

Technical Support for Adopting and Implementing EPA's 2016 Selenium Criterion in Water Quality Standards

Draft

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List of Acronyms

BAF	Bioaccumulation factor
CFR	Code of Federal Regulations
CWA	Clean Water Act
EPA	Environmental Protection Agency
FR	Federal Register
GLI	Great Lakes Initiative
HAC	Highest attainable condition
NDPES	National Pollutant Discharge Elimination System
SSD	Species sensitivity distribution
TMDL	Total maximum daily load
UAA	Use attainability analysis
WQBELs	Water quality-based effluent limits
WQC	Water quality criteria
WQS	Water quality standards

Definitions¹

Water quality criterion element

A magnitude, frequency, and duration for a particular media type. The water quality criterion elements for selenium are related through a hierarchy, with fish tissue criterion elements having primacy over water column criterion elements, and the egg-ovary criterion element having primacy over all other criterion elements.

Steady state

An organism is in steady state when the rates of chemical uptake and depuration are equal and tissue concentrations remain constant over time.² For the purposes of the national CWA section 304(a) recommended selenium criterion, steady state refers to conditions where sufficient time has passed after the introduction of a new or increased discharge of selenium into a water body so that fish tissue concentrations of selenium are no longer increasing.³

Performance-based approach

A water quality criterion that is a transparent process, such as a criterion derivation methodology, rather than a specific outcome, such as a concentration of a pollutant. This process or methodology is sufficiently detailed and has suitable safeguards that ensure predictable, repeatable outcomes. Approval of this process or methodology would also serve for CWA purposes as the approval of each outcome generated from following that process or method.⁴

Bioaccumulation

The uptake and retention of a chemical by an aquatic organism from all surrounding media (e.g., water, food, sediment).⁵

Dissolved total selenium

All species of selenium that are dissolved into the water column and that would be measured in a water sample after it has been passed through a 0.45 µm membrane filter.⁶

¹ This glossary is meant to provide plain language definitions for key terms used in this document. Individuals should consult the regulations to identify whether there are legal definitions of these terms.

² USEPA. 2003. *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000) Volume 2: Development of National Bioaccumulation Factors*. EPA-882-R-03-030. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

<https://nepis.epa.gov/Exe/ZyPDF.cgi/P1005EZQ.PDF?Dockey=P1005EZQ.PDF>

³ USEPA. 2021. *2021 Revision to: Aquatic Life Ambient Water Quality Criterion for Selenium—Freshwater 2016*. EPA 822-R-21-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

<https://www.epa.gov/system/files/documents/2021-08/selenium-freshwater2016-2021-revision.pdf>

⁴ *EPA Review and Approval of State and Tribal Water Quality Standards* 65 Fed. Reg. 24641 (Apr. 27, 2000)

⁵ USEPA. 2003. *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000) Volume 2: Development of National Bioaccumulation Factors*. EPA-882-R-03-030. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

<https://nepis.epa.gov/Exe/ZyPDF.cgi/P1005EZQ.PDF?Dockey=P1005EZQ.PDF>

⁶ Protho, M.G. USEPA. 1993. Memorandum: Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria. Office of Water, Washington DC.

<https://www.epa.gov/sites/production/files/2019-03/documents/metals-criteria-interpret-aqlife-memo.pdf>

Site specific criterion/site specific criterion element

Water quality criterion/criterion element that is modified to reflect site-specific conditions. A criterion/criterion element that is developed to protect aquatic life at a particular site, usually by taking into account a site's physical, chemical, and/or biological conditions (i.e., water quality characteristics or species composition).⁷

Critical species

In the context of the recalculation procedure, a resident species that (a) is commercially or recreationally important at the site, or (b) is listed as threatened or endangered under section 4 of the Endangered Species Act, or (c) is a species for which there is firm evidence that its loss would yield an unacceptable impact on the site's commercially or recreationally important species, endangered species, abundances of a variety of other species, or structure or function.⁸

⁷ USEPA. 2017. *Water Quality Standards Handbook. Chapter 3: Water Quality Criteria*. EPA-823-B-17-001. U.S. Environmental Protection Agency, Office of Water, Washington, DC. <https://www.epa.gov/sites/default/files/2014-10/documents/handbook-chapter3.pdf>

⁸ USEPA. 2013. *Revised Deletion Process for the Site-Specific Recalculation Procedure for Aquatic Life Criteria*. EPA 823-R-13-001. U.S. Environmental Protection Agency, Office of Water, Washington, DC, www.epa.gov/sites/production/files/2015-08/documents/revised_deletion_process_for_the_site-specific_recalculation_procedure_for_aquatic_life_criteria.pdf.

1.0 Introduction

1.1 EPA's National CWA section 304(a) Recommended Chronic Aquatic Life Selenium Criterion in Freshwater

In 2016, the United States Environmental Protection Agency (EPA) updated its national Clean Water Act (CWA) section 304(a) recommended chronic aquatic life criterion for selenium in freshwater systems to reflect the latest scientific information. This information indicates that toxicity to aquatic life is driven by dietary exposures and that the reproductive life-stages of egg-laying vertebrates are the most sensitive to the toxic effects of selenium. The criterion has four criterion elements: (1) a fish egg-ovary criterion element; (2) a fish whole-body and/or muscle criterion element; (3) a water column criterion element (one value for lentic and one value for lotic aquatic systems); and (4) a water column intermittent criterion element (to account for potential chronic effects from short-term exposures to high concentrations in lentic and lotic aquatic systems) (see Table 1). Under EPA's 2016 CWA section 304(a) recommended selenium criterion the fish tissue criterion elements have primacy over water column elements, except where there are no fish, where fish tissue data do not meet state or tribal quality assurance procedures, or for water bodies with new discharges where selenium concentrations in fish tissue might not have stabilized. EPA also recommends that the egg-ovary tissue criterion element has primacy over whole-body and muscle tissue criterion elements.

Toxicity data indicate that the selenium concentration in fish eggs and ovaries is the most robust and consistent measurement endpoint directly tied to adverse reproductive effects in aquatic organisms. Toxicity to developing embryos and larvae is directly linked to egg selenium concentration.⁹ EPA derived the whole-body, muscle tissue, and water column elements from the egg-ovary element so that states and authorized tribes could more readily implement water quality criteria (WQC) based on EPA's national CWA section 304(a) recommended selenium criterion. The assessment of the available data on chronic selenium exposure for fish, invertebrates, and amphibians indicates that a criterion element derived from fish is expected to be protective of the aquatic community, since other taxa appear to be less sensitive to selenium than fish. EPA did not develop an acute criterion for selenium when it updated the chronic criterion because although selenium may cause acute toxicity at high concentrations, the most deleterious effects on aquatic organisms are due to selenium's bioaccumulative properties. The chronic effects of bioaccumulated selenium occur at lower concentrations than acute effects.

In the case of bioaccumulative compounds like selenium, acute toxicity studies do not address risks that result from chronic exposure to chemicals via the diet (through the food web pathway). Such studies also do not account for the accumulation kinetics of many bioaccumulative compounds, such as selenium, and may underestimate effects from long-term accumulation in

⁹ USEPA. 2021. *2021 Revision to: Aquatic Life Ambient Water Quality Criterion for Selenium—Freshwater 2016*. EPA 822-R-21-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. <https://www.epa.gov/system/files/documents/2021-08/selenium-freshwater2016-2021-revision.pdf>

some types of aquatic systems. As described in EPA’s 2021 Revision to: *Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016* (hereafter referred to as *Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*), EPA also included an intermittent exposure criterion element to provide protection from the most significant effects of selenium toxicity, reproductive toxicity, by protecting against selenium bioaccumulation in the aquatic ecosystem resulting from short-term, high concentration exposure events.¹⁰ EPA recommends, as stated in the *Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*, that states and authorized tribes¹¹ adopt into their water quality standards (WQS) a selenium criterion that includes all four criterion elements.¹² For more information see EPA’s *Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*, which can be found at <https://www.epa.gov/system/files/documents/2021-08/selenium-freshwater2016-2021-revision.pdf>

Table 1: Summary of the Recommended Freshwater Selenium Ambient Chronic Water Quality Criterion for Protection of Aquatic Life.

