

Review of EPA 2016 Draft Selenium Criteria Implementation Guidance Documents

EPA-F-820-16-007

EPA-F-820-16-008

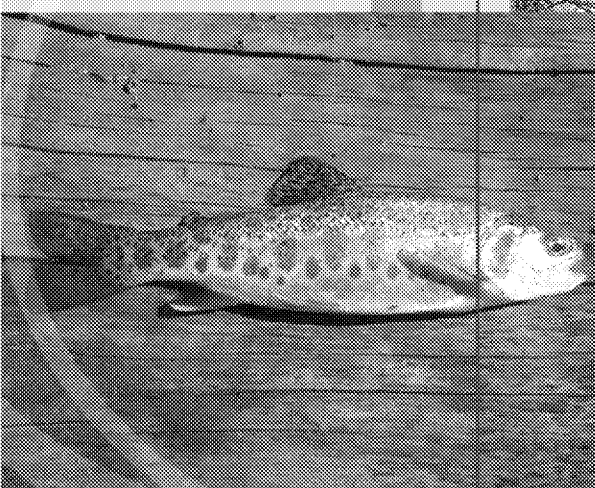
EPA-F-820-16-009

EPA-F-820-16-010

**PREPARED ON BEHALF OF THE
NATIONAL MINING ASSOCIATION**

Submitted to Docket ID No.: EPA-HQ-OW-2016-0551

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1. Introduction

GEI Consultants, Inc. (GEI) toxicologists, water quality specialists, and regulatory strategists are recognized experts in water quality effects on aquatic life. In fact, our significant experience related to selenium (Se) spans over 20 years of study at sites throughout the U.S. and Canada. We frequently provide expert testimony and support for regulatory water quality hearings, environmental assessments, and ambient water quality standards development. Our personnel have served as invited experts for Se risk evaluation in aquatic environments for the Society of Environmental Toxicology and Chemistry, provided peer review for Se effects issues near coal mining sites in British Columbia (on behalf of the BC Ministry of the Environment), and provided technical review of Se issues for the North American Metals Council – Selenium Working Group, as well as other water quality issues for the National Mining Association. We have been involved with Se-related issues in waters throughout the U.S., including the collection of considerable water quality and biological data from a wide variety of waterbodies, evaluation of Se bioaccumulation trends, detailed Se source and fate identification, and development of site-specific Se standards. As such, we believe we can provide a unique perspective on these draft guidance documents and respectfully submit the following comments.

We appreciate the opportunity to review and comment on these documents and hope that the EPA will take our comments under consideration when finalizing the guidance documents.

2. Comments on EPA-F-820-16-0010: *Technical Support for Adopting and Implementing EPA's 2016 Selenium Criterion in Water Quality Standards*

2.1 Comments on Options for Implementing EPA's Selenium Criterion

2.1.1 *Site-specific Fish Tissue Criterion Elements Using the Species Recalculation Procedure*

We agree with the EPA's allowance for the development of site-specific criteria using the recalculation procedure (EPA 2016e). However, since the toxicity database for selenium is relatively small and does not strictly follow the 1985 guidelines minimum data requirements in its complete form, it would be beneficial for the EPA to provide recommendations on minimum requirements for use of the recalculation procedure for selenium.

One recommendation that should be included for a recalculation procedure approach for selenium would be to first delete any species not present or expected to be present, or not acting as a surrogate for other resident species in waters of interest. The next step would be to recalculate the final chronic value (FCV) using the remaining most sensitive species and revised "N". If the recalculated FCV is greater than genus mean chronic value (GMCV) for the most sensitive species in the revised database, defaulting to the lowest GMCV for species present or expected to be present would be appropriate. Alternatively, if following deletion of non-resident species results in a database distinctly not meeting the minimum data requirements (i.e., the 8-family rule), again, the recommended FCV equals the lowest GMCV for species present following EPA (1994).

We would also recommend allowing for development of a site-specific tissue criterion element based on elevated ambient conditions. In states such as Colorado, site-specific criteria for selenium concentrations in the water column have been developed and approved by the EPA for regions of the state where naturally elevated selenium concentrations in water and fish tissues have been linked to the underlying geology. In locations where it has been established that the water column concentrations are naturally elevated, it can be assumed that any elevated fish tissue concentrations are also occurring because of the natural conditions. The EPA should allow for development of site-specific "ambient" tissue criteria based on existing fish tissue concentrations at these locations.

Additionally, in locations where water column concentrations are a result of both ambient conditions and regulated discharges, the fish tissue concentrations are a result of a

combination of ambient and anthropogenic inputs. Ambient tissue criteria for these streams would need to address the degree of influences from the different sources.

2.1.2 Variances

The EPA suggests that states and tribes should consider using water quality standard variances for selenium before revising the designated use for a waterbody for which attainment of the new selenium criteria is not feasible. While we agree with this as one potential option, it should not be the first option considered. We are aware of some states (e.g., Colorado) which require evaluation of all other factors prior to considering a variance, such as whether or not the standards are appropriate due to natural or anthropogenic conditions, evaluation of the correct aquatic life use classification, or modified flow conditions that affect attainability. A reasonable approach to setting standards for a waterbody is to first determine the correct designated uses of the waterbody. Once the designated use is set, a determination can be made as to what standards are necessary and appropriate for protection of that use. Only after these initial evaluations should a variance be considered and pursued to avoid unjustified costs to regulated dischargers. We recommend that the EPA include a discussion of variances as an option; however, the guidance should also clarify that a variance does not need to precede revision of uses or development of appropriate site-specific standards and, in some cases, variances may be used in conjunction with other revisions.

