Aplexa hyporum (Holcombe) (4.0 µg/L)* o *I got an EC20 of about 2.6 µg/L. By excluding the highest treatment with total mortality I could reproduce the 4.0 EC20 value, but it had a poor fit with Y0.*		No edits

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		Ex. 5 - Deliberative Process	

EPA-HQ-OW-2015-0753-0013 (Chris Mebane, US Geological Survey)	*Add the following additional relevant data:*
	• *Pascoe and Mattey 1977*
	  o *Chronic stickleback exposure*
	• *Wang et al. 2014*
	  o *Chronic fathead full life-cycle test*
	• *Brinkman and Vieira 2008*
	  o *Acute and chronic mountain whitefish*
	• *Mebane et al. 2014 (paper provided)*
	  o *Effects of cadmium on larval aquatic insect communities in 30-day experimental stream tests*
			Mebane et al. (2014) added to Section 5.2

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document

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EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*There is concern about the focus on fish in developing the criteria. EPA needs to bring in other species including insects and freshwater mussels into the process when developing criteria for cadmium. This lack of additional species prevents a more holistic picture of the freshwater community, and results in criteria that are not protective of all aquatic-dependent wildlife. EPA has consistently failed to fully consider aquatic-dependent wildlife in the development of national criteria.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0010 (Hampton Roads Sanitation District)	*There is concern with the continued lack of estuarine/marine chronic cadmium toxicity data and that no new chronic toxicity data have been generated since 2001. EPA should conduct additional chronic toxicity studies (particularly with vertebrate species) to expand the estuarine/marine chronic toxicity dataset. More estuarine/marine chronic data are needed to develop a scientifically reliable chronic cadmium criterion.*		No edits
EPA-HQ-OW-2015-0753-0010 (Hampton Roads Sanitation District)	*The mysid Neomysis integer is a new species added to the estuarine/marine acute dataset, but this mysid is potentially non-native to the United States. Since there are available values for two other native mysid species (M. bigelowi and A. bahia), this non-native species should be removed (unless documentation is provided confirming it is naturally occurring within waters of North America).*		Section 3.2.1 and Appendix B

TOPIC 5: Comments regarding ESA considerations

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	**Ex. 5 - Deliberative Process**	No edits

		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*To ensure the final cadmium water quality criteria is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*		No edits
EPA HQ-OW-2015-0753-	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-*		

0009 (California State Water Resources Control Board)	*fitted data* *4. Adjusting derived criteria to ac7count for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0009 (California State Water Resources	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*		No edits

Control Board)			
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a Section 7 Consultation.*	**Ex. 5 - Deliberative Process**	No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*''EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.* *Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined*		No edits

	they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*		No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and that ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*		No edits
EPA HQ-OW-2015-0753-0015 (National Marine Fisheries Service)	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*		No edits

TOPIC 6: Other comments

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014 (Center for Biological Diversity)	*In the description of sources of cadmium in the document, EPA overlooked the contribution from coal combustion, coal mining waste, and coal ash ponds spills, seepage, and discharge. These important sources need to be recognized and addressed.*	Ex. 5 - Deliberative Process	Section 2.1

EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Check the document for errors and typos. Specific examples include:*
	• *Pg.27 which is intended to provide an acute criterion protective of nearly all individuals in the distribution (Stephan et al. **1985);the** FAV/2 approach was developed to estimate minimal effect levels,*
	• *Pg.30 This outcome was based on the poor correlation between hardness and acute toxicity for D. magna and occurred only when tests with **less than** 24-hr old neonates were included in the database. Accordingly, only the five D. magna tests from Chapman et al. (1980} initiated with **less than** 24-hr old neonates were used for the analysis*
	• *Pg.33 Two species of sculpin, Cottus bairdii and Cottus confusus, are used to derive the normalized GMAV of **4.962** µg Cd/L*
	  o ***Per Appendix A, this value should be 4.926***
	• *Pg.34 The hardness-normalized GMAV of **7.911** µg/L total cadmium for the genus Oncorhynchus is the fifth lowest in the acute dataset*
	  o ***Per Appendix A, this value should be 7.841 ***
	• *Pg.42 2. Ceriodaphnia, Cladoceran (GMCV=**1.293µg/l** total Cd)*
	• *Pg. 74 Acceptable chronic toxicity **data** are available for 27 freshwater species representing 20 different genera*
	• *Pg. C-8 [d]Not used to calculate **SMAV** because either a more definitive value available, value is considered an outlier, or preference was given to the more sensitive exposure scenario (LC versus ELS tests).*
			Various locations

EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*While Table 5 summarizes the Phyla, Families, Genera, and Species used to derive the revised criterion, it is unclear which species were used to meet each of the MDRs. Include a table that lists the eight requirements and the species used to fulfill them.*	Ex. 5 - Deliberative Process	Table 5
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Verify that the Spehar and Fiandt 1986 data for Pimephales promelas is appropriate to include in the freshwater acute hardness correction.*		Appendix Table A-1, A-2, C-1 and C-2
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Expand Table 6 to include the actual data that were used in the freshwater acute hardness correction for each species.*		Appendix Table A-2
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process.*		Figure 2
EPA-HQ-OW-2015-0753-0006 Wisconsin Department of Natural Resources)	*Indicate how the R^2 value of 0.964 was obtained in the freshwater acute hardness correction. Attempts to replicate the value resulted in a slope of 1.104 and R^2 of 0.698.* *Indicate how the R^2 value of 0.841 was obtained in the freshwater chronic hardness correction. Attempts to replicate the value resulted in a slope of 0.798 and R^2 of 0.632.*		No edits

		Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*It was not apparent if the MATC or EC_{20} value was used for the freshwater chronic slope derivation. Indicate which of the toxicity values were used in the derivation in Appendix C and Table 8.*		Appendix Table C-2
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process.*		Figure 4
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*The language that describes the computation of the final acute value on pg. 32 is insufficient. Include a reference to section 4.3.1 after the reference to Figure 2 on page 32.*		Section 3.1.1
EPA-HQ-OW-2015-0753-0006 (Wisconsin Department of Natural Resources)	*It is unclear how the intercept of the freshwater acute and chronic criterion equations were derived. Add additional language to clarify how these values were derived.*		No edits

ED_000992_00002423-00020

		Ex. 5 - Deliberative Process	

To: Craig Voros[cvoros@glec.com]; Greg Smith[gsmith@glec.com]
From: Elias, Mike
Sent: Fri 3/18/2016 9:09:32 PM
Subject: RE: Updated conceptual diagram
16 Feb 1 UWAG Cadmium Criteria Comments 59157448.pdf

Greg and Craig, In the attached comments, UWAG makes reference to six papers in their support for a Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process If you have specific questions, please contact Kathryn for clarification. Thanks!

-----Original Message-----
From: Craig Voros [mailto:cvoros@glec.com]
Sent: Friday, March 18, 2016 1:36 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Subject: Re: Updated conceptual diagram

Sounds good. Give me a call when you have time.

Craig Voros
Great Lakes Environmental Center
1295 King Avenue
Columbus, OH 43212
614-487-1040

On 3/18/2016 1:35 PM, Elias, Mike wrote:
> Maybe we can talk at 2pm and run through then?
>
> -----Original Message-----
> From: Craig Voros [mailto:cvoros@glec.com]
> Sent: Friday, March 18, 2016 1:34 PM
> To: Elias, Mike <Elias.Mike@epa.gov>
> Subject: Re: Updated conceptual diagram
>
> I believe all the statements you want are in there. Want to talk about where and see if that is enough?
>
> Craig Voros
> Great Lakes Environmental Center
> 1295 King Avenue
> Columbus, OH 43212
> 614-487-1040
>
> On 3/18/2016 1:09 PM, Elias, Mike wrote:
>> I do have an additional request. I am looking through Kathryn's notes and she thinks we need direct description in the text indicating that we Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process Could you add succinct statements to appropriate locations in the text clarifying this?
>>
>> -----Original Message-----
>> From: Craig Voros [mailto:cvoros@glec.com]
>> Sent: Friday, March 18, 2016 12:59 PM
>> To: Elias, Mike <Elias.Mike@epa.gov>
>> Subject: Re: Updated conceptual diagram
>>
>> Ok sounds good. 3-16-16 is indeed the latest version. I will add the diagram now.

>>
>> Craig Voros
>> Great Lakes Environmental Center
>> 1295 King Avenue
>> Columbus, OH 43212
>> 614-487-1040
>>
>> On 3/18/2016 12:55 PM, Elias, Mike wrote:
>>> Craig, I am going online and just making changes directly to the 3-16-16 version (I did not have a single version incorporating comments anyway), which will allow you to also work on. Please just confirm that is also the most updated version that you have.
>>>
>>> -----Original Message-----
>>> From: Craig Voros [mailto:cvoros@glec.com]
>>> Sent: Friday, March 18, 2016 12:51 PM
>>> To: Elias, Mike <Elias.Mike@epa.gov>
>>> Subject: Updated conceptual diagram
>>>
>>> I had a copy of the conceptual diagram already. Looks like it matched exactly. Let me know when the file is up on SharePoint and I will add it to the document.
>>>
>>> --
>>> Craig Voros
>>> Great Lakes Environmental Center
>>> 1295 King Avenue
>>> Columbus, OH 43212
>>> 614-487-1040
>>>

Cadmium Aquatic Life Ambient Water Quality Criteria
Briefing for OST Office Director
March 23, 2016

Purpose of briefing: Obtain OD's approval for publication of the final cadmium criteria document in the Federal Register

I. Overview of 2016 Final Cadmium Aquatic Life Criteria Update

- Current criteria update revises acute and chronic freshwater and estuarine/marine criteria; values were last updated in 2001
- Updated criteria added toxicity test data for 75 new species to an already robust data set; there were no major changes in scientific approach
- Timeline consideration: Oregon Toxics Lawsuit brought by Northwest Environmental Advocates
  - OST is working to meet a potential settlement agreement with NWEA to propose acute cadmium criteria for Oregon by March 31, 2016 and finalize by January 16, 2017
    - The settlement agreement and criteria revision were driven by a jeopardy call by NMFS for acute cadmium in 2012
    - EPA determined new data were available to evaluate acute toxicity of cadmium
  - The 304(a) national criteria is the basis for this rulemaking; plan to issue as final on March 30, 2016, to support the development of the March 30, 2016 rulemaking for the state
- Review of the updated criteria document included
  - Three rounds of Agency Workgroup review
  - External expert peer review (five reviewers)
    - Positive reception; applicable technical recommendations integrated into revisions
  - Public comment period
    - Comments from states, industry, NGOs, and other federal agencies (e.g., USGS)
    - Ten comment letters received (List of commenters attached)

Table 1. Overview of Milestones

Action	Date
Agency Workgroup Review - Draft	4/20/15 – 5/20/15
External Peer Draft Review	8/22/15-10/2/15
Agency Workgroup Review- Revised Draft	11/2/15 – 11/10/15
60 Day Public Comment Period	12/1/15 – 2/1/16
Agency Workgroup Review - Final	3/1/16 – 3/9/16
FRN Publication	3/30/16

II. Cadmium Occurrence, Uses and Sources of Contamination

- Occurs naturally in the environment at low concentrations, primarily as mineral deposits (e.g., 0.1-0.2 ppm)
- NiCd batteries account for >80% of global consumption; other common industrial uses include pigments, coatings/platings and stabilizers
- More recently used in manufacture of nanoparticles (quantum dots) for photovoltaic devices (e.g., solar cells and emitters for color displays)
- Primary sources to the environment:
    - Anthropogenic sources account for > 90% of environmental release
    - Major anthropogenic sources: Fossil fuel combustion, cement manufacturing, metal smelting, and phosphate fertilizer application
    - Legacy mining sites (e.g., Colorado) represent localized sources

III. 2016 Cadmium Criteria

- Acute freshwater and acute and chronic estuarine/marine values decrease slightly, while chronic freshwater value increases slightly from 2001 value

Table 2. 2016 updated criteria values compared to 2015 draft and existing 2001 current criteria

	2016 Updated Values		FRN Draft Publication Values		2001 Criteria Update	
	Acute (1-hour, dissolved)	**Chronic** (4-day, dissolved)	**Acute** (1-hour, dissolved)	**Chronic** (4-day, dissolved)	**Acute** (1-day, dissolved)	**Chronic** (4-day, dissolved)
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)	**1.8** µg/L[a]	**0.72** µg/L	2.1 µg/L[a]	0.73 µg/L	2.0 µg/L[a]	0.25 µg/L
Estuarine/marine	**33** µg/L	**7.9** µg/L	35 µg/L	8.3 µg/L	40 µg/L	8.8 µg/L

[a] Lowered to protect the commercially and recreationally important rainbow trout, as per the 1985 Guidelines, Stephen et al. (1985).

Table 3. Number of tested aquatic species included in criteria derivation over time

	Freshwater Acute	Freshwater Chronic	Estuarine/Marine Acute	Estuarine/Marine Chronic
1980	29	13	31	1
2001	65	21	61	2
2016	101	27	94	2

IV. Key Document Changes Based on Public Comment Period

- Freshwater acute value decreased from 2.1 ug/L to 1.8 ug/L
  - Corrected hardness equation to remove all tests with unmeasured concentrations to ensure validity of results
  - Data for salmonids were revised based mainly on commenter input
    - Insensitive life stages removed
    - High outlier values removed because data outside tenfold range of acceptability and use of different cadmium salt
    - Low outliers removed due to inappropriate salt used to derive high hardness
- Freshwater chronic value decreased from 0.73 ug/L to 0.72 ug/L due to addition of one test
- Estuarine/marine acute value decreased from 35 ug/L to 33 ug/L due to replacement of nonnative with native test species
- Estuarine/marine chronic value decreased from 8.4 ug/L to 7.9 ug/L total concentration based on change in acute test species

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

V. **Protection of Listed Species**

Attachment

Public Comment Period Letters Received

1. Florida Department of Environmental Protection
2. Illinois Environmental Protection Agency
3. Wisconsin Department of Natural Resources
4. Kansas Department of Health and Environment
5. Utility Water Act Group (via Hunton and Williams)
6. Hampton Roads Sanitation District
7. US Geological Survey (Chris Mebane)
8. National Marine Fisheries Service
9. Center for Biological Diversity
10. California State Water Resources Control Board

Cadmium Aquatic Life Ambient Water Quality Criteria

Briefing for Betsy Southerland

March 14, 2016

1. **OVERVIEW**
   a. **Criteria document revision based on comments received during 60 day public comment period**

   b. **Comment letters received**
      i. Florida Department of Environmental Protection
      ii. Illinois Environmental Protection Agency
      iii. Wisconsin Department of Natural Resources
      iv. Kansas Department of Health and Environment
      v. Utility Water Act Group (via Hunton and Williams)
      vi. Hampton Roads Sanitation District
      vii. US Geological Survey (Chris Mebane)
      viii. National Marine Fisheries Service
      ix. Center for Biological Diversity
      x. California State Water Resources Control Board

   c. **Limited changes in document content occurred as a result of public comments**
      i. Freshwater acute and chronic values decreased slightly
      ii. Estuarine/marine acute and chronic values decreased
      iii. Most other revisions involved addition of clarifying tables, figures, or text

	2016 Revised Values		**FRN Draft Publication Values**		**2001 Criteria Update**	
	Acute (1-hour, dissolved)	**Chronic** (4-day, dissolved)	**Acute** (1-hour, dissolved)	**Chronic** (4-day, dissolved)	**Acute** (1-day, dissolved)	**Chronic** (4-day, dissolved)
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)	**1.8** µg/L[a]	**0.72** µg/L	2.1 µg/L[a]	0.73 µg/L	2.0 µg/L[a]	0.25 µg/L
Estuarine/marine	**33** µg/L	**7.9** µg/L	35 µg/L	8.3 µg/L	40 µg/L	8.8 µg/L

[a] Lowered to protect the commercially and recreationally important rainbow trout, as per the

1985 Guidelines, Stephen et al. (1985).

d. Currently revising based on Agency Workgroup review

Action	Date
Agency Workgroup Draft Review	4/20/15 – 5/20/15
External Peer Draft Review	8/22/15-10/2/15
Agency Workgroup	11/2/15 – 11/10/15
60 Day Public Comment Period/Revisions	12/1/15 – 2/1/16
Agency Workgroup Review of Final Document	3/1/16 – 3/9/16
FRN Publication	3/30/16

2. KEY DOCUMENT CHANGES BASED ON PUBLIC COMMENT PERIOD

a. Freshwater acute value decreased from 2.1 ug/L to 1.8 ug/L dissolved

i. Acute values were reviewed; the following data for salmonids were revised based on commenter input (Chris Mebane, USGS)

- Corrected hardness equation to remove all tests with unmeasured concentrations to ensure validity of results. Resulted in lower hardness slope, from 1.103 in 2015 draft to 0.9789 (which is closer to Mebane's 2006 slope).
- Rainbow trout
    a. Removed insensitive smolt values from Chapman 1978 (>14.67 µg/L normalized)
    b. Retained next highest value for swim-up fry from study (6.575 ug/L normalized)
    c. Removed low values from Davies 1993 due to influence of high magnesium addition in high hardness test water (>400 mg/L H) yielding inaccurately low LC50s
    d. Removed high outliers (LC50>12) of Hollis (1999, 200a) and Niyogi (2004) beyond 10-fold range of expected criteria, which were also suspect because are only rainbow trout data using cadmium nitrate salts (All other tests were with cadmium chloride or sulfate salts).
    e. SMAV changed from 4.468 to ~3.720
- Chinook salmon
    a. Removed insensitive parr and smolt values from Chapman 1978 (17.70 ug/L and >14.67 ug/L normalized)
    b. Retained next highest value for juveniles from study (6.504 ug/L normalized)

c. SMAV changed from 9.888 to 7.141

b. Freshwater chronic value decreased from 0.73 ug/L to 0.72 ug/L dissolved

i. Added in Cottus 21-day chronic test due to importance as sensitive result despite short test duration (Chris Mebane, USGS)

c. Estuarine/marine acute value decreased from 35 ug/L to 33 ug/L dissolved

i. Commenter (UWAG) noted *Neomysis integer* does not occur in North American waters

ii. *Neomysis integer* (65.25 ug/L normalized) was removed from database

iii. *Neomysis Americana* (28.14 ug/L normalized) was added to the database after obtaining an additional paper (Roberts et al. 1982)

d. Estuarine/marine chronic value decreased from 8.3 ug/L to 7.9 ug/L dissolved

i. Estuarine/marine chronic value was based on an integration of *Neomysis integer* with use of Acute-to-Chronic Ratio

e. Notable editorial changes/clarifications

i. Information was added clarifying approach and source of data for converting total to dissolved concentrations for fresh and saltwater including
   - Data sources
   - Water and salts used for testing: Natural surface waters and cadmium chloride and cadmium sulfate salts used for simulation

ii. Footnotes edited in Appendix A and B to differentiate "Data not used to calculate SMAV because more sensitive lifestage available" from "Flow-through measured test available"

iii. Table 5 was modified to identify specific genus used to fulfill each of the family MDRs, instead of only numbers of phyla, family, genera, and species used to derive criteria

iv. Additional tables were added identifying which studies and values were used in the acute and chronic hardness normalization analysis (Appendices A-2 and C-2)

v. Graphs were added showing the freshwater acute hardness linear regressions to better illustrate the normalization process (Figures 2 and 4)

3. **KEY COMMENTS/RESPONSES WITH LIMITED OR NO REVISION**

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Cadmium Aquatic Life Ambient Water Quality Criteria

Briefing for Betsy Southerland

March 14, 2016

1. **OVERVIEW**
   a. **Criteria document revision based on comments received during 60 day public comment period**

   b. **Comment letters received**
      i. Utility Water Act Group (via Hunton and Williams)
      ii. Florida Department of Environmental Protection
      iii. Hampton Roads Sanitation District
      iv. Illinois Environmental Protection Agency
      v. Wisconsin Department of Natural Resources
      vi. Kansas Department of Health and Environment
      vii. US Geological Survey (Chris Mebane)
      viii. National Marine Fisheries Service
      ix. Center for Biological Diversity
      x. California State Water Resources Control Board

   c. **Limited changes in document content occurred as a result of public comments**
      i. Acute freshwater value decreased slightly
      ii. Estuarine/marine acute and chronic values decreased
      iii. Most other revisions involved addition of clarifying tables, figures, or text

Ex. 5 - Deliberative Process

1985 Guidelines, Stephen et al. (1985).

d. Currently revising based on Agency Workgroup review

Action	Date
Agency Workgroup Draft Review	4/20/15 – 5/20/15
External Peer Draft Review	8/22/15-10/2/15
Agency Workgroup	11/2/15 – 11/10/15
60 Day Public Comment Period/Revisions	12/1/15 – 2/1/16
Agency Workgroup Review of Final Document	3/1/16 – 3/9/16
FRN Publication	3/30/16

2. KEY DOCUMENT CHANGES BASED ON PUBLIC COMMENT PERIOD

Ex. 5 - Deliberative Process

b. Estuarine/marine acute value decreased from 35 ug/L to 33 ug/L

i. Commenter (UWAG) noted *Neomysis integer* does not occur in North American waters

ii. *Neomysis integer* (65.25 ug/L normalized) was removed from database

iii. *Neomysis Americana* (28.14 ug/L normalized) was added to the database after obtaining an additional paper (Roberts et al. 1982)

iv. CMC decreased from 34.81 ug/L to 33.13 ug/L, total concentration

c. Estuarine/marine chronic value decreased from 8.4 ug/L to 8.0 ug/L total concentration based on decrease in FAV

i. Estuarine/marine chronic value was based on an integration of *Neomysis integer* and Acute-to-Chronic Ratio

d. Notable editorial changes/clarifications

i. Information was added clarifying approach and source of data for converting total to dissolved concentrations for fresh and saltwater including
   - Data sources
   - Water and salts used for testing: Natural surface waters and cadmium chloride and cadmium sulfate salts used for simulation

ii. Footnotes edited in Appendix A and B to differentiate "Data not used to calculate SMAV because more sensitive lifestage available" from "Flow-through measured test available"

iii. Table 5 was modified to identify specific genus used to fulfill each of the family MDRs, instead of only numbers of phyla, family, genera, and species used to derive criteria

iv. Additional tables were added identifying which studies and values were used in the acute and chronic hardness normalization analysis (Appendices A-2 and C-2)

v. Graphs were added showing the freshwater acute hardness linear regressions to better illustrate the normalization process (Figures 2 and 4)

3. **KEY COMMENTS/RESPONSES WITH LIMITED OR NO REVISION**

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

TOPIC 5: ESA considerations

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docun
EPA-HQ-OW-2015-0753-0014	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0014	*To ensure the final cadmium water quality criteria is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*	Thank you for your comment.	No edits

ED_000992_00002478-00001

EPA HQ-OW-2015-0753-0009	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* 1. *Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* 2. *Curve-fitting all toxicity data used to derive the numeric criterion* 3. *Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* 4. *Adjusting derived criteria to account for chemical mixtures* 5. *Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	No edits
EPA HQ-OW-2015-0753-0009	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*	Please see response to the above comment.	No edits
EPA HQ-OW-2015-0753-0015	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a*	Thank you for your comment.	No edits

	Section 7 Consultation.		
EPA HQ-OW-2015-0753-0015	*''EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.* *Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.*	**Ex. 5 - Deliberative Process**	No edits

		Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0015	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*		No edits
EPA HQ-OW-2015-0753-0015	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and that ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*		No edits
EPA HQ-OW-2015-0753-0015	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*		No edits

To: Greg Smith[gsmith@glec.com]; Craig Voros[cvoros@glec.com]
From: Elias, Mike
Sent: Fri 2/26/2016 8:50:10 PM
Subject: RE: Data Request with a bit more info
Cd Public Comments EPA Response_2 26 16_for Mike (MERev).docx

Here is the redline/markup with EPA comment responses filled in and some minor markups for your final cleanup and pulling together. Please note, I combined comments for the 1 vs 24 hour duration since the concept seemed to start getting repetitive (with a single point being made).

Thank you both for your work on this project. Soon we will be rounding the final bend. Feel free to call me on my cell if you need to reach me Ex. 6 - Personal Privacy

Thanks,

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Friday, February 26, 2016 2:34 PM
To: Elias, Mike <Elias.Mike@epa.gov>; Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Mike

Tyler has the draft document and will do the QA check this afternoon/weekend.

Back to us Monday morning whereby we will make any necessary changes, then to you by Monday afternoon.

Thanks
Greg

On 2/26/2016 12:29 PM, Elias, Mike wrote:

Ok.

From: Craig Voros [mailto:cvoros@glec.com]

Sent: Friday, February 26, 2016 12:23 PM
To: Elias, Mike <Elias.Mike@epa.gov>; Greg Smith <gsmith@glec.com>
Subject: Re: Data Request with a bit more info

The second one worked.

Craig VorosGreat Lakes Environmental Center1295 King AvenueColumbus, OH 43212614-487-1040

On 2/26/2016 12:12 PM, Elias, Mike wrote:

I could not open the version that I just sent, so I am trying again.

From: Craig Voros [mailto:cvoros@glec.com]
Sent: Friday, February 26, 2016 9:38 AM
To: Greg Smith <gsmith@glec.com>; Elias, Mike <Elias.Mike@epa.gov>
Subject: Re: Data Request with a bit more info

Red-lined cadmium draft for review. Please confirm receipt.

Craig VorosGreat Lakes Environmental Center1295 King AvenueColumbus, OH 43212614-487-1040

On 2/26/2016 9:22 AM, Greg Smith wrote:

Now works

On 2/26/2016 9:21 AM, Elias, Mike wrote:

I can give you a call now if that works.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Friday, February 26, 2016 9:02 AM
To: Elias, Mike <Elias.Mike@epa.gov>

Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Hi Mike

Craig had added your text to the document on H. azteca.

The rest of the changes have been made to the document,

but there is one more issue to discuss if you have time for a call this morning.

And we have made all our changes to the Response Table.

Thanks
Greg

On 2/26/2016 8:40 AM, Elias, Mike wrote:

> Greg and Craig,
>
> I am not able to get into Word on the Sharepoint site to make edits to the document. That being said, I only have one minor edit. It is on page 42 of the document. So, I am attaching the text edit for that paragraph in redline/track change mode for you to insert, as was suggested on the call the other day. Please insert this change in track change mode. Once that is done, I have no other changes to the document text at this point.
>
> Could you please send me a copy with your changes in redline via email, and I will take a quick readthrough (will do immediately), then you should be able to finalize and make it 501 compliant.
>
> In the meantime, I will finalize response to comments and prepare to drop those in. I will try to open that smaller response document, but if I

cannot, will ask you to send me the response document, so I can drop my responses in at that time.

Thanks,

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Wednesday, February 24, 2016 11:03 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Hey Mike

Would it be possible to have a call sometime today?

Thanks
Greg

On 2/23/2016 4:38 PM, Elias, Mike wrote:

> Thanks for pointing this out Greg. Is there any lower LOE alternative to illustrating the data w/o just having to say we are not doing something to be responsive? I understand that there may not be.
>
> **From:** Greg Smith [mailto:gsmith@glec.com]
> **Sent:** Tuesday, February 23, 2016 2:44 PM
> **To:** Elias, Mike <Elias.Mike@epa.gov>
> **Cc:** Craig Voros <cvoros@glec.com>
> **Subject:** Re: Data Request with a bit more info

Mike

One consideration to including graphs showing the linear regression to better illustrate the normalization process.

EPA-HQ-OW-2015-0753-0006: "Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process."

EPA-HQ-OW-2015-0753-0006: "Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process."

Is that it will take Keith approximately 4-8 hours to generate the two graphs (a lot of effort to manually normalize the data).

So just wanted to make sure before starting the effort.

Thanks
Greg

On 2/23/2016 1:38 PM, Elias, Mike wrote:

> Greg, I could not get into Edit in Word, so instead made my comments in italics and highlighted in yellow. Please move forward with changes in the document. I think it is almost all responded to at this point. I need to step out, but will be back in a couple of hours.

> **From:** Greg Smith [mailto:gsmith@glec.com]
> **Sent:** Tuesday, February 23, 2016 11:35 AM
> **To:** Elias, Mike <Elias.Mike@epa.gov>
> **Cc:** Craig Voros <cvoros@glec.com>
> **Subject:** Re: Data Request with a bit more info

Mike

So far we have completed all the responses assigned to us in the response table only.

We have not made all the changes to the document. We have only made changes to the document that aren't dependent on the new (revised) criteria values. So if nothing else will change, we can now begin changing the document to reflect the new criteria values and other comments that were assigned to us (the brunt of the work; tables corrections, graphs, values, etc.).

Thanks
Greg

On 2/23/2016 11:16 AM, Elias, Mike wrote:

> I have discussed this with Kathryn. The good news is that we do not need to make any changes to the document before the initiation of the final internal review. However, we will need to review the unmeasured concentrations concurrent with the final Agency review. I can talk with you about a proposed approach to this more tomorrow, but the focus at the moment can be back on finalizing the revisions and comment responses for internal review.
>
> Could you please update me where you are at on your end with revisions?
>
> Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 8:39 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Yes, your understanding is correct.

On 2/23/2016 8:35 AM, Elias, Mike wrote:

So to make sure that I am understanding correctly, if flow through data are not available (i.e., for both static and static renewal), we have for the documents noted:

- Used unmeasured concentrations if measured concentrations are not available

- Used unmeasured concentrations along with measured concentrations if both are available….so they are both given the same priority

Is that a correct understanding? I am trying to sort a few things out and then we should talk.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Tuesday, February 23, 2016 8:04 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>

Subject: Re: Data Request with a bit more info

Hi Mike

Yes we should discuss asap, since to revise the freshwater and saltwater acute values will take some time.

Ex. 5 - Deliberative Process

Examples are acrolein, aluminum, atrazine, carbaryl, chloride, diazinon, manganese, molybdenum, nonylphenol, silver and tributyltin.

Craig and I are in the office all day today for a call.

Thanks
Greg

On 2/23/2016 7:36 AM, Elias, Mike wrote:

> Greg and Craig,
>
> I confirmed with Kathryn that it is acceptable for us to keep the data for salmonids for situations where the pH is 6.5. She is in agreement with our conclusion.

Ex. 5 - Deliberative Process

I am working out of the office today, but should be around except for early afternoon.

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Friday, February 19, 2016 1:21 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Sounds good

On 2/19/2016 1:19 PM, Elias, Mike wrote:

Sorry, pulled away by calls. I will try to give you a call in about 5 mins

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Friday, February 19, 2016 11:23 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Re: Data Request with a bit more info

Mike

Here is a suggested table to fulfill the MDR (this was in the Cd document a couple of years ago before it was removed).

Also need to decide if we want to add tables showing the data used to develop the acute and chronic hardness slopes (current identify them with an * in each appendix).

Thanks
Greg

On 2/19/2016 9:09 AM, Elias, Mike wrote:

Greg and Craig,

I have some answers on the

outstanding questions regarding revisions to the cadmium document, along with some additional tasks, based on my meeting with Kathryn late yesterday. I think this addresses most of the outstanding issues for the current time. We should discuss these when you have time. I am open most of the day. Here is the list:

1. Hyalella azteca inclusion in the chronic value derivation – We are not going to make any changes to calculations for the chronic criterion. I may be adding some additional clarifying text, but that is all in terms of revisions related to this issue.

2. Replacement of N. integer with N. Americana – We should remove N. integer and use N. Americana. Greg and Craig, please make revisions to the tables and text that reflect the additional species that are acceptable in the study from which N. Americana was taken. I will respond to the comment.

3. Please exclude the Chapman 1975 study data for smolt, as per Mebane's comment and revise the tables/text, as appropriate.

We are reviewing some of the other study requests made by Mebane, and should make final conclusions on those shortly

4. Additional items that were not previously discussed.

a. Greg and Craig, please make the following revisions to the document:

i. Add a table summarizing the phyla/family/genera/species used to fulfill the MDRs. The best example of such a table is Table 2 in the ammonia document.

ii. Add tables summarizing the final four species used to develop each criteria value. This is really just repackaging information that is already in the document. Take the list of species at the top of page 42 in the cadmium document, for example, and repackage into a table similar to what is shown in Table 3.6 of the selenium document. Please do that for each of the four criteria values.

b. New issue consideration – Magnesium to calcium ratio/value. Was a magnesium to cadmium ratio or magnesium concentration value used to screen data usability for the hardness slope or toxicity value usability for acute and chronic? I am just not clear on the specific guideline we are following. However, the reason that I am askign is that it looks like we eliminated data for rainbow trout from Davies et al. (1993) from the hardness adjustment based on differences in toxicity due to different levels of hardness based on magnesium. At the same time, it looks like we used the acute and chronic toxicity data from the higher hardness levels of this study in deriving the criteria. Is this contradictory?