Media Type	Fish Tissue ¹		Water Column ⁴	
	Egg-ovary ²	Fish Whole-body or Muscle ³	Monthly Average Exposure	Intermittent Exposure ⁵
Magnitude	15.1 mg/kg dry weight	8.5 mg/kg dry weight whole-body or 11.3 mg/kg dry weight muscle (skinless, boneless fillet)	1.5 µg/L in lentic aquatic systems 3.1 µg/L in lotic aquatic systems	$WQC_{int} = \frac{WQC_{30-day} - C_{bkgrnd}(1 - f_{int})}{f_{int}}$
Duration	Instantaneous measurement ⁶	Instantaneous measurement ⁶	30 days	Number of days/month with an elevated concentration
Frequency	Not to be exceeded	Not to be exceeded	Not more than once in three years on average	Not more than once in three years on average

1. Fish tissue elements are expressed as steady-state.
2. Egg-ovary supersedes any whole-body, muscle, or water column element when fish egg-ovary concentrations are measured, except as noted in footnote 4 below.

¹⁰ USEPA. 2021. *2021 Revision to: Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*. EPA 822-R-21-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. <https://www.epa.gov/system/files/documents/2021-08/selenium-freshwater2016-2021-revision.pdf>

¹¹ Throughout this document and in the [CWA](#), the term “states” means the fifty states, the District of Columbia, the Commonwealth of Puerto Rico, the United States Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands. The term “authorized tribe” means those federally recognized Indian tribes with authority to administer a CWA WQS program.

¹² USEPA. 2021. *2021 Revision to: Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*. EPA 822-R-21-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. <https://www.epa.gov/system/files/documents/2021-08/selenium-freshwater2016-2021-revision.pdf>

3. Fish whole-body or muscle tissue supersedes water column element when both fish tissue and water concentrations are measured, except as noted in footnote 4 below.
4. Water column values are based on dissolved total selenium in water and are derived from fish tissue values via bioaccumulation modeling. When selenium inputs are increasing, water column values are the applicable criterion element in the absence of steady-state condition fish tissue data.
5. Where $WQC_{30\text{-day}}$ is the water column monthly element for either lentic or lotic waters; C_{bkgnd} is the average background selenium concentration; and f_{int} is the fraction of any 30-day period during which elevated selenium concentrations occur, with f_{int} assigned a value ≥ 0.033 (corresponding to 1 day).
6. Fish tissue data provide instantaneous point measurements that reflect integrative accumulation of selenium over time and space in fish population(s) at a given site.

1.2 Selenium Technical Support Materials

EPA has prepared a four-volume set of documents to provide recommendations to states, authorized tribes, and other agencies for implementing WQC based on the national CWA section 304(a) recommended selenium criterion.¹³ These four documents constitute the Technical Support Materials for EPA's *Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*.¹⁴ Each document of the set focuses on a specific aspect of implementation of the national CWA section 304(a) recommended selenium criterion. Together, these four EPA documents provide information that will assist states and authorized tribes with adopting WQC based on EPA's CWA section 304(a) recommended selenium criterion and implementing it in various CWA programs.

- 1) *Technical Support for Adopting and Implementing EPA's Selenium 2016 Criterion in Water Quality Standards, Draft*: provides recommendations for the adoption and implementation of the national CWA section 304(a) recommended selenium criterion, including the various flexibilities available to states and tribes using WQS tools.
- 2) *Technical Support for Fish Tissue Monitoring for Implementation of EPA's 2016 Selenium Criterion, Draft*: provides an overview on how to establish or enhance existing fish tissue monitoring programs to facilitate implementation of the fish tissue-based criterion elements in the national CWA section 304(a) recommended selenium criterion.
- 3) *Frequently Asked Questions: Implementing Water Quality Standards Based on EPA's 2016 Recommended Selenium Criterion in Clean Water Act Section 402 NPDES Permits, Draft*: is intended to help National Pollutant Discharge Elimination System (NPDES) permit writers understand what permitting guidance (i.e., state or tribal implementation procedures) may be appropriate to implement state and authorized tribal WQS based on EPA's CWA section 304(a) recommended selenium criterion. This set of FAQs also provides recommendations on how to establish water quality-based effluent limits (WQBELs) in NPDES permits.

¹³ USEPA. 2021. *2021 Revision to: Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*. EPA 822-R-21-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. <https://www.epa.gov/system/files/documents/2021-08/selenium-freshwater2016-2021-revision.pdf>

¹⁴ USEPA. 2021. *2021 Revision to: Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*. EPA 822-R-21-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. <https://www.epa.gov/system/files/documents/2021-08/selenium-freshwater2016-2021-revision.pdf>

- 4) *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*: provides information on how to complete assessments, list impaired waters, and develop TMDLs based on EPA approved WQS that adhere to EPA's national CWA section 304(a) recommended selenium criterion, including all four elements.

2.0 Adopting EPA's National CWA section 304(a) Recommended Selenium Criterion

2.1 The Four-Part Criterion

As described in EPA's *Aquatic Life Ambient Water Quality Criterion for Selenium—Freshwater 2016* (2021 selenium criterion document),¹⁵ EPA recommends that states and authorized tribes adopt into their WQS one selenium criterion composed of four criterion elements: two fish tissue criterion elements (i.e., egg-ovary and whole-body and/or muscle tissue) and two water column criterion elements (i.e., 30-day average and intermittent exposure). EPA recommends that states and authorized tribes clearly express all four criterion elements as a single criterion composed of multiple parts. States and authorized tribes should clearly indicate that fish tissue criterion elements supersede the water column criterion elements, and that the egg-ovary criterion element supersedes all other criterion elements. Under EPA's recommended selenium criterion, this hierarchy applies to all CWA implementation activities. The egg-ovary criterion element supersedes all other criterion elements because it was derived directly from toxicity data and served as the basis for deriving all the other criterion elements. This hierarchy should be described in a state's or authorized tribe's WQS, either in footnotes accompanying the criterion or as a narrative included with the criterion. EPA recommends using the footnotes provided with the national CWA section 304(a) recommended selenium criterion (Table 1) to describe the hierarchical structure, but the language may be modified as long as the hierarchy is appropriately described. Including all four criterion elements of the selenium criterion in state or tribal WQS ensures protection from excessive selenium when egg-ovary data are unavailable by allowing application of the criterion using other fish tissue or water column data. Along with the four criterion magnitude elements, EPA also recommends adopting the corresponding durations and frequencies for each of the criterion elements.

The assessment of the available data for fish, invertebrates, and amphibians indicates that fish are the most sensitive taxa to the impacts from selenium. As such, the criterion elements were derived from fish toxicity values to be protective of the entire aquatic community, not solely fish species. When all four criterion elements are applied together, they protect aquatic life from the chronic effects of exposure to selenium in waters both inhabited by fish and not inhabited by fish (i.e., fishless).

In addition to the four-part criterion, states or authorized tribes may want to adopt a method to

¹⁵ Ibid.

derive site-specific water column criterion elements, referred to by EPA in 2000 as a “performance-based approach”. EPA first formalized the concept of a performance-based approach for a WQS in the preamble of the rule *EPA Review and Approval of State and Tribal Water Quality Standards*.¹⁶ Here EPA describes this approach as a WQS that is a transparent process rather than a specific outcome. The state or authorized tribe can adopt a process, such as a criterion derivation methodology, rather than a specific outcome, such as a concentration of a pollutant. If a state or authorized tribe adopts a process or methodology that is sufficiently detailed and has suitable safeguards that ensure predictable, repeatable outcomes, EPA can approve that process as a WQS. This approval would also serve for CWA purposes as the approval of each outcome generated from following that process or method. More information about the performance-based approach and what information should be included in the method can be found in section 2.2.1.

