BEFORE THE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

COMMENTS OF THE NORTH AMERICAN METALS COUNCIL-SELENIUM WORK GROUP IN RESPONSE TO EPA'S ESTABLISHMENT OF REVISED NUMERIC CRITERIA FOR SELENIUM FOR THE SAN FRANCISCO BAY AND DELTA, STATE OF CALIFORNIA

External Peer Review Revised Numeric Criteria for Selenium for the San Francisco Bay and Delta, State of California 81 Fed. Reg. 46030 (July 15, 2016)	)	EPA–HQ–OW–2015–0392

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EXECUTIVE SUMMARY

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

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

NAMC commends EPA on the development of the tissue-based approach and believes this is the most credible and scientific approach to assessing potential environmental effects from selenium and protecting aquatic resources in the San Francisco Bay and Delta. Further, we appreciate the attempt by EPA to use species-specific and site-specific information for the San Francisco estuary to model the fate of selenium in the aquatic environment to develop criteria for the San Francisco Bay and Delta.

There are, however, several aspects in the proposed revised criteria that we believe need to be improved and we recommend that EPA address them in preparing the selenium criteria for the San Francisco Bay and Delta in final. First, the Technical Support Document for the Proposed Aquatic Life and Aquatic-Dependent Wildlife Selenium Water Quality Criteria for the San Francisco Bay and Delta (June 2016) failed to recognize the series of technical reports, modeling results, and water quality assessments developed from 2007 through 2015 as part of the development of a selenium total maximum daily load (TMDL) for North San Francisco Bay. (*See* the San Francisco Bay Regional Water Quality Control Board Selenium TMDL website, which is available at http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/seleniumtmdl.shtml.) These studies represent the best available science for the evaluation of selenium within the San Francisco Bay and Delta.

Second, NAMC-SWG is also concerned about the choice of model used to develop EPA's draft selenium criteria presented in this draft. The selected United States Geological Survey (USGS) Ecosystem-Scale Selenium Model over-simplifies the food web and selenium cycle in the San Francisco Bay and Delta as a series of calculations based on empirical

data. As a result, this model does not account for the natural and biogeochemical transformation of various selenium species (selenate, selenite, particulate selenium, and selenide) or modifying factors that affect selenium in the San Francisco Bay, such as sulphate.

NAMC-SWG is concerned that the water and tissue criteria in the draft selenium criterion document are not technically defensible and are demonstrably overly conservative. We provide evidence that may provide a basis for higher but still environmentally protective concentrations that would not unnecessarily expend limited regulatory resources to the detriment of genuine environmental issues, nor unduly penalize human industrial or other activities. We are concerned that the low water criteria concentrations will result in a serious misallocation of resources, thereby reducing rather than enhancing the region's ability to address environmental problems in the Bay and Delta. In the very least, it is surprising that EPA draft criterion is not aligned with the recently completed TMDL for selenium in the North Bay. Related to the concern of misusing regulatory resources is the issue that the tissue criterion is inappropriately expressed as "not to be exceeded" on an instantaneous basis. We recommend that, in accordance with EPA Guidelines, "instantaneous" be replaced with "seasonal average," and "not to be exceeded" be replaced with "not to be exceeded more than once in three years on average." In both cases, the average should be presented as the geometric mean value.

The NAMC-SWG also has concerns about the draft criteria claiming that all elements of the draft selenium criteria for the San Francisco Bay and Delta are equally protective. This is contrary to the final national selenium criteria whereby it has been correctly identified that there needs to be a tiered approach in applying the elements of the criteria (*i.e.*, water values as an initial screen and, if exceeded, the evaluation of fish tissues). For the national criteria, it has been correctly identified that the tissue criteria took supremacy over water values. This is scientifically the most valid way to prioritize the criteria because the tissue values are the values related directly to toxicity effects in the organism. The waterborne selenium values and the values in the clam are modeled concentrations calculated from the effects observed in fish and should be tiered appropriately. Furthermore, there is no precedent for the implementation of a clam or particulate selenium regulatory value. The fact that particulate selenium in water, or tissue concentrations of selenium in prey, were not considered important in national criteria draws into question the inclusion of these elements and importance in the present criteria for the San Francisco Bay and Delta. We recognize that selenium concentrations in water and prey may be useful indicators for conditions in the Bay and Delta, but they are not appropriate as criteria of equal status as the fish tissue criterion.