Please let me know when you are available to talk about these items.

Thanks,

Mike

From: Greg Smith [mailto:gsmith@glec.com]
Sent: Wednesday, February 17, 2016 3:57 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Cc: Craig Voros <cvoros@glec.com>
Subject: Data Request with a bit more info

Mike

Here is the reproduction info

Methods for H. azteca testing

Only found methods for sediment testing (nothing available for water only tests):

ASTM (2005) has recommended minimum dry weight of 0.15 mg/individual, **reproduction from day 28 to day 42 of >2 young/female**

OECD (1998) does not have recommendations

Environment Canada (2013) Biological Test Methods for H. azteca recommends minimum dry

weight of 0.10 mg/individual.
Nothing on reproduction.

Title

TOPIC 1: Duration should be 24 hours, not one hour

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0012	*UWAG has concerns with EPA's proposal to change the acute freshwater and estuarine/marine criteria averaging duration from 24 hours to 1 hour. The change is not adequately justified and is not supported by new studies in the Draft. The current 24-hour duration should be retained unless a strong scientific justification is presented.* *Every previous iteration of the cadmium criteria has endorsed a 24-hour duration for the acute criteria. EPA appears to be making a policy decision that the acute criteria should be 1 hour, but does not present the associated science to support the revision which is inconsistent with CWA § 304(a)(1), which mandates EPA establish "criteria for water quality accurately reflecting the latest scientific knowledge."* *EPA compares the acute toxicity to ammonia but fails to provide information that compares the time-dependent toxicity of cadmium with ammonia. Furthermore, assessing the toxicity of cadmium during the first 24 hours of an acute test is problematic because the vast majority of published studies reporting the acute toxicity of cadmium do not report patterns of lethality during the first 24 hours. Several acceptable selected studies (Besser et al. 2007; Buhl 1997; Diamond et al. 1997; Mebane et al. 2012; Nebeker 1986) do not report 24-hour LC50s and the one study with relevant data (Duncan and Klavercamp 1983) had a 12-hour LC50 that was five times greater than the 96-hour LC50 (5.35 vs. 1.11 µg/L, respectively). This value would be expected to be similar if cadmium was a fast-acting pollutant.* *An earlier EPA publication (*Speed of Action of Metals Acute Toxicity to Aquatic Life*; EPA-822-R-95-002) also justifies the 24-hour averaging period. This document estimated a kinetic coefficient (*k*) using a regression of LC50 values versus time, with the averaging period being calculated as the inverse of* k*. The larger the* k *value the faster acting the pollutant. None of the estimated averaging periods in the document for freshwater and saltwater species approached 1-hour in the document. The highest estimated* k *values mentioned, for the freshwater fathead minnow, were 6 and 17 hours, with saltwater species having even larger*	**Ex. 5 - Deliberative Process**	No edits.

	values. The selection of the 1-hour averaging period is baseless and arbitrary. *Additionally, the 1985 Guidelines say the duration should be "substantially less than 48 to 96 hours," but do not say that 24 hours is an inappropriate duration and therefore the Guidelines do not support, nor should it be a justification for the proposed revision.*		
EPA-HQ-OW-2015-0753-0012			No edits.
EPA-HQ-OW-2015-0753-0012	*Water Quality-Based Effluent Limits (WQBELs) for cadmium are often expressed as a daily (24-hr) maximum value. Changing the WQBEL to a 1-hour averaging duration could require a permittee to collect several compliance samples during a 24-hour period. This additional burden is unnecessary since there is minor variability of the cadmium levels during a typical 24-hour period, and this additional monitoring is unwarranted without sound scientific basis.*		No edits.
TOPIC 2: H. azteca test by Ingersoll is not acceptable; retest [redacted] criteria development			
Comment Number	**Public Comment**	**Ex. 5 - Deliberative Process**	**Revision Location in 2015 Cadmium Criteria Document**
EPA-HQ-OW-2015-0753-0007	*The proposed chronic criterion is based on a flawed toxicity test (Ingersoll and Kemble 2001) conducted on the amphipod Hyalella azteca. The Hyalella test used in the criterion derivation should be repeated using current feeding procedures that are proven to result in better growth and reproduction. While the IEPA acknowledges and commends the improvements USEPA has made in the assessment and analysis of Hyalella sp. data compared to the 2001 cadmium criteria document, specifically in regards to the sensitivity of this organism to the presence/absence of chloride and bromide in culture and test water, the IEPA contends that the feeding regime employed in the 2000 USGS study is deficient by today's standards and likely resulted in malnourished, stressed test organisms.* *Specifically, test organisms in the 2000 USGS study were underfed*		*Self explanatory*

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EPA HQ-OW-2015-0753-0008	*and/or fed improper diets based on current research. Dr. Soucek, at the Illinois Natural History Survey, conducted new research that focused on determining the appropriate amounts of food for test organisms. His research has led to improved growth of test organisms compared to earlier diet regimes. The diet used in the 2000 USGS study consisted of a ration of 1.0 ml YCT/d, whereas Dr. Soucek's research contends that a diet consisting of Tetramin supplemented with diatoms greatly improves growth and reproduction of Hyalella azteca compared to YCT-only diets (Soucek et al. 2016, in press).* *The diet in the 2000 USGS study restricted growth and fecundity when compared to Tetramin-based diets (Soucek et al. 2016, in press), and brings into question the accuracy of the test results.*	**Ex. 5 - Deliberative Process**	
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*Test organisms in the 2000 USGS study did not attain minimum growth requirements based on the direct measure of organism weight, with the average dry weight of the controls being 0.27 mg/individual (<0.50 mg/individual). USEPA concluded that the dry weights measured in the test were inaccurate and subsequently used length data to extrapolate to dry weight via a regression equation. However there is no documentation provided for this equation or how it was derived. It is unlikely that the dry weights were underestimated (while an overestimation can be expected due to inadequate drying of test organisms), and it is therefore considered unlikely that the organisms achieved the minimum weight requirements for this test to be valid.*		No edits.
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*The dilution series (control and 5 treatment concentrations: 0.1, 0.3, 0.5, 2.0 and 3.0 µg/L.) used in the 2000 USGS test did not appropriately bracket the effect concentration. The dilution series was not standard, with a large gap in concentration between the NOEC and LOEC (0.5 and 2.0 µg/L, respectively). While a point estimation technique was used to determine the effect concentration, the lack of a 1.0 µg/L treatment may have changed this estimation. The precision of this estimation is paramount, as the test result was the sole determinant of the GMCV, which is the most sensitive in the chronic dataset, and a small change in the GMCV can therefore have a substantial effect on the final chronic value.*		No edits.
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-*	*At this time, the IEPA is in support of the adoption of the acute cadmium criterion as proposed, but is requesting a one year extension for the adoption of the chronic criterion. A one year extension would allow for a retest on Hyalella azteca using current feeding recommendations and would allow for revisions to be made to the chronic criterion. A round robin approach would ensure that the data are obtained using the appropriate test*		*Self explanatory*

2015-0753-0008	*procedures and would provide additional information regarding the sensitivity of Hyalella azteca to cadmium. If time does not permit a repeat of the test, then the chronic criterion should be recalculated with the Hyalella data removed.*		

TOPIC 3: Dissolved vs total concentration use

Comment Number	Public Comment		Revision Location in 2015 Cadmium Criteria Document
EPA HQ-OW-2015-0753-0005	*Additional documentation is needed to support the total to dissolved conversion factors. Very little information is provided concerning the derivation of the conversion factors, and more detailed information is needed to fully assess their appropriateness for natural waterbodies.*		Section 2.6
EPA HQ-OW-2015-0753-0005	*It is unknown if the solutions prepared from Cd salts, that were used to develop the conversion factors, adequately represent the forms of Cd found in natural waterbodies.*		Section 2.6

Ex. 5 - Deliberative Process

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EPA HQ-OW-2015-0753-0005	*An explanation is needed as to why the conversion factors for the acute and chronic criteria are different. It also appears illogical that the constant conversion factor of 0.994 used for marine water is higher than freshwater, especially because the hardness-dependent conversion factor for freshwater decreases as hardness increases.*	**Ex. 5 - Deliberative Process**	Section 2.6
EPA HQ-OW-2015-0753-0005	*While it is noted in several places in the document, clarify that the recommended criteria values are expressed as dissolved cadmium concentrations (not total). Also clarify if states have the option to adopt total Cd criteria values.*		No edits.
EPA HQ-OW-2015-0753-0011	*Kansas has utilized the total recoverable metals criteria and data, and is not set up to sample for total dissolved metals. A conversion factor would be applied to calculate the dissolved concentration and Kansas recommends that EPA retain this flexibility in its final criteria.*		No edits.

TOPIC 4: Data inclusion in criteria derivation

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0006	*Some of the values that are new/revised since the 2001 AWQC document are from studies that were published before 2001. Table 22 has general information describing why GMAVs have changed between the 2001 and 2015 document, but it does not provide details on why these "new" data were now considered acceptable.*	**Ex. 5 - Deliberative Process**	No edits

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	Include another table that describes why the studies that were excluded previously are now included.	Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0013	*Should toxicity tests conducted under less-than optimal conditions be discounted? This comment goes beyond just the test results for Hyalella, because while laboratory tests used for criteria development use conditions that are as close to optimal as possible, wild populations in diverse natural conditions are often exposed to conditions that sub-optimal, and therefore laboratory tests may be underprotective in natural conditions (i.e., additional stresses) (see, Holmstrump et al. 2010; Besser et al. 2015).*		*Self explanatory*
EPA-HQ-OW-2015-0753-0013	*"Other data" are not addressed consistent with the Guidelines. While these data are not used in the species sensitivity distribution rankings, they should not be thrown away, discounted, or deemed "unacceptable." "Other Data" can be invoked to lower a criterion (e.g., chronic value in the 1987 selenium criterion). Revaluate Riddel et al. (2005a, b) and include a larger discussion of their effect concentrations/findings and other similar behavioral/ecological studies.*		Section 5 and 5.2
EPA-HQ-OW-2015-0753-0013	*With many organisms, a strong difference in the sensitivity of different life stages makes it inappropriate to roll up data from different developmental stages. Pooling salmonid effects concentrations across developmental stages to obtain a SMAV could produce a misleading result (see, Hansen et al. 2002; Mebane et al. 2012; Chapman 1978; Chapman and Stevens 1978).*		Appendix A Ranked FW Acute Table
EPA-HQ-OW-2015-0753-0013	*The decision to only use ELS chronic data in which the exposures began in the egg stage, and to exclude long-term data in which the exposures began in the fry stage is non-conservative.*		No edits.

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EPA-HQ-OW-2015-0753-0013	*SMAV calculations tagged with the footnote "C", indicating that "Data not used to calculate SMAV because more sensitive lifestage available, or flow-through measured test available", should be separated into two different footnotes since they are very different reasons.*	Ex. 5 - Deliberative Process	Appendix A and Appendix B
EPA-HQ-OW-2015-0753-0013	*Address the following Appendix A specific errors/changes:* • *Daphnia magna (various)* o *Many "S,U" tests (tests with unmeasured concentrations) are underlined, indicating they are included in the SMAV calculations. These should be excluded per the Guidelines.*		Appendix A Ranked FW Acute Table
	• *Mayfly (formerly, Ephemerella grandis) Drunella grandis* o *Tested species was listed in the source document as Ephemerella subvaria, which is still a valid species name according to ITIS.gov.*		

	• *Rainbow trout (smolt), Chapman 1975 (>2.9 µg/L)*
	  o *Should be excluded from SMAV because it is from a resistant life stage. Also, should be listed as "Rainbow trout (Steelhead smolt)" as Steelhead are not just Rainbow Trout by a different name, but have physiological differences in regard to ion regulation. Chapman (1975) should only be cited when no alternative exists, because it was never formally released by EPA and is not publicly available online. Chapman (1978) reports the same data and is a better citation.*
	• *Rainbow trout (smolt), Chapman 1975 (4.1 µg/L)*
	  o *Suspect value, exclude from SMAV. Chapman (1978) lists the value for the same test as >2.9 µg/L. Chapman (1978) is the peer-reviewed publication of record for these data; Chapman (1975) was an unpublished, work-in-progress progress report that sometimes still gets cited because it includes data never published elsewhere, such as the coho data shown in the figure in this memo. Exclude from SMAV, resistant life stage and re-label as " "Rainbow trout (Steelhead smolt". See Chapman*		

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	(1978, Table 3).
	• *Rainbow trout (299 mg), Stratus (1.29 µg/L)*
	  o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with unmanipulated pH of 7.5 were much more sensitive*
	• *Chinook salmon (parr, 11.58g) (3.5 µg/L)*
	  o *Exclude value from SMAV, based on a resistant life stage being tested. Value is twice as high as the value obtained with swim-up fry in matched tests and confidence limits don't overlap.*
	• *Chinook salmon (smolt, 32.46 g) (>2.9 µg/L)*
	  o *Should be excluded from SMAV, based on a resistant life stage being tested .*
	• *Bull trout (84.2 mg) (2.89 µg/L)*
	  o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with a natural pH of 7.5 were much more sensitive*
	• *Colorado squawfish*
	  o *Old common name is now considered repugnant. AFS calls it "Colorado pikeminnow". "Pikeminnow" is one word.*
		Ex. 5 - Deliberative Process	

EPA-HQ-OW-2015-0753-0013	*Address the following Appendix C specific errors/changes:* • *Snail, Aplexa hyporum (Holcombe) (4.0 µg/L)* o *I got an EC20 of about 2.6 µg/L. By excluding the highest treatment with total mortality I could reproduce the 4.0 EC20 value, but it had a poor fit with Y0.*		No edits

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		Ex. 5 - Deliberative Process	

EPA-HQ-OW-2015-0753-0013	*Add the following additional relevant data:*
	• *Pascoe and Mattey 1977*
	  o *Chronic stickleback exposure*
	• *Wang et al. 2014*
	  o *Chronic fathead full life-cycle test*
	• *Brinkman and Vieira 2008*
	  o *Acute and chronic mountain whitefish*
	• *Mebane et al. 2014 (paper provided)*
	  o *Effects of cadmium on larval aquatic insect communities in 30-day experimental stream tests*
			Mebane et al. (2014) added to Section 5.2

TOPIC 5: Species use and availability

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document

ED_000992_00002483-00010

EPA-HQ-OW-2015-0753-0014	*There is concern about the focus on fish in developing the criteria. EPA needs to bring in other species including insects and freshwater mussels into the process when developing criteria for cadmium. This lack of additional species prevents a more holistic picture of the freshwater community, and results in criteria that are not protective of all aquatic-dependent wildlife. EPA has consistently failed to fully consider aquatic-dependent wildlife in the development of national criteria.*	**Ex. 5 - Deliberative Process**	*Self explanatory*
EPA-HQ-OW-2015-0753-0010	*There is concern with the continued lack of estuarine/marine chronic cadmium toxicity data and that no new chronic toxicity data have been generated since 2001. EPA should conduct additional chronic toxicity studies (particularly with vertebrate species) to expand the estuarine/marine chronic toxicity dataset. More estuarine/marine chronic data are needed to develop a scientifically reliable chronic cadmium criterion.*		*Self explanatory*
EPA-HQ-OW-2015-0753-0010	*The mysid Neomysis integer is a new species added to the estuarine/marine acute dataset, but this mysid is potentially non-native to the United States. Since there are available values for two other native mysid species (M. bigelowi and A. bahia), this non-native species should be removed (unless documentation is provided confirming it is naturally occurring within waters of North America).*		Section 3.2.1 and Appendix B

TOPIC 6: ESA considerations

ED_000992_00002483-00011

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	**Ex. 5 - Deliberative Process**	*Self explanatory*
EPA-HQ-OW-2015-0753-0014	*To ensure the final cadmium water quality criteria to is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*		*Self explanatory*
EPA HQ-OW-2015-0753-0009	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to account for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft*		No edits.

	recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0009	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*		No edits.
EPA HQ-OW-2015-0753-0015	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a Section 7 Consultation.*		*Self explanatory*
EPA HQ-OW-2015-0753-0015	*EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold*		No edits.

	Oregon's criterion and would be expected to result in more severe effects. *Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.*	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0015	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*		No edits.
EPA HQ-OW-2015-0753-0015	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*		No edits.
EPA HQ-OW-2015-0753-0015	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*		No edits.

TOPIC 7: Other

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014	*In the description of sources of cadmium in the document, EPA overlooked the contribution from coal combustion, coal mining waste, and coal ash ponds spills, seepage, and discharge. These important sources need to be recognized and addressed.*	Ex. 5 - Deliberative Process	Section 2.1

EPA-HQ-OW-2015-0753-0006	*Check the document for errors and typos. Specific examples include:*
	• *Pg.27 which is intended to provide an acute criterion protective of nearly all individuals in the distribution (Stephan et al.* ***1985);the*** *FAV/2 approach was developed to estimate minimal effect levels,*
	• *Pg.30 This outcome was based on the poor correlation between hardness and acute toxicity for D. magna and occurred only when tests with* ***less than*** *24-hr old neonates were included in the database. Accordingly, only the five D. magna tests from Chapman et al. (1980} initiated with* ***less than*** *24-hr old neonates were used for the analysis*
	• *Pg.33 Two species of sculpin, Cottus bairdii and Cottus confusus, are used to derive the normalized GMAV of* ***4.962*** *µg Cd/L*
	  o ***Per Appendix A, this value should be 4.926***
	• *Pg.34 The hardness-normalized GMAV of* ***7.911*** *µg/L total cadmium for the genus Oncorhynchus is the fifth lowest in the acute dataset*
	  o ***Per Appendix A, this value should be 7.841 ***
	• *Pg.42 2. Ceriodaphnia, Cladoceran (GMCV=****1.293µg/l*** *total Cd)*
	• *Pg. 74 Acceptable chronic toxicity* ***data*** *are available for 27 freshwater species representing 20 different genera*
	• *Pg. C-8 [d] Not used to calculate* ***SMAV*** *because either a more definitive value available, value is considered an outlier, or preference was given to the more sensitive exposure scenario (LC versus ELS tests).*
			Various locations

EPA-HQ-OW-2015-0753-0006	*While Table 5 summarizes the Phyla, Families, Genera, and Species used to derive the revised criterion, it is unclear which species were used to meet each of the MDRs. Include a table that lists the eight requirements and the species used to fulfill them.*		Table 5
EPA-HQ-OW-	*Verify that the Spehar and Fiandt 1986 data for Pimephales promelas is appropriate to include in the freshwater acute*		Appendix Table A-1,

2015-0753-0006	*hardness correction.*	**Ex. 5 - Deliberative Process**	A-2, C-1 and C-2
EPA-HQ-OW-2015-0753-0006	*Expand Table 6 to include the actual data that were used in the freshwater acute hardness correction for each species.*		Appendix Table A-2
EPA-HQ-OW-2015-0753-0006	*Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process.*		Figure 2
EPA-HQ-OW-2015-0753-0006	*Indicate how the R^2 value of 0.964 was obtained in the freshwater acute hardness correction. Attempts to replicate the value resulted in a slope of 1.104 and R^2 of 0.698.* *Indicate how the R^2 value of 0.841 was obtained in the freshwater chronic hardness correction. Attempts to replicate the value resulted in a slope of 0.798 and R^2 of 0.632.*		No edits
EPA-HQ-OW-2015-0753-0006	*It was not apparent if the MATC or EC_{20} value was used for the freshwater chronic slope derivation. Indicate which of the toxicity values were used in the derivation in Appendix C and Table 8.*		Appendix Table C-2
EPA-HQ-OW-2015-0753-0006	*Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process.*		Figure 4
EPA-HQ-OW-2015-0753-0006	*The language that describes the computation of the final acute value on pg. 32 is insufficient. Include a reference to section 4.3.1 after the reference to Figure 2 on page 32.*		Section 3.1.1

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EPA-HQ-OW-2015-0753-0006	*It is unclear how the intercept of the freshwater acute and chronic criterion equations were derived. Add additional language to clarify how these values were derived.*	**Ex. 5 - Deliberative Process**	No edits

To: Ingersoll, Christopher[cingersoll@usgs.gov]
From: Elias, Mike
Sent: Tue 1/19/2016 6:17:01 PM
Subject: RE: FW: Cost to conduct acute and chronic Hyalella azteca cadmium toxicity test

9am eastern tomorrow would be great. I will plan on giving you a call at that time. Thanks!

From: Ingersoll, Christopher [mailto:cingersoll@usgs.gov]
Sent: Tuesday, January 19, 2016 1:13 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Subject: Re: FW: Cost to conduct acute and chronic Hyalella azteca cadmium toxicity test

Mike:

I am available now to talk if you would like.

I may not be staying at the office much past 3 pm eastern time today, given we are getting some snow this afternoon.

Alternatively, my schedule is wide open to talk Wednesday morning, perhaps at 9 am eastern time tomorrow?

Chris Ingersoll

Columbia Environmental Research Center, U.S. Geological Survey

4200 New Haven Rd, Columbia, MO 65201, 573/876-1819 (work), -1896 (fax)

cingersoll@usgs.gov, http://igskrgcbwb01050/StaffMembers.aspx?StaffMemberId=192

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_>/ _ "Almost never a bad time to ride a bike"

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On Tue, Jan 19, 2016 at 11:17 AM, Elias, Mike <Elias.Mike@epa.gov> wrote:

Chris,

I just realized that I was thinking backwards in terms of the time difference, and our call is actually set for 2pm EST, and not 12pm EST. Please disregard my voicemail that I just left you.

However, I have a conflict with another meeting at 2pm EST. I was wondering if 3 or 4pm EST might work for you instead? I am also open tomorrow, except between 10 and 11, and 2:30 and 4pm EST tomorrow, if that would work better.

Thank you,

Mike

From: Ingersoll, Christopher [mailto:cingersoll@usgs.gov]
Sent: Wednesday, January 13, 2016 9:49 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Subject: Re: FW: Cost to conduct acute and chronic Hyalella azteca cadmium toxicity test

Mike:

Great. Let's plan to talk Tues Jan 19th at 1 pm central time at my phone number below.

Chris Ingersoll

Columbia Environmental Research Center, U.S. Geological Survey

4200 New Haven Rd, Columbia, MO 65201, 573/876-1819 (work), -1896 (fax)

cingersoll@usgs.gov, http://igskrgcbwb01050/StaffMembers.aspx?StaffMemberId=192

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On Wed, Jan 13, 2016 at 6:39 AM, Elias, Mike <Elias.Mike@epa.gov> wrote:

Chris,

Tuesday at 1pm would be great. I don't think this will take a long time, but I would like to be able to be able to strengthen my understanding of the analysis that was done to be able to address some stakeholder questions. I can just call you at the number below, unless you let me know otherwise.

Thanks,

Mike

From: Ingersoll, Christopher [mailto:cingersoll@usgs.gov]
Sent: Tuesday, January 12, 2016 2:12 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Subject: Re: FW: Cost to conduct acute and chronic Hyalella azteca cadmium toxicity test

Mike:

I forgot that Monday is a holiday.

I am in meeting Tuesday morning.

How about we plan to talk at 1 pm central time Tuesday January 19th?

Chris Ingersoll

Columbia Environmental Research Center, U.S. Geological Survey

4200 New Haven Rd, Columbia, MO 65201, 573/876-1819 (work), -1896 (fax)

cingersoll@usgs.gov, http://igskrgcbwb01050/StaffMembers.aspx?StaffMemberId=192

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On Tue, Jan 12, 2016 at 12:52 PM, Elias, Mike <Elias.Mike@epa.gov> wrote:

Thanks Chris. It looks like Monday is a federal holiday so I will be out, but I am currently open on Tuesday, except between 10 and 12am EST. Would sometime on Tuesday work for you? Alternatively, I am around all other days that week.

Thanks!

Mike

From: Ingersoll, Christopher [mailto:cingersoll@usgs.gov]
Sent: Monday, January 11, 2016 11:30 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Subject: Re: FW: Cost to conduct acute and chronic Hyalella azteca cadmium toxicity test

Mike:

My schedule is fairly open next week. Perhaps we could talk at 1 pm central time Monday Jan 18th?

Chris Ingersoll

Columbia Environmental Research Center, U.S. Geological Survey

4200 New Haven Rd, Columbia, MO 65201, 573/876-1819 (work), -1896 (fax)

cingersoll@usgs.gov, http://igskrgcbwb01050/StaffMembers.aspx?StaffMemberId=192

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On Mon, Jan 11, 2016 at 10:25 AM, Elias, Mike <Elias.Mike@epa.gov> wrote:

Chris, Thanks for your email. I am booked today during that time. It would be great if we can talk next week. Thanks!

Mike

From: Ingersoll, Christopher [mailto:cingersoll@usgs.gov]
Sent: Monday, January 11, 2016 10:21 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Subject: Re: FW: Cost to conduct acute and chronic Hyalella azteca cadmium toxicity test

Mike:

I am on travel this week. I can participate on a call between noon to 2 pm central time today if that works for you.

Alternatively, can we talk next week?

Chris Ingersoll

Columbia Environmental Research Center, U.S. Geological Survey

4200 New Haven Rd, Columbia, MO 65201, 573/876-1819 (work), -1896 (fax)

cingersoll@usgs.gov, http://igskrgcbwb01050/StaffMembers.aspx?StaffMemberId=192

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On Fri, Jan 8, 2016 at 12:57 PM, Elias, Mike <Elias.Mike@epa.gov> wrote:

Hi Chris,

Ex. 5 - Deliberative Process

Thanks!

Mike Elias

Mike Elias | Biologist

Ecological Risk Assessment Branch | Health and Ecological Criteria Division

Office of Science and Technology | Office of Water

U.S. Environmental Protection Agency

1200 Pennsylvania Avenue, NW, Washington, DC 20460

(202) 566-0120 | elias.mike@epa.gov

From: Eignor, Diana
Sent: Thursday, January 07, 2016 2:10 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Subject: FW: Cost to conduct acute and chronic Hyalella azteca cadmium toxicity test

Diana M. Eignor
USEPA/Office of Water/Office of Science and Technology
1200 Pennsylvania Ave.,N.W., MC 4304T
Washington, DC 20460
PHONE: 202-566-1143 FAX: 202-566-1140

Courier/FEDEx Address:
US EPA
Office of Water
Office of Science and Technology
Health and Ecological Criteria Division
Room 5233L
5th Floor Connecting Wing
1301 Constitution Avenue, NW
Washington, DC 20460

From: Ingersoll, Christopher [mailto:cingersoll@usgs.gov]
Sent: Thursday, January 07, 2016 1:49 PM
To: Eignor, Diana <Eignor.Diana@epa.gov>
Cc: Ning Wang <nwang@usgs.gov>; John M Besser <jbesser@usgs.gov>; cmebane@usgs.gov

Subject: Re: Cost to conduct acute and chronic Hyalella azteca cadmium toxicity test

Ex. 5 - Deliberative Process

Chris Ingersoll

Columbia Environmental Research Center, U.S. Geological Survey

4200 New Haven Rd, Columbia, MO 65201, 573/876-1819 (work), -1896 (fax)

cingersoll@usgs.gov, http://igskrgcbwb01050/StaffMembers.aspx?StaffMemberId=192

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On Thu, Jan 7, 2016 at 10:57 AM, Eignor, Diana <Eignor.Diana@epa.gov> wrote:

Chris-

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Thanks.

Diana

Diana M. Eignor
USEPA/Office of Water/Office of Science and Technology
1200 Pennsylvania Ave.,N.W., MC 4304T
Washington, DC 20460
PHONE: 202-566-1143 FAX: 202-566-1140

Courier/FEDEx Address:
US EPA
Office of Water
Office of Science and Technology
Health and Ecological Criteria Division
Room 5233L
5th Floor Connecting Wing
1301 Constitution Avenue, NW
Washington, DC 20460

From: Ingersoll, Christopher [mailto:cingersoll@usgs.gov]
Sent: Tuesday, December 29, 2015 3:04 PM
To: Eignor, Diana <Eignor.Diana@epa.gov>
Cc: Ning Wang <nwang@usgs.gov>; John M Besser <jbesser@usgs.gov>; mdmunn@usgs.gov
Subject: Re: Cost to conduct acute and chronic Hyalella azteca cadmium toxicity test

Diana:

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Chris Ingersoll

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On Tue, Dec 29, 2015 at 12:52 PM, Eignor, Diana
<Eignor.Diana@epa.gov> wrote:

Ex. 5 - Deliberative Process

Diana

Diana M. Eignor
USEPA/Office of Water/Office of Science and Technology
1200 Pennsylvania Ave.,N.W., MC 4304T
Washington, DC 20460
PHONE: 202-566-1143 FAX: 202-566-1140

Courier/FEDEx Address:
US EPA
Office of Water
Office of Science and Technology
Health and Ecological Criteria Division
Room 5233L
5th Floor Connecting Wing
1301 Constitution Avenue, NW
Washington, DC 20460

From: Ingersoll, Christopher [mailto:cingersoll@usgs.gov]
Sent: Monday, December 28, 2015 8:22 AM
To: Eignor, Diana <Eignor.Diana@epa.gov>
Cc: Ning Wang <nwang@usgs.gov>; John M Besser <jbesser@usgs.gov>
Subject: Cost to conduct acute and chronic Hyalella azteca cadmium toxicity test

Diana:

Ex. 5 - Deliberative Process

Hope you are having a good holiday,

Chris Ingersoll

Columbia Environmental Research Center, U.S. Geological Survey

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cingersoll@usgs.gov, http://igskrgcbwb01050/StaffMembers.aspx?StaffMemberId=192

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Cadmium Federal Register Notice (Elias)

On December 1, EPA published the draft cadmium criteria document in the *Federal Register*. The 60-day public comment period ends on February 1. The document has undergone two rounds of Agency review and an external peer review. The external peer review report and EPA's response are available on the Agency's website.[1] EPA plans to publish the final criteria in late spring.

EPA last updated the criteria in 2001. The revised criteria include updates to both the acute and chronic freshwater and saltwater values, which are primarily based on new toxicity data. EPA also is incorporating 70 new species and 49 new genera into the document. For the freshwater criteria, hardness remains the primary driver. The proposed values are similar to those adopted in 2001, as shown in the following table.

	2001 Criteria		**2015 Proposed Criteria**	
	Acute	**Chronic**	**Acute**	**Chronic**
Freshwater	2.0 µg/L	0.25 µg/L	2.1 µg/L	0.73 µg/L
Saltwater	40 µg/L	8.3 µg/L	35 µg/L	8.3 µg/L

Ex. 5 - Deliberative Process

[1] See http://www.epa.gov/wqc/aquatic-life-criteria-cadmium.

Cadmium Aquatic Life Ambient Water Quality Criteria
Briefing for OST Office Director
November 17, 2015

Purpose of briefing: Obtain OD's approval for publication of the draft cadmium criteria document in the Federal Register to solicit public comments.

I. Overview of 2015 Draft Cadmium Aquatic Life Criteria Update

- Current draft criteria update revises acute and chronic freshwater and estuarine/marine criteria; values were last updated in 2001
- Criteria revisions are based on new toxicity test data; no major changes in scientific approach
  - Freshwater acute and chronic are hardness-dependent
  - Direct exposure effects to aquatic animals remains focus of evaluation
    - Direct exposure effects occur at lower concentrations than bioaccumulation effects
- Criteria values are very close to what they were in 2001, indicating previous criteria were robust
  - Revised acute criteria decrease in stringency (higher concentration values) while revised chronic criteria slightly increase in stringency over 2001 values presented
- Timeline consideration: Oregon Toxics Lawsuit brought by Northwest Environmental Advocates
  - OST is working to meet a potential settlement agreement with NWEA to propose cadmium criteria for Oregon by March 31, 2016 and finalize by January 16, 2017
    - The settlement agreement and criteria revision were driven by a jeopardy call by NMFS for acute cadmium in 2012
    - EPA determined new data were available to evaluate toxicity of cadmium
  - The 304(a) national criteria will be the basis for this rulemaking; thus the cadmium draft 304(a) criteria are intended to be proposed on November 30, 2015 and finalized by March 30, 2016, to support the development of the March 30, 2016 rulemaking for the state

II. Cadmium Occurrence, Uses and Sources of Contamination

- Occurs in the environment at low concentrations, primarily as mineral deposits (e.g., 0.1-0.2 ppm)
- No current active cadmium mines in the US, but three companies produced refined cadmium in 2014
  - One (in Tennessee) produced refined cadmium by leaching/roasting and as a byproduct of zinc production
  - Two (in Ohio and Pennsylvania) recovered cadmium from scrap materials
- Domestic production from recycling and refining was estimated at 637 metric tons in 2010; subsequent data has been withheld as proprietary
- NiCd batteries account for >80% of global consumption; other common industrial uses include pigments, coatings/platings and stabilizers
- More recently used in manufacture of nanoparticles (quantum dots) for photovoltaic devices (e.g., solar cells and emitters for color displays)
- Primary widespread sources to the environment:
  - Anthropogenic sources account for > 90% of environmental release
  - Major anthropogenic sources: Fossil fuel combustion, cement manufacturing, metal smelting, and phosphate fertilizer application
- Legacy mining sites (e.g., Colorado) represent localized sources

III. 2015 Draft Cadmium Criteria

Table 1. 2015 updated criteria values compared to the existing 2001 current criteria, based on a hardness equation

Waterbody Type	2015 AWQC Update (dissolved cadmium in µg/L)		2001 AWQC Update (dissolved cadmium in µg/L)	
	Acute (1-day)	Chronic (4-day)	Acute (1-day	Chronic (4-day)
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)	2.1 [a]	0.73	2.0 [a]	0.25
Estuarine/marine	35	8.3	40	8.8

[a] Lowered to protect the commercially and recreationally important rainbow trout, as per the 1985 Guidelines, Stephen et al. Acute value prior to lowering is 3.0 µg/L.