The national CWA section 304(a) recommended selenium criterion is a chronic criterion. EPA no longer recommends an acute criterion for short-term ambient exposures because aquatic organisms are exposed to selenium primarily through their diet. Selenium has the potential to bioaccumulate in aquatic food webs, where it can continue to pose a risk even after short-term elevations of the selenium concentration in the water column returns to ambient levels. Therefore, in place of an acute criterion, EPA recommends an intermittent exposure criterion element to provide protection from long-term chronic effects caused by short-term elevations of selenium water column concentrations in aquatic systems.

Table 1, reproduced from the 2021 selenium criterion document, provides an example of how the four-part criterion could be adopted into a state’s or authorized tribe’s WQS. EPA recommends adopting this table (including the frequency and duration components) with all accompanying footnotes.

Footnote 1 in Table 1 indicates that the fish tissue concentrations of the criterion are expressed as steady-state. An organism is in steady-state when the rates of chemical uptake and depuration are equal and tissue concentrations remain constant over time.¹⁷

Footnotes 2 and 3 in Table 1 describe the structure of the criterion and explain that the criterion explicitly affirms the primacy of the whole-body and/or muscle tissue criterion element over the water column criterion elements, and the egg-ovary criterion element over any other criterion element. This means when assessing a water body in steady-state conditions against the national CWA section 304(a) recommended selenium criterion, egg-ovary measurements are the ultimate arbiter followed by whole-body and/or muscle tissue measurements, and lastly by water column measurements (see *Frequently Asked Questions (FAQs): Implementing the 2016 Selenium*

¹⁶ *EPA Review and Approval of State and Tribal Water Quality Standards* 65 Fed. Reg. 24641 (Apr. 27, 2000)

¹⁷ USEPA. 2003. *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000) Volume 2: Development of National Bioaccumulation Factors*. EPA-882-R-03-030. U.S. Environmental Protection Agency, Office of Water, Washington, DC. pp. 1-4.
<https://nepis.epa.gov/Exec/ZyPDF.cgi/P1005EZQ.PDF?Dockkey=P1005EZQ.PDF>

Criterion in Clean Water Act Sections 303(d) and 305(b) Assessment, Listing, and Total Maximum Daily Load (TMDL) Programs, Draft.¹⁸

Footnote 4 in Table 1 states that the water column criterion elements of the national CWA section 304(a) recommended selenium criterion were derived from the egg-ovary criterion element via mechanistic bioaccumulation modeling (Presser and Luoma 2010).¹⁹

Footnote 4 also indicates that when selenium inputs are increasing, the water column criterion element is the applicable criterion element when steady-state fish tissue data is not available. In this circumstance, fish tissue data do not fully represent potential effects of selenium on the aquatic ecosystem, making the use of the water column criterion element more appropriate to protect the entire aquatic ecosystem. For the purposes of the national CWA section 304(a) recommended selenium criterion, steady-state refers to conditions where sufficient time has passed after the introduction of a new or increased discharge of selenium into a water body so that fish tissue concentrations of selenium are no longer increasing.²⁰ For a fish tissue measurement to be meaningful, the system from which the sample is taken should not be experiencing recent new inputs of selenium. In EPA's *Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*,²¹ “new inputs” are defined as new anthropogenic activities resulting in the release of additional selenium into a lentic or lotic aquatic system. New inputs do not refer to seasonal variability of selenium that occurs naturally within a system (e.g. spring run-off events or precipitation-driven pulses). New inputs will likely result in a greater concentration of selenium in the food web and a relatively slow increase in the selenium concentration in fish tissue. Fish tissue data should not be utilized for implementation of the criterion until after selenium concentrations in the fish have stopped increasing. Alternatively, if selenium inputs are decreasing in a water body, the hierarchy of the criterion applies, and fish tissue data should be used for implementation. Just as the concentrations of selenium increase in fish tissue at a relatively slow pace, they also decrease at a relatively slow pace compared to selenium concentrations in water. Selenium can be persistent in an ecosystem and it will take more time for selenium concentrations to reduce in sediment and biota than it will in water.

¹⁸ USEPA. 2021. *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 823-D-21-004. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

<https://www.epa.gov/wqc/aquatic-life-criterion-selenium>

¹⁹ Presser, T.S. and S.N. Luoma. 2010. A methodology for ecosystem-scale modeling of selenium. *Integrated Environmental Assessment and Management*. 6: 685-710.

Presser, T.S. and S.N. Luoma. 2010. *Ecosystem-Scale Selenium Modeling in Support of Fish and Wildlife Criteria Development for the San Francisco Bay-Delta Estuary, California*. U.S. Geological Survey, Reston, Virginia.

²⁰ This definition of steady-state applies to the national CWA section 304(a) recommended selenium criterion. It does not apply to the discussion of steady-state modeling or conditions in the “Technical Support Document for Water Quality-based Toxics Control” (EPA/505/2-90-001, March 1991).

²¹ USEPA. 2021. *2021 Revision to: Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*. EPA 822-R-21-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. <https://www.epa.gov/system/files/documents/2021-08/selenium-freshwater2016-2021-revision.pdf>

EPA estimates that the concentration of selenium in fish tissue will not reach steady-state for several months in lotic systems and for longer time periods (e.g., two to three years) in lentic systems. Achievement of steady-state in an aquatic system depends on the hydrodynamics of the aquatic system (particularly reservoirs with multiple riverine inputs and controlled releases of water into downstream water bodies), the location of the selenium input, and the particular food web. EPA expects the time needed to achieve steady-state with new or increased selenium inputs to be site-specific. Thus, when selenium concentrations are increasing, EPA recommends that fish tissue criterion elements not take precedence over the water column criterion elements until the aquatic system achieves steady-state. In the interim, EPA recommends sampling fish tissue and water to gain a better understanding of the selenium bioaccumulation dynamics in a receiving water and to determine when steady-state conditions have been reached.

One term in footnote 4, ‘dissolved total selenium’, may warrant further clarification. In this case, ‘total selenium’ refers to the combination of all species of selenium that are dissolved into the water column and does not refer to the total recoverable form of selenium. Dissolved total selenium is the selenium that would be measured in a water sample after it has been passed through a 0.45 µm membrane filter.²² In other words, the criterion is for dissolved selenium in total, not the individual species of selenium (e.g., selenite or selenate, individually).

Footnote 5 of Table 1 describes the equation and input parameters for the intermittent criterion element. For more information, see section 3.3 of EPA’s *Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*.²³

Footnote 6 of Table 1 explains the duration component of the fish tissue criterion elements. These criterion elements were developed to protect aquatic populations from impacts caused by selenium. Fish tissue data provide instantaneous point measurements that reflect integrative accumulation of selenium over time and space in the fish at a given site.²⁴ States and authorized tribes have flexibility in how they interpret a discrete fish sample to represent a given species’ population at a site. Generally, fish tissue samples collected to calculate average tissue concentrations for a species at a site are collected in one sampling event, or over a short time interval due to logistical constraints and costs for obtaining samples. The *Technical Support for*

²² Protho, M.G. U.S. Environmental Protection Agency. 1993. Memorandum: Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria. Office of Water, Washington DC. <https://www.epa.gov/sites/production/files/2019-03/documents/metals-criteria-interpret-aqlife-memo.pdf>

²³ USEPA. 2021. *2021 Revision to: Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*. EPA 822-R-21-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. <https://www.epa.gov/system/files/documents/2021-08/selenium-freshwater2016-2021-revision.pdf>

²⁴ See the *Technical Support for Fish Tissue Monitoring for Implementation of EPA’s 2016 Selenium Criterion, Draft* for information on selection of sampling location and target species to assure appropriate representation of the water body. Mobility and home range of a species should be considered when selecting a target species to assure fish tissue is representative of selenium exposure at the sampling location.