Finally, there were numerous issues with accessing technical supporting documents listed in the docket as many files and hyperlinks (79 of the 213) were absent, making a thorough review of the selenium draft criteria impossible. It was not clear from the file names what the files were (*i.e.*, if they were peer-reviewed literature, what the citation was so that these could be independently investigated and reviewed). Files that claimed they were hyperlinks contained no hyperlinks to the original document. In addition, there were issues with registering for the virtual and in-person public hearing in that the registration deadline was August 1, yet this was not clearly announced in the July 15, 2016, *Federal Register* notice. As a result, we did not participate in the virtual public hearing. These issues do not provide a good example of transparency in government or following good administrative protocol.

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INTRODUCTION

This document, submitted by the North American Metals Council (NAMC), comprises integrated comments provided by individual Members and Associates of the North American Metals Council-Selenium Work Group (NAMC-SWG). This document is provided in response to the U.S. Environmental Protection Agency's (EPA) July 15, 2016, request for public comment on an Establishment of Revised Numeric Criteria for Selenium for the San Francisco Bay and Delta, State of California.

NAMC is an unincorporated, not-for-profit organization serving as a collective voice for the North American metals producers and users. NAMC has been a leading voice for the metals industry on science- and policy-based issues affecting metals. Our organization has worked closely with U.S. federal and international agencies to address risk assessment issues that are unique to metals and various stages of their lifecycle -- sourcing, production, engineering, use, recycling, and recovery. We advocate policy based on good, sound science.

This document comprises integrated comments provided by individual Members and Associates of the NAMC-SWG. The NAMC-SWG is engaged in technical research on issues pertaining to selenium. Activities include the development of water quality tissue-based standards for selenium, the implementation of such standards, development of effects thresholds, and the identification of analytical methods pertinent to such standards. As part of its ongoing

efforts, the NAMC-SWG develops papers on these topics and shares them publicly on its website[1] or through the peer-reviewed scientific literature.

NAMC commends EPA on the development of the tissue-based approach and believes this is the most credible and scientific approach to assessing potential environmental effects from selenium and protecting aquatic resources in the San Francisco Bay and Delta. Further, we appreciate the attempt by EPA to use species-specific and site-specific information for the San Francisco estuary to model the fate of selenium in the aquatic environment to develop criteria for the San Francisco Bay and Delta.

There are, however, several aspects in the proposed revised criteria that we believe need to be improved, which are detailed below. We strongly recommend EPA address these issues as it prepares the criteria for the San Francisco Bay and Delta in final.

1.0 POSITIVE ASPECTS IN THE REVISED CRITERION DOCUMENT

NAMC commends EPA on the development of the tissue-based approach and believes this is the most credible and scientific approach to assessing potential environmental effects from selenium and protecting aquatic resources in the San Francisco Bay and Delta. Further, we appreciate the attempt by EPA to use species-specific and site-specific information for the San Francisco estuary to model the fate of selenium in the aquatic environment to develop

[1] *See* North American Metals Council, "The Selenium Workgroup," available at http://www.namc.org/selenium.html.

site-specific criteria for the San Francisco Bay and Delta in California. We also agree with the selection of white sturgeon as the target species for developing tissue criteria over birds and insect-eating fish.

2.0 CONSTRUCTIVE CRITICISMS IN THE REVISED CRITERION DOCUMENT

2.1 Data

The EPA draft revised selenium criteria were developed using the Ecosystem-Scale Selenium Model and a list of solid/liquid partition coefficients (K_d) values calculated from data collected between June 1998-November 1999 for clam-eating fish and clam-eating birds.[2] The model attempts to capture different seasonal changes in the Bay (*e.g.*, seasonally wet versus dry years) to develop a range of K_d and trophic transfer factors (TTF) values as these can fluctuate considerably from weather and climate cycles as well as California water management activities that affect selenium input into the Delta and San Francisco Bay. The model does not reflect present-day dry conditions in the Bay, however. By May 1998, the five Bay-area refineries[3] implemented changes to the effluent treatment system that significantly changed the amount (over 85% reduction) and speciation (selenite to selenate) of their effluent discharge.[4]

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2 EPA, Technical Support Document for the Proposed Aquatic Life and Aquatic-Dependent Wildlife Selenium Water Quality Criteria for the San Francisco Bay and Delta (TSD) (June 2016) at 72, Table 4-8.

3 *Id.* at 3, Figure 1-1.

4 Cutter, G.A., Cutter L.S. 2004. Selenium biogeochemistry in the San Francisco Bay Estuary: Changes in water column behavior. *Estuarine, Coastal, and Shelf Science*. 61:463-476.

Data used to develop variables for a model to develop criteria should reflect conditions after those refinery effluent changes.

