

BEFORE THE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

COMMENTS OF THE NORTH AMERICAN METALS COUNCIL-SELENIUM WORK
GROUP IN RESPONSE TO EPA'S DRAFT TECHNICAL SUPPORT MATERIALS FOR
THE FINAL FRESHWATER AQUATIC LIFE SELENIUM CRITERION

External Peer Review Draft Technical)
Support Materials for the Final Freshwater) EPA-HQ-OW-2016-0551
Aquatic Life Selenium Criterion)
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EXECUTIVE SUMMARY

The North American Metals Council (NAMC) submits these comments in response to the U.S. Environmental Protection Agency's (EPA) request of October 14, 2016, for input on the Draft Technical Support Materials for the Final Freshwater Aquatic Life Selenium Criterion. NAMC is an unincorporated, not-for-profit organization serving as a collective voice for the North American metals producers and users. NAMC has been a leading voice for the metals industry on science- and policy-based issues affecting metals. Our organization has worked closely with the U.S. federal and international agencies to address risk assessment issues that are unique to metals and various stages of their lifecycle -- sourcing, production, engineering, use, recycling, and recovery. We advocate policy based on good, sound science.

This document comprises integrated comments provided by individual Members and Associates of the North American Metals Council-Selenium Work Group (NAMC-SWG). The NAMC-SWG is engaged in technical research on issues pertaining to selenium. Activities include the development of water quality tissue-based standards for selenium, the implementation of such standards, development of effects thresholds, and the identification of analytical methods pertinent to such standards. As part of its ongoing efforts, the NAMC-SWG develops papers on these topics and shares them publicly on its website or through the peer-reviewed scientific literature.

NAMC commends EPA on many aspects of the documents provided and provides comments to assist in improving those documents. We comment on the following issues: site-specific criteria; fish life-history realities; compliance schedules; inconsistencies; inappropriate recommendations; required guidance/clarification; and statistical issues. We recommend that EPA address our comments in preparing the final versions of the above-noted documents, as our comments are directed at improving the utility and technical defensibility of the documents. We further recommend, for the sake of clarity, transparency, and completeness, that EPA provide a separate comment response document detailing how our and other comments have been addressed, including the rationale for decisions made regarding each comment.

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INTRODUCTION

This document, submitted by the North American Metals Council (NAMC), comprises integrated comments provided by individual Members and Associates of the North American Metals Council-Selenium Work Group (NAMC-SWG). This document is provided in response to the U.S. Environmental Protection Agency's (EPA) October 14, 2016, request for public comment on the Draft Technical Support Materials for the Final Freshwater Aquatic Life Selenium Criterion.

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efforts, the NAMC-SWG develops papers on these topics and shares them publicly on its website¹ or through the peer-reviewed scientific literature.

NAMC has reviewed the following Technical Support Materials:

- Technical Support for Fish Tissue Monitoring for Implementation of EPA’s 2016 Selenium Criterion – Draft EPA 820-F-16-007;
- Frequently Asked Questions (FAQs): Implementing the 2016 Selenium Criterion in Clean Water Act Sections 303(d) and 305(b) Assessment, Listing, and Total Maximum Daily Load (TMDL) Programs – Draft EPA 820-F-16-008;
- Frequently Asked Questions (FAQs): Implementing WQS that Include Elements Similar or Identical to EPA’s 2016 Selenium Criterion in Clean Water Act Section 402 NPDES Programs – Draft EPA 820-F-16-009; and
- Technical Support for Adopting and Implementing EPA’s 2016 Selenium Criterion in Water Quality Standards – Draft EPA 820-F-16-010.

NAMC commends EPA on many aspects of the documents provided and provides comments to assist in improving the documents. Relative to EPA 820-F-16-010, we comment on: site-specific criteria; fish life history realities; compliance schedules; inconsistencies; an inappropriate recommendation; and areas where guidance or clarification are required. Relative to EPA 820-F-16-007, we comment on: fish life history realities; inappropriate recommendations; areas where guidance or clarification are required; and statistical issues. Comments on the two FAQ documents are incorporated into our comments on the above two primary documents.

¹ See NAMC, “The Selenium Workgroup,” available at <http://www.namc.org/selenium.html>.

We recommend that EPA address our comments in preparing the Final Technical Support Materials; addressing our comments will help improve the utility and technical defensibility of the Final Technical Support Materials. We also request that EPA provide a separate comment response document detailing how our and other comments have been addressed, including the rationale for decisions made regarding each comment.