Fish Tissue Monitoring for Implementation of EPA's 2016 Selenium Criterion, Draft contains additional information on sampling fish populations.²⁵

The frequency component of the fish tissue criterion elements of the national CWA section 304(a) recommended selenium criterion differs from the typical “once-in-three years on average” frequency of most water column criteria. Selenium is a bioaccumulative pollutant; therefore, elevated levels of selenium in various ecological compartments (e.g., biota, surficial sediments) require a long period of time to decrease. Therefore, the associated aquatic community requires a long time to recover following reduction or removal of an elevated selenium exposure to a given system. Thus, the typical frequency component is not appropriate for selenium in fish tissue, as this could lead to sustained ecological impacts. Therefore, the recommended frequency for the national CWA section 304(a) recommended selenium criterion is “not to be exceeded”. For additional information regarding duration and frequency, see sections 2.7.6 and 2.7.7 of *Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*.²⁶

If data for a particular criterion element is not available, the national CWA section 304(a) recommended selenium criterion can be implemented with one of the other criterion elements, according to the hierarchy of the criterion. For example, if fish tissue data are not available, but water column data are, the criterion can be implemented using the water column criterion element. This situation may occur for fishless waters or when fish tissue data are not available because they were not collected or did not meet state or tribal quality assurance procedures. Fishless waters are defined as waters with insufficient instream habitat and/or flow to support a population of any fish species on a continuing basis, or waters that once supported populations of one or more fish species but no longer support fish (see the executive summary of EPA's *Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*).²⁷

States and authorized tribes also can develop, adopt, and submit for EPA approval, site-specific criteria for individual sites (see sections 2.2 and 3.1 for information on options for developing and adopting site-specific criteria). In addition, states and authorized tribes can develop a methodology for deriving site-specific water column criterion elements for individual sites, which can be adopted in addition to the four-part criterion and submitted to EPA for approval. Once approved, this process can be followed to develop site-specific water column criterion elements for state or tribal waters. Section 2.2.1 provides more information on the performance-based approach. While EPA presents some methods for developing site-specific criteria in this

²⁵ USEPA. 2021. *Technical Support for Fish Tissue Monitoring for Implementation of EPA's 2016 Selenium Criterion*. Draft. EPA-823-D-21-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC. <https://www.epa.gov/wqc/aquatic-life-criterion-selenium>

²⁶ USEPA. 2021. *2021 Revision to: Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*. EPA 822-R-21-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. <https://www.epa.gov/system/files/documents/2021-08/selenium-freshwater2016-2021-revision.pdf>

²⁷ USEPA. 2021. *2021 Revision to: Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*. EPA 822-R-21-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. <https://www.epa.gov/system/files/documents/2021-08/selenium-freshwater2016-2021-revision.pdf>

document and in the national CWA section 304(a) recommended selenium criterion document, any method that is scientifically defensible may be used to develop site-specific criteria.

2.2 Options for Site-specific Water Column Criterion Elements

As stated above, EPA recommends that when states and authorized tribes adopt this criterion, they adopt all four criterion elements, including the 30-day average water column criterion element. The relationship between the concentration of selenium in the tissues of fish and the concentration of selenium in the water column, however, can differ substantially between different aquatic systems. The chemical form of selenium, species of fish, the species and proportion of prey, and a variety of site-specific biogeochemical factors affect selenium bioaccumulation and thus determine the allowable concentration of selenium in ambient water that is protective of aquatic life. Because of the site-specific nature of this relationship, EPA provides two methodologies for deriving site-specific water column criterion elements:

- 1) The mechanistic modeling approach
- 2) The empirical bioaccumulation factor (BAF) approach.

The mechanistic modeling approach uses scientific knowledge of the physical and chemical processes underlying bioaccumulation to specifically model bioaccumulation and trophic transfer through the food web, to establish a relationship between the concentrations of selenium in the water column and the concentration of selenium in the tissue of aquatic organisms. The mechanistic modeling approach uses site-specific models of trophic transfer of selenium through aquatic food webs to translate the egg-ovary criterion element into an equivalent site-specific water concentration. This approach was used by EPA to derive its default water column criterion elements.²⁸ Alternatively, the empirical bioaccumulation factor approach establishes a site-specific relationship between water column selenium concentrations and fish tissue selenium concentrations by measuring both matrices directly and using the ratio between them to determine a site-specific water column criterion element. Both approaches are described in detail in Appendix K of *Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*.²⁹ Both methodologies provide acceptable approaches to translating the recommended fish tissue criterion elements into site-specific water column criterion elements. In addition, a state or authorized tribe can develop site-specific criteria using other methodologies as long as they are scientifically defensible and protective of the applicable designated uses, pursuant to 40 Code of Federal Regulations (CFR)131.11(b)(1)(iii). The proposed site-specific selenium criteria developed by EPA for the San Francisco Bay and Delta in California are good examples of how to properly derive site-specific water column criterion elements for selenium using the

²⁸ Presser, T.S. and S.N. Luoma. 2010. A methodology for ecosystem-scale modeling of selenium. *Integrated Environmental Assessment and Management* 6:685-710.

Presser, T.S. and S.N. Luoma. 2010. *Ecosystem-Scale Selenium Modeling in Support of Fish and Wildlife Criteria Development for the San Francisco Bay-Delta Estuary, California*. U.S. Geological Survey, Reston, Virginia.

²⁹ Ibid.

mechanistic modeling approach.³⁰ These systems have food webs that are well understood and there is a substantial amount of data available to appropriately define the dynamics of selenium cycling and bioaccumulation in the system. This allowed for the appropriate parameters to be utilized in the model to derive protective criteria. Note that the proposed criteria for the San Francisco Bay and Delta were derived to protect aquatic life and aquatic-dependent wildlife (i.e., clam eating fish and birds) (as opposed to just aquatic life) and were greatly influenced by the presence of an invasive clam species that efficiently accumulates selenium.³¹

There are two approaches to adopting and submitting site-specific selenium water column criterion elements to EPA for review under section 303(c) of the CWA: states and authorized tribes may adopt and submit a performance-based approach for deriving site-specific water column criterion elements or they may adopt and submit individual water column criterion elements each time they are derived. Both are described in more detail below. States and authorized tribes should carefully consider the relative merits of each approach; some considerations are discussed further in *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*.³² When developing a performance-based approach or an individual site-specific criterion element, EPA recommends consulting with your EPA regional office early and often during the process.

2.2.1 Adoption of Site-specific Water Column Criterion Elements through a Performance-Based Approach

States and authorized tribes can choose to adopt into their WQS and submit to EPA a set of procedures to translate the fish tissue criterion elements into site-specific water column criterion elements. This is considered a *performance-based approach* to developing site-specific water column criterion elements. Any translation procedure must be transparent, sufficiently detailed, and include suitable safeguards to ensure repeatable, predictable outcomes. In addition, the resulting water column criterion elements must protect the applicable designated use. Once EPA approves the procedures of the performance-based approach consistent with CWA section 303(c), each resulting site-specific water column criterion element generated consistent with the CWA effective performance-based approach does not need to be adopted into the states' or authorized tribes' WQS regulations or individually approved by EPA under CWA section 303(c). By approving the performance-based approach as consistent with CWA section 303(c),

³⁰ USEPA. July 15, 2016. *Water Quality Standards; Establishment of revised Numeric Criteria for Selenium for the San Francisco Bay and Delta, State of California*. 81 Fed. Reg. 46030, <https://www.epa.gov/wqs-tech/water-quality-standards-establishment-revised-numeric-criteria-selenium-san-francisco-bay>.