In 2010, the San Francisco Bay Regional Water Quality Control Board adopted an order that updated the water quality-based effluent limits for the five refineries within the San Francisco Bay area. This Order included a requirement to conduct a North San Francisco Bay Selenium Characterization Study.[5] The overall goal of the Selenium Characterization Study was to obtain information on current conditions of selenium distribution and speciation under representative hydrologic conditions. EPA's TSD for the draft revised criteria acknowledged the results of the 2012 Selenium Characterization Study; however, the data were not incorporated in the assessment of the draft criterion because the data were considered not to be peer reviewed.[6] We consider this to be poor judgment on the part of the Agency considering that the Linville thesis[7] used to derive the maternal transfer thresholds for sturgeon was also not peer reviewed, but was assessed by EPA to be the only good quality data available to perform this analysis.[8] Recent and relevant data are critical and should have been used in the development of EPA's

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5 Tetra Tech Inc., North San Francisco Bay Selenium Characterization Study - Final Report. (Oct. 5, 2012), appended to Letter to Bruce Wolfe from Kevin Buchan, Western States Petroleum Association (WSPA) (Oct. 5, 2012), available at http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/northsfbayselenium/Se%20Characterization%20Study%20Final%20Report%20pkg%2010-05-2012.pdf.

6 TSD at 74.

7 Linville, R. G. 2006. Effects of excess selenium on the health and reproduction of white sturgeon (*Acipenser transmontanus*), Implications for San Francisco Bay-Delta. Doctoral Dissertation, University of California, Davis, California.

8 TSD at 34.

criteria. Furthermore, although the Selenium Characterization Study itself was not peer reviewed, the data and modeling results from this work were presented in the North San Francisco Bay Total Maximum Daily Load for Selenium in North San Francisco Bay (TMDL) Technical Memoranda[9] as well as the TMDL staff report,[10] which were all put out for external peer review by the regional Board.

On November 18, 2015, the California Regional Water Quality Control Board, San Francisco Bay Region, adopted the Selenium TMDL for the North San Francisco Bay.[11] The State of California Water Resources Control Board subsequently adopted this TMDL on March 15, 2016.[12] EPA Region IX followed by providing its final approval on August 23, 2016.[13]

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9 North San Francisco Bay Selenium Characterization Study - Final Report, appended to Letter to Bruce Wolfe from Kevin Buchan, WSPA.

10 Barbara Baginska, Total Maximum Daily Load Selenium in North San Francisco Bay. Staff Report for Proposed Basin Plan Amendment (Nov. 18, 2015), available at http://www.waterboards.ca.gov/sanfranciscobay/board_info/agendas/2015/November/6_appendix_c.pdf.

11 Amending the Water Quality Control Plan for the San Francisco Bay Basin to Establish a Total Maximum Daily Load and Implementation Plan for Selenium in North San Francisco Bay. California Regional Water Quality Control Board. Resolution No. R2-2015-0048, available at http://www.waterboards.ca.gov/sanfranciscobay/board_info/agendas/2015/November/6_final_to.pdf.

12 Approving an Amendment to the Water Quality Control Plan for the San Francisco Bay Basin to Establish a Total Maximum Daily Load and Implementation Plan for Selenium in North San Francisco Bay, available at http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/northsfbayselenium/SB_Resolution%202016-0017.pdf.

13 *See* North San Francisco Bay Selenium TMDL ("The U.S. EPA approved the TMDL on August 23, 2016."), available at http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/seleniumtmdl.shtml.

Following eight years of scientific effort and the above agency actions, it is unclear why EPA would follow different approaches in the development of its Bay criteria than that used in the approved TMDL. In the TMDL, the only one water criterion adopted was 0.5 µg/L (dissolved). It is our belief that these two different values (0.5 µg/L in the TMDL and 0.2 µg/L proposed by EPA) will only bring confusion to the public and raise unnecessary concern in situations where North San Francisco North Bay could be in compliance with the TMDL, but not with the EPA criterion.

A TTF of 17 was used in the development of the draft revised criterion for clams. This TTF is driven by *Corbula amurensis* data for a single station in Carquinez Strait (United States Geological Survey (USGS) Station 8.1) and particulate selenium data from a Carquinez Strait-Suisun Bay transect reported in Doblin *et al*. (2006).[14] The magnitude of this TTF may not be realistic, because it depends on whether these two separate datasets were appropriately paired. Additional datasets should be evaluated to determine whether the TTF of 17 is accurate, because it has significant direct linear influence on the dissolved selenium criterion. We point out that TTFs are non-linear and decrease as the selenium concentration increases. This places further emphasis on the need for additional measures of the TTF.

[14] Doblin, M.A., Baines, L.S., Cutter, L.S., Cutter, G.A. 2006. Sources and biogeochemical cycling of particulate selenium in the San Francisco Bay Estuary. *Estuarine, Coastal and Shelf Science* 67:681-694.