3. Comments on EPA-F-820-16-007: *Technical Support for Fish Tissue Monitoring for Implementation of EPA's 2016 Selenium Criterion*

We appreciate the guidance provided on fish tissue monitoring to support implementation of the selenium standard. We are in agreement that the fish tissue elements should supersede water column elements when both types of data are available and the system is stable with no new inputs of selenium. We have some comments on more specific portions of the implementation guidance, as follows.

3.1 Comments on Monitoring Strategy-Tissue Type

3.1.1 *Tissue Type*

We appreciate that this section includes an in-depth discussion of the factors that should be considered when determining what type of fish tissue to collect for monitoring plans focused on evaluation of selenium concentrations. Based on the mechanism through which selenium toxicity manifests itself, we agree that collection of egg-ovary tissue is preferable to the collection of whole-body or muscle tissues samples. But, as discussed in the document (EPA 2016b), we have also experienced difficulties in past selenium monitoring studies when the timing of the studies, regulatory restrictions, size of the target fish, and necessary size of the sample mass for analysis have made collection of egg-ovary tissues impractical or impossible. In these cases, we concur that whole-body or muscle tissues should be collected instead.

The implementation guidance could also include some direction as to what documentation, if any, will be required in study plans as to the factors that are considered in making this decision on an individual study plan basis. For example, it may be known that the collection of egg-ovary tissues is impractical, while in other cases, this decision may be need to be made in the field. The guidance should encourage flexibility in the study plan development to state which types of tissue may be available, and then state the factors that were considered (or will be considered during the sampling event) if the choice is to collect whole-body or muscle tissues instead of egg-ovary tissues based on practical concerns. For example, there could be a single or limited number of individuals collected in the field that could provide egg-ovary tissues for analysis, while there could be a larger number of individuals of the same species that could be collected as whole-body fish. In this case, the higher number of whole-body fish would provide more valuable information on variability in selenium concentrations at a site than a single egg-ovary sample.

The EPA provides a detailed description of the necessity for timing the collection of egg/ovary tissues to coincide with the pre-spawn window. The discussion presented also states that a substantial amount of variation in selenium concentrations could be expected to occur based on exact timing of collection during the egg maturation process and differences among species reproductive cycles. In our experience, the timing of spawning can still vary even with species with well-known life-cycles and in streams that we have sampled annually for multiple years. Estimating this window exactly in order to time the sampling to specifically capture this period can be difficult from a practical standpoint. The spawning windows presented in Appendix B are useful, but they indicate that multiple species in each watershed have windows that span five months or more.

Also, collection of egg/ovary tissues from migrating fish species will be contentious in cases where selenium sources are not well documented, as egg/ovary tissues will be collected from one waterbody but will have accumulated the selenium load from a differing waterbody. While this issue is alluded to, there is no clear guidance provided for how to handle this from an impairment listing perspective (EPA 2016b). We would suggest that when there is potential for questions to arise about the origin of the selenium load, the implementation guidance be flexible enough to allow additional data to be assessed or collected if needed to clarify this situation. In some cases, this could be discussions with regional biologists to determine life histories of the migrating fish species specific to the waterbody in question, while in other cases it could be necessary for additional tissue samples to be collected from the waterbody. If additional tissue samples are desired, such sampling could include: 1) egg-ovary tissues from a second fish species that is considered a resident fish could be collected during the same sampling event; 2) whole-body tissue samples could be collected in the same sampling event of the same fish species but in a size range that indicates these are juvenile fish that would not be expected to be migrating, or 3) whole-body fish tissues of the same species collected during a second sampling event that is timed specifically to avoid the collection of migrating fish. In each of these cases, the guidance should be flexible enough to ensure all data would then be considered when making a decision as to impairment of a waterbody and the origin of the selenium source.

Similar to our comment on the timing of the collection of egg-ovary tissues, recommendations should be provided as to determining the appropriate timing when collecting whole-body or muscle samples. The support document appears to indicate in this and future sections that summer or fall may be the appropriate time period, but it then states that seasonal considerations are less stringent for whole-body and muscle tissue (EPA 2016b). Providing flexibility for this type of sampling in order for it to correspond with monitoring strategies that are already in place for other contaminants is an important factor, as noted in the document. Many of the ongoing fish tissue sampling programs that are in place are based on human-health concerns and target the collection of edible-sized fish of certain species that are commonly fished for and consumed. As selenium tissue sampling is instead focusing on the protection of aquatic life, with the emphasis on fish reproductive

success, the guidance should state that the appropriate time period for collection of whole-body or muscle tissues should be based on knowledge of both the waterbody itself and knowledge of the life histories of the fish species to be targeted to ensure that the fish collected for analysis are resident fish that appropriately represent selenium concentrations in the waterbody.

We have also observed considerable variation in whole-body selenium concentrations among fish of the same species and approximate size collected at the same location in different seasons, and we have occasionally observed substantial variation even within the same sampling event. For example, at one site in Colorado, we observed Brook Stickleback whole-body tissue concentrations ranging from 24 mg/kg dw Se to 66 mg/kg dw Se during one spring sampling event, and from 20 mg/kg dw Se to 23 mg/kg dw Se during another sampling event. At another Colorado site with lower whole-body tissue concentrations in Creek Chub, we observed concentrations ranging from 6 to 11 mg/kg dw Se in the spring, while data from the summer and fall ranged from and 3 to 5 mg/kg dw. Using data from only the spring event could have indicated impairment, while data from the summer and fall events were well below the standard. Without a recommended time frame preferred for sampling, the ability to compare among sites and geographic regions is compromised. It may be that despite the desire for egg/ovary tissue data, sampling difficulties would preclude such sampling on a regional or geographic scale. This suggests that the guidance may want to allow the flexibility to simply focus on whole body sampling in general.