³¹ The site-specific nature of this effort results in components that likely will not be generally applicable. In addition to the clam (prey) tissue criterion element and particulate water column criterion element, the criteria are not hierarchical and are independently applicable.

³² USEPA. 2021. *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-823-D-21-004. U.S. Environmental Protection Agency, Office of Water, Washington, DC. <https://www.epa.gov/wqc/aquatic-life-criterion-selenium>

EPA is affirming that each resulting site-specific water column criterion element is scientifically defensible and protective of the applicable designated use.

Importantly, for public transparency, EPA strongly recommends the state or authorized tribe maintain a list of the resulting site-specific water column criterion elements and underlying data used for their respective derivations on their publicly accessible website. EPA also encourages states and authorized tribes to coordinate closely with EPA when developing a *performance-based approach* and when conducting the first few studies to develop site-specific water column criterion elements.

In *Aquatic Life Ambient Water Quality Criterion for Selenium – Freshwater 2016*, EPA provides recommendations for site-specific water column translation procedures in Appendix K.³³ The procedures described in this appendix can be used as a starting point for developing a performance-based approach to derive site-specific water column criterion elements. Appendix K presents the general methods for conducting a site-specific water column translation by either the mechanistic model approach or the BAF approach. In addition, it presents a number of options for determining the values to use as input parameters in both of these methods. States or authorized tribes should decide which of those options they will use for their performance-based approach or describe in their WQS regulations under which circumstances each option will be used. In addition to the general methods included in Appendix K, states and authorized tribes should consider including additional methods in their performance-based approach that will help to make the procedure more transparent and repeatable. These could include methods for: 1) selecting sites and sampling locations within a site, 2) determining what aquatic species are present at the site, 3) selecting target species, 4) selecting tissue type for sampling, 5) sampling plans including spatial and temporal considerations at a site, whether individual or composite samples will be collected, the total number of samples that will be collected per replicate, and the number of replicates that will be collected, 6) extrapolating trophic transfer factors or conversion factors from existing data, and 7) specifying how data will be processed and analyzed. States and authorized tribes should also consider what level of protection will appropriately protect the designated use of the water body, which will influence what percentile of the resulting data set should be used for the final criterion value. States' and authorized tribes' methods for their performance-based approaches should be clear and definitively state which methods will be followed in particular situations. For example, a state's or authorized tribe's performance-based approach should specifically address fishless waters by either including a method specifically designed to derive a site-specific water column criterion element for a fishless water or specifying that the performance-based approach cannot be used to derive a site-specific water column criterion element for a fishless water. An example of a detailed performance-based

³³ USEPA. 2021. *2021 Revision to: Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*. EPA 822-R-21-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. <https://www.epa.gov/system/files/documents/2021-08/selenium-freshwater2016-2021-revision.pdf>

approach is the *Draft Translation of Selenium Tissue Criterion elements to Site-specific Water Column Criterion Elements for California Version 1, August 8, 2018*.³⁴

If a state or authorized tribe chooses to adopt a performance-based approach, one method for incorporation into their WQS regulations could be to add a footnote to the national CWA section 304(a) recommended selenium criterion table (Table 1) that references the document that describes the state or authorized tribe's translation methodology, sampling plans, and data analysis and then adopt the table with the added footnote into their WQS regulations. By doing this in rule, the state or authorized tribe will have incorporated by reference their translation procedure that is scientifically defensible, produces repeatable, predictable outcomes and results in criterion elements that protect the applicable designated use.

2.2.2 Adoption of Site-specific Water Column Criterion Elements Individually

States and authorized tribes can choose to adopt and submit to EPA site-specific water column criterion elements each time they are derived using one of the methodologies described in Appendix K or another scientifically defensible approach. These site-specific water column criterion elements must protect the designated use and must be reviewed and approved by EPA under CWA section 303(c) before they are applicable for CWA purposes, such as NPDES permitting, waterbody assessment and listing, and TMDL development.

One instance where a state may want to develop a site-specific water column criterion element is for fishless waters. A site-specific water column criterion element for a fishless water will need to be protective of the aquatic community present in those waters and assure protection of downstream designated uses. When deriving a site-specific water column criterion element for fishless waters, it may be appropriate to use the mechanistic model³⁵ to translate from either a fish tissue criterion element or an invertebrate toxicity threshold. Fish tissue criterion elements should be used to protect the whole aquatic community if fish populations were once supported in that water body or for protection of fish downstream, depending on the type of water body downstream and the fish present in that downstream water body. Invertebrate toxicity thresholds may be appropriate if fish currently and historically have not used the water body. If using an invertebrate toxicity threshold, state and authorized tribes would need to assure that the resulting water column criterion element is protective of the uses in downstream water bodies. Currently (October 2021) EPA is not aware of sufficient toxicity data on invertebrates for an invertebrate toxicity threshold for selenium. However, as new toxicity data become available, this may be an appropriate taxa to use for deriving site-specific water column criterion elements for fishless

³⁴ USEPA. 2018. Draft Translation of Selenium Tissue Criterion elements to Site-specific Water Column Criterion Elements for California Version 1, August 8, 2018. U.S. Environmental Protection Agency, Office of Water, Washington, DC, https://www.epa.gov/sites/production/files/2018-12/documents/california_selenium_2040-af79_pba_20181121_508c.pdf

³⁵ See Appendix K of EPA 2021 for a description of the mechanistic model. USEPA. 2021. *2021 Revision to: Aquatic Life Ambient Water Quality Criterion for Selenium–Freshwater 2016*. EPA 822-R-21-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. <https://www.epa.gov/system/files/documents/2021-08/selenium-freshwater2016-2021-revision.pdf>

waters. Whichever approach is used, states and authorized tribes may also want to consider if the site-specific water column criterion element is protective of aquatic-dependent oviparous wildlife, particularly birds, that use the fishless water as feeding grounds.

Another instance where EPA recommends developing a site-specific water column element is when the ambient water column concentrations in a water body/waterbody segment are meeting the national recommended water column criterion elements, but the fish tissue concentrations are greater than the national recommended fish tissue criterion elements. In this situation the elevated fish tissue concentrations indicate an impact on the aquatic system and indicate that a water column criterion element lower than the national recommended water column criterion element is needed to be protective of aquatic life.

States and authorized tribes should consider the tradeoffs associated with adopting individual site-specific criterion elements versus adopting a performance-based approach to derive site-specific water column criterion elements. The adoption and EPA approval of individual site-specific water column criterion elements could potentially be simpler to apply in assessment, CWA section 303(d) listing, and TMDL development, as well as in NPDES permit development as the implementation can immediately proceed with the established criterion element value rather than having the additional step of calculating the criterion element value using the criterion derivation methodology. On the other hand, the performance-based approach provides states and authorized tribes the flexibility to adaptively derive site-specific water column criterion elements to account for the most up-to-date data and information for the site without making it necessary for them to submit the site-specific water column criterion element to EPA for review each time those criterion elements are derived. Under the performance-based approach, stakeholders would have the opportunity to provide comments on the derivation process (e.g., translator mechanisms and associated sampling plans, input parameters, and data analysis methods) during the water quality standards adoption process under CWA section 303(c). However, comments on the resulting site-specific water column criterion elements derived through the performance-based approach would be received in response to individual actions through each of the implementing programs, such as during a public notice for an NPDES permit. The performance-based approach would likely involve more coordination among the implementation programs to ensure that they are aiming to achieve the same desired condition in the water body.