Table 2. Number of tested aquatic species included in criteria derivation over time

	Freshwater Acute	Freshwater Chronic	Estuarine/Marine Acute	Estuarine/Marine Chronic
1980	29	13	31	1
2001	65	21	61	2
2015	99	27	94	2

IV. Anticipated Reaction

Ex. 5 - Deliberative Process

V. Next Steps

Table 3. Overview of Milestones

Action	Date
Agency Workgroup Draft Review	4/20/15 – 5/20/15
External Peer Draft Review	8/22/15-9/25/15
Second Agency Workgroup Period- Revised Draft	11/2/15 – 11/10/15
Initiate 60 Day Public Comment Period/Revisions	11/30/15 – 2/28/16
Agency Workgroup Review of Final Document	2/28/16 – 3/15/16
FRN Publication	3/30/16

Appendix A. Detailed information on sensitive species and new data

1. **Freshwater Criteria Development**
   - **A. Acute**
     - i. Fish are drivers of the acute criterion value
     - ii. 75 freshwater genera for acute toxicity (compared to 55 in 2001)
       - a. 14 of 19 added genera are invertebrates
     - iii. CMC was lowered to be protective of the commercially and recreationally important rainbow trout

Table A1. Most acutely sensitive freshwater aquatic organisms tested (ranked most to least sensitive)

Rank	Species	GMAV (µg/L)
1	Bull Trout	4.750
2	Mottled Sculpin	4.926
3	Striped Bass	5.883
4	Brown Trout	6.066
5	Chinook Salmon (SMAV = 9.888 µg/L)	7.841
	Rainbow Trout (SMAV = 4.468 µg/L)	
	Coho Salmon (SMAV = 14.34 µg/L)	
	Cutthroat Trout (SMAV = 5.966 µg/L)	

   - **B. Chronic**
     - i. Invertebrates are drivers of chronic value
     - ii. 20 freshwater genera for chronic toxicity (compared to 16 in 2001)
     - iii. 3 of 4 newly-added genera are invertebrates
       - a. Benthic worm (*Lumbriculus*)
       - b. Freshwater snail (*Lymnaea*)
       - c. Freshwater mussel (*Lampsilis*)
       - d. Freshwater fish- sculpin (*Cottus*)
     - iv. Freshwater CCC increased from 0.25 µg/L to 0.71 µg/L based primarily on inclusion of four new genera, and re-evaluation of amphipod data

Table A2. Most chronically sensitive freshwater aquatic organisms tested

Rank	Species	GMCV (µg/L)
1	Amphipod, *H. azteca*	0.7454
2	Cladoceran, *Ceriodaphnia*	1.293
3	Mottled sculpin	1.721
4	Midge, *Chironomus*	2.000

2. **Estuarine/Marine Criteria Development**
   - **A. Acute**
     - i. 79 estuarine/marine genera for acute toxicity (compared to 54 in 2001)
     - ii. 20 of 24 added genera are invertebrates
     - iii. Three invertebrates and striped bass (*Morone saxatilis*) are drivers of FAV, with moon jellyfish (*Auerelia aurita*) newly-added to the calculation of FAV

iv. Estuarine/marine acute value decreased from 40 µg/L to 35 µg/L based primarily on addition of two of the new genera
    a. Opossum shrimp (*Neomysis*)
    b. Moon jellyfish (*Aurelia*)

Table A3. Most acutely sensitive saltwater aquatic organisms tested

Rank	Species	GMAV (µg/L)
1	Harpacticoid copepod (*Tigriopus brevicornis*)	29.14
2	Moon jellyfish (*Aurelia aurita*)	61.75
3	Mysid (*Neomysis integer*)	65.25
4	Mysid (*Americamysis bahia* and *bigelowi*)	67.39
5	Striped bass (*Morone saxatilis*)	75.0

B. Chronic

i. No new chronic toxicity data available since 2001
ii. This is the only criteria category for which there was insufficient data to develop a sensitivity distribution; thus the value is based on a ratio of acute-to-chronic toxicity
iii. Estuarine/marine CCC increased from 8.8 µg/L to 11 µg/L based primarily on a decrease in the acute-chronic ratio with the incorporation of two freshwater species in the acute-to-chronic ratio
    a. Mottled sculpin (*Cottus bairdii*)
    b. Fatmucket clam (*Lampsilis siliquoidea*)

Table A4. Saltwater aquatic organisms tested for chronic effects

Rank	Species	GMCV (µg/L)
1	Mysid (*Americamysis bahia* and *bigelowi*)	8.449

Appendix B. Overview of External Peer Review

Table B1. List of External Peer Reviewers

Ex. 5 - Deliberative Process

Summary of Major Peer Review Comments and Resolution

1. **Major Comment #1 Summary:** The potential importance of bioaccumulation was not adequately addressed in the document, particularly as it relates to the dietary exposure route.

   Addressing Major Comment #1
   - Extensive additional write-up was added detailing bioaccumulation in fish and invertebrates and discussing exposure routes
     - Incorporates 20 additional papers over peer review draft
   - Revision will not change outcome
     - Available data indicates that at chronic criteria concentrations, cadmium is unlike to accumulate to levels causing effect
     - Data are not adequate to define acceptable tissue concentration or dietary level

2. **Major Comment #2 Summary:** *Hyalella* tests were selectively used in the chronic criteria development. It was unclear why these species were selectively chosen for detailed evaluation.

   Background Information
   - Most *Hyalella* tests were removed from chronic tests based on substandard test conditions (inadequate food, inadequate water quality for optimal control results- low chloride)
   - *Hyalella* was the most sensitive species tested; several of the EC20 values eliminated were lower than the value used

   Addressing Comment #2:
   - ORD/MED lab re-examined data. Conclusion: 42d test reproduction endpoint is acceptable. Data used. Conclusion was based on detailed evaluation of individual tests by ORD/MED, and were discussed with the USGS authors and the peer reviewer making the comment

3. **Major Comment #3 Summary:** One reviewer indicated the Acute-to-Chronic ratio should not incorporate the data for the freshwater mussel fatmucket; one reviewer indicated freshwater species should not be included

   Background Information
   - FACR of 6.254 was obtained from the geometric mean of four ACRs
     - Two based on estuarine/marine mysids (5.275 for *Americamysis bahia* and 9.476 for *A.*

bigelowi)
- Two based on freshwater species
  - Mottled sculpin, *Cottus bairdii* (11.22)
  - Fatmucket, *Lampsilis siliquoidea* (2.727)

Addressing Comment #3
- Seven possible approaches were reviewed for revising FACR
- Most scientifically-defensible approach was selected
- FACR now incorporates six freshwater genus-level ACRs and one estuarine/marine genus-level ACR comprised of acutely-sensitive species

4. **Major Comment #4 Summary:** Dissolved Organic Carbon (DOC) and (to a lesser extent) other water quality parameters that can affect cadmium toxicity, in addition to hardness, have not been addressed in the criteria document. A BLM should be incorporated to account for these parameters.

Addressing Comment #4
- EPA will respond to comment acknowledging that DOC, alkalinity, and pH has potential to influence toxicity and the applicability of the BLM will be considered in future revisions
- Text will be added indicating that tests were conducted at low DOC levels, which will result in conservative criteria values

Secondary Comments

5. **Comment Summary #5:** Reviewer suggested using Early Life Stage (ELS) tests over Life Cycle (LC) tests if ELS results indicate a more sensitive endpoint. 1985 Guidelines recommend generally using LC test data when available. Comment related to 30d tests with salmonids that started with fry vs 60d tests that started with eggs and embryos.

Addressing Comment #5
- Trend of sensitivity is inconsistent when individual tests are considered
  - ELS test most sensitive for rainbow trout and brown trout
  - LC test most sensitive for brook trout
- Evaluated geometric mean of SMCVs across useable tests; incorporating the most sensitive ELS test species

6. **Comment Summary #6:** Non-native species to North America should not be included in the dataset. Specific species cited were *Oreochromis species, Danio rerio, and Xenopus laevis.*

Addressing Comment #6
- Considered including due to evidence of reproducing population
- Xenopus is used in ammonia criteria
- Included species based on presence and potential reproducing populations in North America

To: Elias, Mike[Elias.Mike@epa.gov]
From: Elias, Mike
Sent: Mon 12/7/2015 6:14:07 PM
Subject: FW: Talking Points for Stakeholder notifications for upcoming draft Cd criteria release
Talking Points for Draft Cadmium Criteria Release for Public Comment 11-24-15.docx
ROLL OUT Cadmium WQC 11 30 15_Betsy Edits.docx

From: Gallagher, Kathryn
Sent: Tuesday, November 24, 2015 7:06 PM
To: Behl, Betsy <Behl.Betsy@epa.gov>
Cc: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>; Elias, Mike <Elias.Mike@epa.gov>
Subject: Talking Points for Stakeholder notifications for upcoming draft Cd criteria release

Hi Betsy,

Attached please find some draft talking points I put together for the cadmium stakeholder calls pre-pub.

Ex. 5 - Deliberative Process

Joel still had not signed the FR as of 5 pm, then everyone in the know went home. I'll find tomorrow morning out from Arielle if he signed it today or will tomorrow.

Glynis gave final comments after a full review (none).

Mike is finishing the Response to Peer Review Comments document, after we both reviewed/edited it again today. He'll send it to Lee Schroer tomorrow morning, who said he will review it tomorrow. Looks good!

I am attaching the rollout draft plan with the names and numbers of contacts here also.

Happy vacation! Almost there!

I think we'll all be pretty thankful!

Safe travels.

Kathryn

Kathryn Gallagher, Ph.D. | Branch Chief, Ecological Risk Assessment Branch | Health and Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

Draft Aquatic Life Ambient Water Quality Criteria Cadmium -2015

PUBLIC RELEASE DATE: Monday, November 30, 2015*

ACTION: EPA is requesting public comment on a draft version of the updated national recommended aquatic life water quality criteria for cadmium.

ANTICIPATED REACTION:

Ex. 5 - Deliberative Process

MATERIALS:

- Desk Statement
- Stakeholder notification list
- Water Headline entry
- Questions and Answers for Press Office
- Fact Sheet

DESK STATEMENT:

EPA is requesting public comment on draft water quality criteria for aquatic life for the metal cadmium. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters.

The draft cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. The draft criteria has undergone an external peer review that was completed in 2015. EPA will accept public comments on the draft criteria for 60 days after publication in the Federal Register. EPA will consider the comments and revise the criteria. Once finalized, EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act. More information:
http://www.epa.gov/wqc/aquatic-life-criteria-cadmium

ROLL-OUT SCHEDULE

11/24/15 - 11/27/15	Key EPA and stakeholder notifications via phone (list below).
11/30/15 or 12/1/15	Other EPA and stakeholder notifications via email (list below). Web content goes live. *(*If FRN will publish on 11/30 or 12/1, we will link to it and the docket materials, and webpost the fact sheet. If the FRN is not projected to publish by then, we will webpost a pre-publication version on 11/30 along with the criteria document, peer review comments and fact sheet.)*

NOTIFICATIONS

Communication by: Betsy Behl, Director, Health and Ecological Criteria Division

Upon Signature (expected 11/24/15):

- Email to EPA Regional Water Division Directors
- Phone calls to key stakeholders:
  - National Mining Association, Amanda E. Aspatore (202)463-2646
  - North American Metals Council, Kathleen M. Roberts (443)964-4653
  - International Zinc Association, Eric Van Genderen (919)287-1880
  - International Cadmium Association, no contact information yet
  - National Association of Manufacturers, Rachel Jones 202-637-3175
  - U.S. Fish and Wildlife Services, Gina Schultz, (703)358-1985
  - National Oceanic and Atmospheric Administration, Cathryn Tortorici, 301-427-8495
  - Copper and Brass Fabricators Council, John Arnett 202-833-8575
  - Natural Resource Defense Council, Jon Devine (202)513-6263

Upon FRN Publication (expected 11/30/15):

- Email to Mary Jo Bragan, Regional Lead for distribution to regional and State/Tribal Water Program
- Emails to other interested stakeholders:
  - Association of Clean Water Administrators (ACWA)
  - National Association of Clean Water Agencies (NACWA)
  - Water Quality Standards Managers Association (WQSMA)
  - Environmental NGO List

WATER HEADLINES:

EPA is requesting public comment on draft water quality criteria for aquatic life for the metal cadmium. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters. The draft cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. The draft criteria underwent an external peer review that was completed in 2015. EPA will accept public comments on the draft criteria for 60 days after publication in the Federal Register. Once finalized, EPA's criteria for cadmium will provide recommendations to states and tribes authorized to establish water

quality standards under the Clean Water Act. Learn more

QUESTIONS & ANSWERS:

1) What are National Recommended Aquatic Life Criteria?

Ambient water quality criteria for the protection of aquatic life are numeric concentrations of pollutants, with specific recommendations on the duration and frequency of those concentrations, in surface waters that are protective of aquatic life designated uses. 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 solely 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 a state's water quality standards and approved by EPA.

2) What is Cadmium?

Cadmium is a relatively rare, naturally occurring metal found in mineral deposits and distributed ubiquitously at low concentrations in the environment. Cadmium's primary industrial uses are for the manufacturing of batteries, pigments, plastic stabilizers, metal coatings, alloys and electronics. Recently cadmium has been used in manufacturing nanoparticles (quantum dots) for use in solar cells and color displays.

3) How Does Cadmium Enter Surface Waters?

Cadmium enters the environment by natural and human processes, however, human sources, such as mining and urban processes, are responsible for contributing approximately 90 percent of the cadmium found in surface waters.

4) How Does Cadmium Affect Aquatic Life?

Cadmium is a non-essential metal with no biological function in aquatic life. Chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development and behavior in aquatic organisms.

5) What Are the 2015 Draft Recommended Water Quality Criteria for Cadmium?

In the 2015 draft, EPA recommends:

- the one-hour freshwater acute criterion maximum concentration not exceed 2.1 µg/L.
- the four-day average freshwater chronic criterion magnitude not exceed 0.73µg/L.
- the one-hour estuarine/marine acute criterion maximum concentration not exceed 35 µg/L.
- the four-day average estuarine/marine chronic criterion magnitude not exceed 8.3 µg/L.

The recommended frequency of exceedance for the above is no more than once every three years.

6) How Do the Draft 2015 Criteria Compare to the Previously Recommended 2001 Criteria?

The draft 2015 updated criteria reflect data for 70 new species and 49 new genera. The draft 2015 freshwater acute criterion (2.1 micrograms per liter) for dissolved cadmium is approximately the same as the 2001 acute criterion (2.0 micrograms per liter). The draft 2015 freshwater chronic criterion (0.73 micrograms per liter) for dissolved cadmium is slightly higher (less stringent) compared to the 2001 criteria (0.25 micrograms per liter). These modest increases are primarily due to the inclusion of new toxicity studies. As in the 2001 criteria, the draft 2015 freshwater acute criterion was derived to be protective of endangered species and lowered further to protect the commercially and recreationally important rainbow trout. In addition, the duration of the 2015 acute criteria was changed to 1-hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The draft 2015 estuarine/marine acute criterion for dissolved cadmium (35 micrograms per liter) is slightly lower (more stringent) than the 2001 acute criterion (40 micrograms per liter), which is primarily due to the addition of new toxicity studies for sensitive genera. The draft 2015 estuarine/marine chronic criterion (8.3 micrograms per liter) is also slightly more stringent than the 2001 chronic criterion (8.8 micrograms per liter), due the consideration of more species in the chronic criterion development. Changes in suggested values between 2001 and 2015 can be found in Table 1 below.

Table 1. Summary of 2001 and 2015 Draft Aquatic Life AWQC for Cadmium.

	2015 AWQC Update		2001 AWQC	
	Acute (1-hour, dissolved Cd)[c]	Chronic (4-day, dissolved Cd)	Acute (1-day, dissolved Cd)	Chronic (4-day, dissolved Cd)
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)[a]	2.1 µg/L[b]	0.73 µg/L	2.0 µg/L[b]	0.25 µg/L
Estuarine/marine	35 µg/L	8.3 µg/L	40 µg/L	8.8 µg/L

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.
[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).
[c] The duration of the 2015 acute criteria was changed to 1-hour to reflect the 1985 Guidelines-based recommended acute duration.

7) What is EPA doing to help ensure these criteria protect threatened and endangered species?
The draft criteria document contains an analysis of the protectiveness of the draft criteria for threatened and endangered species using all available quality toxicity test data for species listed under the Endangered Species Act that have been tested for sensitivity to cadmium. EPA is also conducting a detailed analysis of the protectiveness of the draft criteria for endangered salmon to address the National Marine Fisheries Service concerns regarding the protectiveness of the acute cadmium criteria.

8) Is there litigation driving EPA's schedule for this updated criteria? What does the litigation entail?
The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a Clean Water Act duty for EPA to propose a replacement criterion

for Oregon. EPA intends to use the updated criteria document as the scientific basis a rulemaking to propose criteria for Oregon.

The basis of EPA's disapproval of Oregon's cadmium criterion (and EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species based on EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2015 updated criteria have not changed significantly from 2001, a draft Endangered Species Act analysis prepared by EPA indicates that the updated freshwater criteria are expected to provide approximately 95 percent protection for acute exposure to endangered salmonids, a minimal effects level associated with the jeopardy opinion.

9) Cadmium is listed as a contaminant from the Animas river spill in Colorado this summer, how will this document effect that?

Because this is a draft document states will not be required to adopt the criteria or set new scientifically defensible criteria for cadmium as part of the state's water quality standards until the national ambient water quality update for cadmium is final.

States affected by the Animas river spill (CO, NM, AZ) will be using their currently adopted criteria that protect the designated uses of the water bodies within their area for the clean-up. States may have either adopted the 2001 criteria or adopted alternative scientifically defensible criteria for their waters. Water quality criteria are not effective under the Clean Water Act until they have been adopted into a state's water quality standards and approved by EPA.

To: Gallagher, Kathryn[Gallagher.Kathryn@epa.gov]
From: Elias, Mike
Sent: Mon 4/4/2016 10:45:15 AM
Subject: FW: Final Cadmium Criteria
removed.txt

Ex. 5 - Deliberative Process

From: Brown, Samuel L. [mailto:SlBrown@hunton.com]
Sent: Monday, April 04, 2016 1:22 AM
To: Elias, Mike <Elias.Mike@epa.gov>
Subject: Final Cadmium Criteria

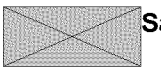
Hi Mike,

I have a question on the final cadmium criteria. It is noteworthy that all of the criterion decreased, *i.e.*, became more stringent, in the final updated criteria from the criteria noticed in the draft update on December 2, 2015. I reviewed the preamble, the final criteria document, and response to comments, and I can't find a clear explanation anywhere for why all of the criterion decreased. Can you explain why and/or point me to where this is explained in the final documents?

December 2015 (Draft):	April 2016 (Final):
Fresh Acute – 2.1	Fresh Acute – 1.8
Fresh Chronic - 0.73	Fresh Chronic - 0.72
E/M Acute – 35	E/M Acute – 33
E/M Chronic – 8.3	E/M Chronic – 7.9

Thanks so much,

Sam



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Rollout

Final Updated Aquatic Life Water Quality Criteria for Cadmium

PUBLIC RELEASE DATE: March 30, 2016

KEY INFORMATION:

- The updated criteria values are very similar to the criteria we issued in 2001. EPA used the approach we routinely use in developing aquatic life recommended criteria, and added new toxicity data representing over 75 additional species.

- The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a CWA duty for EPA to propose a replacement criterion for Oregon. The updated criteria document provides the scientific basis for our proposed rule.

- The basis of EPA's disapproval of Oregon's cadmium criterion was a 2012 jeopardy Biological Opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species. A draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater acute criterion is expected to provide protection for endangered salmonids, based the minimal acute effects level (5%) specified by the NMFS in their Reasonable and Prudent Alternatives. Ex. 5 - Deliberative Process as of 2014 there were three companies that produced refined cadmium in the U.S.: one in Tennessee (as a byproduct of zinc production) and one each in Ohio and Pennsylvania (recovered from scrap metal).

ACTION:
EPA is publishing a Federal Register notice informing the public about the release of the final version of the updated national recommended aquatic life water quality criteria for cadmium.

ANTICIPATED REACTION:

Ex. 5 - Deliberative Process

ED_000992_00002935-00001

Ex. 5 - Deliberative Process

MATERIALS:

- Desk Statement
- Stakeholder Notification List
- Water Headlines Entry
- Questions and Answers for the Press Office
- Fact Sheet
- Updated webpage

DESK STATEMENT:

EPA has published updated water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters.

The 2016 cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. In addition, the effect of total hardness (the amount of dissolved calcium and magnesium in water) on cadmium toxicity was revised with the newly acquired data. The criteria have undergone an external peer review and a 60 day public comment period.

EPA's water quality criteria for cadmium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

More information: http://www.epa.gov/wqc/aquatic-life-criteria-cadmium

BACKGROUND:

Ex. 5 - Deliberative Process

A brief history of EPA's development of ambient water quality criteria (AWQC) for cadmium for the protection of aquatic life:

- 1980- EPA first published AWQC for cadmium.
- 1985- EPA updated the AWQC criteria; this update superseded 1980 criteria.
- 1996- EPA updated the AWQC criteria; this update superseded 1985 criteria.
- 2001- EPA updated the AWQC criteria; this update superseded the 1996 criteria. This update was based on dissolved cadmium to more accurately account for bioavailability and reflected the latest EPA policy for metals risk assessment.
- 2015- EPA published draft updated cadmium criteria for public comment.

The updated criteria include data for 75 new species and 49 new genera. The freshwater acute criterion for dissolved cadmium is slightly lower (i.e. more stringent) than the 2001 acute. The freshwater chronic criterion is slightly higher (i.e., less stringent) compared to the 2001 criterion for dissolved cadmium; this modest increase is primarily due to the inclusion of four new genera, and the reanalysis of other data. As in the 2001 criteria, the draft freshwater acute criterion was derived to be protective of aquatic species and further lowered to protect the commercially and recreationally important rainbow trout. Rainbow trout are sensitive salmonids which were the focus of the jeopardy opinion for NMFS. In addition, the duration of the 2016 acute criteria was changed to one hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The estuarine/marine acute and chronic criteria for dissolved cadmium are more stringent than the 2001 recommended criterion, which is primarily due to the addition of new sensitive genera. Changes in suggested values between 2001 and 2016 can be found in Table 1 below.

Table 1. Summary of 2001 and 2016 Aquatic Life AWQC for Cadmium.

	2016 AWQC Update		**2001 AWQC**	
	Acute (1-hour, dissolved Cd)[c]	**Chronic (4-day, dissolved Cd)**	**Acute (1-day, dissolved Cd)**	**Chronic (4-day, dissolved Cd)**
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)[a]	1.8 µg/L[b]	0.72 µg/L	2.0 µg/L[b]	0.25 µg/L
Estuarine/marine	33 µg/L	7.9 µg/L	40 µg/L	8.8 µg/L

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.

[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).

[c] The duration of the 2016 acute criteria was changed to 1-hour to reflect the 1985 Guidelines-based recommended acute duration.

ROLL OUT SCHEDULE:

Week of 3/21/16	Expected AA signature for FRN
3/28/16-3/29/16	Key EPA and stakeholder notifications via phone (list below).
3/30/2016	Other EPA and stakeholder notifications via email (list below). Web content goes live. *(*If FRN will publish on 3/30, we will link to it and the docket materials, and webpost the fact sheet. If the FRN is not projected to publish by then, we will webpost a pre-publication version on 3/30 along with the criteria document, public review comment response and fact sheet.)*

NOTIFICATIONS

Communication by: Betsy Behl, Director, Health and Ecological Criteria Division

Upon Signature (expected the week of 3/21/16):

- Email to EPA Regional Water Division Directors
- Phone calls to key stakeholders:
  - National Mining Association, Amanda E. Aspatore (202)463-2646
  - North American Metals Council, Kathleen M. Roberts (443)964-4653
  - International Zinc Association, Eric Van Genderen (919)287-1880
  - International Cadmium Association, no contact information yet
  - National Association of Manufacturers, Rachel Jones 202-637-3175
  - U.S. Fish and Wildlife Services, Gina Schultz, (703)358-1985
  - National Oceanic and Atmospheric Administration, Cathryn Tortorici, 301-427-8495
  - Copper and Brass Fabricators Council, John Arnett 202-833-8575
  - Natural Resource Defense Council, Jon Devine (202)513-6263

Upon FRN Publication (expected 3/30/16):

- Email to Mary Jo Bragan, Regional Lead for distribution to regional and State/Tribal Water Program
- Emails to other interested stakeholders:
  - Association of Clean Water Administrators (ACWA)
  - National Association of Clean Water Agencies (NACWA)
  - Water Quality Standards Managers Association (WQSMA)
  - Environmental NGO List

WATER HEADLINES:

EPA is releasing final updated water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters. The 2016 cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. The criteria underwent an external peer review that was completed in 2015 and a 60 day public comment period. EPA's criteria for cadmium provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act. Learn more

QUESTIONS & ANSWERS FOR PRESS OFFICE:

1) What are National Recommended Aquatic Life Criteria?

Ambient water quality criteria for the protection of aquatic life are numeric concentrations of pollutants, with specific recommendations on the duration and frequency of those concentrations, in surface waters that are protective of aquatic life designated uses. 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 solely 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 a state's water quality standards and approved by EPA.

2) What is Cadmium?

Cadmium is a relatively rare, naturally occurring metal found in mineral deposits and distributed ubiquitously at low concentrations in the environment. Cadmium's primary industrial uses are for the manufacturing of batteries, pigments, plastic stabilizers, metal coatings, alloys and electronics. Recently cadmium has been used in manufacturing nanoparticles (quantum dots) for use in solar cells and color displays.

3) How Does Cadmium Enter Surface Waters?

Cadmium enters the environment by natural and human processes. However, human sources, such as mining and urban processes, are responsible for contributing approximately 90 percent of the cadmium found in surface waters.

4) How Does Cadmium Affect Aquatic Life?

Cadmium is a non-essential metal with no biological function in aquatic life. Acute exposure cause mortality. Chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development and behavior in aquatic organisms.

5) Why are the Final Recommended Water Quality Criteria for Cadmium different from the Draft?

Following the 60-day public comment period, EPA considered the comments and revised the draft as necessary; as a result:

- The draft one-hour freshwater acute criterion maximum concentration was lowered from 2.1 µg/L to 1.8 µg/L. This decrease resulted from the removal of two elevated data points from tests with insensitive salmonid life stages.
- The draft four-day average freshwater chronic criterion was slightly lowered from 0.73 µg/L in the draft to 0.72 µg/in the final criteria document.
- The draft one-hour estuarine/marine acute criterion maximum concentration of 35 µg/L was lowered slightly to 33 µg/L. The draft document used a shrimp species not found in North America to calculate the criterion. EPA removed this non-native species and replaced it with data recently found for a shrimp species native to North American waters.
- The draft four-day average estuarine/marine chronic criterion magnitude of 8.3 µg/L was lowered to 7.9 µg/L.

The recommended frequency of exceedance for all the above values is no more than once every three years.

6) How Do the 2016 Criteria Compare to the Previously Recommended 2001 Criteria?

The 2016 criteria reflect data for 75 new species and 49 new genera. The 2016 freshwater acute criterion (1.8 µg/L) for dissolved cadmium is slightly lower (i.e. more stringent) than the 2001 acute criterion. The 2016 freshwater chronic criterion (0.72 micrograms per liter) for dissolved cadmium is slightly higher (less stringent) compared to the 2001 criteria (0.25 micrograms per liter). These modest increases are primarily due to the inclusion of new toxicity studies. As in the 2001 criteria, the 2016 freshwater acute criterion was derived to be protective of aquatic species and lowered further to protect the commercially and recreationally important rainbow trout. In addition, the duration of the 2016 acute criteria was changed to one hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The 2016 estuarine/marine acute criterion for dissolved cadmium (33 µg/L) is slightly lower (more stringent) than the 2001 acute criterion (40 µg/L), which is primarily due to the addition of new toxicity studies for sensitive genera. The 2016 estuarine/marine chronic criterion (7.9 µg/L) is also slightly more stringent than the 2001 chronic criterion (8.8 micrograms per liter) due the consideration of more species in the chronic criterion development. Changes in suggested values between 2001 and 2016 can be found in Table 1 below.

Table 1. Summary of 2001 and 2016 Draft Aquatic Life AWQC for Cadmium.

	2016 AWQC Update		2001 AWQC	
	Acute (1-hour, dissolved Cd)[c]	**Chronic (4-day, dissolved Cd)**	**Acute (1-day, dissolved Cd)**	**Chronic (4-day, dissolved Cd)**
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)[a]	1.8 µg/L[b]	0.72 µg/L	2.0 µg/L[b]	0.25 µg/L
Estuarine/marine	33 µg/L	7.9 µg/L	40 µg/L	8.8 µg/L

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.

[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).

[c] The duration of the 2016 acute criteria was changed to 1 hour to reflect the 1985 Guidelines-based recommended acute duration.

ED_000992_00002935-00006

7) What is EPA doing to help ensure these criteria protect threatened and endangered species?

The criteria document contains an analysis of the protectiveness of the draft criteria for threatened and endangered species using all available quality toxicity test data for species listed under the Endangered Species Act that have been tested for sensitivity to cadmium. EPA is also conducting a detailed analysis of the protectiveness of the draft criteria for endangered salmon to address the National Marine Fisheries Service concerns regarding the protectiveness of the acute cadmium criteria.

8) Is there litigation driving EPA's schedule for this updated criteria? What does the litigation entail?

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a Clean Water Act duty for EPA to propose a replacement criterion for Oregon. EPA intends to use the updated criteria document as the scientific basis for a rulemaking to propose criteria for Oregon.

The basis of EPA's disapproval of Oregon's cadmium criterion (and EPA's resultant duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species based on EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated acute criterion has changed only slightly from 2001, the duration of the acute criterion was made more protective (decreased from 24 to one hour). A draft Endangered Species Act analysis prepared by EPA indicates that the updated freshwater criteria are expected to provide approximately 95 percent protection for acute exposure to endangered salmonids, a minimal effects level associated with the jeopardy opinion.

9) Cadmium is listed as a contaminant from the Animas river spill in Colorado this summer, how will this document effect that?

States affected by the Animas River spill (CO, NM, AZ) will be using their currently adopted criteria that protect the designated uses of the water bodies within their area for the clean-up. States may have either adopted the 2001 criteria or adopted alternative scientifically defensible criteria for their waters. Water quality criteria are not effective under the Clean Water Act until they have been adopted into a state's water quality standards and approved by EPA.

10) Are regulated entities expected to be affected by EPA's new cadmium criteria?

States may adopt the new criteria or set new scientifically defensible criteria for cadmium as part of state water quality standards for cadmium. If states adopt the new cadmium 304(a) criteria recommendation, we expect that few regulated entities will be affected because EPA's updated criteria values are very similar to what we recommended in 2001.

Rollout

Final Updated Aquatic Life Water Quality Criteria for Cadmium

PUBLIC RELEASE DATE: March 30, 2016

KEY INFORMATION:

- The updated criteria values are very similar to the criteria we issued in 2001. EPA used the approach we routinely use in developing aquatic life recommended criteria, and added new toxicity data representing over 75 additional species.

- The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a CWA duty for EPA to propose a replacement criterion for Oregon. The updated criteria document provides the scientific basis for our proposed rule.