1.0 COMMENTS ON THE TECHNICAL SUPPORT FOR ADOPTING AND IMPLEMENTING EPA'S 2016 SELENIUM CRITERION IN WATER QUALITY STANDARDS – DRAFT

1.1 Site-specific Criteria

NAMC commends EPA on providing the option to develop site-specific criteria. Such can be based on species present at a site but not considered in the national database (*i.e.*, by means of the recalculation procedure), which could result in more or less stringent criteria depending on the species sensitivity. Thus, site-specific criteria values can be less conservative than the national, generic criteria, provided that they are technically defensible.

It is unclear, however, what would occur in the case that criteria exceedances were due to natural causes (*e.g.*, geology) or due to historic contamination of sediments, not on-going effluent sources. Provisions for site-specific standards based on the above conditions should be mentioned, including the use of an ambient-based tissue standard using the recalculation procedure for tissue rather than water. This is important considering that the current water quality criteria (WQC) approach is based on effects occurring as specific tissue concentrations with back calculations to water concentrations.

1.2 Fish Life History Realities

In the FAQs, the importance of understanding the life history of fish is correctly noted as a requirement before using fish tissue data in assessment decisions. It should be noted, however, that some fish ovaries begin maturing well in advance of being gravid; thus, there will be different time frames for optimal sampling for different fish species. Also, in northern climates some fish, such as Northern Pike, spawn under ice, making it difficult to sample gravid females.

Further to the above comment, there is appropriate reliance on eggs and gravid ovaries being gravid, however, it is unclear whether the focus should be on whole body when there are no eggs and the ovaries are not gravid. We support the use of whole-body measurements (or muscle for large fish) when gravid ovaries cannot be collected. This may be the norm as opposed to the exception. In addition, tissue concentrations and conversion factors are based on whole body selenium concentrations without regard to spawning time periods, which is not technically defensible. Additional clarity and guidance on timing of tissue sampling is required.

1.3 Compliance Schedules

NAMC commends EPA on clearly stating that compliance schedules can be included in permits, allowing continued discharge while installing treatment technology or controls. It would be useful to include in the document specific examples as to how this could

work. The emphasis of such examples should be on flexibility, particularly if attempts to control selenium discharges are occurring in good faith but there are, for instance, unexpected technical issues. Such examples would provide additional clarity, and help avoid different interpretations during permitting.

1.4 Inconsistencies

The statement is made in the supporting document on fish tissue monitoring that a site-specific water column criterion might be warranted if the water column criterion is exceeded but the fish tissue criteria are not. Attachment 2 of the supporting document on fish tissue monitoring also shows this (Decision Point D). This obviates the very clear statements in this document and in the selenium criterion document regarding the primacy of fish tissue criteria over water column criteria, which reflect the state-of-the-science. The document must consistently emphasize and support the primacy of fish tissue criteria over water column criteria. When the water column criterion is exceeded with no indication of tissue thresholds being exceeded, a site-specific water column number is appropriate.

On page 5, line 5, “cannot not” should be simply “cannot.”

1.5 Inappropriate Recommendation

The document “Frequently Asked Questions (FAQs): Implementing the 2016 Selenium Criterion in Clean Water Act Sections 303(d) and 305(b) Assessment, Listing, and

Total Maximum Daily Load (TMDL) Programs – Draft” states in response to Q5 that states and authorized tribes “might want to consider” collecting fish tissue data “before developing a water quality management plan” based only on water selenium data. The primary data are the fish tissue data, particularly the fish ovary data; this response means that the primary data are not necessary for management decision-making. We understand that EPA cannot mandate what the states and tribes do, they can only recommend, and they are recommending primary reliance on fish tissue data.² Given the importance of this issue, however, we strongly encourage EPA to replace the wording “might want to consider” with much stronger language such as “are urged to collect fish tissue data before developing a water quality management plan to ensure that resources are appropriately allocated.”

1.6 Guidance/Clarification Required

It is stated on page 4 “that fish tissue criterion elements do not take precedence over the water column criterion element until the aquatic system achieves steady-state.” It is unclear how achievement of steady-state will be determined given that there is variation in different ecosystems. We understand that EPA is working on research to answer this question, which will likely be a separate document.³ Because of the importance of this question, however, the Draft Technical Support Materials for the Final Freshwater Aquatic Life Selenium Criterion should not be finalized until this question is conclusively answered and the answer included in

² Information provided by Lars Wilcut (EPA) during the NAMC-SWG meetings, November 11, 2016, Orlando, FL.

