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Environmental Protection Agency  
MC 2822-IT  
1200 Pennsylvania Ave. NW  
Washington, DC 20460

ATTN: Docket No. EPA-HQ-OW-2004-0019

*Via email to: [ow-docket@epa.gov](mailto:ow-docket@epa.gov)*

Dear Environmental Protection Agency,

The Kentucky Division of Water (KDOW) is pleased to provide the U.S. Environmental Protection Agency (EPA) with comments in support of the External Peer Review Draft Aquatic Life Ambient Water Quality Criterion for Selenium – Freshwater 2014 (EPA-822-P-14-001).

As you are aware, Kentucky is the first state to include selenium criteria based on fish tissue levels in its Water Quality Standards (WQSs). KDOW firmly believes water quality standards must be based on sound scientific rationale and appreciates the EPA's recognition of this important tenant of water quality standards.

The EPA draft selenium criteria and elements incorporate a broad diversity of fishes which protects aquatic habitat against toxicity effects of selenium. The toxic effects of selenium in fish are not a response to water column concentrations, but result from accumulation of selenium in fish tissue from dietary uptake (USEPA 1998). The base of the food web (plants, bacteria and invertebrates) is relatively insensitive to selenium, however fish are exposed to potentially chronically toxic concentrations through dietary uptake (Chapman et al. 2010). Kentucky believes a water column threshold which prompts a collection of fish tissue is an appropriate and protective action with regard to aquatic life.

Of the four elements of the criterion that EPA proposes, the egg/ovary criterion results take precedence when available, regardless of the results of the remaining three elements. Kentucky believes this is an appropriate application of the criterion since selenium toxicity is particularly manifested in fish

reproduction and embryo development. Whole-body or muscle tissue analysis is a sound alternative when egg/ovary tissue is unavailable. This approach parallels that of Kentucky in recognizing that tissue bioaccumulation indicates toxicity in the aquatic environment and provides the most reliable medium for monitoring selenium and protecting aquatic habitat. The proposed national criterion and its elements appropriately do not include a criterion for acute toxicity because water column concentration exposure is not indicative of toxicity.

The EPA appropriately reviewed the body of available scientific literature when it developed its database for criterion formulation, which resulted in an pertinent subset of studies based on the understanding of the mode of selenium toxicity. EPA properly excluded bioassay studies using only water column exposure. Chapman, et al. (2010) found the measurement of selenium in fish tissue appropriate given its close ties to chronic toxicity, namely embryo mortality and teratogenic effects.

Kentucky agrees with the EPA's selection of the EC<sub>10</sub> (Effective Concentration) in preference of the EC<sub>20</sub> (the observed or measured effect concentration at 10 or 20 percent, respectively) to measure a chronic end-point (e.g., growth, development effects or reproduction). Previous national toxic criteria were derived using the EC<sub>20</sub>. This approach mirrors that taken by Kentucky when developing its chronic criterion for selenium. Calculations were also made from appropriate studies for the NOEC (No Observed Effect Concentration) and LOEC (Lowest Observed Effect Concentration) with preference given to the EC<sub>10</sub>.

Acceptable study data representing 12 fish species were available to calculate the SMCV (Species Mean Chronic Value) and nine fish genera to calculate the GMCV (Genus Mean Chronic Value). The EPA considered 14 genera to calculate the GMCV, but because the data indicate invertebrates are tolerant of high selenium concentrations, the invertebrate values were not included in deriving the FCV (Final Chronic Value) which is determined from the four most sensitive GMCVs.

The EPA also incorporated the 1985 Guidance (Stephan, et al. 1985) recommendations which include consideration of a commercially or recreationally important warm water species when determining appropriate data to calculate the GMCVs. This important consideration was also essential in developing Kentucky's selenium criteria. Like Kentucky, the EPA concluded that the Doroshov, et al. (1992) catfish (*Ictaluridae*) study contained unusable data because the mode of exposure was injection of the test fishes, rather than through diet.