- The basis of EPA's disapproval of Oregon's cadmium criterion was a 2012 jeopardy Biological Opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species. A draft ESA analysis developed by EPA indicated that the updated freshwater criteria is expected to provide approximately 95% protection for acute exposure to endangered salmonids, a minimal effects level established in the jeopardy opinion.

- Few regulated entities will be affected by the new criteria; as of 2014 there were three companies that produced refined cadmium in the U.S.: one in Tennessee (as a byproduct of zinc production) and one each in Ohio and Pennsylvania (recovered from scrap metal).

ACTION:
EPA is publishing a Federal Register notice informing the public about the release of the final version of the updated national recommended aquatic life water quality criteria for cadmium.

ANTICIPATED REACTION:

Ex. 5 - Deliberative Process

ED_000992_00002940-00001

Ex. 5 - Deliberative Process

MATERIALS:

- Desk Statement
- Stakeholder Notification List
- Water Headlines Entry
- Questions and Answers for the Press Office
- Fact Sheet
- Updated webpage

DESK STATEMENT:

EPA has published updated water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters.

The 2016 cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. In addition, the effect of total hardness (the amount of dissolved calcium and magnesium in water) on cadmium toxicity was revised with the newly acquired data. The criteria have undergone an external peer review and a 60 day public comment period.

EPA's water quality criteria for cadmium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

More information: http://www.epa.gov/wqc/aquatic-life-criteria-cadmium

BACKGROUND:

EPA is obligated to publish final updated cadmium criteria by May 30, 2016 as a result of a settlement agreement with the Northwest Environmental Advocates (NWEA). EPA intends to use the updated criteria document as the scientific basis for a rulemaking to propose criteria for Oregon, which we plan to publish at the beginning of April 2016.

A brief history of EPA's development of ambient water quality criteria (AWQC) for cadmium for the protection of aquatic life:

- 1980- EPA first published AWQC for cadmium.
- 1985- EPA updated the AWQC criteria; this update superseded 1980 criteria.
- 1996- EPA updated the AWQC criteria; this update superseded 1985 criteria.
- 2001- EPA updated the AWQC criteria; this update superseded the 1996 criteria. This update was based on dissolved cadmium to more accurately account for bioavailability and reflected the latest EPA policy for metals risk assessment.
- 2015- EPA published draft updated cadmium criteria for public comment.

The updated criteria include data for 75 new species and 49 new genera. The freshwater acute criterion for dissolved cadmium is slightly lower (i.e. more stringent) than the 2001 acute. The freshwater chronic criterion is slightly higher (i.e., less stringent) compared to the 2001 criterion for dissolved cadmium; this modest increase is primarily due to the inclusion of four new genera, and the reanalysis of other data. As in the 2001 criteria, the draft freshwater acute criterion was derived to be protective of aquatic species and further lowered to protect the commercially and recreationally important rainbow trout. Rainbow trout are sensitive salmonids which were the focus of the jeopardy opinion for National Marine Fisheries service. In addition, the duration of the 2016 acute criteria was changed to one hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The estuarine/marine acute and chronic criteria for dissolved cadmium are more stringent than the 2001 recommended criterion, which is primarily due to the addition of new sensitive genera. Changes in suggested values between 2001 and 2016 can be found in Table 1 below.

Table 1. Summary of 2001 and 2016 Aquatic Life AWQC for Cadmium.

	2016 AWQC Update		**2001 AWQC**	
	Acute (1-hour, dissolved Cd)[c]	**Chronic (4-day, dissolved Cd)**	**Acute (1-day, dissolved Cd)**	**Chronic (4-day, dissolved Cd)**
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)[a]	1.8 µg/L[b]	0.72 µg/L	2.0 µg/L[b]	0.25 µg/L
Estuarine/marine	33 µg/L	7.9 µg/L	40 µg/L	8.8 µg/L

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.

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[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).
[c] The duration of the 2016 acute criteria was changed to 1-hour to reflect the 1985 Guidelines-based recommended acute duration.

ROLL OUT SCHEDULE:

Week of 3/21/16	Expected AA signature for FRN
3/28/16-3/29/16	Key EPA and stakeholder notifications via phone (list below).
3/30/2016	Other EPA and stakeholder notifications via email (list below). Web content goes live. *(*If FRN will publish on 3/30, we will link to it and the docket materials, and webpost the fact sheet. If the FRN is not projected to publish by then, we will webpost a pre-publication version on 3/30 along with the criteria document, public review comment response and fact sheet.)*

NOTIFICATIONS
Communication by: Betsy Behl, Director, Health and Ecological Criteria Division

Upon Signature (expected the week of 3/21/16):

- Email to EPA Regional Water Division Directors
- Phone calls to key stakeholders:
  - National Mining Association, Amanda E. Aspatore (202)463-2646
  - North American Metals Council, Kathleen M. Roberts (443)964-4653
  - International Zinc Association, Eric Van Genderen (919)287-1880
  - International Cadmium Association, no contact information yet
  - National Association of Manufacturers, Rachel Jones 202-637-3175
  - U.S. Fish and Wildlife Services, Gina Schultz, (703)358-1985
  - National Oceanic and Atmospheric Administration, Cathryn Tortorici, 301-427-8495
  - Copper and Brass Fabricators Council, John Arnett 202-833-8575
  - Natural Resource Defense Council, Jon Devine (202)513-6263

Upon FRN Publication (expected 3/30/16):

- Email to Mary Jo Bragan, Regional Lead for distribution to regional and State/Tribal Water Program
- Emails to other interested stakeholders:
  - Association of Clean Water Administrators (ACWA)
  - National Association of Clean Water Agencies (NACWA)
  - Water Quality Standards Managers Association (WQSMA)
  - Environmental NGO List

WATER HEADLINES:
EPA is releasing final updated water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine

systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters. The 2016 cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. The criteria underwent an external peer review that was completed in 2015 and a 60 day public comment period. EPA's criteria for cadmium provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act. Learn more

QUESTIONS & ANSWERS FOR PRESS OFFICE:

1) What are National Recommended Aquatic Life Criteria?

Ambient water quality criteria for the protection of aquatic life are numeric concentrations of pollutants, with specific recommendations on the duration and frequency of those concentrations, in surface waters that are protective of aquatic life designated uses. 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 solely 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 a state's water quality standards and approved by EPA.

2) What is Cadmium?

Cadmium is a relatively rare, naturally occurring metal found in mineral deposits and distributed ubiquitously at low concentrations in the environment. Cadmium's primary industrial uses are for the manufacturing of batteries, pigments, plastic stabilizers, metal coatings, alloys and electronics. Recently cadmium has been used in manufacturing nanoparticles (quantum dots) for use in solar cells and color displays.

3) How Does Cadmium Enter Surface Waters?

Cadmium enters the environment by natural and human processes. However, human sources, such as mining and urban processes, are responsible for contributing approximately 90 percent of the cadmium found in surface waters.

4) How Does Cadmium Affect Aquatic Life?

Cadmium is a non-essential metal with no biological function in aquatic life. Acute exposure cause mortality. Chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development and behavior in aquatic organisms.

5) Why are the Final Recommended Water Quality Criteria for Cadmium different from the Draft?

Following the 60-day public comment period, EPA considered the comments and revised the draft as necessary; as a result:

- The draft one-hour freshwater acute criterion maximum concentration was lowered from 2.1 µg/L to 1.8 µg/L. This decrease resulted from the removal of two elevated data points from tests with insensitive salmonid life stages.
- The draft four-day average freshwater chronic criterion was slightly lowered from 0.73 µg/L in the draft to 0.72 µg/in the final criteria document.
- The draft one-hour estuarine/marine acute criterion maximum concentration of 35 µg/L was lowered slightly to 33 µg/L. The draft document used a shrimp species not found in North America to calculate the criterion. EPA removed this non-native species and replaced it with data recently found for a shrimp species native to North American waters.
- The draft four-day average estuarine/marine chronic criterion magnitude of 8.3 µg/L was lowered to 7.9 µg/L.

The recommended frequency of exceedance for all the above values is no more than once every three years.

6) How Do the 2016 Criteria Compare to the Previously Recommended 2001 Criteria?

The 2016 criteria reflect data for 75 new species and 49 new genera. The 2016 freshwater acute criterion (1.8 µg/L) for dissolved cadmium is slightly lower (i.e. more stringent) than the 2001 acute criterion. The 2016 freshwater chronic criterion (0.72 micrograms per liter) for dissolved cadmium is slightly higher (less stringent) compared to the 2001 criteria (0.25 micrograms per liter). These modest increases are primarily due to the inclusion of new toxicity studies. As in the 2001 criteria, the 2016 freshwater acute criterion was derived to be protective of aquatic species and lowered further to protect the commercially and recreationally important rainbow trout. In addition, the duration of the 2016 acute criteria was changed to one hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The 2016 estuarine/marine acute criterion for dissolved cadmium (33 µg/L) is slightly lower (more stringent) than the 2001 acute criterion (40 µg/L), which is primarily due to the addition of new toxicity studies for sensitive genera. The 2016 estuarine/marine chronic criterion (7.9 µg/L) is also slightly more stringent than the 2001 chronic criterion (8.8 micrograms per liter) due the consideration of more species in the chronic criterion development. Changes in suggested values between 2001 and 2016 can be found in Table 1 below.

Table 1. Summary of 2001 and 2016 Draft Aquatic Life AWQC for Cadmium.

	2016 AWQC Update			
	Acute (1-hour, dissolved Cd)[c]	**Chronic (4-day, dissolved Cd)**	**Acute (1-day, dissolved Cd)**	**Chronic (4-day, dissolved Cd)**
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)[a]	1.8 µg/L[b]	0.72 µg/L	2.0 µg/L[b]	0.25 µg/L
Estuarine/marine	33 µg/L	7.9 µg/L	40 µg/L	8.8 µg/L

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.

[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).

[c] The duration of the 2016 acute criteria was changed to 1 hour to reflect the 1985 Guidelines-based recommended acute duration.

7) What is EPA doing to help ensure these criteria protect threatened and endangered species?

The criteria document contains an analysis of the protectiveness of the draft criteria for threatened and endangered species using all available quality toxicity test data for species listed under the Endangered Species Act that have been tested for sensitivity to cadmium. EPA is also conducting a detailed analysis of the protectiveness of the draft criteria for endangered salmon to address the National Marine Fisheries Service concerns regarding the protectiveness of the acute cadmium criteria.

8) Is there litigation driving EPA's schedule for this updated criteria? What does the litigation entail?

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a Clean Water Act duty for EPA to propose a replacement criterion for Oregon. EPA intends to use the updated criteria document as the scientific basis for a rulemaking to propose criteria for Oregon.

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The basis of EPA's disapproval of Oregon's cadmium criterion (and EPA's resultant duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species based on EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated acute criterion has changed only slightly from 2001, the duration of the acute criterion was made more protective (decreased from 24 to one hour). A draft Endangered Species Act analysis prepared by EPA indicates that the updated freshwater criteria are expected to provide approximately 95 percent protection for acute exposure to endangered salmonids, a minimal effects level associated with the jeopardy opinion.

9) Cadmium is listed as a contaminant from the Animas river spill in Colorado this summer, how will this document effect that?

States affected by the Animas River spill (CO, NM, AZ) will be using their currently adopted criteria that protect the designated uses of the water bodies within their area for the clean-up. States may have either adopted the 2001 criteria or adopted alternative scientifically defensible criteria for their waters. Water quality criteria are not effective under the Clean Water Act until they have been adopted into a state's water quality standards and approved by EPA.

10) Are regulated entities expected to be affected by EPA's new cadmium criteria?
States may adopt the new criteria or set new scientifically defensible criteria for cadmium as part of state water quality standards for cadmium. If states adopt the new cadmium 304(a) criteria recommendation, we expect that few regulated entities will be affected because EPA's updated criteria values are very similar to what we recommended in 2001.

MEMORANDUM

SUBJECT: Notice of Availability: Recommended Aquatic Life Ambient Water Quality Criteria for Cadmium – 2016 (Tier 3, SAN 5843) - ACTION MEMORANDUM

FROM: Elizabeth Southerland
Director, Office of Science and Technology

TO: Joel Beauvais
Deputy Assistant Administrator

PURPOSE
Attached for your signature is the *Federal Register* notice announcing the U.S. Environmental Protection Agency's release of the Updated Aquatic Life Criteria for Cadmium. The public will be able to access the criteria document through the EPA docket and website www.regulations.gov.

Following closure of the public comment period, the EPA will consider the public comments and revise the document accordingly. Once finalized, the EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act (CWA).

DEADLINE
The Updated Aquatic Life Criteria for Cadmium needs to be published by March 30, 2015, in order to maintain a timeline set by a potential lawsuit settlement agreement with Northwest Environmental Advocates.

OVERVIEW
The EPA is in the process of updating the agency's 304(a) cadmium aquatic life ambient water quality criteria. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species.

The driver for updating the cadmium criteria was a lawsuit brought on by Northwest Environmental Advocates following the EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. The EPA's disapproval triggered a CWA duty for the EPA to propose a replacement criterion for Oregon. The EPA intends to use the updated criteria document as the scientific basis for the proposed rule. The agency is currently negotiating a settlement with the litigants in which the EPA would commit to propose cadmium criterion for Oregon by March 31, 2016, and take final rulemaking action by January 16, 2017. The 304(a) criteria being proposed are the basis for the rulemaking and, therefore, the document is time sensitive. We proposed the draft criteria for 60 days of public comment on December 1, 2015. The numbers have changed slightly as a result of adopting changes derived from the public comment period.

The basis of the EPA's disapproval of Oregon's cadmium criterion (and the EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effect to salmon species based on the EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated freshwater acute criterion is slightly more stringent than the 2001 value, a draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater acute criterion is expected to provide protection for endangered salmonids based on acute effects to the minimal effects level (5%) specified by the NMFS in their reasonable and prudent alternatives in the associated with the jeopardy biological opinion. It is likely, however, that the Services may still question this criterion as they expected our update to result in an even more stringent value.

ANTICIPATED PUBLIC AND STAKEHOLDER RESPONSE

Ex. 5 - Deliberative Process

INTERNAL DEVELOPMENT AND REVIEW PROCESS

Office of Science and Technology partnered within the agency with Office of Research and Development to develop the document. The document was reviewed by the Office of Research and Development, Office of Chemical Safety and Pollution Prevention, and the Regions (3, 4, 5, 8, 9, and 10) and Office of Policy. The EPA conducted an external contractor-led letter peer review on the criteria document that was completed in 2015. The document was available for a 60-day public comment period which ended February 1, 2016.

If you need additional information or have questions regarding this notice, please call Elizabeth Behl at (202) 566-0788.

To: Gallagher, Kathryn[Gallagher.Kathryn@epa.gov]
Cc: Harper, Ashley[harper.ashley@epa.gov]
From: Fleisig, Erica
Sent: Mon 3/21/2016 4:24:38 PM
Subject: RE: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline today

Hi Kathryn,

Ex. 5 - Deliberative Process

From: Gallagher, Kathryn
Sent: Monday, March 21, 2016 12:21 PM
To: Fleisig, Erica <Fleisig.Erica@epa.gov>
Cc: Harper, Ashley <harper.ashley@epa.gov>
Subject: FW: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline today
Importance: High

Hi Erica,

Ex. 5 - Deliberative Process

I'm sharing our draft so we can coordinate.

Kathryn

Ex. 5 - Deliberative Process

The basis of the EPA's disapproval of Oregon's cadmium acute criterion (and the EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service for acute effect to salmon species based on the EPA's 2001 freshwater acute cadmium criterion, which Oregon had adopted as the state's water quality standards. The 2016 updated freshwater acute criterion is slightly more stringent than the 2001 acute value. An Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater criterion are expected to provide protection for endangered salmonids from acute effects of cadmium at the minimal effects level (5%) specified by NOAA/NMFS Reasonable and Prudent Alternatives (RPAs) in the 2012 jeopardy opinion. **Ex. 5 - Deliberative Process**

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Kathryn Gallagher, Ph.D. | Branch Chief, Ecological Risk Assessment Branch | Health and Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

From: Harper, Ashley
Sent: Thursday, March 17, 2016 9:00 AM
To: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>
Subject: RE: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon

See attached

From: Behl, Betsy
Sent: Thursday, March 17, 2016 8:22 AM
To: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>; Harper, Ashley <harper.ashley@epa.gov>; Flaherty, Colleen <Flaherty.Colleen@epa.gov>
Subject: FW: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon

From: Conerly, Octavia
Sent: Thursday, March 17, 2016 8:04 AM
To: Flaherty, Colleen <Flaherty.Colleen@epa.gov>; Behl, Betsy <Behl.Betsy@epa.gov>; Lape, Jeff <lape.jeff@epa.gov>
Cc: Southerland, Elizabeth <Southerland.Elizabeth@epa.gov>
Subject: RE: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon

Good morning All,

Below are lists of items/topics for Joel's weekly email to Gina or to be submitted as a communique. OST is responsible for 2 communiques and a blurb on the White House Summit for the weekly email.

Communiques:

•□□□□□□□□ **Cadmium ALC:** (OST) DAA signature anticipated 3/24. *Included in Admin weekly email on 3/04.*

•□□□□□□□□ **Oregon ALC:** (OST) Administrator signature anticipated 3/31. *(Consent Decree Deadline)*

Weekly email:

•□□□□□□□□ White House Summit

Although there is no real deadline for the communiques, I would recommend that we prepare them so Betsy can send them to Joel by Monday. (See below for material I received for cadmium from Kathryn; attached is an example communique.)

The weekly email items are due to Karen today by 1pm so please send it to me by 12noon.

Cadmium

- EPA is preparing to announce release of the updated national 304(a) recommended aquatic life water quality criteria for cadmium via a March 30, 2016 Federal Register notice. The acute toxicity database for cadmium increased greatly since 2001; there are 27 additional freshwater species and 33 additional saltwater species included in the 2016 acute test dataset that were not in the 2001 dataset. Six new freshwater species chronic tests are also included in the 2016 criteria dataset. The criteria document underwent vigorous internal and external peer review and was released as draft on November 30, 2015 for a 60-day public comment period. EPA revised the draft criteria considering public comments. Once finalized, EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.
    - The driver for updating EPA's cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following a jeopardy call from the National Marine Fisheries Service in 2012 on EPA's 2001 freshwater acute cadmium criteria. As a result of settlement negotiations EPA plans to propose updated cadmium criteria in rulemaking for Oregon by March 31, 2016 and finalize by January 16, 2017. EPA's updated 304(a) national criteria will be the basis for this rulemaking and is thus being finalized prior to proposal of criteria for Oregon. Region 10 is leading discussions with the National Marine Fisheries Service on cadmium effects on endangered salmonids. OW is providing technical analyses to support these effort; ORD is also supporting the region with technical assistance on this effort.

Thanks in advance.

Octavia Conerly

Special Assistant to the Office Director

Office of Science and Technology

1200 Pennsylvania Ave. NW MC 4304T

Room 5231H

Washington, DC 20460

EMAIL: conerly.octavia@epa.gov

PHONE: (202) 566-1094

FAX: (202) 566-0441

From: Gude, Karen
Sent: Tuesday, March 15, 2016 11:00 AM
To: Greene, Ashley <Greene.Ashley@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>; Nandi, Romell <Nandi.Romell@epa.gov>; Farris, Erika D. <Farris.Erika@epa.gov>; Klasen, Matthew <Klasen.Matthew@epa.gov>
Cc: Campbell, Ann <Campbell.Ann@epa.gov>; Ruf, Christine <Ruf.Christine@epa.gov>; Lousberg, Macara <Lousberg.Macara@epa.gov>; Loop, Travis <Loop.Travis@epa.gov>; Orvin, Chris <Orvin.Chris@epa.gov>; Evalenko, Sandy <Evalenko.Sandy@epa.gov>
Subject: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon

Dear Special Assistants,

Below please find a list of possible topics for the 3/18 Administrator Weekly Email and communiques list. If you could please send the Administrator Weekly Email write-ups no later than noon on Thursday (3/17).

Possible Topics for 3/18 Administrator Weekly Email:

- **Update on Animas/San Juan** (OWOW – Tom Wall). *This is a request from Joel.*

- **Blending** (Placeholder for Joel)

•□□□□□□□□ **Drinking Water Strategy/White House Announcement** (OGWDW)

•□□□□□□□□ **CWSRF Eligibilities Paper** (OWM)

•□□□□□□□□ **NPDES Updates Rule** (OWM)

•□□□□□□□□ **Something on the White House Water Summit?**

-

Communiques:

•□□□□□□□□ **NPDES Construction General Permit:** (OWM) Anticipate RAs signature 3/29. (Erika – Please provide the communique with the review materials/draft permit for Joel, when they are ready.)

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•□□□□□□□□ **Cadmium ALC:** (OST) DAA signature anticipated 3/24. *Included in Admin weekly email on 3/04.*

•□□□□□□□□ **Oregon ALC:** (OST) Administrator signature anticipated 3/31. *(Consent Decree Deadline)*

Thank you,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

3/11 Weekly is below for reference:

Administrator and company – Here's the OW weekly update. As noted below, I'll be out of the office on travel to Gulfport next Tuesday afternoon and Wednesday.

NEJAC: Next week I will travel to Gulfport to attend NEJAC, where I'll be participating in a session on water issues. In addition, I'm hoping to attend the Gulf of Mexico Environmental Justice Community Café event where communities along the Gulf of Mexico to have an opportunity to showcase their efforts around community recovery and revitalization and we will be hosting our own table to bring information to Gulf communities in attendance about the tools available to help achieve their goal.

Blending Discussion at CEQ: Ex. 5 - Deliberative Process

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Harmful Algal Blooms and Hypoxia Comprehensive Research Plan and Action Strategy: An Interagency Report: Next week, we expect to release the *Harmful Algal Blooms and Hypoxia Comprehensive Research Plan and Action Strategy*, a report highlighting the progress that federal agencies have made over the past decade, and the current state of the science, on HABs and hypoxia. The report responds to the Harmful Algal Bloom and Hypoxia Research and Control Act and was written by representatives from a 12-member federal interagency working group. The report details gaps in the detection, assessment and mitigation efforts of HABs and hypoxia, as identified by stakeholders around the country, and includes recommendations to better assess, manage, and communicate the risks of HABs and hypoxia in the United States.

National Rivers and Streams Assessment (NRSA) 2008/2009 Final Report: Next week, we expect to release the National Rivers and Streams Assessment (NRSA) 2008/2009 Final Report. As a reminder, the NRSA report represents the first-ever national monitoring study of the overall condition of the nation's streams and rivers, and employed an unprecedented sampling effort undertaken by EPA and state and tribal partners. The study makes the following pretty sobering findings, which point to the critical importance of making progress on nutrient pollution in particular:

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loss of fishing and recreational opportunities.

•□□□□□□□□ Rivers and streams are under significant stress from runoff from urban areas, agricultural practices, and wastewater.

•□□□□□□□□ Nutrients pollution and poor habitat continue to be the most widespread problems.

•□□□□□□□□ 40% of the nation's river and stream miles have excessive levels of phosphorus, and 27% have high levels of nitrogen.

•□□□□□□□□ Poor vegetative cover and human disturbance of river and stream banks is widespread, and these habitat conditions make rivers and streams more vulnerable to flooding, erosion, and spread of pollutants from waterways.

WaterSense Fix a Leak Week: Next week the WaterSense program and its partners will celebrate the 8th annual "Fix A Leak Week" to remind Americans to find and fix common household leaks. We will kick off the event on March 14th with a Twitter party from 2-3 PM. This year we are encouraging partners to incorporate its "Leak Detective" theme in their communities. Partners will host events across the country, and WaterSense will assist two to three communities to amplify their promotional efforts.

Beach Modeling Implementation Guide: Next week, we expect to issue new modeling implementation guidance entitled *Six Key Steps to Developing and Using Predictive Tools at Your Beach* to promote and encourage use of modeling as a predictive tool to make timely beach advisory or closure decisions and issue same day notifications. States, territories, tribes, and local jurisdictions monitor coastal recreation waters to determine if people swimming and playing in these waters are safe from exposure to fecal contamination. The culture-based method that is currently widely used for assessing water quality conditions at beaches results in delays in notifying the public of water quality problems. Predictive tools can help anticipate problems due to changing conditions and enable prompt notification.

Rollout

Final Updated Aquatic Life Water Quality Criteria for Cadmium

PUBLIC RELEASE DATE: March 30, 2016

KEY INFORMATION:

- The updated criteria values are very similar to the criteria we issued in 2001. EPA used the approach we routinely use in developing aquatic life recommended criteria, and added new toxicity data representing over 75 additional species.

- The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a CWA duty for EPA to propose a replacement criterion for Oregon. The updated criteria document provides the scientific basis for our proposed rule.

- The basis of EPA's disapproval of Oregon's cadmium criterion was a 2012 jeopardy Biological Opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species. A draft ESA analysis developed by EPA indicated that the updated freshwater criteria is expected to provide approximately 95% protection for acute exposure to endangered salmonids, a minimal effects level established in the jeopardy opinion.

- Ex. 5 - Deliberative Process as of 2014 there were three companies that produced refined cadmium in the U.S.: one in Tennessee (as a byproduct of zinc production) and one each in Ohio and Pennsylvania (recovered from scrap metal).

ACTION:
EPA is publishing a Federal Register notice informing the public about the release of the final version of the updated national recommended aquatic life water quality criteria for cadmium.

ANTICIPATED REACTION:

Ex. 5 - Deliberative Process

ED_000992_00002962-00001

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MATERIALS:

- Desk Statement
- Stakeholder Notification List
- Water Headlines Entry
- Questions and Answers for the Press Office
- Fact Sheet
- Updated webpage

DESK STATEMENT:

EPA has published updated water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters.

The 2016 cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. In addition, the effect of total hardness (the amount of dissolved calcium and magnesium in water) on cadmium toxicity was revised with the newly acquired data. The criteria have undergone an external peer review and a 60 day public comment period.

EPA's water quality criteria for cadmium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

More information: http://www.epa.gov/wqc/aquatic-life-criteria-cadmium

BACKGROUND:

EPA is obligated to publish final updated cadmium criteria by May 30, 2016 as a result of a settlement agreement with the Northwest Environmental Advocates (NWEA). EPA intends to use the updated criteria document as the scientific basis for a rulemaking to propose criteria for Oregon, which we plan to publish at the beginning of April 2016.

A brief history of EPA's development of ambient water quality criteria (AWQC) for cadmium for the protection of aquatic life:

- 1980- EPA first published AWQC for cadmium.
- 1985- EPA updated the AWQC criteria; this update superseded 1980 criteria.
- 1996- EPA updated the AWQC criteria; this update superseded 1985 criteria.
- 2001- EPA updated the AWQC criteria; this update superseded the 1996 criteria. This update was based on dissolved cadmium to more accurately account for bioavailability and reflected the latest EPA policy for metals risk assessment.
- 2015- EPA published draft updated cadmium criteria for public comment.

The updated criteria include data for 75 new species and 49 new genera. The freshwater acute criterion for dissolved cadmium is slightly lower (i.e. more stringent) than the 2001 acute. The freshwater chronic criterion is slightly higher (i.e., less stringent) compared to the 2001 criterion for dissolved cadmium; this modest increase is primarily due to the inclusion of four new genera, and the reanalysis of other data. As in the 2001 criteria, the draft freshwater acute criterion was derived to be protective of aquatic species and further lowered to protect the commercially and recreationally important rainbow trout. Rainbow trout are sensitive salmonids which were the focus of the jeopardy opinion for National Marine Fisheries service. In addition, the duration of the 2016 acute criteria was changed to one hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The estuarine/marine acute and chronic criteria for dissolved cadmium are more stringent than the 2001 recommended criterion, which is primarily due to the addition of new sensitive genera. Changes in suggested values between 2001 and 2016 can be found in Table 1 below.

Table 1. Summary of 2001 and 2016 Aquatic Life AWQC for Cadmium.

	2016 AWQC Update		**2001 AWQC**	
	Acute (1-hour, dissolved Cd)[c]	**Chronic (4-day, dissolved Cd)**	**Acute (1-day, dissolved Cd)**	**Chronic (4-day, dissolved Cd)**
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)[a]	1.8 µg/L[b]	0.72 µg/L	2.0 µg/L[b]	0.25 µg/L
Estuarine/marine	33 µg/L	7.9 µg/L	40 µg/L	8.8 µg/L

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.

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[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).
[c] The duration of the 2016 acute criteria was changed to 1-hour to reflect the 1985 Guidelines-based recommended acute duration.

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NOTIFICATIONS
Communication by: Betsy Behl, Director, Health and Ecological Criteria Division

Upon Signature (expected the week of 3/21/16):

- Email to EPA Regional Water Division Directors
- Phone calls to key stakeholders:
  - National Mining Association, Amanda E. Aspatore (202)463-2646
  - North American Metals Council, Kathleen M. Roberts (443)964-4653
  - International Zinc Association, Eric Van Genderen (919)287-1880
  - International Cadmium Association, no contact information yet
  - National Association of Manufacturers, Rachel Jones 202-637-3175
  - U.S. Fish and Wildlife Services, Gina Schultz, (703)358-1985
  - National Oceanic and Atmospheric Administration, Cathryn Tortorici, 301-427-8495
  - Copper and Brass Fabricators Council, John Arnett 202-833-8575
  - Natural Resource Defense Council, Jon Devine (202)513-6263

Upon FRN Publication (expected 3/30/16):

- Email to Mary Jo Bragan, Regional Lead for distribution to regional and State/Tribal Water Program
- Emails to other interested stakeholders:
  - Association of Clean Water Administrators (ACWA)
  - National Association of Clean Water Agencies (NACWA)
  - Water Quality Standards Managers Association (WQSMA)
  - Environmental NGO List

WATER HEADLINES:
EPA is releasing final updated water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine

systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters. The 2016 cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. The criteria underwent an external peer review that was completed in 2015 and a 60 day public comment period. EPA's criteria for cadmium provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act. Learn more

QUESTIONS & ANSWERS FOR PRESS OFFICE:

1) What are National Recommended Aquatic Life Criteria?

Ambient water quality criteria for the protection of aquatic life are numeric concentrations of pollutants, with specific recommendations on the duration and frequency of those concentrations, in surface waters that are protective of aquatic life designated uses. 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 solely 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 a state's water quality standards and approved by EPA.

2) What is Cadmium?

Cadmium is a relatively rare, naturally occurring metal found in mineral deposits and distributed ubiquitously at low concentrations in the environment. Cadmium's primary industrial uses are for the manufacturing of batteries, pigments, plastic stabilizers, metal coatings, alloys and electronics. Recently cadmium has been used in manufacturing nanoparticles (quantum dots) for use in solar cells and color displays.

3) How Does Cadmium Enter Surface Waters?

Cadmium enters the environment by natural and human processes. However, human sources, such as mining and urban processes, are responsible for contributing approximately 90 percent of the cadmium found in surface waters.

4) How Does Cadmium Affect Aquatic Life?

Cadmium is a non-essential metal with no biological function in aquatic life. Acute exposure cause mortality. Chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development and behavior in aquatic organisms.

5) Why are the Final Recommended Water Quality Criteria for Cadmium different from the Draft?

Following the 60-day public comment period, EPA considered the comments and revised the draft as necessary; as a result:

- The draft one-hour freshwater acute criterion maximum concentration was lowered from 2.1 µg/L to 1.8 µg/L. This decrease resulted from the removal of two elevated data points from tests with insensitive salmonid life stages.
- The draft four-day average freshwater chronic criterion was slightly lowered from 0.73 µg/L in the draft to 0.72 µg/in the final criteria document.
- The draft one-hour estuarine/marine acute criterion maximum concentration of 35 µg/L was lowered slightly to 33 µg/L. The draft document used a shrimp species not found in North America to calculate the criterion. EPA removed this non-native species and replaced it with data recently found for a shrimp species native to North American waters.
- The draft four-day average estuarine/marine chronic criterion magnitude of 8.3 µg/L was lowered to 7.9 µg/L.

The recommended frequency of exceedance for all the above values is no more than once every three years.

6) How Do the 2016 Criteria Compare to the Previously Recommended 2001 Criteria?