2.2 Model Selection

EPA's draft revised criteria were based on the USGS Ecosystem-Scale Selenium Model described in *A Methodology for Ecosystem-Scale Modeling of Selenium.*[15] The Ecosystem-Scale Selenium Model is conceptually overviewed in the schematic of the model in Figure 1 and described as follows:

> *The organizing principle for the methodology is the progressive solution of a set of simple equations or models, each of which quantifies a process important in Se exposure . . . Environmental partitioning between dissolved and particulate phases (K_d) is used here to characterize operationally the uptake and transformation (commonly termed bioconcentration) of dissolved Se into the base of the food web.*[16]

By this approach, the Ecosystem-Scale Selenium Model provides a very simple representation of the bioaccumulation of selenium through the food chain, from the partitioning of dissolved and particulate selenium within a water column, to the uptake of particulate selenium by clams and other invertebrate organisms, to the consumption of clams and other invertebrates by fish and birds. Based on a set of empirical data for any ecosystem for a particular point or range in time, the model provides a set of equations that represents each step of this food chain and calculates a series of K_d and TTF values. Presser and Luoma further describe this model by the following statements:

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

[16] *Id*. at 686.

> *Environmental partitioning between dissolved and particulate phases (K_d) is used here to characterize operationally the uptake and transformation (commonly termed bioconcentration) of dissolved Se into the base of the food web . . . K_d is environment specific (i.e., dependent on site hydrology, dissolved speciation, and type of particulate material) and is the ratio of the particulate material Se concentration (in dry weight, dw) to the dissolved Se concentration observed at any instant. The base of the food web, as sampled in the environment and characterized by K_d, can include phytoplankton, periphyton, detritus, inorganic suspended material, biofilm, sediment, or attached vascular plants.*[17]
>
> *Biodynamic models have the further advantage of providing a basis for deriving a simplified measure of the linkage between trophic levels: trophic transfer factors (TTFs. . .). TTFs are species-specific and link particulate, invertebrate, and predator Se concentrations (e.g., TTF_{clam} or $TTF_{sturgeon}$). They can be derived from laboratory experiments or from field data.*[18]

Based on empirical monitoring data from an ecosystem, calculated K_d and TTF values, and target fish tissue values established by the analysis of toxicity data, dissolved selenium concentrations in the water column (the water quality criteria) can be calculated that will maintain fish tissue values below the protective values. Further analysis can also establish separate water quality criteria for flowing water systems such as rivers and streams (lotic) and stationary water systems such as ponds and lakes (lentic).

The Ecosystem-Scale Selenium Model provides a useful methodology to use existing water quality and fish tissue monitoring data from any ecosystem to represent the local food chain, the uptake and bioaccumulation of selenium, and the calculation of water quality and fish tissue criteria. For ecosystems that have a long history of selenium monitoring efforts and

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17 *Id*.

18 *Id*. at 687.

technical studies (such as those developed for the North San Francisco Bay TMDL), however, this model does not provide the best available scientific method. The Ecosystem-Scale Selenium Model does not fully represent selenium loadings, the selenium cycle (the ongoing biological and geochemical transformations of selenium species within an ecosystem), and the fate and transport of these selenium species throughout an ecosystem. A model that considers and accounts for the selenium cycle and selenium species (such as the model developed for the selenium TMDL) is necessary for developing water quality criteria.

To provide a wider basis of scientific support for the proposed water quality and fish tissue criteria, the TSD and criteria development methodology should also recognize the hydrodynamic selenium model[19] developed as part of a series of technical studies and reports prepared from 2007 through 2015 during the development of a selenium TMDL for the San Francisco Bay.[20] Where appropriate, the TSD and criteria development methodology should then incorporate any findings and results from these TMDL studies that may support any adjustments to the proposed criteria.

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19 Tetra Tech, Inc., Technical Memorandum 6: Application of ECoS3 for Simulation of Selenium Fate and Transport in North San Francisco Bay (Feb. 2010), available at http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/northsfbayselenium/TM-6_Modeling_Final_Report_02-10.pdf.

20 *See* all TMDL Technical Documents, available at http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/seleniumtmdl.shtml.

