

# TOXIC SELENIUM IN KENTUCKY STREAMS

Selenium is a mineral that occurs naturally and is necessary for life in small amounts; however, it can be toxic to aquatic life at very low levels. Selenium can also be harmful to human health. Short-term exposure can cause hair and fingernail loss, and irritability. Long-term exposure can damage the liver, kidneys, nervous system, and circulatory system. Selenium contaminates streams when coal seams and associated rock layers containing selenium are exposed through surface coal mining. Once in the ecosystem, selenium bioaccumulates in fish, birds, and other aquatic organisms, building up to toxic levels in the animals' tissues. Humans can be exposed to selenium through drinking water and eating contaminated fish.



Abnormal spine curvature cause by selenium (left).<sup>2</sup>

## What Levels are Toxic?

Studies have found toxic effects of selenium on fish at levels as low as **2 - 5 µg/L** (micrograms per liter) in water, and **3 ppm** (parts per million) in fish tissues.<sup>1</sup>

The EPA has already established a chronic standard for selenium in freshwater of **5 µg/L**.

Despite extensive scientific evidence that selenium is toxic to aquatic life at very low levels, the state of Kentucky is proposing to weaken standards for selenium pollution to **258 µg/L** in water for acute exposure and **8.6 ppm** in fish tissue for chronic exposure.

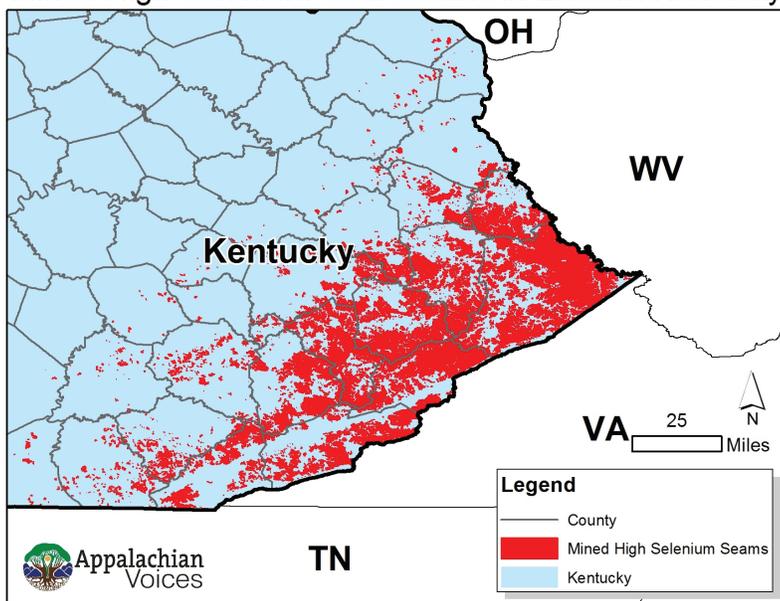
## SELENIUM CONTAMINATION OF STREAMS THROUGH COAL MINING IN KENTUCKY IS PREVALENT

A USGS study indicates that Kentucky has the highest average concentration of selenium in coal of any Central Appalachian state. Over 700 samples were analyzed in Kentucky. Many of those samples exceeded 4 ppm, the level identified by the EPA as likely to result in stream selenium concentrations higher than 5 µg/L when these coal seams are disturbed.<sup>3</sup>

### Average selenium concentrations in coal seams, by state:

- Kentucky: 4.2 ppm
- Southern West Virginia: 3.8 ppm
- Tennessee: 3.1 ppm
- Virginia: 2.7 ppm
- Northern West Virginia: 2.5 ppm<sup>4</sup>

### Mined High Selenium Coal Seams in Eastern Kentucky



## KENTUCKY HAS UNDERESTIMATED THE NUMBER OF STREAMS IMPACTED BY SELENIUM

West Virginia has assessed 58.3% of its waterways, and identified 218.3 miles as impaired by selenium, while Kentucky has assessed **only 21.9%** of its waterways, and identified **only 1.5 miles** as impaired by selenium.

**Both Kentucky Energy and Environment Cabinet and coal mining companies operating in the state are aware of selenium pollution occurring at mines throughout Eastern Kentucky**

Self-reported pollutant discharge data submitted by coal companies to the state confirm selenium pollution from many mines. Selenium levels were often 3 µg/L or higher, indicating stream contamination was likely. Some mines discharged selenium at much higher concentrations.

## Company-Reported Selenium Discharges:

Permit	Selenium Discharge
KYG 046480	79 µg/L
KYG 046480	26 µg/L
KYG 046588	25 µg/L
KYG 046455	15 µg/L
KYG 046636	14 µg/L
KYG 045589	34 µg/L



Photo: KFTC

## THE PROPOSED CHANGES TO KENTUCKY'S SELENIUM WATER QUALITY STANDARDS VIOLATE THE LAW AND ENDANGER STREAMS AND WILDLIFE

Kentucky's current selenium water quality standards set an acute (1-hour) limit of 20 µg/L in the water column and a chronic (4-day average) limit of 5 µg/L in the water column.

The Division of Water has proposed changing the standards to an acute limit of 258 µg/L in water (or higher depending on sulfate concentration), and a chronic standard based on the concentration of selenium in fish tissue.

### The proposed acute standard harms fish and wildlife:

- The proposed acute standard is identical to a standard that EPA declined to adopt in 2004 after receiving overwhelming criticism from scientists
  - The U.S. Fish and Wildlife Service objected to EPA's proposed standard because it **fails to account for the dramatic impacts** on the food web from short-lived but high-concentration discharges
  - Studies show that short selenium spikes at levels **less than five percent** of the proposed standard lead to dangerous levels of selenium higher up the food chain that persist long after the spike
- The proposed acute standard also ignores the overwhelming science by allowing for even higher discharges of selenium if sulfate is also present in the discharge
  - The U.S. Fish and Wildlife Service has previously objected to this approach by noting that **sulfate has never been shown to mitigate selenium toxicity in the field**

### The proposed chronic standard is flawed, unenforceable, and harms fish and wildlife:

- The proposed chronic fish tissue standard (8.6 ppm) is even higher than a similar standard that EPA considered and rejected, and is based on flawed science
  - The standard was developed under guidelines that were **not intended for use with toxins like selenium that bioaccumulate in the food chain**
  - The standard will not protect selenium sensitive species that are important to Kentucky like bluegill, sunfish, and catfish
- The proposed chronic fish tissue standard is unenforceable
  - The fish tissue approach **won't protect streams where fish are absent**, leaving salamanders, crayfish, and key parts of the food chain at risk
  - There is **no way** to use the chronic standard to set effective limits in a discharge permit for a new operation

1, 2. Lemly, A. Dennis. Aquatic Hazard of Selenium Pollution From Mountaintop Removal Coal Mining. 2009.

3. Bryant, Gary, McPhilliamy, Scott and Childers, Hope. April 8, 2002. A Survey of the Water Quality of Streams in the Primary Region of Mountaintop Valley Fill Coal Mining: October 1999 to January 2001. USEPA Environmental Services Division Region 3.

4. Neuzil, S. G., Dulong, F. T., Cecil, C. B. Spatial Trends in Ash Yield, Sulfur, Selenium, and Other Selected Trace Element Concentrations in Coal Beds of the Appalachian Plateau Region, U.S.A. U.S. Department of the Interior, U.S.G.S. 2005.