Finally, the guidance appears to be recommending against the collection of muscle plugs in lieu of egg/ovary, whole-body, or muscle fillet samples based on the variability in selenium concentrations based on sample collection location, detrimental effects to individual fish from this type of sample collection, and the potential to collect too little sample mass for analysis needs. The intent of this discussion on the potential issues with using muscle plugs should be clarified. The current text should more clearly state that the collection of muscle plugs should be avoided unless there is a specific need to collect information on a species of special concern that can be safely sampled in this manner without a risk of mortality. Also, the guidance should note that data from this type of sample collection may be considered acceptable if data on selenium concentrations in endangered or threatened species are necessary, as this may be the only way to collect such data from species at risk.

3.1.2 Sample Type

We agree that compositing fish tissue samples is necessary in some cases to provide sufficient amount of tissue for analysis in small-bodied fish species. However, while compositing fish of sufficient size may save on analytical costs, EPA also seems to be recommending replicate sampling to allow evaluation of the variability of selenium within a population. In addition, replicates are needed for statistical testing of data between locations or over time (noted elsewhere in the EPA guidance), which would be difficult, at best, if only composites were taken. As noted above, variable selenium concentrations can be found even

when sampling time, sampling location, species collected, and size of fish collected have been accounted for. While this issue is acknowledged, the guidance needs to allow flexibility for states to develop their own guidance to help resolve this issue locally. Analyzing fish tissue samples individually and then utilizing the mean or geometric mean of these values (similar to the EPA's calculation of GMCVs) to determine compliance would ensure that the appropriate measure is used for attainment decisions, while still ensuring information on this variability was not lost. As there is no recommendation included for multiple sites, locations, or years to be sampled for a waterbody, this may be particularly important to identify when selenium concentrations in a single fish sample are exerting a large influence in either direction on the average or composite.

A recommendation should be included in this portion of the discussion for the first (or first few) such sampling event in a water body to involve analysis of individual fish samples rather than composite fish samples when sufficient mass is available to provide some information on what to expect in variability at a site. If little variability is documented, then compositing of fish could be recommended on that basis. We realize some of these concerns are briefly addressed in the "Individual Sample" section; however, their vague specifications do not provide clear direction on how flexible states can be when making the decision of when to collect individual versus composite samples.

If compositing of fish continues to be recommended but the number of composite replicates is to be determined on a case-by-case basis, the discussion in this section should include further details on how to justify that decision. Based on how the guidance currently discusses sample type and number, one composite sample of five or fewer fish would be considered a sufficient amount of data upon which to determine impairment or non-impairment. As discussed further in a later section of this document, we have observed considerable variation in selenium concentrations among individuals from the same site and species, and this variation will not be accounted for adequately when determining impairment if a single composite sample is all the information this decision is based on. The EPA should clarify that the number of samples required for an impairment decision may differ between sites based on site-specific variability of fish tissue concentrations and population size of fish species present, but at a minimum decisions should not be based on a single sample, whether from an individual fish or composite.

This document should also present more clarification as to the length and description of stream reach utilized for the composite sample. If tissue samples are collected throughout a stream reach that includes portions both upstream and downstream of a selenium source, then collection of fish tissues throughout this reach may not provide valuable information when composited.

3.1.3 Target Species

As noted in the criteria document and this support document, toxicity data on fish species indicates that sensitivity to and bioaccumulation of selenium varies considerably in different fish species (EPA 2016a and 2016b). A list of fish species to target is included in this section for use by monitoring agencies to determine if their monitoring programs are including the appropriate fish species, which is stated to be those that are selenium sensitive and potentially accumulate high concentrations of selenium. We would first like to ask that a discussion of how these species included in Table 3 were selected, as selenium toxicity data are not available for most of these species. We assume that the list may reflect common species in genera for which there are fish tissue thresholds, but that is not clear.

Clarification should also be given as to the difference between a species being sensitive to selenium versus having the potential to accumulate high concentrations of selenium. The beginning of this section indicates that states and tribes should target species with higher selenium sensitivity, but then subsequently notes that the appropriate species are those that potentially accumulate high concentrations of selenium. In our experience, many waterbodies do not have a resident fish species that exhibits both attributes. For example, collection of a sensitive fish species from the genus *Oncorhynchus* versus a more tolerant species that also has a higher bioaccumulation potential such as those from the genus *Rhinichthys* could result in a different decision as to whether the waterbody was considered impaired or not. In addition, there may be low numbers of the sensitive species to the point that the sample number would be limited or that a higher risk exists of population-level effects from tissue collection, while higher numbers of the tolerant species were present. Further, specific recommendations as to how to select the species for sampling from those on the target list should be provided to maintain consistency in state sampling plans when these types of decisions arise. For example, if multiple species from the target list are present in a waterbody but the intent is to collect only a single species, then the species to be collected should be the most sensitive fish species that is present in sufficient numbers to allow for tissue collection without impacting the population. For example, in Idaho, collecting permits address the concern of impacts to populations by specifying that the number of fish of each species collected for tissues can be no more than 30 percent of the total number of fish of that species collected within the specified reach, and Colorado Parks and Wildlife specifies that the number of fish sampled for tissues shall be restricted to 10 percent of the total take of that species per sampling location.

The support document should also provide guidance on whether and when the collection of multiple species would be appropriate, and then discuss how data from multiple species would be utilized in the determination of impairment or non-impairment. For example, if Northern Pike (*Esox lucius*) were found to have whole-body tissue concentrations of 12.0 mg/kg dw, and White Sturgeon (*Acipenser transmontanus*) at the same sample site was found to have whole-body tissue concentrations of 7.5 mg/kg dw, one species is exceeding the criterion while the other is not. Since Northern Pike are one of the less sensitive species in

the selenium toxicity database (with a whole-body chronic value of 14.2 mg/kg dw), and White Sturgeon are more sensitive, it would be more appropriate to use the White Sturgeon data for comparison to the criterion when a large discrepancy exists between tissue concentrations in different species with known differing sensitivities.