The 2016 criteria reflect data for 75 new species and 49 new genera. The 2016 freshwater acute criterion (1.8 µg/L) for dissolved cadmium is slightly lower (i.e. more stringent) than the 2001 acute criterion. The 2016 freshwater chronic criterion (0.72 micrograms per liter) for dissolved cadmium is slightly higher (less stringent) compared to the 2001 criteria (0.25 micrograms per liter). These modest increases are primarily due to the inclusion of new toxicity studies. As in the 2001 criteria, the 2016 freshwater acute criterion was derived to be protective of aquatic species and lowered further to protect the commercially and recreationally important rainbow trout. In addition, the duration of the 2016 acute criteria was changed to one hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The 2016 estuarine/marine acute criterion for dissolved cadmium (33 µg/L) is slightly lower (more stringent) than the 2001 acute criterion (40 µg/L), which is primarily due to the addition of new toxicity studies for sensitive genera. The 2016 estuarine/marine chronic criterion (7.9 µg/L) is also slightly more stringent than the 2001 chronic criterion (8.8 micrograms per liter) due the consideration of more species in the chronic criterion development. Changes in suggested values between 2001 and 2016 can be found in Table 1 below.

Table 1. Summary of 2001 and 2016 Draft Aquatic Life AWQC for Cadmium.

	2016 AWQC Update			
	Acute (1-hour, dissolved Cd)[c]	**Chronic (4-day, dissolved Cd)**	**Acute (1-day, dissolved Cd)**	**Chronic (4-day, dissolved Cd)**
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)[a]	1.8 µg/L[b]	0.72 µg/L	2.0 µg/L[b]	0.25 µg/L
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[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.

[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).

[c] The duration of the 2016 acute criteria was changed to 1 hour to reflect the 1985 Guidelines-based recommended acute duration.

7) What is EPA doing to help ensure these criteria protect threatened and endangered species?

The criteria document contains an analysis of the protectiveness of the draft criteria for threatened and endangered species using all available quality toxicity test data for species listed under the Endangered Species Act that have been tested for sensitivity to cadmium. EPA is also conducting a detailed analysis of the protectiveness of the draft criteria for endangered salmon to address the National Marine Fisheries Service concerns regarding the protectiveness of the acute cadmium criteria.

8) Is there litigation driving EPA's schedule for this updated criteria? What does the litigation entail?

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a Clean Water Act duty for EPA to propose a replacement criterion for Oregon. EPA intends to use the updated criteria document as the scientific basis for a rulemaking to propose criteria for Oregon.

The basis of EPA's disapproval of Oregon's cadmium criterion (and EPA's resultant duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species based on EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated acute criterion has changed only slightly from 2001, the duration of the acute criterion was made more protective (decreased from 24 to one hour). A draft Endangered Species Act analysis prepared by EPA indicates that the updated freshwater criteria are expected to provide approximately 95 percent protection for acute exposure to endangered salmonids, a minimal effects level associated with the jeopardy opinion.

9) Cadmium is listed as a contaminant from the Animas river spill in Colorado this summer, how will this document effect that?

States affected by the Animas River spill (CO, NM, AZ) will be using their currently adopted criteria that protect the designated uses of the water bodies within their area for the clean-up. States may have either adopted the 2001 criteria or adopted alternative scientifically defensible criteria for their waters. Water quality criteria are not effective under the Clean Water Act until they have been adopted into a state's water quality standards and approved by EPA.

10) Are regulated entities expected to be affected by EPA's new cadmium criteria?
States may adopt the new criteria or set new scientifically defensible criteria for cadmium as part of state water quality standards for cadmium. If states adopt the new cadmium 304(a) criteria recommendation, we expect that few regulated entities will be affected because EPA's updated criteria values are very similar to what we recommended in 2001.

Rollout

Final Updated Aquatic Life Water Quality Criteria for Cadmium

PUBLIC RELEASE DATE: March 30, 2016

KEY INFORMATION:

- The updated criteria values are very similar to the criteria we issued in 2001. EPA used the approach we routinely use in developing aquatic life recommended criteria, and added new toxicity data representing over 75 additional species.

- The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a CWA duty for EPA to propose a replacement criterion for Oregon. The updated criteria document provides the scientific basis for our proposed rule.

- The basis of EPA's disapproval of Oregon's cadmium criterion was a 2012 jeopardy Biological Opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species. A draft ESA analysis developed by EPA indicated that the updated freshwater criteria is expected to provide approximately 95% protection for acute exposure to endangered salmonids, a minimal effects level established in the jeopardy opinion.

- Few regulated entities will be affected by the new criteria; as of 2014 there were three companies that produced refined cadmium in the U.S.: one in Tennessee (as a byproduct of zinc production) and one each in Ohio and Pennsylvania (recovered from scrap metal).

ACTION:
EPA is publishing a Federal Register notice informing the public about the release of the final version of the updated national recommended aquatic life water quality criteria for cadmium.

ANTICIPATED REACTION:

Ex. 5 - Deliberative Process

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Ex. 5 - Deliberative Process

MATERIALS:

- Desk Statement
- Stakeholder Notification List
- Water Headlines Entry
- Questions and Answers for the Press Office
- Fact Sheet
- Updated webpage

DESK STATEMENT:

EPA has published updated water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters.

The 2016 cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. In addition, the effect of total hardness (the amount of dissolved calcium and magnesium in water) on cadmium toxicity was revised with the newly acquired data. The criteria have undergone an external peer review and a 60 day public comment period.

EPA's water quality criteria for cadmium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

More information: http://www.epa.gov/wqc/aquatic-life-criteria-cadmium

BACKGROUND:
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The basis of EPA's disapproval of Oregon's cadmium criterion (and EPA's resultant duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species based on EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated acute criterion has changed only slightly from 2001, the duration of the acute criterion was made more protective (decreased from 24 to one hour). A draft Endangered Species Act analysis prepared by EPA indicates that the updated freshwater criteria are expected to provide approximately 95 percent protection for acute exposure to endangered salmonids, a minimal effects level associated with the jeopardy opinion.

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States may adopt the new criteria or set new scientifically defensible criteria for cadmium as part of state water quality standards for cadmium. If states adopt the new cadmium 304(a) criteria recommendation, we expect that few regulated entities will be affected because EPA's updated criteria values are very similar to what we recommended in 2001.

To: Gallagher, Kathryn[Gallagher.Kathryn@epa.gov]
From: Harper, Ashley
Sent: Thur 3/17/2016 12:59:52 PM
Subject: RE: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon
Communique Cadmium 3 17 16.docx

See attached

From: Behl, Betsy
Sent: Thursday, March 17, 2016 8:22 AM
To: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>; Harper, Ashley <harper.ashley@epa.gov>; Flaherty, Colleen <Flaherty.Colleen@epa.gov>
Subject: FW: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon

Kathryn, can you please pull these two items together? Ashley can help

From: Conerly, Octavia
Sent: Thursday, March 17, 2016 8:04 AM
To: Flaherty, Colleen <Flaherty.Colleen@epa.gov>; Behl, Betsy <Behl.Betsy@epa.gov>; Lape, Jeff <lape.jeff@epa.gov>
Cc: Southerland, Elizabeth <Southerland.Elizabeth@epa.gov>
Subject: RE: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon

Good morning All,

Below are lists of items/topics for Joel's weekly email to Gina or to be submitted as a communique. OST is responsible for 2 communiques and a blurb on the White House Summit for the weekly email.

Communiques:

•□□□□□□□□ **Cadmium ALC:** (OST) DAA signature anticipated 3/24. *Included in Admin weekly email on 3/04.*

•□□□□□□□□ **Oregon ALC:** (OST) Administrator signature anticipated 3/31. *(Consent Decree Deadline)*

Weekly email:

•□□□□□□□□ White House Summit

Although there is no real deadline for the communiques, I would recommend that we prepare them so Betsy can send them to Joel by Monday. (See below for material I received for cadmium from Kathryn; attached is an example communique.)

The weekly email items are due to Karen today by 1pm so please send it to me by 12noon.

Cadmium

- EPA is preparing to announce release of the updated national 304(a) recommended aquatic life water quality criteria for cadmium via a March 30, 2016 Federal Register notice. The acute toxicity database for cadmium increased greatly since 2001; there are 27 additional freshwater species and 33 additional saltwater species included in the 2016 acute test dataset that were not in the 2001 dataset. Six new freshwater species chronic tests are also included in the 2016 criteria dataset. The criteria document underwent vigorous internal and external peer review and was released as draft on November 30, 2015 for a 60-day public comment period. EPA revised the draft criteria considering public comments. Once finalized, EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.
    - The driver for updating EPA's cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following a jeopardy call from the National Marine Fisheries Service in 2012 on EPA's 2001 freshwater acute cadmium criteria. As a result of settlement negotiations EPA plans to propose updated cadmium criteria in rulemaking for Oregon by March 31, 2016 and finalize by January 16, 2017. EPA's updated 304(a) national criteria will be the basis for this rulemaking and is thus being finalized prior to proposal of criteria for Oregon. Region 10 is leading discussions with the National Marine Fisheries Service on cadmium effects on endangered salmonids. OW is providing technical analyses to support these effort; ORD is also supporting

the region with technical assistance on this effort.

Thanks in advance.

Octavia Conerly

Special Assistant to the Office Director

Office of Science and Technology

1200 Pennsylvania Ave. NW MC 4304T

Room 5231H

Washington, DC 20460

EMAIL: conerly.octavia@epa.gov

PHONE: (202) 566-1094

FAX: (202) 566-0441

From: Gude, Karen
Sent: Tuesday, March 15, 2016 11:00 AM
To: Greene, Ashley <Greene.Ashley@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>; Nandi, Romell <Nandi.Romell@epa.gov>; Farris, Erika D. <Farris.Erika@epa.gov>; Klasen, Matthew <Klasen.Matthew@epa.gov>
Cc: Campbell, Ann <Campbell.Ann@epa.gov>; Ruf, Christine <Ruf.Christine@epa.gov>; Lousberg, Macara <Lousberg.Macara@epa.gov>; Loop, Travis <Loop.Travis@epa.gov>; Orvin, Chris <Orvin.Chris@epa.gov>; Evalenko, Sandy <Evalenko.Sandy@epa.gov>
Subject: Draft Topics List for 3/18 Administrator Weekly Email & Communiques -- Deadline Thursday at noon

Dear Special Assistants,

Below please find a list of possible topics for the 3/18 Administrator Weekly Email and

communiques list. If you could please send the Administrator Weekly Email write-ups no later than noon on Thursday (3/17).

Possible Topics for 3/18 Administrator Weekly Email:

•□□□□□□□□ **Update on Animas/San Juan** (OWOW – Tom Wall). *This is a request from Joel.*

•□□□□□□□□ **Blending** (Placeholder for Joel)

•□□□□□□□□ **Drinking Water Strategy/White House Announcement** (OGWDW)

•□□□□□□□□ **CWSRF Eligibilities Paper** (OWM)

•□□□□□□□□ **NPDES Updates Rule** (OWM)

•□□□□□□□□ **Something on the White House Water Summit?**

-

Communiques:

•□□□□□□□□ **NPDES Construction General Permit:** (OWM) Anticipate RAs signature 3/29. (Erika – Please provide the communique with the review materials/draft permit for Joel, when they are ready.)

•□□□□□□□□ **Cadmium ALC:** (OST) DAA signature anticipated 3/24. *Included in Admin weekly email on 3/04.*

•□□□□□□□□ **Oregon ALC:** (OST) Administrator signature anticipated 3/31. *(Consent Decree Deadline)*

Thank you,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

3/11 Weekly is below for reference:

Administrator and company – Here's the OW weekly update. As noted below, I'll be out of the office on travel to Gulfport next Tuesday afternoon and Wednesday.

NEJAC: Next week I will travel to Gulfport to attend NEJAC, where I'll be participating in a session on water issues. In addition, I'm hoping to attend the Gulf of Mexico Environmental Justice Community Café event where communities along the Gulf of Mexico to have an opportunity to showcase their efforts around community recovery and revitalization and we will be hosting our own table to bring information to Gulf communities in attendance about the tools available to help achieve their goal.

Blending Discussion at CEQ: Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Harmful Algal Blooms and Hypoxia Comprehensive Research Plan and Action Strategy: An Interagency Report: Next week, we expect to release the *Harmful Algal Blooms and Hypoxia Comprehensive Research Plan and Action Strategy*, a report highlighting the progress that federal agencies have made over the past decade, and the current state of the science, on HABs and hypoxia. The report responds to the Harmful Algal Bloom and Hypoxia Research and Control Act and was written by representatives from a 12-member federal interagency working group. The report details gaps in the detection, assessment and mitigation efforts of HABs and hypoxia, as identified by stakeholders around the country, and includes recommendations to better assess, manage, and communicate the risks of HABs and hypoxia in the United States.

National Rivers and Streams Assessment (NRSA) 2008/2009 Final Report: Next week, we expect to release the National Rivers and Streams Assessment (NRSA) 2008/2009 Final Report. As a reminder, the NRSA report represents the first-ever national monitoring study of the overall condition of the nation's streams and rivers, and employed an unprecedented sampling effort undertaken by EPA and state and tribal partners. The study makes the following pretty sobering findings, which point to the critical importance of making progress on nutrient pollution in particular:

•□□□□□□□□ 55 percent of the nation's river and stream miles do not support healthy populations of aquatic life, as measured by the condition of aquatic insects, and this can lead to loss of fishing and recreational opportunities.

•□□□□□□□□ Rivers and streams are under significant stress from runoff from urban areas, agricultural practices, and wastewater.

•□□□□□□□□ Nutrients pollution and poor habitat continue to be the most widespread problems.

•□□□□□□□□ 40% of the nation's river and stream miles have excessive levels of phosphorus, and 27% have high levels of nitrogen.

•□□□□□□□□ Poor vegetative cover and human disturbance of river and stream banks is widespread, and these habitat conditions make rivers and streams more vulnerable to flooding, erosion, and spread of pollutants from waterways.

WaterSense Fix a Leak Week: Next week the WaterSense program and its partners will celebrate the 8th annual "Fix A Leak Week" to remind Americans to find and fix common household leaks. We will kick off the event on March 14th with a Twitter party from 2-3 PM. This year we are encouraging partners to incorporate its "Leak Detective" theme in their communities. Partners will host events across the country, and WaterSense will assist two to three communities to amplify their promotional efforts.

Beach Modeling Implementation Guide: Next week, we expect to issue new modeling implementation guidance entitled *Six Key Steps to Developing and Using Predictive Tools at Your Beach* to promote and encourage use of modeling as a predictive tool to make timely beach advisory or closure decisions and issue same day notifications. States, territories, tribes, and local jurisdictions monitor coastal recreation waters to determine if people swimming and playing in these waters are safe from exposure to fecal contamination. The culture-based method that is currently widely used for assessing water quality conditions at beaches results in delays in notifying the public of water quality problems. Predictive tools can help anticipate problems due to changing conditions and enable prompt notification.

Update of: *Recommended Aquatic Life Ambient Water Quality Criteria for Cadmium – 2016*

Substance

The EPA is in the process of updating the agency's 304(a) cadmium aquatic life ambient water quality criteria for final publication. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species.

The driver for updating the cadmium criteria was a lawsuit brought on by Northwest Environmental Advocates following the EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. The EPA's disapproval triggered a CWA duty for the EPA to propose a replacement criterion for Oregon. The EPA would intend to use the updated criteria document as the scientific basis for the proposed rule. The agency is currently negotiating a settlement with the litigants in which the EPA would commit to propose cadmium criteria for Oregon by March 31, 2016, and take final rulemaking action by January 16, 2017. The 304(a) criteria being proposed are the basis for the rulemaking and, therefore, the document is time sensitive. We proposed the draft criteria for 60 days of public comment on December 1, 2015. The numbers presented in the final document have changed slightly from the draft as a result of adopting changes derived from the public comment period.

The basis of the EPA's disapproval of Oregon's cadmium criterion (and the EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service for acute effect to salmon species based on the EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated freshwater acute criterion is slightly more stringent than the 2001 value, a draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater criterion are expected to provide approximately 95 percent protection for endangered salmonids based on acute effects, a minimal effects level associated with the jeopardy opinion. It is likely, however, that the Services may still question these criteria as they expected our update to result in even more stringent values.

Process

Office of Science and Technology partnered within the agency with Office of Research and Development to develop the document. The document was reviewed by the Office of Research and Development, Office of Chemical Safety and Pollution Prevention, and the Regions (3, 4, 5, 8, 9, and 10) and Office of Policy. The EPA conducted an external contractor-led letter peer review on the criteria document that was completed in 2015. The document was available for a 60-day public comment period which ended February 1, 2016.

Stakeholder Reaction

Ex. 5 - Deliberative Process

MEMORANDUM

SUBJECT: Notice of Availability: Recommended Aquatic Life Ambient Water Quality Criteria for Cadmium – 2016 (Tier 3, SAN 5843) - ACTION MEMORANDUM

FROM: Elizabeth Southerland
Director, Office of Science and Technology

TO: Joel Beauvais
Acting Deputy Assistant Administrator

PURPOSE
Attached for your signature is the *Federal Register* notice announcing the U.S. Environmental Protection Agency's release of the Updated Aquatic Life Criteria for Cadmium. The public will be able to access the draft criteria document through the EPA docket and website www.regulations.gov.

Following closure of the public comment period, the EPA will consider the public comments and revise the document accordingly. Once finalized, the EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

DEADLINE
The Updated Aquatic Life Criteria for Cadmium needs to be published by March 30, 2015, in order to maintain a timeline set by a potential lawsuit settlement agreement with Northwest Environmental Advocates.

OVERVIEW
The EPA is in the process of updating the Agency's 304(a) cadmium aquatic life ambient water quality criteria. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species.

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following the EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. The EPA's disapproval triggered a CWA duty for the EPA to propose a replacement criterion for Oregon. The EPA would intend to use the updated criteria document as the scientific basis for the proposed rule. The agency is currently negotiating a settlement with the litigants in which the EPA would commit to propose cadmium criteria for Oregon by March 31, 2016, and take final rulemaking action by January 16, 2017. The 304(a) criteria being proposed are the basis for the rulemaking and, therefore, the document is time sensitive. We proposed the draft criteria for 60 days of public comment on December 1, 2015. The numbers have changed slightly as a result of adopting changes derived from the public comment period. The freshwater acute number is slightly lower than the draft because two relatively insensitive end-points (life stages) were removed from the calculation. The draft one-hour estuarine/marine acute criterion maximum concentration was lowered in the final. The draft document used a shrimp species not found in North America to calculate the criterion, EPA removed this non-native species and replaced it with data recently found for a shrimp species native to North American waters, which resulted in a lower number. Because the chronic value is based on a ratio, the estuarine/ marine chronic value changed in accordance with the acute to chronic ratio.

The basis of the EPA's disapproval of Oregon's cadmium criterion (and the EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service for acute effect to salmon species based on the EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated freshwater acute criteria is slightly more stringent than the 2001 value, a draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater criteria are expected to provide approximately 95 percent protection for endangered salmonids based on acute effects, a minimal effects level associated with the jeopardy opinion. It is likely, however, that the Services may still question these criteria as they expected our update to result in even more stringent values.

ANTICIPATED PUBLIC AND STAKEHOLDER RESPONSE

Ex. 5 - Deliberative Process

INTERNAL DEVELOPMENT AND REVIEW PROCESS

Office of Science and Technology partnered within the agency with Office of Research and Development to develop the document. The document was reviewed by the Office of Research and Development, Office of Chemical Safety and Pollution Prevention, and the Regions (3, 4, 5, 8, 9, and 10) and Office of Policy. The EPA conducted an external contractor-led letter peer review on the criteria document that was completed in 2015. The document was available for a 60-day public comment period

which ended February 1, 2016.

If you need additional information or have questions regarding this notice, please call Elizabeth Behl at (202) 566-0788.

MEMORANDUM

SUBJECT: Notice of Availability: Recommended Aquatic Life Ambient Water Quality Criteria for Cadmium – 2016 (Tier 3, SAN 5843) - ACTION MEMORANDUM

FROM: Elizabeth Southerland
Director, Office of Science and Technology

TO: Joel Beauvais
Acting Deputy Assistant Administrator

PURPOSE
Attached for your signature is the *Federal Register* notice announcing the U.S. Environmental Protection Agency's release of the Updated Aquatic Life Criteria for Cadmium. The public will be able to access the draft criteria document through the EPA docket and website www.regulations.gov.

Following closure of the public comment period, the EPA will consider the public comments and revise the document accordingly. Once finalized, the EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

DEADLINE
The Updated Aquatic Life Criteria for Cadmium needs to be published by March 30, 2015, in order to maintain a timeline set by a potential lawsuit settlement agreement with Northwest Environmental Advocates.

OVERVIEW
The EPA is in the process of updating the Agency's 304(a) cadmium aquatic life ambient water quality criteria. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species.

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following the EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. The EPA's disapproval triggered a CWA duty for the EPA to propose a replacement criterion for Oregon. The EPA would intend to use the updated criteria document as the scientific basis for the proposed rule. The agency is currently negotiating a settlement with the litigants in which the EPA would commit to propose cadmium criteria for Oregon by March 31, 2016, and take final rulemaking action by January 16, 2017. The 304(a) criteria being proposed are the basis for the rulemaking and, therefore, the document is time sensitive. We proposed the draft criteria for 60 days of public comment on December 1, 2015. The numbers have changed slightly as a result of adopting changes derived from the public comment period. The freshwater acute number is slightly lower than the draft because two relatively insensitive end-points (life stages) were removed from the calculation. The draft one-hour estuarine/marine acute criterion maximum concentration was lowered slightly in the final. The draft document used a shrimp species not found in North America to calculate the criterion, EPA removed this non-native species and replaced it with data recently found for a shrimp species native to North American waters, which resulted in a lower number. Because the chronic value is based on a ratio, the estuarine/ marine chronic value changed in accordance with the acute to chronic ratio.

The basis of the EPA's disapproval of Oregon's cadmium criterion (and the EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service for acute effect to salmon species based on the EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated criteria have not changed significantly from 2001, a draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater criteria are expected to provide approximately 95 percent protection for endangered salmonids based on acute effects, a minimal effects level associated with the jeopardy opinion. Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

ANTICIPATED PUBLIC AND STAKEHOLDER RESPONSE

Ex. 5 - Deliberative Process

INTERNAL DEVELOPMENT AND REVIEW PROCESS

Office of Science and Technology partnered within the agency with Office of Research and Development, Office of Chemical Safety and Pollution Prevention, and the Regions (3, 4, 5, 8, 9, and 10) to develop and review the updated criteria. Office of Policy was asked to review the document, but currently has not submitted their response. The EPA also conducted an external contractor-led letter peer review on the criteria document that was completed in 2015.

If you need additional information or have questions regarding this notice, please call Elizabeth Behl at (202) 566-0788.

Cadmium Aquatic Life Ambient Water Quality Criteria
Updated Briefing for Betsy Southerland
March 14, 2016

1. **OVERVIEW**
   a. **Criteria document revision based on comments received during 60 day public comment period**

   b. **Comment letters received**
      i. Florida Department of Environmental Protection
      ii. Illinois Environmental Protection Agency
      iii. Wisconsin Department of Natural Resources
      iv. Kansas Department of Health and Environment
      v. Utility Water Act Group (via Hunton and Williams)
      vi. Hampton Roads Sanitation District
      vii. US Geological Survey
      viii. National Marine Fisheries Service
      ix. Center for Biological Diversity
      x. California State Water Resources Control Board

   c. **Limited changes in document content occurred as a result of public comments**
      i. Freshwater acute and chronic values decreased slightly
      ii. Estuarine/marine acute and chronic values decreased
      iii. Most other revisions involved addition of clarifying tables, figures, or text

Internal, Deliberative

	2016 Revised Values		FRN Draft Publication Values		2001 Criteria Update	
	Acute (1-hour, dissolved)	**Chronic** (4-day, dissolved)	**Acute** (1-hour, dissolved)	**Chronic** (4-day, dissolved)	**Acute** (1-day, dissolved)	**Chronic** (4-day, dissolved)
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)	**1.8** µg/L[a]	**0.72** µg/L	2.1 µg/L[a]	0.73 µg/L	2.0 µg/L[a]	0.25 µg/L
Estuarine/marine	**33** µg/L	**7.9** µg/L	35 µg/L	8.3 µg/L	40 µg/L	8.8 µg/L

[a] Lowered to protect the commercially and recreationally important rainbow trout, as per the

1985 Guidelines, Stephen et al. (1985).

d. Currently revising based on Agency Workgroup review

Action	Date
Agency Workgroup Draft Review	4/20/15 – 5/20/15
External Peer Draft Review	8/22/15-10/2/15
Agency Workgroup	11/2/15 – 11/10/15
60 Day Public Comment Period/Revisions	12/1/15 – 2/1/16
Agency Workgroup Review of Final Document	3/1/16 – 3/9/16
FRN Publication	3/30/16

2. KEY DOCUMENT CHANGES BASED ON PUBLIC COMMENT PERIOD

a. Freshwater acute value decreased from 2.1 ug/L to 1.8 ug/L dissolved

i. Corrected hardness equation to remove all tests with unmeasured concentrations to ensure validity of results. Resulted in lower hardness slope, from 1.103 in 2015 draft to 0.9789 (which is closer to the Idaho 2006 slope).

ii. Acute values were reviewed; the following data for salmonids were revised based on commenter input (USGS)

- Rainbow trout
  a. Removed insensitive smolt values from Chapman 1978 (>14.67 µg/L normalized)
  b. Retained next highest value for swim-up fry from study (6.575 ug/L normalized)
  c. Removed low values from Davies 1993 due to influence of high magnesium addition in high hardness test water (>400 mg/L H) yielding inaccurately low LC50s
  d. Removed high outliers (LC50>12) of Hollis (1999, 200a) and Niyogi (2004) beyond 10-fold range of expected criteria, which were also suspect because are only rainbow trout data using cadmium nitrate salts (All other tests were with cadmium chloride or sulfate salts).
  e. SMAV changed from 4.468 to ~3.720
- Chinook salmon
  a. Removed insensitive parr and smolt values from Chapman 1978 (17.70 ug/L and >14.67 ug/L normalized)
  b. Retained next highest value for juveniles from study (6.504 ug/L normalized)
  c. SMAV changed from 9.888 to 7.141

Internal Deliberative

b. Freshwater chronic value decreased from 0.73 ug/L to 0.72 ug/L dissolved

i. Added in Cottus 21-day chronic test due to importance as sensitive result despite short test duration (USGS)

c. Estuarine/marine acute value decreased from 35 ug/L to 33 ug/L dissolved

i. Commenter (UWAG) noted *Neomysis integer* does not occur in North American waters

ii. *Neomysis integer* (65.25 ug/L normalized) was removed from database

iii. *Neomysis Americana* (28.14 ug/L normalized) was added to the database after obtaining an additional paper (Roberts et al. 1982)

d. Estuarine/marine chronic value decreased from 8.3 ug/L to 7.9 ug/L dissolved

i. Estuarine/marine chronic value was based on an removal and replacement of *Neomysis integer* with use of Acute-to-Chronic Ratio

e. Notable editorial changes/clarifications

i. Information was added clarifying approach and source of data for converting total to dissolved concentrations for fresh and saltwater including
   - Data sources
   - Water and salts used for testing: Natural surface waters and cadmium chloride and cadmium sulfate salts used for simulation

ii. Footnotes edited in Appendix A and B to differentiate "Data not used to calculate SMAV because more sensitive lifestage available" from "Flow-through measured test available"

iii. Table 5 was modified to identify specific genus used to fulfill each of the family MDRs, instead of only numbers of phyla, family, genera, and species used to derive criteria

iv. Additional tables were added identifying which studies and values were used in the acute and chronic hardness normalization analysis (Appendices A-2 and C-2)

v. Graphs were added showing the freshwater acute hardness linear regressions to better illustrate the normalization process (Figures 2 and 4)

Internal, Deliberative

3. **KEY COMMENTS/RESPONSES WITH LIMITED OR NO REVISION**

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

To: Gallagher, Kathryn[Gallagher.Kathryn@epa.gov]
From: Lousberg, Macara
Sent: Fri 3/4/2016 8:04:55 PM
Subject: RE: Looking for Joel weekly e-mail items

Thanks Kathryn.

From: Gallagher, Kathryn
Sent: Friday, March 04, 2016 3:01 PM
To: Conerly, Octavia <Conerly.Octavia@epa.gov>; Bethel, Heidi <Bethel.Heidi@epa.gov>; Lousberg, Macara <Lousberg.Macara@epa.gov>
Cc: Zipf, Lynn <Zipf.Lynn@epa.gov>; Hisel-Mccoy, Sara <Hisel-McCoy.Sara@epa.gov>; Behl, Betsy <Behl.Betsy@epa.gov>; Flaherty, Colleen <Flaherty.Colleen@epa.gov>
Subject: RE: Looking for Joel weekly e-mail items

Cadmium

•□□□□□□□□ EPA is preparing to announce release of the updated national 304(a) recommended aquatic life water quality criteria for cadmium via a March 30, 2016 Federal Register notice. The acute toxicity database for cadmium increased greatly since 2001; there are 27 additional freshwater species and 33 additional saltwater species included in the 2016 acute test dataset that were not in the 2001 dataset. Six new freshwater species chronic tests are also included in the 2016 criteria dataset. The criteria document underwent vigorous internal and external peer review and was released as draft on November 30, 2015 for a 60-day public comment period. EPA revised the draft criteria considering public comments. Once finalized, EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

o The driver for updating EPA's cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following a jeopardy call from the National Marine Fisheries Service in 2012 on EPA's 2001 freshwater acute cadmium criteria. As a result of settlement negotiations EPA plans to propose updated cadmium criteria in rulemaking for Oregon by March 31, 2016 and finalize by January 16, 2017. EPA's updated 304(a) national criteria will be the basis for this rulemaking and is thus being finalized prior to proposal of criteria for Oregon. Region 10 is leading discussions with the National Marine Fisheries Service on cadmium effects on endangered salmonids. OW is providing technical analyses to support these effort; ORD is also supporting the region with technical assistance on this effort.

Kathryn Gallagher, Ph.D. | Branch Chief, Ecological Risk Assessment Branch | Health and Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

From: Conerly, Octavia
Sent: Friday, March 04, 2016 10:46 AM
To: Bethel, Heidi <Bethel.Heidi@epa.gov>; Lousberg, Macara <Lousberg.Macara@epa.gov>
Cc: Zipf, Lynn <Zipf.Lynn@epa.gov>; Hisel-Mccoy, Sara <Hisel-McCoy.Sara@epa.gov>; Behl, Betsy <Behl.Betsy@epa.gov>; Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>; Flaherty, Colleen <Flaherty.Colleen@epa.gov>
Subject: RE: Looking for Joel weekly e-mail items

I was waiting on the writeup for cadmium.

Octavia Conerly

Special Assistant to the Office Director

Office of Science and Technology

1200 Pennsylvania Ave. NW MC 4304T

Room 5231H

Washington, DC 20460

EMAIL: conerly.octavia@epa.gov

PHONE: (202) 566-1094

FAX: (202) 566-0441

From: Bethel, Heidi
Sent: Friday, March 04, 2016 10:41 AM
To: Lousberg, Macara <Lousberg.Macara@epa.gov>
Cc: Zipf, Lynn <Zipf.Lynn@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>; Hisel-Mccoy, Sara <Hisel-McCoy.Sara@epa.gov>; Behl, Betsy <Behl.Betsy@epa.gov>; Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>; Flaherty, Colleen <Flaherty.Colleen@epa.gov>

Subject: Looking for Joel weekly e-mail items

Ex. 5 - Deliberative Process

On Mar 4, 2016, at 9:54 AM, Lousberg, Macara <Lousberg.Macara@epa.gov> wrote:

> **I'm wondering if she sent it just to you and forgot to cc me? She's out today so I'm hoping she sent something late yesterday.**

To: Gallagher, Kathryn[Gallagher.Kathryn@epa.gov]
From: Elias, Mike
Sent: Wed 3/2/2016 3:08:45 PM
Subject: Cadmium - Response to Public Comments for Review
Cd Public Comments EPA Response_030216 (KGRev).docx
Appendix B - CERC EC20 robustness evaluation 02-26-16.doc

Hi Kathryn,

Attached is the draft summarized comments and responses for your review. I did flag the response to one comment, **Ex. 5 - Deliberative Process** .looking at that now.

Please let me know if you need any additional information for your review.

Did you get any feedback from Betsy S. regarding who we need to brief before the document is signed?

Thanks!