³ *Id.*

the final document. There needs to be a clear distinction between aquatic systems that have been receiving selenium inputs for extended periods of time versus those that may receive new inputs from recently permitted discharges. We point out that Adams (1976) showed that time to steady state for several species of fish exposed to selenate and selenite reported steady state after 90 days for both uptake and elimination based on water exposures.⁴ This may be a useful starting place to evaluate steady state.

The least uncertainty regarding potential effects occurs when fish eggs/ovaries are analyzed for selenium; the most uncertainty occurs when water alone is analyzed for selenium. The document and accompanying documents recommend in some cases relying on water only data, in other cases on whole body or muscle tissue only. How is uncertainty to be handled in those cases where reliance is not on egg/ovary analyses?

For locations where no egg/ovary tissue data are available, it would seem prudent that a minimum number of samples should be collected to understand, for a location or region, what the egg/ovary selenium concentration relationship is to the whole-body selenium tissue concentration to establish a baseline ratio, and to determine whether the location-specific ratios for a species differ from the species ratios published in EPA (2016).⁵

⁴ Adams, WJ. 1976. Toxicity and Residue Dynamics of Selenium in Fish and Aquatic Invertebrates. Ph.D. Thesis, Michigan State University, East Lansing, Michigan.

⁵ EPA, Aquatic Life Ambient Water Quality Criterion for Selenium -- Freshwater 2016 (June 2016), available at https://www.epa.gov/sites/production/files/2016-07/documents/aquatic_life_awqc_for_selenium_-_freshwater_2016.pdf.

Regarding the recommendation that the water criteria take precedence over the tissue criteria for National Pollutant Discharge Elimination System (NPDES) permitting purposes and development of total maximum daily loads (TMDL), it is not clear how the fish tissue number will be translated into a water-quality-based permit limit. One would assume that if the WQC for lentic and lotic values are exceeded, but no effects are observed based on tissue measurements, then the water number should be increased to calculate the TMDL. Clarity is required regarding determining site-specific water-quality-based limits from the fish tissue number, with emphasis on not simply defaulting to the applicable generic published water quality criteria for lentic and lotic sites.

2.0 COMMENTS ON TECHNICAL SUPPORT FOR FISH TISSUE MONITORING FOR IMPLEMENTATION OF EPA'S 2016 SELENIUM CRITERION -- DRAFT

2.1 Fish Life History Realities

The document states: "Seasonal considerations are less stringent for whole-body and muscle tissue sampling. Seasonal collection of whole-body or muscle fish tissue samples should be timed to avoid the pre-spawning influence on selenium tissue concentrations, particularly for females, since enhanced depuration of selenium from tissue stores may occur during vitellogenesis prior to spawning." In fact, most of the egg/ovary to whole body relationships were established at spawning when the tissue stores for species were likely depleted due to mobilization of excess selenium from tissue stores into the eggs. Further, since these types of sampling efforts are targeting whole body, they would by default (if the fish used are

females) include eggs in the “whole body.” Clarity is required in the document regarding this issue.

2.2 Inappropriate Recommendations

Dry-ashing digestion (high temperature) should not be recommended for selenium analysis as it will cause loss of selenium from the sample.⁶ Oven drying at 60°C could also result in loss of selenium from the sample, although less likely as demonstrated by Adams (1976).⁷ Freeze drying minimizes selenium losses and should be the standard for selenium analysis along with closed vessel microwave digestions to minimize selenium losses during analyses. Alternatively, analyses of wet tissue can be conducted, with dry weight values calculated based on a tissue moisture determination. Freeze drying, however, allows for the moisture content and selenium analyses to be conducted on the same tissue, whereas analyses of wet tissue require separate tissues to be analyzed to estimate moisture content in order to convert measurements to dry weight.

Given the statistical routines available in Pro UCL, it is unreasonable to suggest setting less than detectable concentrations to ½ the method detection limit (MDL). Given that selenium is an essential element, the probability that fish tissue concentrations would be less than the MDL is low, unless the MDLs are too high.

⁶ Ohlendorf H, Covington S, Byron E, Arenal C. 2011. Conducting Site-specific Assessments of Selenium Bioaccumulation in Aquatic Systems. *Integr. Environ. Assess. Manage.* 7(3):314-324 (cited in the document).

⁷ Adams, WJ. 1976. Toxicity and Residue Dynamics of Selenium in Fish and Aquatic Invertebrates. Ph.D. Thesis, Michigan State University, East Lansing, Michigan.