This section also states that part of the reasoning behind providing the target species list is to encourage states to sample the same species since it is difficult to compare contaminant monitoring results within a state or among states otherwise because of the various factors that cause variability in selenium sensitivity and bioaccumulation rates. Despite acknowledging this and presenting a list of target species that appears to include those with a wide range of both sensitivities and bioaccumulation rates, it is an inherent part of the criteria document that all data are compared to the same tissue criterion. However, when data from multiple species are available, and sensitivities are known, the most scientifically valid approach is to compare the most sensitive species to the criterion value.

3.2 Comments on Leveraging Existing Fish Tissue Monitoring Programs and Sample Design

Many of the comments discussed in Section 3.1.1 are also applicable to the subsections *Consistency with Existing Programs* and *Temporal Considerations*.

The support document should discuss more fully how to deal with the issue that arises when migrating fish are collected for tissue analysis in one section of a waterbody that may have spent previous months in another section of the waterbody. While this migration period may be the optimal time frame for the collection of egg/ovary tissue samples, attributing these data to the correct stream reach or waterbody accountable for the selenium bioaccumulation versus the actual reach the fish were collected in will be difficult in some cases. In waterbodies with well documented selenium inputs and fish species with well-known life migratory patterns, perhaps inferences can be made as to how to appropriately react to any exceedances or lack of exceedances that occur. However, further sampling (such as whole-body tissue collection during seasons when fish would not be migrating) or research on the origin of selenium inputs should be recommended when the outcome is not clear and migratory species are involved. Otherwise, we foresee that lack of specific guidance for these situations as resulting in issues with interpretation of the data when determining compliance or non-compliance. For example, the current fish tissue sampling protocol in Idaho recommends that young of year salmonids (defined as fish less than 100 millimeters in length) be preferentially collected where possible in the months of August or September to ensure that the fish that are collected have spent most of their life history in the stream (Idaho Fish Sampling Protocol Technical Team 2016).

Regular yearly sampling and more intensive sampling in targeted basins is suggested in this section, but no guidance is provided as to how to interpret variation between years or sites.

We also presume that even in some basins that are not targeted, there would be a benefit to sampling multiple sites within the basin.

3.3 Comments on Existing Resources and Information

We agree that all available existing data should be considered and utilized as necessary. However, because existing data may have been collected in conjunction with fish advisory programs to protect human health, it was likely collected with different end points in mind. The EPA should expand this discussion to provide guidance on how fish tissue collected for human health studies will be incorporated into monitoring and listing strategies by the states for selenium. Recommendations or discussion of how to incorporate these differing types of historical data that may not necessarily be collected consistent with the recommendations in this guidance document would also be useful. We recommend that the guidance provide enough flexibility for the states to allow data collected for different study types be qualified, and used only for preliminary assessments, and that final decisions are not made until additional data are collected. In addition, while historical data may be informative and could be utilized to indicate areas in which more targeted monitoring may be necessary, it would be helpful to have some guidance on what period of time would be considered when evaluating compliance or additional monitoring needs based on historical data, such as a recommendation to use data no more than five years old.

3.4 Comments on Sample Assessment: Analytical Chemistry

Although we agree that a list of test procedures and method detection limits (MDLs) provided in tables 5 and 6 is useful, this section would be even more informative if the EPA provided specific MDL targets for laboratories to meet. We would recommend a minimum of the 0.2 mg/kg limit achieved by EPA Method 6020A for tissues. We also would like to point out that the MDL for EPA Method 6010C of 5 mg/kg listed in the table may not be significantly lower than the tissue criterion of 8.5 mg/kg; the difference between these two values could potentially be within the realm of analytical error, this method should not be included in this table. Similarly, the MDL listed in Table 6 for EPA Method 200.8 Rev 5.4 (7.9 µg/L) is higher than the water column criteria for lotic and lentic waters of 3.1 and 1.5 µg/L, respectively; therefore, this method or detection limit should be excluded from this table. We are aware of labs using Method 200.8 that are able to attain much lower detection limits using this method than 7.9 µg/L. An appropriate detection level for comparison to the water column criteria values would be the 0.6 µg/L listed for EPA Method 200.9. Additionally, method 6020A listed in Table 5 for tissues, is also applicable to water, with a detection limit of approximately 0.7 µg/L, this method would also be appropriate.

3.5 Comments on Sample Assessment: Statistical Analysis

The support document cites EPA (2000) in recommending that the t-test be used to statistically compare the mean of all fish tissue data for a single species to the criterion to

determine if the mean exceeds the water quality standard. This section should be expanded to provide more specific guidance as to what this means and to support whether use of a t-test for comparison is appropriate when comparing site values to a single criterion value. Limited amounts of tissue data or highly variable tissue data may not be appropriate for comparison using the t-test statistic. The ANOVA approach or use of a nonparametric statistical test may be more appropriate under some scenarios.

4. Comments on EPA-F-820-16-009: FAQs: Implementing WQS that Include Elements Similar or Identical to EPA's 2016 Selenium Criterion in Clean Water Act Section 402 NPDES Programs

4.1 Comments on Q1-2 - Which elements of a four-part criterion for selenium should be used when implementing WQS through the NPDES permits program?

We agree that states or tribes should be able to use any of the elements of the four-part criterion for reasonable potential (RP) analysis. However, this concept is somewhat contradicted in the flowchart in Attachment 2, and in the responses to Q2-1 and Q2-4. For clarity, we recommend this question be deleted from Section 1 of this document and be covered only in Section 2, the discussion of RP determinations.