A review of the literature and scientific findings leads to the conclusion that toxicity through contaminated food consumption is of paramount concern, and that the proposed criteria protect the most sensitive aspect of the fish life cycle. Of note, Crutchfield (2000) found a positive correlation between selenium-affected Centrarchidae (sunfish population decreased as selenium concentration increased) and a negative correlation to Ictaluridae (catfish population decreased as selenium concentrations decreased). These correlative relationships were illustrated after selenium contamination in Belews Lake, North Carolina, in which only three of the 29 inhabiting species remained, including catfish (Young et al. 2010). This result contradicted the Doroshov (1992) study. Also of note, a Lemly (1993) study indicated that cold-stress increases selenium toxicity, and that a fish population should be monitored in the winter if selenium residue exceeded a screening value in fish tissue. Subsequent studies could not produce those same results (Hermanutz, et al. 1996; McIntyre et al. 2008). Regardless, a thermal regime of 4° C for 120 days does not exist in Kentucky waters nor for most of the waters of the United States. Given that EPA followed the recommendations in Stephan et al (1985), the EPA-proposed tissue-based criterion presumptively protects all aquatic species, including those on the Threatened and Endangered Species lists. The four most sensitive aquatic taxa were used to calculate the GMCV, and that GMCV was used to

calculate the FCV.

Kentucky believes that EPA's approach to deriving water column elements, considering lotic and lentic waters separately, appropriately considers how aquatic habitat affects selenium speciation, water residence time, and selenium accumulation in the food chain. Each water column element is derived by translating egg/ovary criterion which accounts for ingestion rate, assimilation efficiency, elimination, and concentration in food. The model indicated that growth rate is offset by ingestion rate at different points in the life cycle, and water column intake is inconsequential. Ultimately, the growth and ingestion rates are used to calculate a Trophic Transfer Function for each trophic level. These findings parallel the biogeochemistry and are recognized in various studies (Chapman, et al. 2009, 2010; Presser and Luoma 2010a, 2010b, 2013). Datasets from the EPA database were used to derive the lotic and lentic water column concentrations, setting the criterion at the 20<sup>th</sup> percentile to ensure adequate protection of the aquatic habitat. This calculation affirms the data analysis review from the Kingston, Tennessee coal-ash spill. A similar approach led Kentucky to conclude a 30-day average of 5.0 µg/L water column threshold for total selenium is protective of aquatic life in lotic waterbodies.

The element of the criterion which addresses intermittent exposure in the water column is meant to mitigate exposure to high concentration pulses or "spikes" in selenium entering a waterbody and accumulating in food particles at a concentration that may cause chronic toxicity to the aquatic habitat. This criterion component is appropriately determined site-specifically and depends on the frequency and magnitude of selenium "spikes" over a 30-day period. To account for variability in the selenium concentrations, the mathematical average is used as the input data. The calculated intermittent criterion element would be applied to the mathematical average of the spike concentrations. The 30-day average concentration element is the appropriate element to utilize. Kentucky's criterion require tissue sampling in the event the water column concentration exceeds the threshold of 5.0 µg/L, which protects the critical aquatic endpoint, the fish, which are monitored to detect any potential toxicity concerns.

For the above reasons, Kentucky supports EPA's approach to developing selenium criteria and encourages the EPA in the formal selenium criteria proposal to:

- 1/ Adopt the statement that fish tissue data should take precedence over water column data in assessing selenium levels (May 14, 2014 79 FR at 27602), and
- 2/ Establish that the chronic selenium criteria is sufficient to protect streams and aquatic habitats, and forego any recommendation for state adoption of an acute criteria.

KDOW appreciates the opportunity to comment on this proposed regulation, and remains ready to answer any questions or provide further information regarding these comments or the Kentucky criterion for selenium.

Sincerely,



Peter T. Goodman, Director  
Division of Water

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