Mike

Mike Elias | Biologist

Ecological Risk Assessment Branch | Health and Ecological Criteria Division

Office of Science and Technology | Office of Water

U.S. Environmental Protection Agency

1200 Pennsylvania Avenue, NW, Washington, DC 20460

(202) 566-0120 | elias.mike@epa.gov

Title

TOPIC 1: Duration should be 24 hours, not one hour

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docur
EPA-HQ-OW-2015-0753-0012	*UWAG has concerns with EPA's proposal to change the acute freshwater and estuarine/marine criteria averaging duration from 24 hours to 1 hour. The change is not adequately justified and is not supported by new studies in the Draft. The current 24-hour duration should be retained unless a strong scientific justification is presented.* *Every previous iteration of the cadmium criteria has endorsed a 24-hour duration for the acute criteria. EPA appears to be making a policy decision that the acute criteria should be 1 hour, but does not present the associated science to support the revision which is inconsistent with CWA § 304(a)(1), which mandates EPA establish "criteria for water quality accurately reflecting the latest scientific knowledge."* *EPA compares the acute toxicity to ammonia but fails to provide information that compares the time-dependent toxicity of cadmium with ammonia. Furthermore, assessing the toxicity of cadmium during the first 24 hours of an acute test is problematic because the vast majority of published studies reporting the acute toxicity of cadmium do not report patterns of lethality during the first 24 hours. Several acceptable selected studies (Besser et al. 2007; Buhl 1997; Diamond et al. 1997; Mebane et al. 2012; Nebeker 1986) do not report 24-hour LC50s and the one study with relevant data (Duncan and Klavercamp 1983) had a 12-hour LC50 that was five times greater than the 96-hour LC50 (5.35 vs. 1.11 µg/L, respectively). This value would be expected to be similar if cadmium was a fast-acting pollutant.* *An earlier EPA publication (*Speed of Action of Metals Acute Toxicity to Aquatic Life*; EPA-822-R-95-002) also justifies the 24-hour averaging period. This document estimated a kinetic coefficient (*k*) using a regression of LC50 values versus time, with*	**Ex. 5 - Deliberative Process**	No edits

	the averaging period being calculated as the inverse of k. *The larger the* k *value the faster acting the pollutant. None of the estimated averaging periods in the document for freshwater and saltwater species approached 1-hour. The highest estimated* k *values mentioned, for the freshwater fathead minnow, were 6 and 17 hours, with saltwater species having even larger values. The selection of the 1-hour averaging period is baseless and arbitrary.* *Additionally, the 1985 Guidelines say the duration should be "substantially less than 48 to 96 hours," but do not say that 24 hours is an inappropriate duration and therefore the Guidelines do not support, nor should it be a justification for the proposed revision.*	Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0012	*Water Quality-Based Effluent Limits (WQBELs) for cadmium are often expressed as a daily (24-hr) maximum value. Changing the WQBEL to a 1-hour averaging duration could require a permittee to collect several compliance samples during a 24-hour period. This additional burden is unnecessary since there is minor variability of the cadmium levels during a typical 24-hour period, and this additional monitoring is unwarranted without sound scientific basis.*		No edits

TOPIC 2: *H. azteca* test by Ingersoll is not acceptable; retest should be done or test should be removed from criteria development

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docur

ED_000992_00003094-00003

EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*The proposed chronic criterion is based on a flawed toxicity test (Ingersoll and Kemble 2001) conducted on the amphipod Hyalella azteca. The Hyalella test used in the criterion derivation should be repeated using current feeding procedures that are proven to result in better growth and reproduction. While the IEPA acknowledges and commends the improvements USEPA has made in the assessment and analysis of Hyalella sp. data compared to the 2001 cadmium criteria document, specifically in regards to the sensitivity of this organism to the presence/absence of chloride and bromide in culture and test water, the IEPA contends that the feeding regime employed in the 2000 USGS study is deficient by today's standards and likely resulted in malnourished, stressed test organisms.* *Specifically, test organisms in the 2000 USGS study were underfed and/or fed improper diets based on current research. Dr. Soucek, at the Illinois Natural History Survey, conducted new research that focused on determining the appropriate amounts of food for test organisms. His research has led to improved growth of test organisms compared to earlier diet regimes. The diet used in the 2000 USGS study consisted of a ration of 1.0 ml YCT/d, whereas Dr. Soucek's research contends that a diet consisting of Tetramin supplemented with diatoms greatly improves growth and reproduction of Hyalella azteca compared to YCT-only diets (Soucek et al. 2016, in press).* *The diet in the 2000 USGS study restricted growth and fecundity when compared to Tetramin-based diets (Soucek et al. 2016, in press), and brings into question the accuracy of the test results.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*Test organisms in the 2000 USGS study did not attain minimum growth requirements based on the direct measure of organism weight, with the average dry weight of the controls being 0.27 mg/individual (<0.50 mg/individual). USEPA concluded that the dry weights measured in the test were inaccurate and subsequently used length data to extrapolate to dry weight via a regression equation. However there is no documentation provided for this equation or how it was derived. It is unlikely that the dry weights were underestimated (while an overestimation can be expected due to inadequate drying of test organisms), and it is therefore considered unlikely that the organisms achieved the minimum*		No edits

	weight requirements for this test to be valid.	Ex. 5 - Deliberative Process	
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*The dilution series (control and 5 treatment concentrations: 0.1, 0.3, 0.5, 2.0 and 3.0 µg/L.) used in the 2000 USGS test did not appropriately bracket the effect concentration. The dilution series was not standard, with a large gap in concentration between the NOEC and LOEC (0.5 and 2.0 µg/L, respectively). While a point estimation technique was used to determine the effect concentration, the lack of a 1.0 µg/L treatment may have changed this estimation. The precision of this estimation is paramount, as the test result was the sole determinant of the GMCV, which is the most sensitive in the chronic dataset, and a small change in the GMCV can therefore have a substantial effect on the final chronic value.*		No edits
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*At this time, the IEPA is in support of the adoption of the acute cadmium criterion as proposed, but is requesting a one year extension for the adoption of the chronic criterion. A one year extension would allow for a retest on Hyalella azteca using current feeding recommendations and would allow for revisions to be made to the chronic criterion. A round robin approach would ensure that the data are obtained using the appropriate test procedures and would provide additional information regarding the sensitivity of Hyalella azteca to cadmium. If time does not permit a repeat of the test, then the chronic criterion should be recalculated with the Hyalella data removed.*		No edits

TOPIC 3: Dissolved vs total concentration use

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docur

ED_000992_00003094-00005

EPA HQ-OW-2015-0753-0005	*Additional documentation is needed to support the total to dissolved conversion factors. Very little information is provided concerning the derivation of the conversion factors, and more detailed information is needed to fully assess their appropriateness for natural waterbodies.*	**Ex. 5 - Deliberative Process**	Section 2.6
EPA HQ-OW-2015-0753-0005	*It is unknown if the solutions prepared from Cd salts, that were used to develop the conversion factors, adequately represent the forms of Cd found in natural waterbodies.*		Section 2.6
EPA HQ-OW-2015-0753-0005	*An explanation is needed as to why the conversion factors for the acute and chronic criteria are different. It also appears illogical that the constant conversion factor of 0.994 used for marine water is higher than for freshwater, especially because the hardness-dependent conversion factor for freshwater decreases as hardness increases.*		Section 2.6

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		Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0005	*While it is noted in several places in the document, clarify that the recommended criteria values are expressed as dissolved cadmium concentrations (not total). Also clarify if states have the option to adopt total Cd criteria values.*		No edits
EPA HQ-OW-2015-0753-0011	*Kansas has utilized the total recoverable metals criteria and data, and is not set up to sample for total dissolved metals. A conversion factor would be applied to calculate the dissolved concentration and Kansas recommends that EPA retain this flexibility in its final criteria.*		No edits

TOPIC 4: Data quality, use, and availability

Comment Number	Public Comment		Revision Locat in 2015 Cadmi Criteria Docu
EPA-HQ-OW-2015-0753-0006	*Some of the values that are new/revised since the 2001 AWQC document are from studies that were published before 2001. Table 22 has general information describing why GMAVs have changed between the 2001 and 2015 document, but it does not provide details on why these "new" data were now considered acceptable. Include another table that describes why the studies that were excluded previously are now included.*		No edits
EPA-HQ-OW-2015-0753-0013	*Should toxicity tests conducted under less-than optimal conditions be discounted? This comment goes beyond just the test results for Hyalella, because while laboratory tests used for criteria development use conditions that are as close to optimal as possible, wild populations in diverse natural conditions are often exposed to conditions that sub-optimal, and therefore laboratory tests may be underprotective in natural conditions (i.e., additional*		No edits

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	stresses) (see, Holmstrump et al. 2010; Besser et al. 2015).	**Ex. 5 - Deliberative Process**	
EPA-HQ-OW-2015-0753-0013	*"Other data" are not addressed consistent with the Guidelines. While these data are not used in the species sensitivity distribution rankings, they should not be thrown away, discounted, or deemed "unacceptable." "Other Data" can be invoked to lower a criterion (e.g., chronic value in the 1987 selenium criterion). Revaluate Riddel et al. (2005a, b) and include a larger discussion of their effect concentrations/findings and other similar behavioral/ecological studies.*		Sections 5 and 5.
EPA-HQ-OW-2015-0753-0013	*With many organisms, a strong difference in the sensitivity of different life stages makes it inappropriate to roll up data from different developmental stages. Pooling salmonid effects concentrations across developmental stages to obtain a SMAV could produce a misleading result (see, Hansen et al. 2002; Mebane et al. 2012; Chapman 1978; Chapman and Stevens 1978).*		Appendix A Ranked FW Acut Table
EPA-HQ-OW-2015-0753-0013	*The decision to only use ELS chronic data in which the exposures began in the egg stage, and to exclude long-term data in which the exposures began in the fry stage is non-conservative.*		No edits
EPA-HQ-OW-2015-0753-0013	*SMAV calculations tagged with the footnote "C", indicating that "Data not used to calculate SMAV because more sensitive life stage available, or flow-through measured test available", should be separated into two different footnotes since they are very different reasons.*		Appendix A and Appendix B
EPA-HQ-OW-2015-0753-0013			Appendix A Ranked FW Acut

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	Address the following Appendix A specific errors/changes: • *Daphnia magna (various)* o *Many "S, U" tests (tests with unmeasured concentrations) are underlined, indicating they are included in the SMAV calculations. These should be excluded per the Guidelines.*	Ex. 5 - Deliberative Process	Table
	• *Mayfly (formerly, Ephemerella grandis) Drunella grandis* o *Tested species was listed in the source document as Ephemerella subvaria, which is still a valid species name according to ITIS.gov.*		

	• *Rainbow trout (smolt), Chapman 1975 (>2.9 µg/L)*
	  o *Should be excluded from SMAV because it is from a resistant life stage. Also, should be listed as "Rainbow trout (Steelhead smolt)" as Steelhead are not just Rainbow Trout by a different name, but have physiological differences in regard to ion regulation. Chapman (1975) should only be cited when no alternative exists, because it was never formally released by EPA and is not publicly available online. Chapman (1978) reports the same data and is a better citation.*
	• *Rainbow trout (smolt), Chapman 1975 (4.1 µg/L)*
	  o *Suspect value, exclude from SMAV. Chapman (1978) lists the value for the same test as >2.9 µg/L. Chapman (1978) is the peer-reviewed publication of record for these data; Chapman (1975) was an unpublished, work-in-progress progress report that sometimes still gets cited because it includes data never published elsewhere, such as the coho data shown in the figure in this memo. Exclude from SMAV, resistant life stage and re-label as " "Rainbow trout (Steelhead smolt". See Chapman (1978, Table 3).*		

	Rainbow trout (299 mg), Stratus (1.29 µg/L) o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with unmanipulated pH of 7.5 were much more sensitive*	Ex. 5 - Deliberative Process	
	• *Chinook salmon (parr, 11.58g) (3.5 µg/L)* o *Exclude value from SMAV, based on a resistant life stage being tested. Value is twice as high as the value obtained with swim-up fry in matched tests and confidence limits don't overlap.* • *Chinook salmon (smolt, 32.46 g) (>2.9 µg/L)* o *Should be excluded from SMAV, based on a resistant life stage being tested.*		
	• *Bull trout (84.2 mg) (2.89 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with a natural pH of 7.5 were much more sensitive*		
	• *Colorado squawfish* o *Old common name is now considered repugnant. AFS calls it "Colorado pikeminnow". "Pikeminnow" is one word.*		
EPA-HQ-OW-2015-0753-0013	*Address the following Appendix C specific errors/changes:* • *Snail, Aplexa hyporum (Holcombe) (4.0 µg/L)* o *I got an EC20 of about 2.6 µg/L. By excluding the highest treatment with total mortality I could reproduce the 4.0 EC20 value, but it had a poor fit with Y0.*		No edits

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		Ex. 5 - Deliberative Process	

EPA-HQ-OW-2015-0753-0013	*Add the following additional relevant data:*
	
	• *Pascoe and Mattey 1977*
	  o *Chronic stickleback exposure*
	• *Wang et al. 2014*
	  o *Chronic fathead full life-cycle test*
	• *Brinkman and Vieira 2008*
	  o *Acute and chronic mountain whitefish*
	• *Mebane et al. 2014 (paper provided)*
	  o *Effects of cadmium on larval aquatic insect communities in 30-day experimental stream tests*
			Mebane et al. (20
			added to Section

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docum

ED_000992_00003094-00011

EPA-HQ-OW-2015-0753-0014	*There is concern about the focus on fish in developing the criteria. EPA needs to bring in other species including insects and freshwater mussels into the process when developing criteria for cadmium. This lack of additional species prevents a more holistic picture of the freshwater community, and results in criteria that are not protective of all aquatic-dependent wildlife. EPA has consistently failed to fully consider aquatic-dependent wildlife in the development of national criteria.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0010	*There is concern with the continued lack of estuarine/marine chronic cadmium toxicity data and that no new chronic toxicity data have been generated since 2001. EPA should conduct additional chronic toxicity studies (particularly with vertebrate species) to expand the estuarine/marine chronic toxicity dataset. More estuarine/marine chronic data are needed to develop a scientifically reliable chronic cadmium criterion.*		No edits
EPA-HQ-OW-2015-0753-0010	*The mysid Neomysis integer is a new species added to the estuarine/marine acute dataset, but this mysid is potentially non-native to the United States. Since there are available values for two other native mysid species (M. bigelowi and A. bahia), this non-native species should be removed (unless documentation is provided confirming it is naturally occurring within waters of North America).*		Section 3.2.1 and Appendix B

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TOPIC 5: ESA considerations

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docu
EPA-HQ-OW-2015-0753-0014	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0014	*To ensure the final cadmium water quality criteria is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*	Thank you for your comment.	No edits

EPA HQ-OW-2015-0753-0009	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to account for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	No edits
EPA HQ-OW-2015-0753-0009	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*	Please see response to the above comment.	No edits
EPA HQ-OW-2015-0753-0015	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a*	Thank you for your comment.	No edits

	Section 7 Consultation.		
EPA HQ-OW-2015-0753-0015	*''EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.* *Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.*	**Ex. 5 - Deliberative Process**	No edits

		Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0015	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*		No edits
EPA HQ-OW-2015-0753-0015	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and that ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*		No edits
EPA HQ-OW-2015-0753-0015	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*		No edits

TOPIC 6: Other

Comment	Public Comment	EPA Response	Revision Locat in 2015 Cadmi

Number			Criteria Docum
EPA-HQ-OW-2015-0753-0014	*In the description of sources of cadmium in the document, EPA overlooked the contribution from coal combustion, coal mining waste, and coal ash ponds spills, seepage, and discharge. These important sources need to be recognized and addressed.*	Ex. 5 - Deliberative Process	ction 2.1

EPA-HQ-OW-2015-0753-0006	*Check the document for errors and typos. Specific examples include:*
	• *Pg.27 which is intended to provide an acute criterion protective of nearly all individuals in the distribution (Stephan et al. **1985);the** FAV/2 approach was developed to estimate minimal effect levels,*
	• *Pg.30 This outcome was based on the poor correlation between hardness and acute toxicity for D. magna and occurred only when tests with **less than** 24-hr old neonates were included in the database. Accordingly, only the five D. magna tests from Chapman et al. (1980} initiated with **less than** 24-hr old neonates were used for the analysis*
	• *Pg.33 Two species of sculpin, Cottus bairdii and Cottus confusus, are used to derive the normalized GMAV of **4.962** µg Cd/L*
	  o ***Per Appendix A, this value should be 4.926***
	• *Pg.34 The hardness-normalized GMAV of **7.911** µg/L total cadmium for the genus Oncorhynchus is the fifth lowest in the acute dataset*
	  o ***Per Appendix A, this value should be 7.841 ***
	• *Pg.42 2. Ceriodaphnia, Cladoceran (GMCV=**1.293µg/l** total Cd)*
	• *Pg. 74 Acceptable chronic toxicity **data** are available for 27 freshwater species representing 20 different genera*
	• *Pg. C-8 [d]Not used to calculate **SMAV** because either a more definitive value available, value is considered an outlier, or preference was given to the more sensitive exposure scenario (LC versus ELS tests).*
			rious locations

EPA-HQ-OW-2015-0753-0006	*While Table 5 summarizes the Phyla, Families, Genera, and Species used to derive the revised criterion, it is unclear which species were used to meet each of the MDRs. Include a table that lists the eight requirements and the species used to fulfill them.*		ble 5

EPA-HQ-OW-2015-0753-0006	*Verify that the Spehar and Fiandt 1986 data for Pimephales promelas is appropriate to include in the freshwater acute hardness correction.*	**Ex. 5 - Deliberative Process**	Appendix Table A-2, C-1 and C-2
EPA-HQ-OW-2015-0753-0006	*Expand Table 6 to include the actual data that were used in the freshwater acute hardness correction for each species.*		Appendix Table A
EPA-HQ-OW-2015-0753-0006	*Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process.*		Figure 2
EPA-HQ-OW-2015-0753-0006	*Indicate how the R^2 value of 0.964 was obtained in the freshwater acute hardness correction. Attempts to replicate the value resulted in a slope of 1.104 and R^2 of 0.698.* *Indicate how the R^2 value of 0.841 was obtained in the freshwater chronic hardness correction. Attempts to replicate the value resulted in a slope of 0.798 and R^2 of 0.632.*		No edits
EPA-HQ-OW-2015-0753-0006	*It was not apparent if the MATC or EC_{20} value was used for the freshwater chronic slope derivation. Indicate which of the toxicity values were used in the derivation in Appendix C and Table 8.*		Appendix Table C
EPA-HQ-OW-2015-0753-0006	*Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process.*		Figure 4
EPA-HQ-OW-	*The language that describes the computation of the final acute*		

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2015-0753-0006	*value on pg. 32 is insufficient. Include a reference to section 4.3.1 after the reference to Figure 2 on page 32.*		
EPA-HQ-OW-2015-0753-0006	*It is unclear how the intercept of the freshwater acute and chronic criterion equations were derived. Add additional language to clarify how these values were derived.*	**Ex. 5 - Deliberative Process**	No edits

Appendix A
Representative Publications Using H. azteca Length-to-Weight Regression

Besser JM, Brumbaugh WG, Ingersoll CG, Ivey CD, Kunz JL, Kemble NE, Schlekat CE, Garman ER. 2013. Chronic toxicity of nickel - spiked freshwater sediments: Variation in toxicity among eight invertebrate taxa and eight sediments. Environ Toxicol Chem 32:2495-2506.

Besser JM, Ingersoll CG, Brumbaugh WG, Kemble NE, May TW, Wang N, MacDonald DD, Roberts AD. 2015. Toxicity of sediments from lead-zinc mining areas to juvenile freshwater mussels (*Lampsilis siliquoidea*), compared to standard test organisms. Environ Toxicol Chem 34:626-639.

Besser JM, Ivey CD, Brumbaugh WG, Ingersoll CG. 2015. Effect of Diet Quality on Chronic Toxicity of Aqueous Lead to the Amphipod, Hyalella azteca. Environ Toxicol Chem (in press) doi:10.1002/etc.3341

Ivey CD, Ingersoll CG. 2016. Influence of bromide on the performance of the amphipod Hyalella azteca in reconstituted waters. Environ Toxicol Chem: This issue.

Kemble NE, Hardesty DK, Ingersoll CG, Kunz JL, Sibley PK, Calhoun DL, Gilliom RJ, Kuivila KM, Nowell LH, Moran PW. 2013. Contaminants in stream sediments from seven U.S. metropolitan areas: II. Sediment toxicity to the amphipod *Hyalella azteca* and the midge *Chironomus dilutus*. *Arch Environ Contam Toxicol* 64:52-64.

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Appendix B
Sensitivity of CERC Cd *Hyalella* Study to Concentration Intervals

ED_000992_00003094-00021

TOPIC 6: ESA considerations

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	**Ex. 5 - Deliberative Process**	*None*
EPA-HQ-OW-2015-0753-0014	*To ensure the final cadmium water quality criteria to is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*	Thank you for your comment.	*None*

EPA HQ-OW-2015-0753-0009	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to account for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0009	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*	Please see response to comment above.	

EPA HQ-OW-2015-0753-0015	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a Section 7 Consultation.*	Thank you for your comment.	*None*
EPA HQ-OW-2015-0753-0015	*EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.*	**Ex. 5 - Deliberative Process**	

	Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0015	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*		
EPA HQ-OW-2015-0753-0015	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*		

EPA HQ-OW-2015-0753-0015	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*	**Ex. 5 - Deliberative Process**	

TOPIC 6: ESA considerations

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	Ex. 5 - Deliberative Process	*Self explanatory*
EPA-HQ-OW-2015-0753-0014	*To ensure the final cadmium water quality criteria to is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*	Thank you for your comment.	*Self explanatory*

EPA HQ-OW-2015-0753-0009	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to account for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0009	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*	**Ex. 5 - Deliberative Process**	

EPA HQ-OW-2015-0753-0015	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a Section 7 Consultation.*	**Ex. 5 - Deliberative Process**	*Self explanatory*
EPA HQ-OW-2015-0753-0015	*EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.*		

	Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.		
EPA HQ-OW-2015-0753-0015	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0015	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*		
EPA HQ-OW-	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine*		

2015-0753-0015	*waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*	**Ex. 5 - Deliberative Process**	

To: Lalley, Cara[Lalley.Cara@epa.gov]
Cc: Harper, Ashley[harper.ashley@epa.gov]; Elias, Mike[Elias.Mike@epa.gov]
From: Gallagher, Kathryn
Sent: Mon 4/4/2016 7:16:20 PM
Subject: RE: MEDIA INQUIRY: GREENWIRE; Cadmium criteria
Response to Questions 4-4-16.docx

Updated responses attached.

Kathryn Gallagher, Ph.D. | Branch Chief, Ecological Risk Assessment Branch | Health and Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

-----Original Message-----
From: Lalley, Cara
Sent: Monday, April 04, 2016 11:21 AM
To: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>
Cc: Harper, Ashley <harper.ashley@epa.gov>
Subject: FW: MEDIA INQUIRY: GREENWIRE; Cadmium criteria
Importance: High

Kathryn,

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

-----Original Message-----
From: Schollhamer, Mary
Sent: Friday, April 01, 2016 2:35 PM
To: Lalley, Cara <Lalley.Cara@epa.gov>
Cc: Loop, Travis <Loop.Travis@epa.gov>
Subject: MEDIA INQUIRY: EE GREENWIRE; Cadmium [DDL Flex.]

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Mary G Schollhamer
Acting Deputy Director of Communications Office of Water U.S. Environmental Protection Agency
Office: 202-564-5759
Mobile: 202-853-5317
schollhamer.mary@epa.gov

-----Original Message-----
From: Daguillard, Robert
Sent: Friday, April 01, 2016 2:29 PM
To: Schollhamer, Mary <Schollhamer.Mary@epa.gov>
Subject: RE: MARY ACTION: EE GREENWIRE; NEGOT. DEADLINE; CADMIUM

Follow-up:

Ex. 5 - Deliberative Process

Thanks, R.

-----Original Message-----
From: Daguillard, Robert
Sent: Friday, April 01, 2016 1:47 PM
To: Schollhamer, Mary <Schollhamer.Mary@epa.gov>
Subject: MARY ACTION: EE GREENWIRE; NEGOT. DEADLINE; CADMIUM

Mary, EE Greenwire is asking us to react to the Center for Biological Diversity's release below. Please note, they're referring to the national cadmium announcement we issued two days ago, not to today's proposed criteria for Oregon.

Ex. 5 - Deliberative Process

-----Original Message-----
From: Corbin Hiar
Sent: Friday, April 01, 2016 1:38 PM
To: Daguillard, Robert <Daguillard.Robert@epa.gov>
Subject: FW: EPA Approves Dangerous Water Quality Standard for Cadmium

Hi Robert,

I'm pinch hitting for our water reporter Tiffany, who's on vacation today. Does EPA have any comment on CBD's claims? Did the agency put out any PR about this new standard?

I plan to file by 3 p.m.

Thanks.

Corbin Hiar
E&E Reporter

http://www.biologicaldiversity.org/news/press_releases/2016/cadmium-04-01-2016.html

For Immediate Release, April 1, 2016

Contact: Brett Hartl, (202) 817-8121, Bhartl@biologicaldiversity.org

EPA Approves Dangerous Water Quality Standard for Cadmium

Endangered Salmon, Sturgeon, Sea Turtles, Corals, Freshwater Animals Will Continue to Be Harmed After EPA Ignores Comments From Experts

WASHINGTON- The Environmental Protection Agency today finalized a new, nationwide water-quality criterion for cadmium that is nearly 40 percent higher than the standard the National Marine Fisheries Service concluded would be safe for endangered salmon in Idaho. Used in the manufacturing of batteries, plastics and electronics, cadmium is toxic to people and wildlife and regulated under the Clean Water Act. But despite the recommendation from the Fisheries Service that the EPA consult with it, as required by the Endangered Species Act, the EPA refused.

"It is beyond disappointing that the EPA continues to turn a blind eye to our nation's most endangered species," said Brett Hartl, endangered species policy director at the Center for Biological Diversity. "Freshwater animals like sturgeon, crayfish and mussels are some of the fastest-declining species in the United States in large part because toxic metals like cadmium continue to be poorly regulated by the EPA."

The new acute water quality criteria of 1.8 micrograms/liter is nearly 40 percent higher than the standard of 1.3 micrograms/liter, which the National Marine Fisheries Service concluded would be safe for endangered salmon in Idaho. Although naturally occurring in extremely low levels, cadmium is a known human carcinogen and is acutely toxic. Chronic exposure to cadmium causes negative impacts on reproduction, immune and endocrine system response, and development for aquatic species.

Despite the Endangered Species Act requirement that the EPA consult with the expert wildlife agencies on any action they take that could harm endangered species, the EPA failed to do so. As a result, the U.S. Fish and Wildlife Service did not even submit comments to EPA on the proposed cadmium standard, leaving the fate of more than 200 species of endangered fish and mussels completely unaccounted for in EPA's decision-making. The National Marine Fisheries Service provided detailed comments noting that the impacts from cadmium on sea turtles and corals had not been assessed leaving these animals vulnerable. The Fisheries Service also noted that EPA's 30-year-old protocols for assessing ecological impacts was completely out of date.

"The EPA needs to stop its head-in-the-sand approach to toxic pollutants, and instead start listening to the best scientific experts about the real-world impacts of these harmful chemicals on endangered species," said Hartl. "If EPA had set a standard that protected the most sensitive endangered species, it would have also set a standard that fully protects our own health and well-being."

The Center for Biological Diversity is a national, nonprofit conservation organization with more than 990,000 members and online activists dedicated to the protection of endangered species and wild places.

To unsubscribe reply with "unsubscribe" in subject line

To: Lalley, Cara[Lalley.Cara@epa.gov]
Cc: Harper, Ashley[harper.ashley@epa.gov]; Elias, Mike[Elias.Mike@epa.gov]
From: Gallagher, Kathryn
Sent: Mon 4/4/2016 3:39:44 PM
Subject: RE: MEDIA INQUIRY: GREENWIRE; Cadmium criteria

We need to edit these. I'll work with Mike today.

Kathryn Gallagher, Ph.D. | Branch Chief, Ecological Risk Assessment Branch | Health and Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

-----Original Message-----
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Ex. 5 - Deliberative Process

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Ex. 5 - Deliberative Process

Mary G Schollhamer
Acting Deputy Director of Communications Office of Water U.S. Environmental Protection Agency
Office: 202-564-5759
Mobile: 202-853-5317
schollhamer.mary@epa.gov

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Follow-up:

Ex. 5 - Deliberative Process

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Sent: Friday, April 01, 2016 1:47 PM
To: Schollhamer, Mary <Schollhamer.Mary@epa.gov>
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Mary, EE Greenwire is asking us to react to the Center for Biological Diversity's release below. Please note, they're referring to the national cadmium announcement we issued two days ago, not to today's proposed criteria for Oregon.

Ex. 5 - Deliberative Process

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Sent: Friday, April 01, 2016 1:38 PM
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Subject: FW: EPA Approves Dangerous Water Quality Standard for Cadmium

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Corbin Hiar
E&E Reporter

http://www.biologicaldiversity.org/news/press_releases/2016/cadmium-04-01-20

16.html

For Immediate Release, April 1, 2016

Contact: Brett Hartl, (202) 817-8121, Bhartl@biologicaldiversity.org

EPA Approves Dangerous Water Quality Standard for Cadmium

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The Center for Biological Diversity is a national, nonprofit conservation organization with more than 990,000 members and online activists dedicated to the protection of endangered species and wild places.

To unsubscribe reply with "unsubscribe" in subject line

To: Harper, Ashley[harper.ashley@epa.gov]
From: Gallagher, Kathryn
Sent: Wed 3/23/2016 4:50:40 PM
Subject: RE: Draft Topics List for 3/25 Administrator Weekly Email & Communiques

good

Kathryn Gallagher, Ph.D. | Branch Chief, Ecological Risk Assessment Branch | Health and Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

From: Harper, Ashley
Sent: Wednesday, March 23, 2016 9:25 AM
To: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>
Subject: RE: Draft Topics List for 3/25 Administrator Weekly Email & Communiques
Importance: High

What about this Kathryn:

Cadmium

The EPA is in the process of updating the agency's 304(a) cadmium aquatic life ambient water quality criteria for final publication. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species. We released draft updated cadmium aquatic life criteria for public comment on December 1, 2015. The Cadmium FRN is expected to be signed today, March, 24 2016, for publication in the Federal Register by March 31, 2016.

Ashley S. Harper | Communications Specialist

Health and Ecological Criteria Division | Office of Water

U.S. Environmental Protection Agency

1200 Pennsylvania Avenue, NW, Washington, DC 20460

☎ Phone: (202) 566-0532 | harper.ashley@epa.gov

From: Flaherty, Colleen
Sent: Wednesday, March 23, 2016 9:15 AM
To: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>; Harper, Ashley <harper.ashley@epa.gov>
Cc: Behl, Betsy <Behl.Betsy@epa.gov>
Subject: FW: Draft Topics List for 3/25 Administrator Weekly Email & Communiques

Ex. 5 - Deliberative Process Due by 1pm. Thanks, Kathryn and Ashley.

From: Conerly, Octavia
Sent: Wednesday, March 23, 2016 8:26 AM
To: Behl, Betsy <Behl.Betsy@epa.gov>; Flaherty, Colleen <Flaherty.Colleen@epa.gov>; Hisel-Mccoy, Sara <Hisel-McCoy.Sara@epa.gov>; Washington, Evelyn <Washington.Evelyn@epa.gov>; Wood, Robert <Wood.Robert@epa.gov>; Zipf, Lynn <Zipf.Lynn@epa.gov>
Cc: Southerland, Elizabeth <Southerland.Elizabeth@epa.gov>; Lape, Jeff <lape.jeff@epa.gov>
Subject: RE: Draft Topics List for 3/25 Administrator Weekly Email & Communiques

Good morning All,

We have already sent communiques to Joel for both cadmium and Oregon, now we need to develop shorter versions of these for Joel's weekly email to the Administrator. I have included our cadmium (weekly email) submission from 3 weeks ago. (Please update this one for this week. The communique for OR Cu and Cd ALC is included also. Please provide a condensed version of this for Joel's weekly. I need both of these by 1pm today. Thanks in advance.

Cadmium (from 3 weeks ago)

We are updating the 2001 cadmium criteria to reflect substantial new toxicity data. We released draft updated cadmium aquatic life criteria for public comment on December 1, 2015. We are currently reviewing the public comments and revising the document and will publish the final updated cadmium criteria by March 31, 2016.

Communique for Proposed Rule on Oregon Copper and Cadmium Aquatic Life Criteria

Description of Action: This rule proposes acute cadmium and acute and chronic copper aquatic life criteria for freshwaters under Oregon's jurisdiction. On January 23, 2013 EPA took a formal action to disapprove the acute cadmium criterion and acute and chronic copper criteria adopted by Oregon and submitted to EPA in 2004. The disapproval was informed, in part, by the National Marine Fisheries Service's 2012 conclusion that these criteria would jeopardize the continued existence of endangered salmonids in Oregon.