4.2 Comments on Q1-4 - May permit writers use mixing zones, initial zones of dilution, or dilution factors in NPDES permitting for selenium?

Q1-4 addresses the use of mixing zones or dilution factors for National Pollutant Discharge Elimination System (NPDES) permitting for selenium. The EPA's response is that because selenium is a bioaccumulative pollutant mixing zones should be handled as described in Chapter 5 in the Water Quality Standards Handbook (EPA 2014). However, the Water Quality Standards Handbook is referring to bioaccumulative pollutants for which human health risks are a concern, not protection of aquatic life. Mixing zones and dilution factors should be allowed for selenium where appropriate, as selenium does not cause a human health risk at levels near those which cause aquatic life impairment, and therefore should not be classified with other bioaccumulative pollutants.

4.3 Comments on Q2-1 - Which elements of a four-part criterion for selenium should be used for conducting RP analyses?

In response to Q2-1 the EPA states that "any of the elements of the criterion can be used by the permitting authority to determine whether the discharge causes, has the RP to cause, or contributes to an in-stream excursion above the state or authorized tribe's EPA approved WQC". The EPA then goes on to state that fish tissue concentrations not exceeding the fish tissue element does not mean there is no RP, and that the RP evaluation should then include

an evaluation of the water column element of the standard. We do not agree with this approach.

As stated in the 2016 selenium criteria document the egg-ovary element supersedes all other elements, and muscle/whole-body supersedes the water column element. This is an appropriate approach because the tissue based elements are based directly on measured tissue concentrations and toxic effects in fish, while the water column element is based on modeling and includes multiple levels of uncertainty. Since the EPA intends for tissue based elements to supersede water column elements per the criteria document, this determination should apply in all situations, including RP analysis. If a receiving stream below an existing discharger is not exceeding the tissue-based element, which is the criterion value, then there is strong evidence that the existing discharger can continue historical selenium discharge amounts without RP to cause or contribute to an exceedance of the criteria in the future.. More specifically, even if the discharger is exceeding the water column element, if fish tissues in the receiving waters are in attainment this just indicates that the food web and bioaccumulation pathways (uptake and trophic transfer functions) in this particular system differ from those used in the back-calculation of the default water-column element and do not result in elevated fish-tissue concentrations. While there is acknowledgment of this uncertainty in converting tissue elements to water column concentrations in the criteria document, the document also says that uncertainty can be reduced by using site-specific data. Measured fish tissue concentrations from the receiving waters downstream of a discharger are, in fact, such site-specific data and are more appropriate for determining RP than the back-calculated water column criterion element.

Use of fish tissue concentrations to determine RP is also in alignment with the decision making process for assessment protocol. According to the EPA's FAQ's on implementing the criteria for 303(d) and 303(b), when fish tissues are below the criteria, the stream segment is considered attaining, regardless of whether the water column criteria is exceeded.

4.4 Comments on Q2-4 - If a state or authorized tribe has sufficient and representative fish tissue data available to demonstrate that selenium levels in fish tissue do not indicate an excursion of the fish tissue elements of the four-part selenium criterion, can that information be used to determine that there is no RP and, thus, no need for a WQBEL?

The response to Q2-4 somewhat contradicts the response to Q2-1, by noting that while the EPA considers the water column element to be the most appropriate predictor for whether the discharge has RP, there may be specific situations for which there may be a determination that there is no RP based on fish tissue concentrations. One of these situations is if the population of fish have already been exposed to existing levels of selenium and the system is determined to be in steady-state. However, there is no explanation in this document as to

what data would be required to demonstrate “steady-state” (EPA 2016d). The EPA states in the selenium criterion document that it estimates that concentrations of selenium in fish tissue will not reach steady-state for several months in lotic systems and longer time periods in lentic systems (EPA 2016a). We recommend the EPA provide more specific guidance on what length of time constitutes steady-state. For example, we would recommend that if an existing discharger has been discharging into lotic waters for at least year, and there have been no other changes to selenium concentrations in the system, it should be presumed that this system is at steady state. This same approach can be used in situations where new discharges are constructed on streams that already receive selenium inputs and the new discharge does not appreciably change the selenium concentration in the receiving stream. The EPA should also provide guidance as to what specific information would be required to demonstrate that a new discharger is at steady-state, such as monthly effluent data initially to show either consistency with selenium concentrations or at least no increase in selenium concentrations over time.

The response to this question also states that fish tissue levels must be “significantly below the criterion’s fish tissue element.” There is no indication in the criteria document that attainment with the standard requires tissue to be “significantly” below the criterion. If tissues are below the criterion they are not exceeding the criterion. Safety factors that are inherent in the criteria derivation provide enough conservatism to allow a direct comparison of the fish tissue concentration to the criterion. Alternatively, application of a confidence interval could be considered when comparing multiple samples to the criterion, and would be useful in accounting for some of the variability in fish tissue results. The mercury implementation guidance states that RP may be found if tissues are below but “close” to the criterion and recommends applying a confidence interval such as the 95 percent upper confidence limit on the mean for use in comparing tissue values to the tissue based criterion.

As such, we recommend the EPA combine the responses to questions regarding RP to develop a more coherent and cohesive response. There is a discrepancy between the responses given to the questions, with one stating that you must revert to WQ data even if fish tissues are meeting the criteria and the other stating there are exceptions and fish tissue may be used to determine RP. Regardless, fish tissue data should and can be used to determine RP.

4.5 Comments on Q2-5 - In cases in which a discharge occurs at a lotic location and downstream waters are lentic waterbody types (e.g., lakes, impoundments), which selenium criterion water column element should be used in RP analysis?