Figures 2 and 3 provide a graphical overview of the selenium model for San Francisco Bay developed by Chen *et al.*[21] using the ECoS framework as part of the North San Francisco Bay TMDL. Originally developed by Meseck and Cutter in 2006,[22] this model simulates salinity, total suspended material, phytoplankton, and different species of dissolved and particulate selenium (dissolved selenate, selenite, organic selenide, particulate elemental selenium, particulate organic selenides, and adsorbed selenite and selenate) (Figure 2). The Ecosystem-Scale Selenium Model does not consider any of these variables and their influences on the selenium cycle within the Bay or any aquatic ecosystem. The selenium TMDL model expanded upon the Meseck and Cutter selenium cycle model and provided a complete selenium fate and transport model for the San Francisco Bay and Delta (Figure 3). Once calibrated, this model was used to develop various selenium management strategies, load allocations, and waste load allocations listed within the selenium TMDL. A portion of this overall model incorporates a food-web model (DYMBAM) that is very similar to the Ecosystem-Scale Selenium Model (Figure 1) and also includes a list of K_d and TTF calculations. By modeling the complete selenium cycle and the fate and transport of selenium throughout the San Francisco Bay in 2009 and 2010, the technical reports demonstrated that San Francisco Bay has assimilative capacity for selenium. An overall result of this model is described by Chen *et al.*:[23]

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21 Chen, L., Meseck, S.L., Roy, S.B., Grieb, T.M., Baginska, B. 2012. Modeling fate, transport, and biological uptake of selenium in North San Francisco Bay. *Estuaries and Coasts* 35:1551-1570.

22 Meseck, S.L., Cutter, G.A. 2006. Evaluating the biogeochemical cycle of selenium in San Francisco Bay through modeling. *Limnology and Oceanography* 51:2018-2032.

23 Chen *et al*. (2012).

> *The model was able to simulate different selenium speciation and the bioavailability of each species, therefore is able to simulate selenium concentrations on particulates relatively well for different time periods (e.g., 1999 and 1998). The model could also represent the long-term variations (interannual and seasonal) in clam selenium concentrations for both prior to refinery clean-up (1994–1998) and post-refinery clean up time periods (1998–2010), including years with high and low clam selenium concentrations. The accumulation of selenium to higher trophic organisms is simulated using a TTF approach, which is able to represent selenium concentrations in white sturgeon and greater scaup in the bay.*

The completion of the North San Francisco Bay Selenium Characterization Study[24] in 2012 provided an updated set of measured boundary conditions, selenium speciation data for refinery effluents, transect water quality and selenium speciation data throughout the Bay, selenium loading and speciation data for several additional rivers and streams that enter North San Francisco Bay, and other monitoring data. Throughout 2013 and 2014, these data were then used to: update and calibrate the model; run hindcasts against the latest sets of clam data, fish tissue data, and other monitoring data for the Bay; and, then run forecasts against various water management options, selenium control options, and anticipated selenium loadings in the future. All of this work then supported the development of the Regional Water Quality Control Board, San Francisco Bay Region's proposed selenium TMDL in 2015.[25]

In summary, to ensure that EPA's proposed water quality and fish tissue quality criteria for selenium are based on the best available science within the San Francisco Bay and

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[24] North San Francisco Bay Selenium Characterization Study - Final Report, appended to Letter to Bruce Wolfe from Kevin Buchan, WSPA.

[25] Total Maximum Daily Load Selenium in North San Francisco Bay. Staff Report for Proposed Basin Plan Amendment.

Delta, the criteria development methodology and results should be re-evaluated against the methodology and results of the San Francisco Bay's selenium TMDL and its technical support documents.