2.3 Relationship of EPA's National CWA section 304(a) Recommended Selenium Criterion to the Great Lakes Initiative

EPA's 304(a) recommendation for the freshwater selenium criterion does not supersede the requirements applicable to the Great Lakes at Title 40 of the CFR Part 132. Those requirements, known as the *Great Lakes Water Quality Guidance* (also known as the *Great Lakes Initiative* or *GLI*), apply to all streams, rivers, lakes, and other bodies of water within the U.S. portion of the Great Lakes drainage basin. For those waters, a state or authorized tribe must adopt requirements (including WQC) that are *consistent with (as protective as)* regulations EPA promulgated on

March 23, 1995 (see 60 Federal Register (FR) 15366, March 23, 1995, and 40 CFR 132.1(b) and 132.4).

Under the Great Lakes system-specific regulations, if a state or authorized tribe adopts a revised criterion for selenium, EPA in its review must determine if the new criterion is as protective as the selenium chronic criterion (5 µg/L) promulgated in 40 CFR 132.6, Table 2, and whether all binding implementation procedures are as protective as the GLI procedures (see 40 CFR 132.5(g)). EPA makes its approval/disapproval decisions on a case-by-case basis depending upon the supporting information. However, EPA expects that GLI states and authorized tribes would likely be able to demonstrate that the revised selenium criterion is as protective as the GLI chronic criterion if they adopt the national CWA section 304(a) recommended selenium criterion. If a state or authorized tribe uses a site-specific translation to derive site-specific water column criterion elements for a particular water body, translated water concentrations could, in some cases, be higher than the 5 µg/L promulgated in 40 CFR 132.6 and could, in other cases, be lower, depending on local conditions. EPA expects that they generally would be considered as protective as the GLI selenium criterion. Additionally, a site-specific water column criterion element would take into account a broad range of factors, including local conditions, and would include additional data and a more refined understanding of the mechanisms through which selenium accumulates and causes toxicity at that site.

3.0 Options for Implementing EPA's Selenium Criterion

There is some flexibility available to states and authorized tribes when they adopt the national CWA section 304(a) recommended selenium criterion. Options include deriving site-specific fish tissue criterion elements, adopting WQS variances, revising designated uses, and granting compliance schedules. This section describes how each option can fit within a state's or authorized tribe's WQS adoption and implementation processes.

3.1 Site-specific Fish Tissue Criterion Elements

3.1.1 Site-specific Fish Tissue Criterion Elements Using the Species Recalculation Procedure³⁶

The WQS regulation at 40 CFR 131.11(b)(1)(ii) provides states and authorized tribes with the opportunity to adopt WQC that are "...modified to reflect site-specific conditions." As with any criterion, a site-specific criterion must protect the designated use, must be based on a sound scientific rationale, and is subject to EPA review and approval or disapproval. One process that can be used to modify a criterion to site-specific conditions is the recalculation procedure. The

³⁶ USEPA. 2013. *Revised Deletion Process for the Site-Specific Recalculation Procedure for Aquatic Life Criteria*. EPA 823-R-13-001. U.S. Environmental Protection Agency, Office of Water, Washington, DC, www.epa.gov/sites/production/files/2015-08/documents/revised_deletion_process_for_the_site-specific_recalculation_procedure_for_aquatic_life_criteria.pdf.

recalculation procedure is a process used to modify the taxonomic composition of the toxicity dataset used for the species sensitivity distribution (SSD) upon which a site-specific criterion is based, to better match the species assemblage that is expected to occur at the site. The recalculation procedure creates a site-specific toxicity dataset (and corresponding SSD) that is appropriate for deriving a site-specific aquatic life criterion by correcting, adding, and/or deleting test results from the national toxicity dataset for the pollutant of concern based on the resident species of the site. This procedure is intended to provide flexibility to states and authorized tribes to derive site-specific criteria that best reflect the expected resident species at a site. The species recalculation procedure may result in site-specific criteria that differ from national criteria recommendations (i.e., concentrations that are higher or lower than national recommendations) when there are demonstrated differences in sensitivity between the expected resident aquatic species and those that were used to derive the national criteria recommendations.

Critical species also need to be taken into consideration when using the recalculation procedure. A critical species is a resident species that (a) is commercially or recreationally important at the site, or (b) is listed as threatened or endangered under section 4 of the Endangered Species Act (states and authorized tribes may also want to consider species that are candidates for protection under the Endangered Species Act as critical species), or (c) is a species for which there is firm evidence that its loss would yield an unacceptable impact on the site's commercially or recreationally important species, endangered species, abundances of a variety of other species, or structure or function. The deletion process of the recalculation procedure should not be undertaken unless toxicity data are available for at least one species in each *class* of aquatic plants or animals that contains a *critical species*. For example, if the site has a salmonid that fits the designation of a critical species, the Deletion Process should not be undertaken unless toxicity data for a species in class teleostei are available (possibly via new testing). It is important to note that species not present at the site but included in the national criterion database may be surrogates for other species that are present the site but not included in the national criterion database.

The 304(a) selenium criterion recommendation was developed by first deriving an egg-ovary criterion element from egg-ovary toxicity data, and then deriving all other criterion elements from that egg-ovary criterion element. A state or authorized tribe developing site-specific fish tissue criterion elements using the recalculation procedure would likely start with deriving the egg-ovary criterion element and then other fish-tissue criterion elements. States and authorized tribes should also consider corresponding changes to the applicable water column criterion elements. See section 2.2 for more information.

Note that a state or authorized tribe that wants to adopt EPA's national recommendations for the fish tissue criterion elements, but is interested in developing site-specific water column values, can proceed as described in section 2.2.

As with any criteria, states and authorized tribes using the recalculation procedure should ensure that their site-specific criteria "...provide for the attainment and maintenance of the water quality standards of downstream waters" (40 CFR 131.10(b)). This requirement can be met in a number

of ways, including using a combination of water quality standards, such as criteria (numeric criteria and/or narrative criteria) and general policies. Additional information about this requirement can be found in *Protection of Downstream Waters in Water Quality Standards: Frequently Asked Questions*.³⁷ In addition, states and authorized tribes should consider how they will demonstrate that a species that is being removed from the national dataset (or any species for which that species might be a taxonomic surrogate) is not present at the site before selecting that approach. For additional information on the procedure, see EPA's *Revised Deletion Process for the Site-Specific Recalculation Procedure for Aquatic Life Criteria*.³⁸ States and authorized tribes that wish to develop site-specific fish tissue criterion elements based on the revised deletion process should engage their EPA Regional office early in the process to ensure the development of sound scientific analyses. The deletion process for site-specific criterion development is not appropriate for a performance-based approach because different survey techniques will be needed at different sites to determine which species are currently present.

When developing site-specific criterion elements, consideration should be given to what area is defined as the site. In the general context of site-specific criteria, a "site" may be a state, region, watershed, water body, or segment of a water body. The site-specific criterion must provide adequate protection for the entire site, however the site is defined. For the recalculation procedure, all species that occur at the site need to be considered when deciding what species, if any, are to be deleted (or added) from (to) the dataset. Unique populations or less sensitive uses within sites may justify a designation as a distinct site. If the site contains critical habitat for endangered or threatened species, EPA will engage in interagency consultation (under the Endangered Species Act Section 7(a)(2)) with either or both the United States Fish and Wildlife Service and National Marine Fisheries Service during the review of the proposed site-specific criterion to determine whether the approval of the site-specific criterion would be likely or not likely to adversely affect the species and any designated critical habitat. EPA would consider the potential effect of the action on the species as well as on the physical and biological features of the critical habitat as well as how EPA's action on the site-specific criterion may affect water quality required for the species within the critical habitat.

For additional information on site-specific WQC, see chapter 3 of EPA's *Water Quality Standards Handbook*.³⁹

³⁷ USEPA. 2014. *Protection of Downstream Waters in Water Quality Standards: Frequently Asked Questions*. EPA 820-F-14-001. U.S. Environmental Protection Agency, Office of Water, Washington, DC, www.epa.gov/sites/production/files/2018-10/documents/protection-downstream-wqs-faqs.pdf.