The response to Q2-5 states that water quality and hydrological modeling may be needed to ensure protection of downstream waters. However, if a system is in “steady-state” modeling would not be necessary and a simpler option would be to determine if fish tissues in the

downstream lentic waters are attaining the tissue criteria. If a discharge is ongoing and is not expected to change, and if fish tissues are in attainment in downstream lentic waters this would indicate the upstream discharge is not impacting the lentic system, and would not be expected to impact the system in the future. There are many factors affecting the uptake in different types of waterbodies that would be difficult to account for using hydrological modeling. The use of actual data is much more straightforward and eliminates uncertainty and assumptions.

GEI has conducted studies in regions where they have observed naturally elevated water column and tissue concentrations in the lotic waters, but attaining values in the downstream lentic waters. For example, in a study conducted in the Cottonwood Creek watershed in the Denver metro area in Colorado, selenium in the water column was found to be elevated in the creeks due to the natural geology in the region. Fish tissue concentrations in one of these creeks were also elevated and ranged from 12.6 to 17.5 mg/kg dw. However, tissues collected from the reservoir located approximately 1 mile downstream ranged from 3.3 mg/kg dw whole-body to 4.4 mg/kg dw in egg/ovary tissue, values which are both well below the criterion. This demonstrates that lotic and lentic systems are very different, and concentrations in one cannot necessarily be used to predict the other.

4.6 Comments on Q3-1 - Can an NPDES permitting authority using a state- or authorized tribal-adopted standard based on or similar to EPA's recommended four-part selenium criterion derive selenium NPDES permit WQBELs for a noncontinuous or intermittent effluent discharge containing selenium? How?

The response to Q3-1 states that the intermittent element can be used for determination of NPDES permit limits for non-continuous or intermittent discharges. We do not recommend use of the intermittent element to develop permit limits. The intermittent element equation is based on the number of days that the discharge occurs, and it is unclear how this could be incorporated in an NPDES permit, since for many intermittent discharges the discharge is dependent on volume, storm events, or other factors and the number of days that the discharge would occur is unknown and would not be able to be incorporated into the permit prior to occurring. One option would be to include the equation itself as a permit limit, this would allow the intermittent limit to be calculated and reported on the discharge monitoring report once the factors above are known. It is possible that there could be instances where an intermittent discharger has regular discharge intervals and the last five years of data could be used to estimate a discharge frequency. However, this would only apply to limited situations.

Alternatively, an acute standard may be appropriate for these situations if discharges occur at a frequency and duration that is less than a chronic exposure. While the EPA has not provided a true acute criterion, other studies have shown that such a value can be derived

using biokinetic modeling to ensure that short term pulses do not exceed exposures that could result in non-attainment of the fish tissue criterion (e.g., DeForest et al. 2016).

4.7 Comments on Q3-2 – Can an NPDES permitting authority develop permit limits (WQBELs) for a four-part selenium criterion using the fish tissue element(s) of a four-part criterion (i.e., egg-ovary or whole body and/or muscle) rather than the water column element?

The response to Q3-2 states that the water column element should be used to develop water quality based effluent limits (WQBELs) in NPDES permits and that the EPA has not developed guidance for calculating a WQBEL directly from a fish-tissue criterion element. Use of fish tissue should be an option and we recommend the EPA provide general guidance on developing permit limits from the tissue criterion element rather than leaving it open to broad interpretation. While a tissue based permit limit may not be desirable in all situations, such as when there are multiple dischargers or selenium sources in a waterbody, there may be instances in which it would be beneficial. For example, if a permittee has demonstrated that fish tissue concentrations are attaining the criterion, but the permit writer has other reasons for including a selenium limit even though there should technically be no RP, it may be beneficial for a permittee to request a tissue-based permit limit.

We understand that any option being considered for implementation of tissue-based limits must address all aspects of permitting including monitoring and reporting requirements, potential use of mixing zones, antidegradation considerations, and total maximum daily loads (TMDL) for the site. While challenges exist for each of these permitting components, options do exist for implementing a tissue-based permit limit.

Monitoring requirements for a tissue-based permit limit could include an annual or semi-annual sampling requirement, with the requirement to meet the EPA's fish tissue criteria values unless site-specific standards have been established. While there may be concern with infrequent monitoring, this would be similar to whole effluent toxicity (WET) testing, in which samples are often collected quarterly, and in some cases only semi-annually or annually.

Another option would be to implement a permit "trigger" water column concentration similar to what Kentucky has included in their selenium criteria implementation. This water column trigger could be based on the assumption that if fish tissue are meeting the EPA criterion values in the receiving water, the current selenium concentrations being discharged from the facility result in attainment, therefore the trigger could be set to match the discharge concentration.

As discussed in Section 4.2, the concerns with mixing zones for bioaccumulative pollutants was based on human health risks, not protection of aquatic life. Mixing zones and dilution

factors should be allowed for selenium, as selenium does not cause a human health risk at levels near those which cause aquatic life impairment, and therefore should not be classified with other bioaccumulative pollutants. The selenium fish tissue concentration is unlikely to change dramatically based on exposure to mixing zones unless the full life cycle of the fish exists within the mixing zone.

According to the EPA's Water Quality Standards Handbook, "The antidegradation review requirements of this provision of the antidegradation policy are triggered by any action that would result in the lowering of water quality in a high-quality water." Should fish tissue limits be implemented, the concentration in the tissue would be a reflection of the water quality. It is likely states would need to make revisions to their antidegradation and antibacksliding policies to be able to compare tissue limits to previous water column limits. The most straightforward way would be to assume that if water column concentrations were in attainment in the receiving water during the previous permit cycle, any fish tissue collected during that same permit cycle represents attaining conditions. Therefore, if the permit limit for the next permit cycle is set to be in line with the fish tissue concentrations measured in the receiving water during the previous permit cycle, these attaining conditions are maintained and there would be no degradation of the water quality.