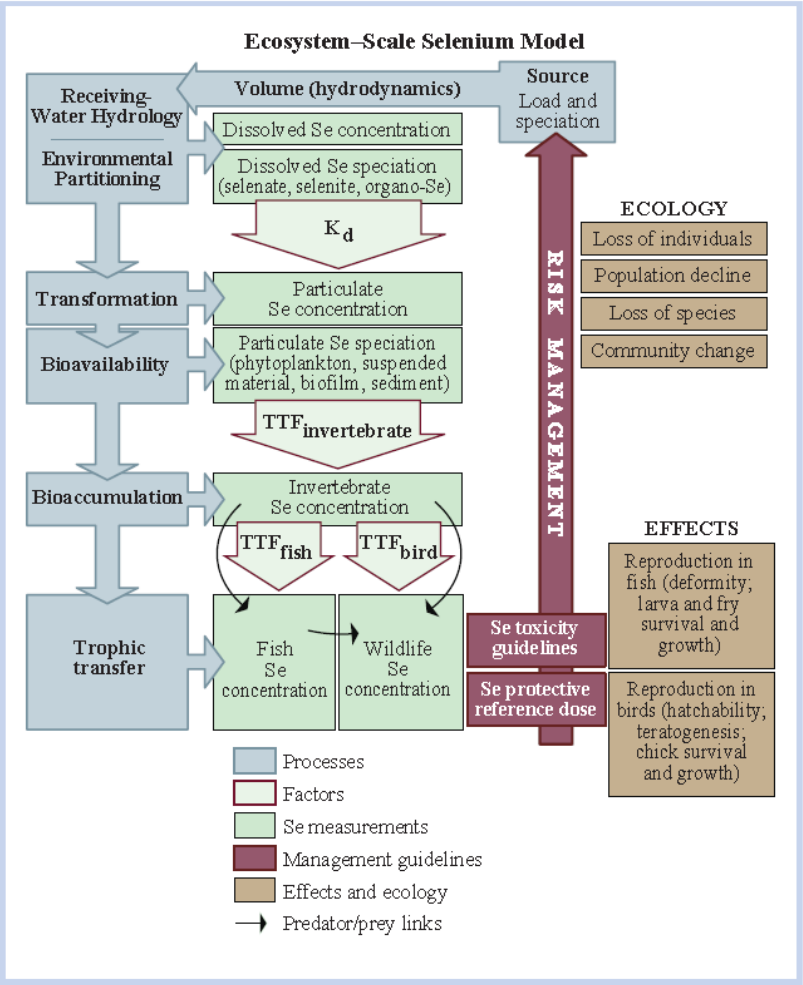


Figure 1. Ecosystem-scale Se model. The model conceptualizes processes and parameters important for quantifying and understanding the effects of Se in the environment. The model can be applied to forecast exposure and to evaluate the implications of management or regulatory choices. K_d – empirically determined environmental partitioning factor between water and particulate material; TTF – biodynamic food web transfer factor between an animal and its food.

Figure 1: Ecosystem-Scale Selenium Model[26]

26 Presser and Luoma (2010) at 687.

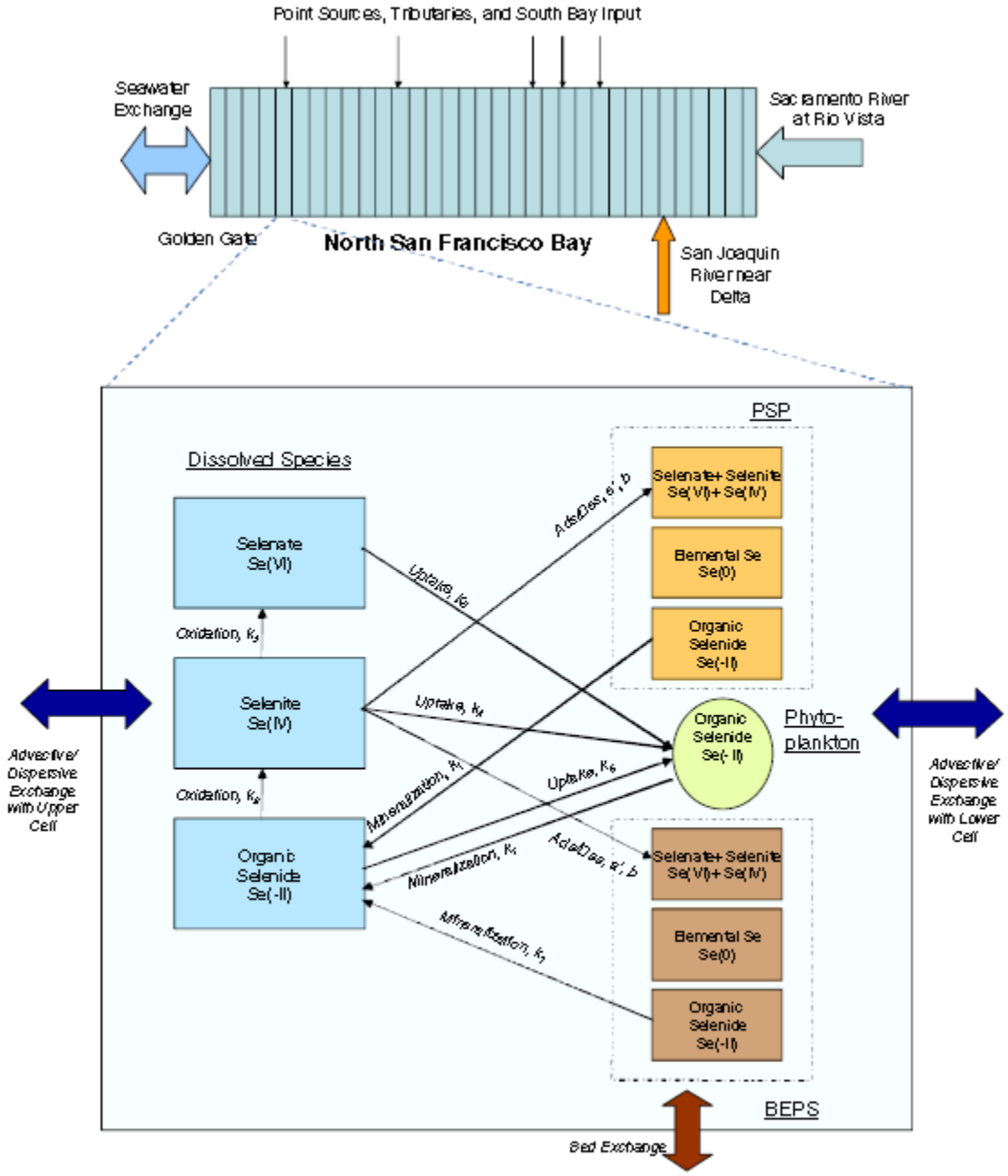
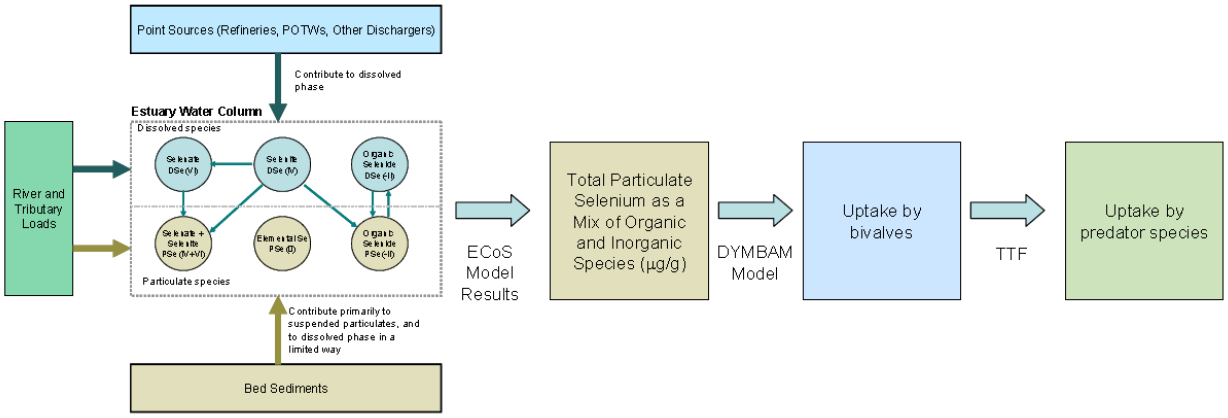