³⁸ USEPA. 2013. *Revised Deletion Process for the Site-Specific Recalculation Procedure for Aquatic Life Criteria*. EPA 823-R-13-001. U.S. Environmental Protection Agency, Office of Water, Washington, DC, www.epa.gov/sites/production/files/2015-08/documents/revised_deletion_process_for_the_site-specific_recalculation_procedure_for_aquatic_life_criteria.pdf.

³⁹ USEPA. 2017. Chapter 3: Water Quality Criteria in *Water Quality Standards Handbook*. EPA 823-B-17-001. U.S. Environmental Protection Agency, Office of Water, Washington, DC, <https://www.epa.gov/sites/production/files/2014-10/documents/handbook-chapter3.pdf>.

3.1.2 Site-specific Fish Tissue Criterion Elements for Sites with Naturally Elevated Selenium Levels

Natural conditions are generally associated with the condition of ecological integrity, defined as the structure, composition, function or diversity of a habitat in the absence of human disturbance or alteration.⁴⁰ For some areas in the United States, selenium may be elevated in soils and water bodies under natural conditions. States and authorized tribes have two options when addressing areas that have naturally elevated selenium concentrations: (1) they may develop site-specific criteria for water bodies in these locations (e.g., where the current aquatic life designated use is appropriate) or (2) they may refine or subcategorize the aquatic life use for water bodies in these areas and set new criteria to be protective of the modified use (See section 3.3 for more information on the revision of designated uses). These are two separate pathways for accomplishing the goal of setting appropriate criteria for these water bodies.

To set a site-specific criterion using a natural conditions justification, the state or authorized tribe would need to demonstrate that the elevated levels of selenium are due to natural conditions and that no anthropogenic activities (e.g., agriculture, mining, irrigation, coal or oil combustion) are responsible for elevating selenium concentrations in the water body. In many areas where soils are elevated in selenium, anthropogenic activities either release selenium or expose soils or rock to weathering, which results in the release of additional selenium into the water column. When an anthropogenic activity leads to greater release of selenium than natural weathering, a site-specific criterion cannot be developed using the natural conditions justification.

When developing a site-specific criterion, the state or authorized tribe must identify the site boundaries and temporal dynamics to which a natural background criterion applies (i.e., it is important that such criteria are developed to maintain and protect the spatial and temporal variation in selenium concentrations under natural conditions). If concentrations vary seasonally, adoption of seasonal criteria may be appropriate. Where concentrations vary spatially, additional water body segmentation may be appropriate. In cases where selenium is elevated due to both natural conditions and anthropogenic activities, methods such as modeling (e.g., historical or hydrologic modeling) or an examination of past paleolimnological studies may be considered as an option for defining natural conditions.⁴¹ EPA's current national policy regarding the

⁴⁰ Landres, P.B., P. Morgan, and F.J. Swanson. 1999. Overview of the use of natural variability concepts in managing ecological systems. *Ecological Applications* 9(4): pp. 1179–1188.

Davies, S.P. and S.K. Jackson. 2006. The biological condition gradient: A descriptive model for interpreting change in aquatic ecosystems. *Ecological Applications* 16(4): pp. 1251–1266.

⁴¹ Swetnam, T.W., C.D. Allen, and J.L. Betancourt. 1999. Applied historical ecology: Using the past to manage for the future. *Ecological Applications* 9(4): pp. 1189–1206.

Hughes, R.M., S.G. Paulsen, and J.L. Stoddard. 2000. EMAP-Surface waters: A multi-assemblage, probability survey of ecological integrity in the U.S.A. *Hydrobiologia* 422/423: pp. 429–443.

Kilgour, B.W., and L.W. Stanfield. 2006. Hindcasting reference conditions in streams. *American Fisheries Society Symposium* 48: pp. 623–639.

Herlihy, A.T., S.G. Paulsen, J. Van Sickle, J.L. Stoddard, C.P. Hawkins, and L.L. Yuan. 2008. Striving for consistency in a national assessment: The challenges of applying a reference-condition approach at a continental scale. *Journal of the North American Benthological Society* 27(4): pp. 860–877.

establishment of site-specific criteria that reflect natural background recommends that interested states and authorized tribes establish site-specific numeric aquatic life criteria by setting the criteria values equal to *natural background*, where natural background is defined as due *only* to non-anthropogenic sources (i.e., non-human-induced sources). As articulated in the 1997 memorandum: *Establishing Site-Specific Aquatic Life Criteria Equal to Natural Background*,⁴² EPA does not consider it appropriate to adjust criteria to authorize degradation that is a result of anthropogenic disturbance.

When deriving site-specific fish tissue criterion elements, states and authorized tribes should consider corresponding changes to the applicable water column criterion elements. See section 2.2 for more information.

3.2 Water Quality Standards Variances

A state or authorized tribe could consider a WQS variance if it determines that it is not feasible to attain a newly adopted selenium criterion and associated designated use now, but it may be attainable in the future. A WQS variance may also be considered if there is uncertainty about the feasibility of meeting the designated use and criterion, but progress can be made by implementing known controls and tracking environmental improvements. The WQS regulations at 40 CFR 131.3(o) define a *WQS variance* as “a time-limited designated use and criterion for a specific pollutant(s) or water quality parameter(s) that reflect the highest attainable condition (HAC) during the term of the WQS variance.” The WQS variance regulation at 40 CFR 131.14 ensures that incremental progress is made toward improving overall water quality, while not allowing any lowering of the currently attained ambient water quality. This is accomplished by establishing a HAC, which serves as the basis for deriving less-stringent NPDES permit limits and requirements throughout the term of the WQS variance.⁴³ Although less stringent than the adopted criterion, the HAC still provides a target for incrementally improving water quality until the applicable designated use and associated selenium criterion become attainable. It is important to note that these permit limits and requirements are applicable only to the discharger(s), pollutant(s)/parameter(s), and water body or waterbody segment(s) identified in the WQS variance. All other applicable standards not specifically addressed by the EPA-approved WQS variance would continue to apply.

A state or authorized tribe can choose to adopt a WQS variance that is applicable to a single discharger, multiple dischargers, or an entire water body/waterbody segment. Because the national CWA section 304(a) recommended selenium criterion is intended to protect aquatic life (CWA section 101(a)(2)), the state or authorized tribe must provide supporting documentation demonstrating that attaining the designated use and criterion is not feasible throughout the term of the WQS variance because of one of the factors listed at 40 CFR 131.14(b)(2)(i)(A). Such a

⁴² Davies, T. U.S. Environmental Protection Agency. 1997. Memorandum: Establishing Site Specific Aquatic Life Criteria Equal to Natural Background. Office of Water, Washington DC, <https://www.epa.gov/sites/production/files/2014-08/documents/naturalbackground-memo.pdf>

⁴³ WQS variances with a term greater than 5 years must be reevaluated at least every 5 years to determine whether the HAC is more stringent than originally adopted. See 40 CFR 131.14 (b)(1)(v).

demonstration, when combined with the other regulatory requirements of 40 CFR 131.14, provide the framework for WQS variances as a water quality improvement tool. The regulations at 40 CFR Part 132 apply to states and authorized tribes that regulate waters in or contributing to waters of the Great Lakes System. If 40 CFR 131.14 and 40 CFR Part 132 overlap, the more stringent regulation applies. WQS variances are considered new or revised WQS and, therefore, must be reviewed and approved or disapproved by EPA to be in effect for CWA purposes.