On April 30, 2015, the Northwest Environmental Advocates (NWEA) filed a complaint in district court seeking to compel EPA to (1) promptly propose these and other aquatic life criteria that EPA disapproved in 2013 and (2) finalize those criteria within 90 days of proposal. A consent decree between EPA and NWEA is expected to be finalized shortly and will require that this proposed rule for cadmium and copper be signed by March 31, 2016 (and that a final rule be signed by January 16, 2017).

The acute cadmium criterion that EPA is proposing for Oregon is consistent with EPA's 2016 updated national acute cadmium criterion recommendation for aquatic life protection. Similarly, the acute and chronic copper criteria that EPA is proposing for Oregon are consistent with EPA's latest (2007) national recommended aquatic life copper criteria.

Internal Review: This rule was developed by OW's Office of Science and Technology with substantive input from the Region 10 Office of Water and Watersheds. Additional input and review was provided by Office of Wastewater Management, Office of Policy, Office of General Counsel, and Office of Research and Development; all internal parties have worked collaboratively and are comfortable with the proposed rule. This proposed rule was designated Tier 3, and OMB determined that it is not significant under EO 12866.

Ex. 5 - Deliberative Process

Octavia Conerly

Special Assistant to the Office Director

Office of Science and Technology

1200 Pennsylvania Ave. NW MC 4304T

Room 5231H

Washington, DC 20460

EMAIL: conerly.octavia@epa.gov

PHONE: (202) 566-1094

FAX: (202) 566-0441

From: Gude, Karen
Sent: Tuesday, March 22, 2016 12:05 PM
To: Greene, Ashley <Greene.Ashley@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>; Nandi, Romell <Nandi.Romell@epa.gov>; Farris, Erika D. <Farris.Erika@epa.gov>; Klasen, Matthew <Klasen.Matthew@epa.gov>
Cc: Campbell, Ann <Campbell.Ann@epa.gov>; Ruf, Christine <Ruf.Christine@epa.gov>; Lousberg, Macara <Lousberg.Macara@epa.gov>; Loop, Travis <Loop.Travis@epa.gov>; Orvin, Chris <Orvin.Chris@epa.gov>
Subject: Draft Topics List for 3/25 Administrator Weekly Email & Communiques -- Deadline Thursday at noon

Dear Special Assistants,

Sorry for the delay in getting this out. Below please find a list of possible topics for the 3/25 Administrator Weekly Email, as well as upcoming communiques. If you could please send the Administrator Weekly Email write-ups no later than noon on Thursday (3/24).

Travis/Matt/Chris/Macara/Ann – If it looks like I might be missing anything for this week, please let me know.

Possible Topics for 3/18 Administrator Weekly Email:

- **Drinking Water Strategy/White House Announcement** (OGWDW), if ready

- **Nutrient Recycling Challenge** (OWM)

- **NPDES CGP Signing/Release** (OWM)

- **Customer Assistance Program Compendium (OWM)** – Not sure this rises to the level of the Admin Weekly. Maybe an FYI for Joel?

- **Coordinated Federal Permitting of Offshore Aquaculture Operations in the Gulf of Mexico** (OWM) – Not sure this rises to the level of the Admin Weekly. Maybe an FYI for Joel?

- **Proposed Rule for Oregon Signing/Release** (OST)

- **Cadmium Signing/Release** (OST) – The previous write provided by OST is included here:

o ***Cadmium:*** *We are updating the 2001 aquatic life water quality cadmium criteria to reflect substantial new toxicity data. Draft criteria were released for public comment on December 1, 2015. We are currently reviewing the public comments and revising the document and expect to publish the final updated cadmium criteria by March 31, 2016.*

The driver for updating EPA's cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following a jeopardy call from the National Marine Fisheries Service in 2012 on EPA's 2001 freshwater acute cadmium criteria. As a result of settlement negotiations EPA plans to propose updated cadmium criteria in rulemaking for Oregon by March 31, 2016

and finalize by January 16, 2017. EPA's updated 304(a) national criteria will be the basis for this rulemaking and is thus being finalized prior to proposal of criteria for Oregon. Region 10 is leading discussions with the National Marine Fisheries Service on cadmium effects on endangered salmonids. OW is providing technical analyses to support these effort; ORD is also supporting the region with technical assistance on this effort.

The acute toxicity database for cadmium increased greatly since 2001; there are 27 additional freshwater species and 33 additional saltwater species included in the 2016 acute test dataset that were not in the 2001 dataset. Six new freshwater species chronic tests are also included in the 2016 criteria dataset.

Communiques:

- **NPDES Updates Rule (OWM)** – tracking Administrator signature for 4/7. Has a communique been drafted for this action?

- **CWSRF Allotment Formula RTC and CSO GLB RTC (OWM)** – Is OWM planning communiques on these actions? I can double check with Ann/Joel on this, if needed.

- **NPDES Construction General Permit:** (OWM) Anticipate RAs signature 3/29. Communique provided to Joel 3/15.

- **Oregon ALC:** (OST) Administrator signature anticipated 3/31. Joel sent communique to Administrator on 3/14.

Thanks,

Karen Gude, Special Assistant

U.S. Environmental Protection Agency

Office of Water

Phone: (202) 564-0831

To: Evans, Crystal[Evans.Crystal@epa.gov]
From: Gallagher, Kathryn
Sent: Wed 3/23/2016 2:15:20 PM
Subject: Re: OST Monday Meeting notes for this week from kathryn

Thanks!

Sent from my iPhone

On Mar 23, 2016, at 8:49 AM, Evans, Crystal <Evans.Crystal@epa.gov> wrote:

Thank you. **Ex. 5 - Deliberative Process**

Crystal

From: Gallagher, Kathryn
Sent: Tuesday, March 22, 2016 9:22 PM
To: Evans, Crystal <Evans.Crystal@epa.gov>
Subject: OST Monday Meeting notes for this week from kathryn

Aquatic Life

Cadmium

•□□□□□□□□ HECD (Mike Elias) briefed Joel Beauvais on the final cadmium final Aquatic Life Criteria on March 23 prior to signature and release the criteria on the planned date of March 30. The criteria reflect addition of toxicity data on 75 additional freshwater species since the last criteria update in 2001. The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. The EPA's disapproval triggered a CWA duty for the EPA to propose a replacement criterion for Oregon. The disapproval stemmed from a jeopardy call for endangered salmonids for the acute freshwater criteria. OST is working to meet the pending consent decree with NWEA to propose acute cadmium criteria for Oregon by March 31, 2016 and finalize by January 16, 2017. The criteria provide the scientific basis for the criteria rulemaking,

Selenium

•□□□□□□□□ HECD (Joe Beaman) kicked off the final Agency workgroup review of the selenium chronic Aquatic Life Criterion on March 15. The Agency review will close on April 15. Following subsequent revision of the document, the criterion will be released as final in June 2016.

Regional Assistance

HECD provided technical assistance this week to:

Ex. 5 - Deliberative Process

Kathryn Gallagher, Ph.D. | Branch Chief, Ecological Risk Assessment Branch | Health and Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

From: Evans, Crystal
Sent: Friday, March 04, 2016 2:01 PM
To: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>
Cc: Elias, Mike <Elias.Mike@epa.gov>
Subject: OST Monday Meeting

Can you please forward the OST notes for this Monday, March 7th to me this afternoon.

Ms. Behl is seeking this information today.

Thank you,

Crystal Evans

To: Evans, Crystal[Evans.Crystal@epa.gov]
From: Gallagher, Kathryn
Sent: Wed 3/23/2016 1:22:22 AM
Subject: OST Monday Meeting notes for this week from kathryn

Aquatic Life

Cadmium

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Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

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Sent: Friday, March 04, 2016 2:01 PM
To: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>
Cc: Elias, Mike <Elias.Mike@epa.gov>
Subject: OST Monday Meeting

Can you please forward the OST notes for this Monday, March 7th to me this afternoon.

Ms. Behl is seeking this information today.

Thank you,

Crystal Evans

Update of: *Recommended Aquatic Life Ambient Water Quality Criteria for Cadmium – 2016*

Substance

The EPA is updating the agency's 304(a) cadmium aquatic life ambient water quality criteria for final publication. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species.

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following the EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. The EPA's disapproval triggered a CWA duty for the EPA to propose a replacement criterion for Oregon. The agency is currently negotiating a settlement with the litigants in which the EPA would commit to propose these new cadmium criteria for Oregon by March 31, 2016, and take final rulemaking action by January 16, 2017.

The basis of the EPA's disapproval of Oregon's cadmium criterion (and the EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effect to salmon species based on the EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standard). The 2016 updated freshwater acute criterion is slightly more stringent than the 2001 value. A draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater acute criterion is expected to provide protection for endangered salmonids, based the minimal acute effects level (5%) specified by the NMFS in their Reasonable and Prudent Alternatives. Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Process

Office of Science and Technology partnered within the agency with Office of Research and Development to develop the criteria. The criteria were reviewed by the Office of Research and Development, Office of Chemical Safety and Pollution Prevention, and the Regions (3, 4, 5, 8, 9, and 10) and Office of Policy. The EPA conducted an external contractor-led letter peer review on the criteria document that was completed in 2015. The document was available for a 60-day public comment period which ended February 1, 2016.

Stakeholder Reaction

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

To: Behl, Betsy[Behl.Betsy@epa.gov]
From: Gallagher, Kathryn
Sent: Mon 3/21/2016 10:52:31 PM
Subject: RE: Draft Cd briefing for Joel
Cadmium Aquatic Life Criteria - Draft Briefing for OW DAA on 3-23-16bb.docx

Here it is all edits accepted, and that one uncertainty text move to the bottom.

Kathryn Gallagher, Ph.D. | Branch Chief, Ecological Risk Assessment Branch | Health and Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

From: Behl, Betsy
Sent: Monday, March 21, 2016 6:39 PM
To: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>
Cc: Elias, Mike <Elias.Mike@epa.gov>
Subject: RE: Draft Cd briefing for Joel

I revised Ex. 5 - Deliberative Process See what you think

From: Gallagher, Kathryn
Sent: Monday, March 21, 2016 5:25 PM
To: Behl, Betsy <Behl.Betsy@epa.gov>
Cc: Elias, Mike <Elias.Mike@epa.gov>
Subject: Draft Cd briefing for Joel
Importance: High

Betsy,

Attached please find the draft Cd criteria briefing for Joel. Erica/SHPD reviewed.

Thanks in advance for any edits.

Kathryn Gallagher, Ph.D. | Branch Chief, Ecological Risk Assessment Branch | Health and Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

MEMORANDUM

SUBJECT: Notice of Availability: Recommended Aquatic Life Ambient Water Quality Criteria for Cadmium – 2016 (Tier 3, SAN 5843) - ACTION MEMORANDUM

FROM: Elizabeth Southerland
Director, Office of Science and Technology

TO: Joel Beauvais
Deputy Assistant Administrator

PURPOSE
Attached for your signature is the *Federal Register* notice announcing the U.S. Environmental Protection Agency's release of the Updated Aquatic Life Criteria for Cadmium. The public will be able to access the criteria document through the EPA docket and website www.regulations.gov.

Following closure of the public comment period, the EPA will consider the public comments and revise the document accordingly. Once finalized, the EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act (CWA).

DEADLINE
The Updated Aquatic Life Criteria for Cadmium needs to be published by March 30, 2015, in order to maintain a timeline set by a potential lawsuit settlement agreement with Northwest Environmental Advocates.

OVERVIEW
The EPA is in the process of updating the agency's 304(a) cadmium aquatic life ambient water quality criteria. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species.

The driver for updating the cadmium criteria was a lawsuit brought on by Northwest Environmental Advocates following the EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. The EPA's disapproval triggered a CWA duty for the EPA to propose a replacement criterion for Oregon. The EPA intends to use the updated criteria document as the scientific basis for the proposed rule. The agency is currently negotiating a settlement with the litigants in which the EPA would commit to propose cadmium criterion for Oregon by March 31, 2016, and take final rulemaking action by January 16, 2017. The 304(a) criteria being proposed are the basis for the rulemaking and, therefore, the document is time sensitive. We proposed the draft criteria for 60 days of public comment on December 1, 2015. The numbers have changed slightly as a result of adopting changes derived from the public comment period.

The basis of the EPA's disapproval of Oregon's cadmium criterion (and the EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effect to salmon species based on the EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). The 2016 updated freshwater acute criterion is slightly more stringent than the 2001 value. A draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater acute criterion is expected to provide protection for endangered salmonids, based the minimal acute effects level (5%) specified by the NMFS in their Reasonable and Prudent Alternatives. It is likely, however, that the Services may still question this criterion as they expected our update to result in an even more stringent value.

ANTICIPATED PUBLIC AND STAKEHOLDER RESPONSE

Ex. 5 - Deliberative Process

INTERNAL DEVELOPMENT AND REVIEW PROCESS

Office of Science and Technology partnered within the agency with Office of Research and Development to develop the document. The document was reviewed by the Office of Research and Development, Office of Chemical Safety and Pollution Prevention, and the Regions (3, 4, 5, 8, 9, and 10) and Office of Policy. The EPA conducted an external contractor-led letter peer review on the criteria document that was completed in 2015. The document was available for a 60-day public comment period which ended February 1, 2016.

If you need additional information or have questions regarding this notice, please call Elizabeth Behl at (202) 566-0788.

Update of: *Recommended Aquatic Life Ambient Water Quality Criteria for Cadmium – 2016*

Substance

The EPA is in the process of updating the agency's 304(a) cadmium aquatic life ambient water quality criteria for final publication. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species.

The driver for updating the cadmium criteria was a lawsuit brought on by Northwest Environmental Advocates following the EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. The EPA's disapproval triggered a CWA duty for the EPA to propose a replacement criterion for Oregon. The EPA would intend to use the updated criteria document as the scientific basis for the proposed rule. The agency is currently negotiating a settlement with the litigants in which the EPA would commit to propose cadmium criteria for Oregon by March 31, 2016, and take final rulemaking action by January 16, 2017. The 304(a) criteria being proposed are the basis for the rulemaking and, therefore, the document is time sensitive. We proposed the draft criteria for 60 days of public comment on December 1, 2015. The numbers presented in the final document have changed slightly from the draft as a result of adopting changes derived from the public comment period.

The basis of the EPA's disapproval of Oregon's cadmium criterion (and the EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service for acute effect to salmon species based on the EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated freshwater acute criterion is slightly more stringent than the 2001 value, a draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater criterion are expected to provide approximately 95 percent protection for endangered salmonids based on acute effects, a minimal effects level associated with the jeopardy opinion. It is likely, however, that the Services may still question these criteria as they expected our update to result in even more stringent values.

Process

Office of Science and Technology partnered within the agency with Office of Research and Development to develop the document. The document was reviewed by the Office of Research and Development, Office of Chemical Safety and Pollution Prevention, and the Regions (3, 4, 5, 8, 9, and 10) and Office of Policy. The EPA conducted an external contractor-led letter peer review on the criteria document that was completed in 2015. The document was available for a 60-day public comment period which ended February 1, 2016.

Stakeholder Reaction

Ex. 5 - Deliberative Process

Rollout

Final Updated Aquatic Life Water Quality Criteria for Cadmium

PUBLIC RELEASE DATE: March 30, 2016

KEY INFORMATION:

- The updated criteria values are very similar to the criteria we issued in 2001. EPA used the approach we routinely use in developing aquatic life recommended criteria, and added new toxicity data representing over 75 additional species.

- The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a CWA duty for EPA to propose a replacement criterion for Oregon. The updated criteria document provides the scientific basis for our proposed rule.

- The basis of EPA's disapproval of Oregon's cadmium criterion was a 2012 jeopardy Biological Opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species. A draft ESA analysis developed by EPA indicated that the updated freshwater criteria is expected to provide approximately 95% protection for acute exposure to endangered salmonids, a minimal effects level established in the jeopardy opinion.

- Few regulated entities will be affected by the new criteria; as of 2014 there were three companies that produced refined cadmium in the U.S.: one in Tennessee (as a byproduct of zinc production) and one each in Ohio and Pennsylvania (recovered from scrap metal).

ACTION:
EPA is publishing a Federal Register notice informing the public about the release of the final version of the updated national recommended aquatic life water quality criteria for cadmium.

ANTICIPATED REACTION:

Ex. 5 - Deliberative Process

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Ex. 5 - Deliberative Process

MATERIALS:

- Desk Statement
- Stakeholder Notification List
- Water Headlines Entry
- Questions and Answers for the Press Office
- Fact Sheet
- Updated webpage

DESK STATEMENT:
EPA has published updated water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters.

The 2016 cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. In addition, the effect of total hardness (the amount of dissolved calcium and magnesium in water) on cadmium toxicity was revised with the newly acquired data. The criteria have undergone an external peer review and a 60 day public comment period.

EPA's water quality criteria for cadmium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

More information: http://www.epa.gov/wqc/aquatic-life-criteria-cadmium

BACKGROUND:

EPA is obligated to publish final updated cadmium criteria by May 30, 2016 as a result of a settlement agreement with the Northwest Environmental Advocates (NWEA). EPA intends to use the updated criteria document as the scientific basis for a rulemaking to propose criteria for Oregon, which we plan to publish at the beginning of April 2016.

A brief history of EPA's development of ambient water quality criteria (AWQC) for cadmium for the protection of aquatic life:

- 1980- EPA first published AWQC for cadmium.
- 1985- EPA updated the AWQC criteria; this update superseded 1980 criteria.
- 1996- EPA updated the AWQC criteria; this update superseded 1985 criteria.
- 2001- EPA updated the AWQC criteria; this update superseded the 1996 criteria. This update was based on dissolved cadmium to more accurately account for bioavailability and reflected the latest EPA policy for metals risk assessment.
- 2015- EPA published draft updated cadmium criteria for public comment.

The updated criteria include data for 75 new species and 49 new genera. The freshwater acute criterion for dissolved cadmium is slightly lower (i.e. more stringent) than the 2001 acute. The freshwater chronic criterion is slightly higher (i.e., less stringent) compared to the 2001 criterion for dissolved cadmium; this modest increase is primarily due to the inclusion of four new genera, and the reanalysis of other data. As in the 2001 criteria, the draft freshwater acute criterion was derived to be protective of aquatic species and further lowered to protect the commercially and recreationally important rainbow trout. Rainbow trout are sensitive salmonids which were the focus of the jeopardy opinion for National Marine Fisheries service. In addition, the duration of the 2016 acute criteria was changed to one hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The estuarine/marine acute and chronic criteria for dissolved cadmium are more stringent than the 2001 recommended criterion, which is primarily due to the addition of new sensitive genera. Changes in suggested values between 2001 and 2016 can be found in Table 1 below.

Table 1. Summary of 2001 and 2016 Aquatic Life AWQC for Cadmium.

	2016 AWQC Update		**2001 AWQC**	
	Acute (1-hour, dissolved Cd)[c]	**Chronic (4-day, dissolved Cd)**	**Acute (1-day, dissolved Cd)**	**Chronic (4-day, dissolved Cd)**
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)[a]	1.8 µg/L[b]	0.72 µg/L	2.0 µg/L[b]	0.25 µg/L
Estuarine/marine	33 µg/L	7.9 µg/L	40 µg/L	8.8 µg/L

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.

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[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).
[c] The duration of the 2016 acute criteria was changed to 1-hour to reflect the 1985 Guidelines-based recommended acute duration.

ROLL OUT SCHEDULE:

Week of 3/21/16	Expected AA signature for FRN
3/28/16-3/29/16	Key EPA and stakeholder notifications via phone (list below).
3/30/2016	Other EPA and stakeholder notifications via email (list below). Web content goes live. *(*If FRN will publish on 3/30, we will link to it and the docket materials, and webpost the fact sheet. If the FRN is not projected to publish by then, we will webpost a pre-publication version on 3/30 along with the criteria document, public review comment response and fact sheet.)*

NOTIFICATIONS
Communication by: Betsy Behl, Director, Health and Ecological Criteria Division

Upon Signature (expected the week of 3/21/16):

- Email to EPA Regional Water Division Directors
- Phone calls to key stakeholders:
  - National Mining Association, Amanda E. Aspatore (202)463-2646
  - North American Metals Council, Kathleen M. Roberts (443)964-4653
  - International Zinc Association, Eric Van Genderen (919)287-1880
  - International Cadmium Association, no contact information yet
  - National Association of Manufacturers, Rachel Jones 202-637-3175
  - U.S. Fish and Wildlife Services, Gina Schultz, (703)358-1985
  - National Oceanic and Atmospheric Administration, Cathryn Tortorici, 301-427-8495
  - Copper and Brass Fabricators Council, John Arnett 202-833-8575
  - Natural Resource Defense Council, Jon Devine (202)513-6263

Upon FRN Publication (expected 3/30/16):

- Email to Mary Jo Bragan, Regional Lead for distribution to regional and State/Tribal Water Program
- Emails to other interested stakeholders:
  - Association of Clean Water Administrators (ACWA)
  - National Association of Clean Water Agencies (NACWA)
  - Water Quality Standards Managers Association (WQSMA)
  - Environmental NGO List

WATER HEADLINES:
EPA is releasing final updated water quality criteria for aquatic life for the metal cadmium. Acute exposure to cadmium causes mortality at elevated concentrations. Chronic exposure to cadmium negatively impacts growth, development, behavior, reproduction, and immune and endocrine

systems in aquatic life. Mining and urbanization are responsible for approximately 90 percent of the cadmium found in surface waters. The 2016 cadmium water quality criteria reflect the best available science, including the results of new laboratory aquatic toxicity tests. The criteria underwent an external peer review that was completed in 2015 and a 60 day public comment period. EPA's criteria for cadmium provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act. Learn more

QUESTIONS & ANSWERS FOR PRESS OFFICE:

1) What are National Recommended Aquatic Life Criteria?

Ambient water quality criteria for the protection of aquatic life are numeric concentrations of pollutants, with specific recommendations on the duration and frequency of those concentrations, in surface waters that are protective of aquatic life designated uses. 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 solely 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 a state's water quality standards and approved by EPA.

2) What is Cadmium?

Cadmium is a relatively rare, naturally occurring metal found in mineral deposits and distributed ubiquitously at low concentrations in the environment. Cadmium's primary industrial uses are for the manufacturing of batteries, pigments, plastic stabilizers, metal coatings, alloys and electronics. Recently cadmium has been used in manufacturing nanoparticles (quantum dots) for use in solar cells and color displays.

3) How Does Cadmium Enter Surface Waters?

Cadmium enters the environment by natural and human processes. However, human sources, such as mining and urban processes, are responsible for contributing approximately 90 percent of the cadmium found in surface waters.

4) How Does Cadmium Affect Aquatic Life?

Cadmium is a non-essential metal with no biological function in aquatic life. Acute exposure cause mortality. Chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development and behavior in aquatic organisms.

5) Why are the Final Recommended Water Quality Criteria for Cadmium different from the Draft?

Following the 60-day public comment period, EPA considered the comments and revised the draft as necessary; as a result:

- The draft one-hour freshwater acute criterion maximum concentration was lowered from 2.1 µg/L to 1.8 µg/L. This decrease resulted from the removal of two elevated data points from tests with insensitive salmonid life stages.
- The draft four-day average freshwater chronic criterion was slightly lowered from 0.73 µg/L in the draft to 0.72 µg/in the final criteria document.
- The draft one-hour estuarine/marine acute criterion maximum concentration of 35 µg/L was lowered slightly to 33 µg/L. The draft document used a shrimp species not found in North America to calculate the criterion. EPA removed this non-native species and replaced it with data recently found for a shrimp species native to North American waters.
- The draft four-day average estuarine/marine chronic criterion magnitude of 8.3 µg/L was lowered to 7.9 µg/L.

The recommended frequency of exceedance for all the above values is no more than once every three years.

6) How Do the 2016 Criteria Compare to the Previously Recommended 2001 Criteria?

The 2016 criteria reflect data for 75 new species and 49 new genera. The 2016 freshwater acute criterion (1.8 µg/L) for dissolved cadmium is slightly lower (i.e. more stringent) than the 2001 acute criterion. The 2016 freshwater chronic criterion (0.72 micrograms per liter) for dissolved cadmium is slightly higher (less stringent) compared to the 2001 criteria (0.25 micrograms per liter). These modest increases are primarily due to the inclusion of new toxicity studies. As in the 2001 criteria, the 2016 freshwater acute criterion was derived to be protective of aquatic species and lowered further to protect the commercially and recreationally important rainbow trout. In addition, the duration of the 2016 acute criteria was changed to one hour. Both changes are consistent with procedures described in EPA's current aquatic life criteria guidelines.

The 2016 estuarine/marine acute criterion for dissolved cadmium (33 µg/L) is slightly lower (more stringent) than the 2001 acute criterion (40 µg/L), which is primarily due to the addition of new toxicity studies for sensitive genera. The 2016 estuarine/marine chronic criterion (7.9 µg/L) is also slightly more stringent than the 2001 chronic criterion (8.8 micrograms per liter) due the consideration of more species in the chronic criterion development. Changes in suggested values between 2001 and 2016 can be found in Table 1 below.

Table 1. Summary of 2001 and 2016 Draft Aquatic Life AWQC for Cadmium.

	2016 AWQC Update			
	Acute (1-hour, dissolved Cd)[c]	**Chronic (4-day, dissolved Cd)**	**Acute (1-day, dissolved Cd)**	**Chronic (4-day, dissolved Cd)**
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)[a]	1.8 µg/L[b]	0.72 µg/L	2.0 µg/L[b]	0.25 µg/L
Estuarine/marine	33 µg/L	7.9 µg/L	40 µg/L	8.8 µg/L

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.

[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).

[c] The duration of the 2016 acute criteria was changed to 1 hour to reflect the 1985 Guidelines-based recommended acute duration.

7) What is EPA doing to help ensure these criteria protect threatened and endangered species?

The criteria document contains an analysis of the protectiveness of the draft criteria for threatened and endangered species using all available quality toxicity test data for species listed under the Endangered Species Act that have been tested for sensitivity to cadmium. EPA is also conducting a detailed analysis of the protectiveness of the draft criteria for endangered salmon to address the National Marine Fisheries Service concerns regarding the protectiveness of the acute cadmium criteria.

8) Is there litigation driving EPA's schedule for this updated criteria? What does the litigation entail?

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates (NWEA) following EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. EPA's disapproval triggered a Clean Water Act duty for EPA to propose a replacement criterion for Oregon. EPA intends to use the updated criteria document as the scientific basis for a rulemaking to propose criteria for Oregon.

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The basis of EPA's disapproval of Oregon's cadmium criterion (and EPA's resultant duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service (NMFS) for acute effects to salmon species based on EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated acute criterion has changed only slightly from 2001, the duration of the acute criterion was made more protective (decreased from 24 to one hour). A draft Endangered Species Act analysis prepared by EPA indicates that the updated freshwater criteria are expected to provide approximately 95 percent protection for acute exposure to endangered salmonids, a minimal effects level associated with the jeopardy opinion.

9) Cadmium is listed as a contaminant from the Animas river spill in Colorado this summer, how will this document effect that?

States affected by the Animas River spill (CO, NM, AZ) will be using their currently adopted criteria that protect the designated uses of the water bodies within their area for the clean-up. States may have either adopted the 2001 criteria or adopted alternative scientifically defensible criteria for their waters. Water quality criteria are not effective under the Clean Water Act until they have been adopted into a state's water quality standards and approved by EPA.

10) Are regulated entities expected to be affected by EPA's new cadmium criteria?
States may adopt the new criteria or set new scientifically defensible criteria for cadmium as part of state water quality standards for cadmium. If states adopt the new cadmium 304(a) criteria recommendation, we expect that few regulated entities will be affected because EPA's updated criteria values are very similar to what we recommended in 2001.

MEMORANDUM

SUBJECT: Notice of Availability: Recommended Aquatic Life Ambient Water Quality Criteria for Cadmium – 2016 (Tier 3, SAN 5843) - ACTION MEMORANDUM

FROM: Elizabeth Southerland
Director, Office of Science and Technology

TO: Joel Beauvais
Acting Deputy Assistant Administrator

PURPOSE
Attached for your signature is the *Federal Register* notice announcing the U.S. Environmental Protection Agency's release of the Updated Aquatic Life Criteria for Cadmium. The public will be able to access the draft criteria document through the EPA docket and website www.regulations.gov.

Following closure of the public comment period, the EPA will consider the public comments and revise the document accordingly. Once finalized, the EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

DEADLINE
The Updated Aquatic Life Criteria for Cadmium needs to be published by March 30, 2015, in order to maintain a timeline set by a potential lawsuit settlement agreement with Northwest Environmental Advocates.

OVERVIEW
The EPA is in the process of updating the Agency's 304(a) cadmium aquatic life ambient water quality criteria. These criteria provide scientifically sound recommendations to states for levels that are protective of aquatic communities. States may choose to adopt the 304(a) criteria or other scientifically defensible values in their water quality standards. The cadmium criteria revise acute and chronic freshwater and estuarine/marine values that were last updated in 2001. The updated criteria values are very similar to what they were in 2001. The EPA used the approach it routinely uses in developing aquatic life recommended criteria to develop the criteria, and added new toxicity data representing over 75 additional freshwater species.

The driver for updating the cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following the EPA's 2013 disapproval of Oregon's freshwater acute cadmium criterion. The EPA's disapproval triggered a CWA duty for the EPA to propose a replacement criterion for Oregon. The EPA would intend to use the updated criteria document as the scientific basis for the proposed rule. The agency is currently negotiating a settlement with the litigants in which the EPA would commit to propose cadmium criteria for Oregon by March 31, 2016, and take final rulemaking action by January 16, 2017. The 304(a) criteria being proposed are the basis for the rulemaking and, therefore, the document is time sensitive. We proposed the draft criteria for 60 days of public comment on December 1, 2015. The numbers have changed slightly as a result of adopting changes derived from the public comment period.

The basis of the EPA's disapproval of Oregon's cadmium criterion (and the EPA's duty to propose a replacement criterion for Oregon) was a 2012 jeopardy biological opinion from the National Marine Fisheries Service for acute effect to salmon species based on the EPA's 2001 freshwater acute cadmium criterion (which Oregon had adopted as the state's water quality standards). Although the 2016 updated freshwater acute criteria is slightly more stringent than the 2001 value, a draft Endangered Species Act analysis prepared by the EPA indicates that the updated freshwater criteria are expected to provide approximately 95 percent protection for endangered salmonids based on acute effects, a minimal effects level associated with the jeopardy opinion. Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

ANTICIPATED PUBLIC AND STAKEHOLDER RESPONSE

Ex. 5 - Deliberative Process

INTERNAL DEVELOPMENT AND REVIEW PROCESS

Office of Science and Technology partnered within the agency with Office of Research and Development to develop the document. The document was reviewed by the Office of Research and Development, Office of Chemical Safety and Pollution Prevention, and the Regions (3, 4, 5, 8, 9, and 10) and Office of Policy. The EPA conducted an external contractor-led letter peer review on the criteria document that was completed in 2015. The document was available for a 60-day public comment period which ended February 1, 2016.

If you need additional information or have questions regarding this notice, please call Elizabeth Behl at (202) 566-0788.

To: Behl, Betsy[Behl.Betsy@epa.gov]; Flaherty, Colleen[Flaherty.Colleen@epa.gov]
From: Gallagher, Kathryn
Sent: Mon 3/7/2016 1:50:33 PM
Subject: Fwd: Looking for Joel weekly e-mail items

Sorry. Forgot to send bullets.
One below on Cadmium

Ex. 5 - Deliberative Process

Begin forwarded message:

From: "Gallagher, Kathryn" <Gallagher.Kathryn@epa.gov>
Date: March 4, 2016 at 3:01:24 PM EST
To: "Conerly, Octavia" <Conerly.Octavia@epa.gov>, "Bethel, Heidi" <Bethel.Heidi@epa.gov>, "Lousberg, Macara" <Lousberg.Macara@epa.gov>
Cc: "Zipf, Lynn" <Zipf.Lynn@epa.gov>, "Hisel-Mccoy, Sara" <Hisel-McCoy.Sara@epa.gov>, "Behl, Betsy" <Behl.Betsy@epa.gov>, "Flaherty, Colleen" <Flaherty.Colleen@epa.gov>
Subject: RE: Looking for Joel weekly e-mail items

Cadmium

•□□□□□□□□ EPA is preparing to announce release of the updated national 304(a) recommended aquatic life water quality criteria for cadmium via a March 30, 2016 Federal Register notice. The acute toxicity database for cadmium increased greatly since 2001; there are 27 additional freshwater species and 33 additional saltwater species included in the 2016 acute test dataset that were not in the 2001 dataset. Six new freshwater species chronic tests are also included in the 2016 criteria dataset. The criteria document underwent vigorous internal and external peer review and was released as draft on November 30, 2015 for a 60-day public comment period. EPA revised the draft criteria considering public comments. Once finalized, EPA's water quality criteria for cadmium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

o The driver for updating EPA's cadmium criteria was a lawsuit brought by Northwest Environmental Advocates following a jeopardy call from the National Marine Fisheries Service in 2012 on EPA's 2001 freshwater acute cadmium criteria. As a result of settlement

negotiations EPA plans to propose updated cadmium criteria in rulemaking for Oregon by March 31, 2016 and finalize by January 16, 2017. EPA's updated 304(a) national criteria will be the basis for this rulemaking and is thus being finalized prior to proposal of criteria for Oregon. Region 10 is leading discussions with the National Marine Fisheries Service on cadmium effects on endangered salmonids. OW is providing technical analyses to support these effort; ORD is also supporting the region with technical assistance on this effort.