Fig. 2 Schematic of model representation of the NSFB, showing model cells or nodes (*vertical boxes*), boundary conditions, and external loads. Each cell is 3 km wide. The locations of the external loads are illustrative and are added in the model location at the approximate location they enter the estuary

Figure 2: ECoS Model[27]

[27] Chen *et al*. (2012).



Schematic of selenium transfers from the water column and suspended particulates to bivalves, and then to predator species.

Figure 3: TMDL Selenium Model[28]

2.3 Clam and Particulate Selenium Criteria

The inclusion of clam and particulate selenium criteria in the draft revised San Francisco Bay water quality criteria sets a precedent and there is uncertainty what these additional parameters will add to the protection of the aquatic life in the San Francisco Bay and Delta. To date, selenium criteria have been promulgated only for water, and for fish or bird tissues (*e.g.*, EPA National Selenium Criteria finalized in 2016 and Province of British Columbia, 2014[29]). Toxicologically, development of tissue thresholds in egg-laying vertebrates is the most relevant. Routine monitoring of tissues is not practical, however; therefore, water criteria have been back-calculated from tissue values. Although the concern over the clam

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28 Technical Memorandum 6: Application of ECoS3 for Simulation of Selenium Fate and Transport in North San Francisco Bay at 2-20.

29 Beatty, J.M., Russo, G.A. April 2014. Ambient Water Quality Guidelines for Selenium Technical Report. Province of British Columbia. ISBN 978-0-7726-6740-3, available at http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/selenium/wqgupdate2014.pdf.

contribution to clam-eating vertebrates is valid, there is also concern around developing a criterion in an organism using modeled data and not based on direct toxicity to that organism. As for the inclusion of a particulate criterion, local variations of particulates in the Bay (caused by sediment suspension or phytoplankton blooms) are most likely not fully represented by models. Effects by sediment re-suspension and phytoplankton blooms may be occasional and not continuous. The Selenium Characterization Study (2012) identified that a better understanding of the role of the estuarine particulate variation was needed and Bay-wide studies on phytoplankton and suspended sediments may allow improved characterization of particulate selenium. Also observed in the Selenium Characterization Study and associated modeling was that, in general over the 1999-2012 period, the particulate species fit less well than dissolved species in model predictions. The Study concluded that this was related to the complexity of the underlying processes governing particulate selenium and the variability of the collected data. Particulate selenium species often display considerable variation between adjacent stations sampled on the same day, a pattern not seen with dissolved species. Additionally, it is recognized that accurate measurements of particulate selenium are difficult and vary as a function of the amount of suspended sediment. Therefore, a water particulate value that is not a reliable predictor of resulting toxicity is not a good candidate for a criterion value.