Discharge to an impacted stream segment would require the evaluation of a TMDL. The new EPA tissue based criteria allows for 303(d) assessments to be based solely on tissue samples collected in the stream segment; however, the EPA expects the TMDL to be implemented through a water column criteria, which may be site-specific if necessary. If a TMDL is established based on tissue limits, the tissue-based permit limit could easily be evaluated in the context of the TMDL. For example, if a TMDL for the entire stream segment is set at 12.0 mg/kg dw (egg/ovary) of a certain species, representative fish collected for the segment would have to remain below that amount. Unlike typical TMDLs which allocates a small portion of the pollutant to each discharger, a single tissue based TMDL would be included for each discharger. This approach facilitates communication amongst dischargers along a stream segment encouraging them to coordinate the collection of data and in turn, collectively work to reduce the tissue based TMDL.

4.8 Comments on Q3-3 - EPA's 2016 selenium criterion does not include an acute expression. Must permits contain both short- and long-term limit expressions?

Question 3-3 discusses the need for permits to include both short- and long-term limits even though the EPA has only provided a monthly average criterion element and an intermittent exposure element. The response states that both maximum daily and average monthly limitations (or average weekly and average monthly for publicly owned treatment works) are required "unless impracticable." Because selenium toxicity is based on long term dietary uptake of selenium and maternal transfer it does seem impracticable (and unnecessary) to determine acute and chronic limits for all dischargers. In most cases, with a continuous

discharge, monthly limits are appropriate, and there is no need to develop acute limits since use of the intermittent equation to calculate an acute limit would result in a value equivalent to the monthly average value anyway. There may be certain situations where an acute limit may be necessary, depending on discharge frequency and potential for instream dilution, but these situations are likely very limited.

There are other parameters for which acute and chronic limits are not implemented in NPDES permits. The WET limits are an example in which, in many cases, either acute or chronic limits are present in permits, not both. WET is not a standard toxicant, and is designed to evaluate the potential combined toxicity of pollutants in effluent. In the permits issued under the Colorado Discharge Permit System, the determination to use acute or chronic WET limits is based on the instream waste concentration ($IWC = [Facility\ Flow / (Stream\ Chronic\ Low\ Flow + Facility\ Flow)] \times 100\%$). If the IWC is greater than 9.1% the permit will have chronic WET limits and if the IWC is less than or equal to 9.1%, or the stream does not have an aquatic life use, acute limits apply. Because selenium is not a standard toxicant either, in that its toxicity is a result of longer term dietary uptake, a similar approach should be taken for selenium limits in permits.

4.9 Comments on Q3-4 - NPDES regulations require that permit limits for metals be expressed as total recoverable; however, selenium is a nonmetal or metalloid. Should selenium be expressed as total recoverable in WQBELs and, if so, how should an NPDES permitting authority translate the dissolved selenium water column element of EPA's 2016 selenium criterion to a total recoverable selenium NPDES permit limit?

The response to Q3-4 suggests that a total recoverable-to-dissolved selenium ratio of 1.00 be used to calculate total recoverable permit limits from the dissolved selenium water column. While we agree that it is often necessary to use a default ratio, it should be clarified that there are options for calculation site-specific translators if data are available. There is a history of use of a selenium translator that differs from 1.00. The EPA previously reported that 92.2 percent of the selenium in Belews Lake was dissolved, resulting in a total recoverable-to-dissolved selenium ratio of 1.085. This ratio has been used by several states (Colorado and Utah) to convert the EPA's former total recoverable chronic criterion of 5 µg/L selenium to a dissolved chronic criterion of 4.6 µg/L dissolved selenium. If applied to the EPA's current dissolved criterion values of 3.1 µg/L lotic and 1.5 µg/L lentic this ratio would convert the criterion values to total recoverable values of 3.4 µg/L and 1.6 µg/L. Although these changes seem minor, when applied to permit limits, use of a total recoverable-to-dissolved selenium ratio other than 1.00 could result in larger differences. Alternatively, the EPA could use the updated selenium database to calculate a new translator ratio based on concentrations reported in the studies that were used for criteria derivation if the appropriate data are available.

4.10 Comments on Q4-1 - What EPA analytical test methods are recommended for use in analyzing water and fish tissue samples for selenium under EPA’s NPDES program?

Comments regarding this question/answer are found in Section 3.4.

4.11 Comments on Q5-1 - Would a compliance schedule be allowed in an NPDES renewal permit in which a WQBEL is being replaced with a more stringent permit limit based on EPA’s 2016 selenium criterion?

The response to this question states that a compliance schedule would “possibly” be allowed. This contradicts the Draft *Technical Support for Adopting and Implementing EPA’s 2016 Selenium Criterion in Water Quality Standards* in which compliance schedules are specifically listed as an option for implementing the selenium criterion. Compliance schedules should be allowed in all cases as the new the EPA water column criterion element is significantly lower than the previous criterion and will likely require dischargers to make operational changes in order to meet them.

5. Comments on EPA-F-820-16-008: FAQs: Implementing the 2016 Selenium Criterion in Clean Water Act Section 303(d) and 305(b) Assessment, Listing, and Total Maximum Daily Load (TMDL) Programs

5.1 Comments on Q1 – How should states, authorized tribes, and territories implement EPA’s 2016 selenium criterion in their assessment and section 303(d) listing programs?

As discussed in Section 4.4, further discussion and a clear definition of steady-state should be included in the technical support documents and FAQs since the decision matrix is based on a determination of whether a waterbody is at steady-state.