There is a need to revisit detection limits listed in Table 5 with current analytical laboratory capabilities, particularly since the MDL in Table 5 for tissue (5 mg/kg dw) is within possible laboratory analytical error of the whole-body criterion of 8.5 mg/kg dw. In Table 6, the water MDL (7.9 µg/L) is higher than the lentic and lotic water criteria (1.5 and 3.1 µg/L, respectively). We recommend a MDL of 1 mg/kg for tissue and 0.5 µg/L for water. Both are achievable. Further, considering that many laboratories have difficulty analyzing selenium accurately, we recommend that laboratories use certified standards that are commercially available for both water and tissue.

Guidance on the recommendation for 20 g of tissue is based on an EPA publication that is over 20 years old; there have been extensive developments in analytical techniques and sample processing over the last 20 years. Sample weights approximately an order of magnitude less can be analyzed for all elements, including selenium; much less tissue is required if only selenium is being analyzed; often only 0.5 gram is required. Additional tissue is required for measurement of % moisture, replicates for QC, and for contingencies requiring re-analyses. Analyses of smaller sample sizes can reduce the number of fish that need to be collected and thus sampling efforts and possible effects on fish populations. Updating should be provided based on current analytical laboratory abilities and requirements, as well as more up-to-date analytical methods, particularly those accredited in accordance with ISO 17025 (*e.g.*, APHA SM 3125), which the latter should be explicitly referenced and allowed instead of only EPA methods. 20 g is not necessary given the analytical techniques available. The use of inductively

coupled plasma mass spectrometry (ICP-MS) with various types of “collision cells” to eliminate interferences has become the routine for selenium analyses.

2.3 Guidance/Clarification Required

EPA’s four-part criterion states that water column values are the applicable criterion element in the absence of steady-state condition fish tissue data. Appendix K of the criterion document (Section 1.2.1.2) describes other potential options, including: “sampling the most sensitive fish species inhabiting nearby, most proximate downstream waters”; and “measuring the selenium concentrations in water, biotic and/or abiotic particulate material, and/or the tissues of invertebrate aquatic organisms that reside there.” EPA’s draft Technical Support Materials do not provide further guidance on these potential options, however. Because fish are the most sensitive species to selenium exposure and effects, and because EPA derives its criterion directly from fish toxicity data, measuring selenium in the most sensitive fish species inhabiting downstream waters should be a direct and reliable approach to assessing the protectiveness of certain fishless waters. We recommend EPA include additional guidance that considers fish-tissue monitoring in downstream waters as an allowable alternative to applying a water-column element. This could avoid application of overly-protective water-column values to fishless waters, especially since EPA’s recommended methods to calculating water-column values are designed to protect fish.

The mean of samples from a single species (or the results of a single composite sample) are to be compared to the criterion and not individual samples. It is not clear, however,

how many fish results over what time period will provide sufficient data for a final listing determination that the criterion is met (it is clearly stated that the criterion is not met if one species exceeds criteria). We understand that EPA is reluctant to provide specific guidance on the amount of data necessary for making a decision other than to recommend the best scientific information.⁸ Such guidance is necessary to provide for consistency and greater certainty for both regulators and those regulated. Hence, we recommend some guidance or reference be mentioned to approaches used in the past. A discussion around acceptable standard error in the tissue measurement would be helpful.

The recommendation for states to use the same species, where possible, to compare across sites is excellent. Clarification should be provided that comparisons across sites and within sites (*e.g.*, site-specific trends) should also be based on the same species, however. It also needs to be emphasized strongly that composite or average data should not be based on different fish species, even if they are within the same genus.

For individual samples, the guidance document aligns with the common practice of targeting at least five individual fish tissue samples. The 75% rule regarding fish of similar size, however, may be unnecessarily restrictive and unnecessary if it can be demonstrated that there are no significant differences in selenium body burdens in different age classes (sizes of fish), or if monitoring is based on collection of a similar age class.

⁸ Information provided by Lars Wilcut (EPA) during the NAMC-SWG meetings, November 11, 2016, Orlando, FL.

There is extensive discussion regarding the need for composites and small sample sizes to get good detection levels, but there is not similar focus on the analytical techniques necessary to produce adequate and good data. With appropriate analytical techniques, even very small samples (*e.g.*, single ovary, small bodied fish) can provide adequate and good data.

It is not clear whether the weights of fish tissue required for analysis are in dry or wet weight. It is assumed this is wet weight, but clarification is required.