Kathryn Gallagher, Ph.D. | Branch Chief, Ecological Risk Assessment Branch | Health and Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

From: Conerly, Octavia
Sent: Friday, March 04, 2016 10:46 AM
To: Bethel, Heidi <Bethel.Heidi@epa.gov>; Lousberg, Macara <Lousberg.Macara@epa.gov>
Cc: Zipf, Lynn <Zipf.Lynn@epa.gov>; Hisel-Mccoy, Sara <Hisel-McCoy.Sara@epa.gov>; Behl, Betsy <Behl.Betsy@epa.gov>; Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>; Flaherty, Colleen <Flaherty.Colleen@epa.gov>
Subject: RE: Looking for Joel weekly e-mail items

I was waiting on the writeup for cadmium.

Octavia Conerly

Special Assistant to the Office Director

Office of Science and Technology

1200 Pennsylvania Ave. NW MC 4304T

Room 5231H

Washington, DC 20460

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From: Bethel, Heidi
Sent: Friday, March 04, 2016 10:41 AM
To: Lousberg, Macara <Lousberg.Macara@epa.gov>
Cc: Zipf, Lynn <Zipf.Lynn@epa.gov>; Conerly, Octavia <Conerly.Octavia@epa.gov>; Hisel-Mccoy, Sara <Hisel-McCoy.Sara@epa.gov>; Behl, Betsy <Behl.Betsy@epa.gov>; Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>; Flaherty, Colleen <Flaherty.Colleen@epa.gov>
Subject: Looking for Joel weekly e-mail items

Ex. 5 - Deliberative Process

Sent from my iPhone

On Mar 4, 2016, at 9:54 AM, Lousberg, Macara <Lousberg.Macara@epa.gov> wrote:

> **I'm wondering if she sent it just to you and forgot to cc me? She's out today so I'm hoping she sent something late yesterday.**

To: Elias, Mike[Elias.Mike@epa.gov]
From: Gallagher, Kathryn
Sent: Wed 3/2/2016 8:55:59 PM
Subject: RE: Cadmium - Response to Public Comments for Review
Cd Public Comments EPA Response_030216 (KGRev).docx

Mike,

I just had minor edits. Please just check formatting before sending to Betsy. Plus it needs a title and the content of Appendix B is missing…

Kathryn Gallagher, Ph.D. | Branch Chief, Ecological Risk Assessment Branch | Health and Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

From: Elias, Mike
Sent: Wednesday, March 02, 2016 10:09 AM
To: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>
Subject: Cadmium - Response to Public Comments for Review

Hi Kathryn,

Attached is the draft summarized comments and responses for your review. I did flag the response to one comment, which addresses the **Ex. 5 - Deliberative Process** looking at that now.

Please let me know if you need any additional information for your review.

Did you get any feedback from Betsy S. regarding who we need to brief before the document is signed?

Thanks!

Mike

Mike Elias | Biologist

Ecological Risk Assessment Branch | Health and Ecological Criteria Division

Office of Science and Technology | Office of Water

U.S. Environmental Protection Agency

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(202) 566-0120 | elias.mike@epa.gov

Title

TOPIC 1: Duration should be 24 hours, not one hour

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docur
EPA-HQ-OW-2015-0753-0012	*UWAG has concerns with EPA's proposal to change the acute freshwater and estuarine/marine criteria averaging duration from 24 hours to 1 hour. The change is not adequately justified and is not supported by new studies in the Draft. The current 24-hour duration should be retained unless a strong scientific justification is presented.* *Every previous iteration of the cadmium criteria has endorsed a 24-hour duration for the acute criteria. EPA appears to be making a policy decision that the acute criteria should be 1 hour, but does not present the associated science to support the revision which is inconsistent with CWA § 304(a)(1), which mandates EPA establish "criteria for water quality accurately reflecting the latest scientific knowledge."* *EPA compares the acute toxicity to ammonia but fails to provide information that compares the time-dependent toxicity of cadmium with ammonia. Furthermore, assessing the toxicity of cadmium during the first 24 hours of an acute test is problematic because the vast majority of published studies reporting the acute toxicity of cadmium do not report patterns of lethality during the first 24 hours. Several acceptable selected studies (Besser et al. 2007; Buhl 1997; Diamond et al. 1997; Mebane et al. 2012; Nebeker 1986) do not report 24-hour LC50s and the one study with relevant data (Duncan and Klavercamp 1983) had a 12-hour LC50 that was five times greater than the 96-hour LC50 (5.35 vs. 1.11 µg/L, respectively). This value would be expected to be similar if cadmium was a fast-acting pollutant.* *An earlier EPA publication (*Speed of Action of Metals Acute Toxicity to Aquatic Life*; EPA-822-R-95-002) also justifies the 24-hour averaging period. This document estimated a kinetic coefficient (*k*) using a regression of LC50 values versus time, with*	**Ex. 5 - Deliberative Process**	No edits

	the averaging period being calculated as the inverse of k. *The larger the* k *value the faster acting the pollutant. None of the estimated averaging periods in the document for freshwater and saltwater species approached 1-hour. The highest estimated* k *values mentioned, for the freshwater fathead minnow, were 6 and 17 hours, with saltwater species having even larger values. The selection of the 1-hour averaging period is baseless and arbitrary.* *Additionally, the 1985 Guidelines say the duration should be "substantially less than 48 to 96 hours," but do not say that 24 hours is an inappropriate duration and therefore the Guidelines do not support, nor should it be a justification for the proposed revision.*	**Ex. 5 - Deliberative Process**	
EPA-HQ-OW-2015-0753-0012	*Water Quality-Based Effluent Limits (WQBELs) for cadmium are often expressed as a daily (24-hr) maximum value. Changing the WQBEL to a 1-hour averaging duration could require a permittee to collect several compliance samples during a 24-hour period. This additional burden is unnecessary since there is minor variability of the cadmium levels during a typical 24-hour period, and this additional monitoring is unwarranted without sound scientific basis.*		No edits

TOPIC 2: *H. azteca* test by Ingersoll is not acceptable; retest should be done or test should be removed from criteria development

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docu

ED_000992_00003645-00003

EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*The proposed chronic criterion is based on a flawed toxicity test (Ingersoll and Kemble 2001) conducted on the amphipod Hyalella azteca. The Hyalella test used in the criterion derivation should be repeated using current feeding procedures that are proven to result in better growth and reproduction. While the IEPA acknowledges and commends the improvements USEPA has made in the assessment and analysis of Hyalella sp. data compared to the 2001 cadmium criteria document, specifically in regards to the sensitivity of this organism to the presence/absence of chloride and bromide in culture and test water, the IEPA contends that the feeding regime employed in the 2000 USGS study is deficient by today's standards and likely resulted in malnourished, stressed test organisms.* *Specifically, test organisms in the 2000 USGS study were underfed and/or fed improper diets based on current research. Dr. Soucek, at the Illinois Natural History Survey, conducted new research that focused on determining the appropriate amounts of food for test organisms. His research has led to improved growth of test organisms compared to earlier diet regimes. The diet used in the 2000 USGS study consisted of a ration of 1.0 ml YCT/d, whereas Dr. Soucek's research contends that a diet consisting of Tetramin supplemented with diatoms greatly improves growth and reproduction of Hyalella azteca compared to YCT-only diets (Soucek et al. 2016, in press).* *The diet in the 2000 USGS study restricted growth and fecundity when compared to Tetramin-based diets (Soucek et al. 2016, in press), and brings into question the accuracy of the test results.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*Test organisms in the 2000 USGS study did not attain minimum growth requirements based on the direct measure of organism weight, with the average dry weight of the controls being 0.27 mg/individual (<0.50 mg/individual). USEPA concluded that the dry weights measured in the test were inaccurate and subsequently used length data to extrapolate to dry weight via a regression equation. However there is no documentation provided for this equation or how it was derived. It is unlikely that the dry weights were underestimated (while an overestimation can be expected due to inadequate drying of test organisms), and it is therefore considered unlikely that the organisms achieved the minimum*		No edits

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	weight requirements for this test to be valid.		
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*The dilution series (control and 5 treatment concentrations: 0.1, 0.3, 0.5, 2.0 and 3.0 µg/L.) used in the 2000 USGS test did not appropriately bracket the effect concentration. The dilution series was not standard, with a large gap in concentration between the NOEC and LOEC (0.5 and 2.0 µg/L, respectively). While a point estimation technique was used to determine the effect concentration, the lack of a 1.0 µg/L treatment may have changed this estimation. The precision of this estimation is paramount, as the test result was the sole determinant of the GMCV, which is the most sensitive in the chronic dataset, and a small change in the GMCV can therefore have a substantial effect on the final chronic value.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0007 *EPA HQ-OW-2015-0753-0008*	*At this time, the IEPA is in support of the adoption of the acute cadmium criterion as proposed, but is requesting a one year extension for the adoption of the chronic criterion. A one year extension would allow for a retest on Hyalella azteca using current feeding recommendations and would allow for revisions to be made to the chronic criterion. A round robin approach would ensure that the data are obtained using the appropriate test procedures and would provide additional information regarding the sensitivity of Hyalella azteca to cadmium. If time does not permit a repeat of the test, then the chronic criterion should be recalculated with the Hyalella data removed.*		No edits

TOPIC 3: Dissolved vs total concentration use

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docur

ED_000992_00003645-00005

EPA HQ-OW-2015-0753-0005	*Additional documentation is needed to support the total to dissolved conversion factors. Very little information is provided concerning the derivation of the conversion factors, and more detailed information is needed to fully assess their appropriateness for natural waterbodies.*	**Ex. 5 - Deliberative Process**	Section 2.6
EPA HQ-OW-2015-0753-0005	*It is unknown if the solutions prepared from Cd salts, that were used to develop the conversion factors, adequately represent the forms of Cd found in natural waterbodies.*		Section 2.6
EPA HQ-OW-2015-0753-0005	*An explanation is needed as to why the conversion factors for the acute and chronic criteria are different. It also appears illogical that the constant conversion factor of 0.994 used for marine water is higher than for freshwater, especially because the hardness-dependent conversion factor for freshwater decreases as hardness increases.*		Section 2.6

EPA HQ-OW-2015-0753-0005	*While it is noted in several places in the document, clarify that the recommended criteria values are expressed as dissolved cadmium concentrations (not total). Also clarify if states have the option to adopt total Cd criteria values.*	No edits
EPA HQ-OW-2015-0753-0011	*Kansas has utilized the total recoverable metals criteria and data, and is not set up to sample for total dissolved metals. A conversion factor would be applied to calculate the dissolved concentration and Kansas recommends that EPA retain this flexibility in its final criteria.*	No edits

TOPIC 4: Data quality, use, and availability

Comment Number	Public Comment	Revision Locat in 2015 Cadmi Criteria Docu
EPA-HQ-OW-2015-0753-0006	*Some of the values that are new/revised since the 2001 AWQC document are from studies that were published before 2001. Table 22 has general information describing why GMAVs have changed between the 2001 and 2015 document, but it does not provide details on why these "new" data were now considered acceptable. Include another table that describes why the studies that were excluded previously are now included.*	No edits
EPA-HQ-OW-2015-0753-0013	*Should toxicity tests conducted under less-than optimal conditions be discounted? This comment goes beyond just the test results for Hyalella, because while laboratory tests used for criteria development use conditions that are as close to optimal as possible, wild populations in diverse natural conditions are often exposed to conditions that sub-optimal, and therefore laboratory tests may be underprotective in natural conditions (i.e., additional stresses) (see, Holmstrump et al. 2010; Besser et al. 2015).*	No edits

Ex. 5 - Deliberative Process

ED_000992_00003645-00007

EPA-HQ-OW-2015-0753-0013	*"Other data" are not addressed consistent with the Guidelines. While these data are not used in the species sensitivity distribution rankings, they should not be thrown away, discounted, or deemed "unacceptable." "Other Data" can be invoked to lower a criterion (e.g., chronic value in the 1987 selenium criterion). Revaluate Riddel et al. (2005a, b) and include a larger discussion of their effect concentrations/findings and other similar behavioral/ecological studies.*	**Ex. 5 - Deliberative Process**	Sections 5 and 5.
EPA-HQ-OW-2015-0753-0013	*With many organisms, a strong difference in the sensitivity of different life stages makes it inappropriate to roll up data from different developmental stages. Pooling salmonid effects concentrations across developmental stages to obtain a SMAV could produce a misleading result (see, Hansen et al. 2002; Mebane et al. 2012; Chapman 1978; Chapman and Stevens 1978).*		Appendix A Ranked FW Acut Table
EPA-HQ-OW-2015-0753-0013	*The decision to only use ELS chronic data in which the exposures began in the egg stage, and to exclude long-term data in which the exposures began in the fry stage is non-conservative.*		No edits
EPA-HQ-OW-2015-0753-0013	*SMAV calculations tagged with the footnote "C", indicating that "Data not used to calculate SMAV because more sensitive life stage available, or flow-through measured test available", should be separated into two different footnotes since they are very different reasons.*		Appendix A and Appendix B
EPA-HQ-OW-2015-0753-0013	*Address the following Appendix A specific errors/changes:* • *Daphnia magna (various)* ○ *Many "S, U" tests (tests with unmeasured*		Appendix A Ranked FW Acut Table

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	concentrations) are underlined, indicating they are included in the SMAV calculations. These should be excluded per the Guidelines.		
	• *Mayfly (formerly, Ephemerella grandis) Drunella grandis* o *Tested species was listed in the source document as Ephemerella subvaria, which is still a valid species name according to ITIS.gov.*	**Ex. 5 - Deliberative Process**	

	• *Rainbow trout (smolt), Chapman 1975 (>2.9 µg/L)*
	  o *Should be excluded from SMAV because it is from a resistant life stage. Also, should be listed as "Rainbow trout (Steelhead smolt)" as Steelhead are not just Rainbow Trout by a different name, but have physiological differences in regard to ion regulation. Chapman (1975) should only be cited when no alternative exists, because it was never formally released by EPA and is not publicly available online. Chapman (1978) reports the same data and is a better citation.*
	• *Rainbow trout (smolt), Chapman 1975 (4.1 µg/L)*
	  o *Suspect value, exclude from SMAV. Chapman (1978) lists the value for the same test as >2.9 µg/L. Chapman (1978) is the peer-reviewed publication of record for these data; Chapman (1975) was an unpublished, work-in-progress progress report that sometimes still gets cited because it includes data never published elsewhere, such as the coho data shown in the figure in this memo. Exclude from SMAV, resistant life stage and re-label as " "Rainbow trout (Steelhead smolt". See Chapman (1978, Table 3).*		

	• *Rainbow trout (299 mg), Stratus (1.29 µg/L)* o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with unmanipulated pH of*	**Ex. 5 - Deliberative Process**	

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	7.5 were much more sensitive
	• *Chinook salmon (parr, 11.58g) (3.5 µg/L)*
	  o *Exclude value from SMAV, based on a resistant life stage being tested. Value is twice as high as the value obtained with swim-up fry in matched tests and confidence limits don't overlap.*
	• *Chinook salmon (smolt, 32.46 g) (>2.9 µg/L)*
	  o *Should be excluded from SMAV, based on a resistant life stage being tested.*
	• *Bull trout (84.2 mg) (2.89 µg/L)*
	  o *Exclude from SMAV; pH was manipulated (lowered to 6.5) and matched tests with a natural pH of 7.5 were much more sensitive*
	• *Colorado squawfish*
	  o *Old common name is now considered repugnant. AFS calls it "Colorado pikeminnow". "Pikeminnow" is one word.*
		Ex. 5 - Deliberative Process	

EPA-HQ-OW-2015-0753-0013	*Address the following Appendix C specific errors/changes:* • *Snail, Aplexa hyporum (Holcombe) (4.0 µg/L)* o *I got an EC20 of about 2.6 µg/L. By excluding the highest treatment with total mortality I could reproduce the 4.0 EC20 value, but it had a poor fit with Y0.*		No edits

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		Ex. 5 - Deliberative Process	

EPA-HQ-OW-2015-0753-0013	*Add the following additional relevant data:*
	
	• *Pascoe and Mattey 1977*
	  o *Chronic stickleback exposure*
	• *Wang et al. 2014*
	  o *Chronic fathead full life-cycle test*
	• *Brinkman and Vieira 2008*
	  o *Acute and chronic mountain whitefish*
	• *Mebane et al. 2014 (paper provided)*
	  o *Effects of cadmium on larval aquatic insect communities in 30-day experimental stream tests*
			Mebane et al. (20
			added to Section

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docun

EPA-HQ-OW-2015-0753-0014	*There is concern about the focus on fish in developing the criteria. EPA needs to bring in other species including insects and freshwater mussels into the process when developing criteria for cadmium. This lack of additional species prevents a more holistic picture of the freshwater community, and results in criteria that are not protective of all aquatic-dependent wildlife. EPA has consistently failed to fully consider aquatic-dependent wildlife in the development of national criteria.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0010	*There is concern with the continued lack of estuarine/marine chronic cadmium toxicity data and that no new chronic toxicity data have been generated since 2001. EPA should conduct additional chronic toxicity studies (particularly with vertebrate species) to expand the estuarine/marine chronic toxicity dataset. More estuarine/marine chronic data are needed to develop a scientifically reliable chronic cadmium criterion.*		No edits
EPA-HQ-OW-2015-0753-0010	*The mysid Neomysis integer is a new species added to the estuarine/marine acute dataset, but this mysid is potentially non-native to the United States. Since there are available values for two other native mysid species (M. bigelowi and A. bahia), this non-native species should be removed (unless documentation is provided confirming it is naturally occurring within waters of North America).*		Section 3.2.1 and Appendix B

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TOPIC 5: ESA considerations

Comment Number	Public Comment	EPA Response	Revision Locat in 2015 Cadmi Criteria Docu
EPA-HQ-OW-2015-0753-0014	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	**Ex. 5 - Deliberative Process**	No edits
EPA-HQ-OW-2015-0753-0014	*To ensure the final cadmium water quality criteria is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*	Thank you for your comment.	No edits

ED_000992_00003645-00013

EPA HQ-OW-2015-0753-0009	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to account for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	No edits
EPA HQ-OW-2015-0753-0009	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*	Please see response to the above comment.	No edits
EPA HQ-OW-2015-0753-0015	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a*	Thank you for your comment.	No edits

	Section 7 Consultation.		
EPA HQ-OW-2015-0753-0015	*''EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected to result in more severe effects.* *Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.*	**Ex. 5 - Deliberative Process**	No edits

		Ex. 5 - Deliberative Process	
EPA HQ-OW-2015-0753-0015	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*		No edits
EPA HQ-OW-2015-0753-0015	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and that ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*		No edits
EPA HQ-OW-2015-0753-0015	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*		No edits

TOPIC 6: Other

Comment	Public Comment	EPA Response	Revision Locat in 2015 Cadmi

Number			Criteria Docum
EPA-HQ-OW-2015-0753-0014	*In the description of sources of cadmium in the document, EPA overlooked the contribution from coal combustion, coal mining waste, and coal ash ponds spills, seepage, and discharge. These important sources need to be recognized and addressed.*	**Ex. 5 - Deliberative Process**	Section 2.1

EPA-HQ-OW-2015-0753-0006	*Check the document for errors and typos. Specific examples include:*
	• *Pg.27 which is intended to provide an acute criterion protective of nearly all individuals in the distribution (Stephan et al.* ***1985);the*** *FAV/2 approach was developed to estimate minimal effect levels,*
	• *Pg.30 This outcome was based on the poor correlation between hardness and acute toxicity for D. magna and occurred only when tests with* ***less than*** *24-hr old neonates were included in the database. Accordingly, only the five D. magna tests from Chapman et al. (1980} initiated with* ***less than*** *24-hr old neonates were used for the analysis*
	• *Pg.33 Two species of sculpin, Cottus bairdii and Cottus confusus, are used to derive the normalized GMAV of* ***4.962*** *µg Cd/L*
	  o ***Per Appendix A, this value should be 4.926***
	• *Pg.34 The hardness-normalized GMAV of* ***7.911*** *µg/L total cadmium for the genus Oncorhynchus is the fifth lowest in the acute dataset*
	  o ***Per Appendix A, this value should be 7.841 ***
	• *Pg.42 2. Ceriodaphnia, Cladoceran (GMCV=****1.293µg/l*** *total Cd)*
	• *Pg. 74 Acceptable chronic toxicity* ***data*** *are available for 27 freshwater species representing 20 different genera*
	• *Pg. C-8 [d]Not used to calculate* ***SMAV*** *because either a more definitive value available, value is considered an outlier, or preference was given to the more sensitive exposure scenario (LC versus ELS tests).*
			Various locations

EPA-HQ-OW-2015-0753-0006	*While Table 5 summarizes the Phyla, Families, Genera, and Species used to derive the revised criterion, it is unclear which species were used to meet each of the MDRs. Include a table that lists the eight requirements and the species used to fulfill them.*	**Ex. 5 - Deliberative Process**	Table 5

EPA-HQ-OW-2015-0753-0006	*Verify that the Spehar and Fiandt 1986 data for Pimephales promelas is appropriate to include in the freshwater acute hardness correction.*	**Ex. 5 - Deliberative Process**	Appendix Table A A-2, C-1 and C-2
EPA-HQ-OW-2015-0753-0006	*Expand Table 6 to include the actual data that were used in the freshwater acute hardness correction for each species.*		Appendix Table A
EPA-HQ-OW-2015-0753-0006	*Include a graph showing the freshwater acute hardness linear regression to better illustrate the normalization process.*		Figure 2
EPA-HQ-OW-2015-0753-0006	*Indicate how the R^2 value of 0.964 was obtained in the freshwater acute hardness correction. Attempts to replicate the value resulted in a slope of 1.104 and R^2 of 0.698.* *Indicate how the R^2 value of 0.841 was obtained in the freshwater chronic hardness correction. Attempts to replicate the value resulted in a slope of 0.798 and R^2 of 0.632.*		No edits
EPA-HQ-OW-2015-0753-0006	*It was not apparent if the MATC or EC_{20} value was used for the freshwater chronic slope derivation. Indicate which of the toxicity values were used in the derivation in Appendix C and Table 8.*		Appendix Table C
EPA-HQ-OW-2015-0753-0006	*Include a graph showing the freshwater chronic hardness linear regression to better illustrate the normalization process.*		Figure 4
EPA-HQ-OW-	*The language that describes the computation of the final acute*		

2015-0753-0006	*value on pg. 32 is insufficient. Include a reference to section 4.3.1 after the reference to Figure 2 on page 32.*		
EPA-HQ-OW-2015-0753-0006	*It is unclear how the intercept of the freshwater acute and chronic criterion equations were derived. Add additional language to clarify how these values were derived.*	**Ex. 5 - Deliberative Process**	No edits

Appendix A
Representative Publications Using H. azteca Length-to-Weight Regression

Besser JM, Brumbaugh WG, Ingersoll CG, Ivey CD, Kunz JL, Kemble NE, Schlekat CE, Garman ER. 2013. Chronic toxicity of nickel - spiked freshwater sediments: Variation in toxicity among eight invertebrate taxa and eight sediments. Environ Toxicol Chem 32:2495-2506.

Besser JM, Ingersoll CG, Brumbaugh WG, Kemble NE, May TW, Wang N, MacDonald DD, Roberts AD. 2015. Toxicity of sediments from lead-zinc mining areas to juvenile freshwater mussels (*Lampsilis siliquoidea*), compared to standard test organisms. Environ Toxicol Chem 34:626-639.

Besser JM, Ivey CD, Brumbaugh WG, Ingersoll CG. 2015. Effect of Diet Quality on Chronic Toxicity of Aqueous Lead to the Amphipod, Hyalella azteca. Environ Toxicol Chem (in press) doi:10.1002/etc.3341

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ED_000992_00003645-00020

Appendix B
Sensitivity of CERC Cd *Hyalella* Study to Concentration Intervals

ED_000992_00003645-00021

TOPIC 6: ESA considerations

Comment Number	Public Comment	EPA Response	Revision Location in 2015 Cadmium Criteria Document
EPA-HQ-OW-2015-0753-0014	*EPA must ensure that any criteria ("Action") that it recommends to states for adoption will be fully protective of listed species. The federal act of establishing criteria has both direct and indirect effects for listed species. Therefore Section 7 consultations would be beneficial since there are several areas where peer reviewers and the EPA disagree (i.e., bioaccumulation, data used in the hardness correction, and incorporation of the BLM). Involvement of biologists from the Services could benefit the resolution of these and other issues. Furthermore, the language in the Endangered Species Act ("ESA") states that EPA must consult the Services in its recommendations of the criteria.*	**Ex. 5 - Deliberative Process**	*None*
EPA-HQ-OW-2015-0753-0014	*To ensure the final cadmium water quality criteria to is fully protective of all types of wildlife, EPA should engage the Fish and Wildlife Services (FWS) broadly (not just as is legally required by the ESA) and include other divisions of the FWS that may have additional expertise and information that would be beneficial to the EPA.* *Congress expected that EPA would engage with the FWS and other federal agencies when developing criteria. This engagement does not need to be burdensome or formalistic. The Fish and Wildlife Coordination Act (FWCA) can be used as a framework to achieve this coordination and strengthen the final recommended criteria.*	Thank you for your comment.	*None*

EPA HQ-OW-2015-0753-0009	*The NMFS and FWS Final Biological Opinion for the State of Oregon's adoption of the previous AWQC cadmium criteria (2001) and USEPA's disapproval of the acute criterion required the State to develop replacement criteria based on:* *1. Only using toxicity data for cadmium that was specific to salmonid fishes, and green sturgeon and eulachon, if available* *2. Curve-fitting all toxicity data used to derive the numeric criterion* *3. Extrapolating threshold acute and chronic toxic effect concentrations using the curve-fitted data* *4. Adjusting derived criteria to account for chemical mixtures* *5. Using a population model that integrates the derived criteria to predict no negative change in each species population's intrinsic growth rate* *These requirements were not applied to the new draft recommended criteria and the new acute value is greater than the previous recommendation. Since California shares similar ESA species populations to those in Oregon, the NMFS biological opinion must be considered. Furthermore, since the previous lower acute value resulted in a jeopardy decision, it is likely the new higher criteria will not be viewed favorably.*	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0009	*The new chronic criterion also presents a similar challenge, since it is higher than the criterion in the FWS and NMFS biological opinions. The 2015 draft recommended criteria are not sufficiently protective of ESA species in California.*	Please see comment above. Thank you for your comment..	

EPA HQ-OW-2015-0753-0015	*EPA needs to work with the NMFS to conduct a more thoughtful evaluation of the implications of their guidelines methodology for criteria development for ESA listed species, especially in context of the limited data available for ESA-listed species. Comments on the prior ESA Section 7 Consultation with NMFS are included as attachments (multiple attachments).* *EPA's approach to addressing obligations under ESA (ESA consultation when agency approves state-proposed criteria) leads to a piecemeal approach, particularly for broadly-ranging species. Given the scope of the guidelines, the conclusions of such an assessment and any associated implementation guidance would need to have the same authority/regulatory implications of a Section 7 Consultation.*	Thank you for your comment.	*None*
EPA HQ-OW-2015-0753-0015	*EPA's freshwater acute guideline is slightly above Oregon's proposed criterion of 2.0 µg/L. It was determined that the proposed 2.0 µg/L criterion would jeopardize the continued existence of ESA-listed species occurring in that state. Several of the 96 hour LC50 values for the ESA-listed species used in the derivation of the Oregon standard are below the criterion, so these data were used to evaluate the implications on population growth rates. The analyses identified cases where population growth rates would be significantly altered based on exposure to 2.0 µg/L cadmium (see NMFS Attachment 4).* *EPA's chronic freshwater guideline for cadmium is also higher than the chronic criterion proposed by Oregon (0.73 µg/L vs 0.25 µg/L). NMFS analyses indicated exposure to 0.25 µg/L cadmium would result in sublethal effects, but the effects did not rise to the level of jeopardy. EPA's 0.73µg/L guideline is nearly three-fold Oregon's criterion and would be expected*	**Ex. 5 - Deliberative Process**	

	to result in more severe effects. *Idaho's proposed (2006) acute and chronic freshwater criteria of 1.3 and 0.6 µg/L, respectively, and a NMFS analysis of these criteria determined they were not likely to adversely affect Idaho's ESA-listed salmonids under NMFS jurisdiction (see NMFS Attachment 5). However, criteria applied elsewhere would still require an analysis incorporating location-specific considerations.*	**Ex. 5 - Deliberative Process**	
EPA HQ-OW-2015-0753-0015	*While the Oregon consultation concluded that ESA-listed sea turtles would be unlikely to accumulate a significant amount of cadmium from state waters, the draft cadmium guidelines apply to all waters of the US, so exposures would occur throughout the US portion of a sea turtle's range. Cadmium accumulates in tissue with age and sea turtles are long lived species (20-50 years). For long lived species, it needs to be determined if cadmium accumulation from US waters over a lifespan would reach tissue concentrations resulting in or contributing to adverse effects. Dietary exposure of the more omnivorous sea turtle species (i.e., leatherback, loggerhead) are of particular concern.*		
EPA HQ-OW-2015-0753-0015	*There is a concern about the lack of data for the effects of cadmium on smalltooth sawfish and Atlantic, Gulf, or shortnose sturgeon species, and ambient aquatic exposures alone would be inadequate to assess effects to ESA-listed species. These are long-lived species (>20 years) that are known to ingest sediment (which may include particulate-bound cadmium originating from the water column) with their benthic prey.*	Thank you for your comment.	

EPA HQ-OW-2015-0753-0015	*While the limited data (see, Reichelt-Brushett and Harrison 2005; Mitchelmore et al. 2007; Howe et al. 2014) suggest that the EPA guidelines for cadmium in marine waters are protective of coral species, the certainty of this conclusion is limited by the absence of data on colonization and recruitment, wound recovery, and predation activity.*	**Ex. 5 - Deliberative Process** Thank you for your comment.	

To: Elias, Mike[Elias.Mike@epa.gov]
From: Gallagher, Kathryn
Sent: Tue 2/16/2016 11:01:46 PM
Subject: /Cadmium Revisions
H_azteca Comment Response Summary (021116).docx

Comments on H. azteca write-up attached

Kathryn Gallagher, Ph.D. | Branch Chief, Ecological Risk Assessment Branch | Health and Ecological Criteria Division | Office of Science and Technology | US EPA Office of Water | 202-564-1398 | WJC West Room 5231AA

From: Elias, Mike
Sent: Tuesday, February 16, 2016 3:34 PM
To: Gallagher, Kathryn <Gallagher.Kathryn@epa.gov>
Subject: RE: SETAC Draft Proposal/Cadmium Revisions

Thanks Kathryn. I do have several cadmium comments to run by you.. Ex. 5 - Deliberative Process Ex. 5 - Deliberative Process needed to discuss a few others with you as well before giving a go-ahead to GLEC to make revisions.

From: Gallagher, Kathryn
Sent: Tuesday, February 16, 2016 3:27 PM
To: Elias, Mike <Elias.Mike@epa.gov>
Subject: Re: SETAC Draft Proposal/Cadmium Revisions

I will review SEYAC proposal later today.

I am in training.

Also have your cadmium h. Azteca comments.

Sent from my iPhone

On Feb 16, 2016, at 3:02 PM, Elias, Mike <Elias.Mike@epa.gov> wrote:

Kathryn,

Since we were not able to meet this morning, I wanted to go ahead and send over a draft of the session proposal for SETAC, for your review.

Additionally, I need to meet with you to discuss potential revisions for the cadmium criteria document.

Thanks,

Mike

Mike Elias | Biologist

Ecological Risk Assessment Branch | Health and Ecological Criteria Division

Office of Science and Technology | Office of Water

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<SETAC Proposal (021616)2.docx>