To help states and authorized tribes in the process of adopting WQS variances, EPA has developed various resources including a WQS variances website⁴⁴, the *WQS Variance Building Tool*,⁴⁵ *Checklist for Evaluating State Submission of Discharger-Specific Water Quality Standards Variances*,⁴⁶ and several other resources available on the “Resources” tab of the *WQS Variance Building Tool*. States and authorized tribes are encouraged to coordinate with EPA throughout the WQS variance adoption process to strengthen their WQS variance submissions.

3.3 Revision to Designated Uses

The WQS regulation at 40 CFR 131.10(g) provides that states or authorized tribes may remove a CWA section 101(a)(2) designated use which is *not* an existing use, as defined in 40 CFR 131.3(e), or establish subcategories of such use that requires less stringent criteria if the state or authorized tribe can demonstrate that attaining the designated use is not feasible because of one or more of the six factors listed in 40 CFR 131.10(g). Those factors are:

- (1) Naturally occurring pollutant concentrations prevent the attainment of the use; or
- (2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating state water conservation requirements to enable uses to be met; or
- (3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or
- (4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or

⁴⁴ USEPA, *Water Quality Standards Variance website*, <https://www.epa.gov/wqs-tech/water-quality-standards-variances>.

⁴⁵ USEPA, *Water Quality Standards Variance Building Tool*, <https://www.epa.gov/wqs-tech/water-quality-standards-variance-building-tool>

⁴⁶ USEPA. 2016. *Checklist for Evaluating State Submission of Discharger-Specific Water Quality Standards Variances*. U.S. Environmental Protection Agency, Office of Water. Washington, DC, <https://www.epa.gov/sites/production/files/2016-03/documents/checklist-evaluating-discharger-specific.pdf>.

- (5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
- (6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

The state or authorized tribe would make such a demonstration through a *use attainability analysis* (UAA), which is defined under 40 CFR 131.3(g) as "...a structured scientific assessment of the factors affecting the attainment of the use which may include physical, chemical, biological, and economic factors as described in 40 CFR 131.10(g)." A state must conduct a UAA whenever (1) the state designates for the first time, or has previously designated for a water body, uses that do not include the uses specified in section 101(a)(2) of the Act; or (2) the state wishes to remove a designated use that is specified in section 101(a)(2) of the Act, to remove a subcategory of such a use, or to designate a subcategory of such a use that requires a criterion less stringent than previously applicable (40 CFR 131.10(j)). If a state or authorized tribe adopts a new or revised WQS based on a required use attainability analysis, the state or authorized tribe shall also adopt the highest attainable use, as defined in 40 CFR 131.3(m).⁴⁷ The WQS regulations also do not allow states and authorized tribes to remove any uses that are existing uses. In addition, uses cannot be removed if they can be attained by implementing effluent limits required under sections 301(b) and 306 of the Act and by implementing cost-effective and reasonable best management practices for nonpoint source control.

For selenium, there are two particular circumstances where a use change may be appropriate for a water body. The first is fishless waters. States or authorized tribes may want to recognize the difference in aquatic communities in these waters by creating a subcategory of the aquatic life designated use. When doing so, the state or authorized tribe should be sure that protections for other forms of aquatic life, such as macroinvertebrates, are protected by the revised designated use and associated criterion. If aquatic-dependent wildlife uses the water body, then the state or authorized tribe may also want to set a selenium criterion for the protection of these species as well. The second is water bodies located in areas where the selenium is naturally elevated in the underlying geology and are thus particularly vulnerable to elevated selenium concentrations in the water. Ambient selenium concentrations in these water bodies can be exacerbated by anthropogenic activities. If the conditions in this circumstance are precluding attainment of the designated use, a limited or modified aquatic life use may be more appropriate for these water bodies. EPA's regulations at 40 CFR 131.10(g) provide factors related to natural and anthropogenic conditions for states and authorized tribes to employ in a UAA to justify revising the aquatic life use (see 40 CFR 131.10(j) for when a UAA is required). If the state or authorized tribe can justify the aquatic life use change using at least one of the factors at 40 CFR 131.10(g),

⁴⁷ 40 CFR 131.3(m) defines "highest attainable use" as the "...modified aquatic life, wildlife, or recreation use that is both closest to the uses specified in section 101(a)(2) of the Act and attainable, based on the evaluation of the factor(s) in §131.10(g) that preclude(s) attainment of the use and any other information or analyses that were used to evaluate attainability."

then the designated use the state or authorized tribe must adopt in place of the full aquatic life use must be the highest attainable use for the water body, as required by 40 CFR 131.10(g).

For additional information on use changes and UAAs, see EPA's *Water Quality Standards Handbook*.⁴⁸ Additional information also is available at <http://water.epa.gov/scitech/swguidance/standards/uses/uaa/>.

3.4 Compliance Schedules

If a state or authorized tribe's WQS include a provision authorizing the use of permit compliance schedules, a compliance schedule can be included in a permit with water quality-based effluent limits (WQBELs) for selenium. The NPDES permit regulations allow this if (1) the discharger cannot immediately meet the new WQBEL, and requires time to install treatment technology or implement other controls necessary to meet the new WQBEL, (2) the permitting authority (the state in most cases, and EPA in some limited cases) determines that a compliance schedule is *appropriate* in light of all the circumstances and, (3) the discharger is required to meet its final selenium WQBEL *as-soon-as-possible*. See section 502(17) of the CWA for a definition of *schedules of compliance* and 40 CFR 122.47 for more information about the schedules.

Compliance schedules in NPDES permits can be used to meet WQBELs based on WQS adopted after July 1, 1977, if the state or authorized tribe has indicated clearly in its WQS or implementing regulations that it intends to allow the use of permit compliance schedules.⁴⁹ To ensure that the compliance schedule is enforceable by the permitting authority, the schedule must consist of a sequence of interim requirements, actions, or operations leading to compliance with the CWA and its implementing regulations (40 CFR 122.2). If the schedule is longer than 1 year, it must include annual interim requirements and dates for their achievement (40 CFR 122.47(a)(3)). Additionally, the permit must include a final WQBEL and a date for its achievement. The decision to include a compliance schedule as well as the dates and interim requirements must be supported by the administrative record. The permit fact sheet should include justification for the compliance schedule being determined to be *appropriate* and why the chosen time frame was deemed to be *as soon as possible*. For additional information on compliance schedules, see section 9.1.3 of EPA's *NPDES Permit Writers' Manual*⁵⁰ (September 2010, EPA-833-K-10-001, https://www.epa.gov/sites/production/files/2015-09/documents/pwm_2010.pdf) and the memorandum from EPA's Office of Wastewater

⁴⁸ USEPA. 2012. Chapter 2: Designation of Uses in *Water Quality Standards Handbook*. EPA 823-B-12-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC, <https://www.epa.gov/sites/production/files/2014-10/documents/handbook-chapter2.pdf>.

⁴⁹ 40 CFR 131.15 states that: "If a State intends to authorize the use of schedules of compliance for water quality-based effluent limits in NPDES permits, the State must adopt a permit compliance schedule authorizing provision. Such authorizing provision is a water quality standard subject to EPA review and approval under section 303 of the Act and must be consistent with sections 502(17) and 301(b)(1)(C) of the Act."

⁵⁰ USEPA. 2010. *NPDES Permit Writers' Manual*. EPA 833-K-10-001. U.S. Environmental Protection Agency, Office of Water, Washington, DC, https://www.epa.gov/sites/production/files/2015-09/documents/pwm_2010.pdf.

Management on compliance schedules for water quality-based effluent limitations in NPDES permits dated May 10, 2007.⁵¹

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⁵¹ Hanlon, J.A. U.S. Environmental Protection Agency. 2007. Memorandum: Compliance Schedules for Water Quality-Based Effluent Limitations in NPDES Permits. Office of Water, Washington DC.
https://www3.epa.gov/npdes/pubs/memo_complianceschedules_may07.pdf