2.4 Not to Be Exceeded Criteria

The draft fish tissue and clam criteria are expressed with a frequency of “not to be exceeded.” There was no rationale provided in the TSD on why this frequency was selected for the tissue criteria. We are concerned that criteria expressed as “not to be exceeded” go against

understanding of natural variability in biological organisms and that a single fish above the criterion would be considered impairment for selenium. In response to comments to the national criteria, EPA has indicated that technical support materials are being developed for this criterion "*and is not recommending a single fish having selenium concentrations above the criterion be considered an exceedance of the criterion*."[30] EPA has clarified that the selenium criterion is focused on the protection of populations, not individuals; this should equally be stated in the San Francisco Bay and Delta selenium criteria document. Furthermore, the water criterion (dissolved, intermittent, and particulate exposure) is presented as having a frequency of "*no more than once in three years*," which EPA claims is the typical frequency for its recommended ambient water quality criteria for aquatic life.[31] EPA did not bother to consider what San Francisco Bay concentrations would look like if a once-in-three-year target was attained for the tissue criteria, however. EPA has arbitrarily dismissed the once-in-three-year frequency option for fish tissues. EPA's own 2016 criterion document for the national selenium criteria[32] presents information showing that Hyco Reservoir recovered immediately after fish concentrations decreased to acceptable levels. Furthermore, the State of Utah has established, with EPA approval, that

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30 EPA Response to Public Comments on the 2014 External Peer Review Draft Aquatic Life Ambient Water Quality Chronic Criterion for Selenium-Freshwater (2016) at 94, available at https://www.epa.gov/sites/production/files/2016-07/documents/2014_response_to_public_comment_on_external_peer_review_draft_aquatic_life_criterion_for_selenium-freshwater.pdf.

31 TSD at 77.

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

selenium tissue excursions even more frequent than once in three years will still protect the beneficial use.[33]

2.5 Need for Tiered Approach

The current draft criterion states that "[*a*]*ll proposed values are considered comparably protective*"[34] with no indication that one value would take precedence over another if the data were available for multiple parameters. This approach is inconsistent with the recently finalized national selenium water criterion where the four-part criterion was tiered so that if the water criterion were exceeded, the tissue values would supersede water values. The current proposed format with five parts adds unnecessary complexity and potential confusion in regard to implementation. Therefore, NAMC-SWG recommends that EPA make it clear that the official criterion is the fish tissue value and we recommend that EPA implement the following approach:

1. First, compare waterborne concentration in the San Francisco Bay and Delta to the dissolved selenium water criterion.

2. Exceedance of Tier 1 dissolved water concentrations would indicate a potential risk, triggering a more robust line of evidence investigating fish tissue thresholds in the San Francisco Bay and Delta.

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[33] Utah Department of Environmental Quality. 2008. Development of a Selenium Standard for the Open Waters of Great Salt Lake, available at http://www.deq.utah.gov/locations/G/greatsaltlake/gsl_wqsc/GLS_Selenium_Standards/index.htm.

[34] TSD at viii.

As mentioned in Section 2.3, we do not believe that the clam and particulate criteria should be adopted due to the variable nature of the particulate water selenium criterion and questions regarding the representativeness of the data used to develop the clam criterion. We recognize that selenium concentrations in water and prey may be useful indicators for conditions in the Bay and Delta, but they are not appropriate as criteria of equal status as the fish tissue criterion.

CONCLUSIONS

The primary conclusion from our review of the draft revised selenium criteria for the San Francisco Bay and Delta is that several necessary improvements should be made. In summary, these include the following main points:

- The 2015 North San Francisco Bay Selenium TMDL model represents the best available science toward the modeling of the entire selenium cycle and the fate and transport of selenium throughout San Francisco Bay. As such, the proposed site-specific criteria for selenium should be re-evaluated with this model.
- Misalignment of the dissolved water quality criteria with the TMDL must be avoided -- two different thresholds will cause unwarranted, and potentially resource-draining, confusion.
- Due to stated concerns over the inclusion and appropriateness of clam and water particulate criteria, they should be removed.
- Due to concern over the lack of a tiered approach to the proposed criteria, they should be tiered so that if the water value is exceeded, the fish tissue value takes supremacy.
- The criteria should be re-evaluated using more recent data to better reflect the current conditions of the San Francisco Bay and Delta using the selenium model developed for the North San Francisco Bay selenium TMDL.