While we agree with the decision matrix for situations in which fish tissue and water column data are available, we do not agree with scenario 8 if fish tissue are not available due to the waterbody being a fishless water (EPA 2016c). Viable fish populations cannot become established in stream reaches with limited or unsuitable habitat, as is often characteristic of ephemeral, intermittent, and headwater streams. Attainment of the water column criteria in these streams will not result in fish inhabiting the waterbody when their absence is due to physical habitat limitations. In addition, water in many of these streams is only flowing in certain reaches and may rarely (if ever) reach downstream waters. In these cases, the lack of connection downstream naturally inhibits the migration of any fish into these waters. We would argue that an alternative to assessment of fishless waters could be the requirement to collect fish tissue data at the nearest downstream exposure point and compare those values to the fish tissue element of the criterion. If downstream waters that support fish are in attainment with the fish tissue criterion, it is not necessary to implement unreasonable water quality standards to protect non-existent fish in upstream waters.

A second alternative for waters with insufficient habitat and/or flow to support a fish population on a continuing basis could be evaluation based on invertebrate tissue concentrations instead of water column concentrations. Evaluation of invertebrate tissue concentrations is more in line with protection of the existing aquatic life, and toxicity data presented in the selenium criterion document for invertebrate species (EPA 2016a). In fact, the research cited in the technical support document for fish tissue monitoring states that selenium bioaccumulation in insects provided a more accurate measurement of accumulation risk in the food chain than selenium concentrations in the water column (EPA 2016b). This is a further indication that it would be more appropriate to evaluate fishless waters on the basis of selenium concentrations in macroinvertebrate tissues relative to macroinvertebrate toxicity

data than the current recommendation to use water column concentrations. The discussion on mussels and clams further supports this, as it points to the differences in potential selenium bioaccumulation based on differences in macroinvertebrate communities.

Overall, use of a water column criterion element that is back-calculated from a fish tissue-based criterion is not appropriate in waters that do not support fish populations because of habitat or flow restrictions – particularly because macroinvertebrates are known to be less sensitive than fish, as documented by toxicity values listed in EPA’s criterion document and EPA’s reference to field studies that demonstrate they are less sensitive than fish.

5.2 Comments on Q5 - Should states and authorized tribes complete assessments and section 303(d) listings for waterbodies that have only selenium water column data?

When water column data are the only data available and they indicate an exceedance of the criterion, the EPA should recommend states and tribes not place the waterbody on a 303(d) list, but rather move such waterbodies to a type of monitoring or provisional list and require the collection of fish tissue data to confirm whether listing of a waterbody is necessary. For example, Colorado currently uses this approach such that if a water is not determined to be “impaired” but further evaluation is needed they place these waterbodies on a “monitoring and evaluation” (M&E) list. Because most 303(d) listing cycles are two-year cycles, this would allow sufficient time for collection of fish tissue data prior to the next listing cycle. This would reduce the need for states to put extensive effort into developing TMDLs for situations where they may not be needed.

5.3 Comments on Q6 - How should states and authorized tribes complete assessments and section 303(d) listings for fishless waters?

The comments for Q1 that were associated with assessment of fishless waters are also applicable to this comment.

5.4 Comments on Q7 - How should states and authorized tribes complete assessments and section 303(d) listings using fish data?

The EPA’s answer to this question indicates that states and tribes should assess the waterbody using the water column elements of the criterion if target species are not captured or present. We do not agree with this, the waterbody should be assessed using fish tissue data from any species present. We have conducted studies on many streams that supported healthy fish populations but did not include any of the species listed in the table. As such, fish tissue data from any available species provides more valuable information to evaluate against the fish tissue element of the criterion rather than evaluation of the water column element.

However, the guidance should allow additional flexibility for states to evaluate the potential that such available fish species may not be as sensitive as those that drive the criterion and comparisons may not necessarily lead to impairment decisions simply because of that.

5.5 Comments on Q8 - How should states and authorized tribes complete assessments and section 303(d) listings when there are data for multiple fish species?

The EPA should give more consideration to the use of data from multiple fish species in which average selenium concentrations are less than the fish tissue criterion for most species but higher than this criterion for other species. If the species in exceedance had toxicity data available that indicated that the tissue concentration is less than the EC₁₀ for the species, the waterbody should be given further consideration before listing it as impaired. See also our response in Section 3.1.3, in which we discuss concerns with target species.

5.6 Comments on Q9 – How should states and authorized tribes complete assessments and section 303(d) listings when there are multiple samples for a single fish species?

While we agree with the flexibility provided in the EPA’s answer to Q9, recommendations as to how to interpret varying results when there are multiple samples for a single fish species would be helpful. This would include some specification as to the temporal and spatial variability that would be considered acceptable when averaging fish tissue values or compositing fish tissue samples. Further guidance would result in a greater ability to compare data within or across states.

5.7 Comment on Q10 - How should states and authorized tribes complete assessments and section 303(d) listings when there are anadromous or potamodromous fish species in the waterbody?

We agree with not using adult anadromous fish for completing water quality assessments. While we agree that life histories of potamodromous fish should be considered, and the migration period may be the optimal time frame for the collection of egg/ovary tissue samples, attributing these data to the correct stream reach or waterbody accountable for the selenium bioaccumulation versus the actual reach the fish were collected in will be difficult in some cases. This was addressed in more detail in Section 3.2.

5.8 Comment on Q11 - How should states and authorized tribes complete assessments and section 303(d) listings when there are new inputs of selenium?

Our comments on defining “steady-state” in Section 4.4 are also applicable to the answer to this question.

6. Conclusion

Overall, if the changes outlined above are made, we believe this guidance will be useful for stakeholders in the implementation of EPA's tissue-based selenium criterion. We are not sure splitting them into four separate documents is necessary, however, and some consolidation and reduction in redundancy by combining into a single guidance document may benefit the reader.

7. References

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