It is not clear in the documentation what monitoring/assessment actions are to be taken if the data are statistically above the criterion. For instance, should sediments or food source (*e.g.*, plankton, benthos) be monitored to determine whether there are changes in the potential for accumulation? Increased lethal monitoring of fish in some areas could be detrimental to the fish populations. As discussed in the criterion and technical support documents, it could take some time for tissue concentrations to decrease. We understand that states have wide flexibility in their decisions and interpretation; if states decide there is impairment, the site is listed and action taken.⁹ Additional guidance is required to ensure that resources are appropriately allocated, there is consistency, and uncertainty is reduced for both regulators and those regulated, however.

In the section on Target Species, the focus is on species with the highest sensitivity. Presumably this means resident species with the highest sensitivity? And how is

⁹ *Id.*

“highest sensitivity” determined? Note in regard to this latter question that the majority of species listed in Table 3 cannot be classified as sensitive or insensitive due to absence of data.

The document focuses on compositing fish tissue samples. If data can be obtained on individual fish, however, then averaging of tissue results for individual fish in comparison to the criterion should be suitable. Not compositing allows for more complete association of the tissue selenium concentration with other variables and less attenuation of concentrations (*i.e.*, loss of information). The availability of very good analytical techniques that do not require 20 g of tissue should reduce the need for compositing tissue samples. Defining the point estimate for compliance (*i.e.*, mean) should be based on individual samples rather than on compositing.

The guidance allows mixing male and females of the same species for a composite sample. It should be noted that keeping the sexes separate allows for egg/ovary estimations from fish tissue, however.

The required sample size for Method 3052 (total metals) is 0.5 g. Clarification is required as to whether this is wet or dry weight (presumably the former?). Further, if only 0.5 g is required for analysis, why must 20 g be collected for a single tissue sample?

There is, appropriately, reference in the document to quality assurance/quality control (QA/QC), but state-of-the-art guidance is lacking. Such guidance should be provided, not simply referencing dated EPA documents that do not fully address all QA/QC issues. For

instance, there is no guidance regarding what type of container fish eggs and ovaries should be stored in to avoid contamination.

It is unclear why “acetone-washed and baked aluminum foil” is recommended for dissection. Since typically selenium would not be the only element analyzed, this could cause contamination of other metals potentially in the aluminum form. Clarification is required.

2.4 Statistical Issues

The statistical comparison to the criterion could result in a scenario where the mean or median of the ovary chemistry is numerically above the criterion but, due to variance in the data, there is no difference between the criterion and the measurements; presumably this would indicate no difference and no action required? Presumably if the data are either statistically below or not different than the criterion, there is no exceedance? A few example scenarios of how the statistical analysis should be interpreted would be beneficial. It is assumed that, if the data are statistically below or there is no statistical difference, then there is no exceedance of the criterion, but this needs to be explicitly stated. Further, if the guidance is followed, and composite samples are collected, it could be difficult if not impossible to make statistical comparisons to the criterion if the sample size is small (*e.g.*, one or two composite samples). It would be more useful to avoid composite samples and generate the replicate data needed to make statistical comparisons.

Statistical analyses are based on t-tests, which will not be appropriate in all situations. Does flexibility exist regarding technically defensible statistical analyses, for

example, evaluation of parametric or non-parametric tests, and spatial and temporal variations in measured data?

CONCLUSIONS

The primary conclusions from our review of the Draft Technical Support Materials for the Final Freshwater Aquatic Life Selenium Criterion is that, while there are many positive aspects to the documents, necessary improvements are required. These include, but are not restricted to, the following:

- Statements that appear to negate the primacy of fish tissue data compared to water data must be revised to remove such inconsistencies.
- Stronger language is needed to emphasize to states and tribes the importance of collecting fish tissue data before developing a water quality management plan.
- Given that fish tissue selenium does not take precedence over water column selenium until the ecosystem achieves “steady-state,” it is imperative that guidance as to how this can be determined be provided in the final documents.
- Flexibility is recommended regarding scientifically defensible statistical tests other than the t-test, which latter will not be appropriate in all situations.
- Clarity is required that, if there is no statistical difference between data from exposed sites and the criteria, regardless of the variability of the data, then there is no criterion exceedance.
- Guidance is required as to how many fish results over what time period will provide sufficient data for a final listing determination that the criterion is met.
- Guidance is required as to what monitoring/assessment actions are to be taken if the data are statistically above the criteria.

- Guidance is required for dealing with cases where criteria exceedances are due to natural causes (*e.g.*, geology) or due to historic sediment contamination rather than on-going effluent sources, including the means for developing site-specific standards in such cases.
- There must be allowance for more recent analytical techniques than the dated EPA techniques such that much smaller samples can be analyzed at better detection limits.
- Guidance is required as to whether compositing is necessary or even desirable given that compositing will reduce the sample size for statistical analyses.