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Chapter 7

Selenium Issues in the Coal Industry

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Synopsis

§ 7.01. History of Selenium Water Quality Standards.

Selenium is a naturally occurring element that is necessary in the diet of humans[1] and most mammals. At low levels in aquatic environments, however, it can bioaccumulate in waterways and cause adverse effects to fish and birds.[2] Prior to 1987, the U.S. Environmental Protection Agency (USEPA) maintained a recommended chronic water quality criterion of 35 micrograms per liter (parts per billion)(ug/l)[3] in waters supporting aquatic

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1 The Food and Drug Administration recommends dietary allowances for selenium ranging from 15 to 70 micrograms (ug/l) per day with an upper limit of 400 ug/l. Dietary Supplement Fact Sheet: Selenium, http://dietarysupplements.info.nih.gov/factsheets/selenium.asp (last visited September 24, 2009).

2 Unlike metals such as aluminum and iron which can interfere with the proper operation of gills in fish, selenium actually accumulates in tissue and can cause birth defects in fish and aquatic birds. It also can cause selenosis (also known as the "blind staggers") in cattle and other mammals that consume high levels of selenium in their forage.

3 EPA has no current "acute" criterion to protect aquatic life in freshwater. *See* Notice of Draft Aquatic Life Criteria for Selenium and Request for Scientific Information, Data and Views, 69 Fed. Reg. 75541, 75543 (Proposed Dec. 17, 2004). It did adopt one for the Great Lakes, but later withdrew it in response to a lawsuit challenging the application of a single value to both selenite and selenate, the two most common forms of selenium. *Id.* Aisi v. Envtl. Prot. Agency, 115 F.3d 979 (D.C. Cir. 1997). *See* National Recommended Water Quality Criteria, http://www.epa.gov/waterscience/criteria/wqctable/#appendxa (last visited September 24, 2009).

life uses.[4] However, in 1987, as a result of a widely publicized event involving Belews Lake in North Carolina, USEPA lowered the chronic water quality criterion to 5 ug/l to protect aquatic life.[5]

Many states, including West Virginia, Virginia, Kentucky, and Tennessee, have adopted USEPA's recommended chronic criterion of 5 ug/l to protect aquatic life in their waters.[6] West Virginia did so in 1992. Until

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4 The federal Water Pollution Control Act ("Clean Water Act") allows states to establish allowable in-stream concentrations — or "criteria" — for various water uses. 33 U.S.C. § 1313; 40 C.F.R. § 130.3 (2003); 40 C.F.R., and Part 131 (1995). USEPA maintains a list of "national recommended criteria" for various water "uses" that it issues pursuant to 33 U.S.C. § 1314. It publishes with updates the list in the federal register. A compilation of the current list appears at www.epa.gov/waterscience/criteria/wqctable. Once EPA publishes a criterion, it expects states to 1) adopt the recommended criterion; 2) adopt a criterion modified to reflect site-specific conditions; or 3) adopt a criterion using other "scientifically deliverable" methods. 40 C.F.R. § 131.11 (1992).

5 Belews Lake is a manmade reservoir created in 1973 by Duke Energy to provide a source of cooling water. www.duke-energy.com/lakes/facts-and-maps/Belews-lake.asp. For approximately ten years, until Duke Power changed its operations, the lake was contaminated with waterborne selenium from a waste ash decant pond. The waterborne levels were as high as 20 ug/l, which was well under the chronic criterion of 35 ug/l. The selenium accumulated in fish tissue, causing both fish deformities and reproductive failures. *See,* Dennis Lemly, "Selenium Impacts on Fish: an Insidious Time Bomb," 5 *Human and Ecological Risk Assessment*, No. 6, pp. 1139-1151 (1999)("Lemly"). As a result of changes in its ash handling process, selenium contributions to the lake were reduced. Consequently, a fish consumption advisory was lifted in August of 2000, and the Lake removed from a list of impaired waters. Water Quality Data and Information by Subbasin. http://h2o.enr.state.nc.us/basinwide/ roanoke/2001/ 2001% 20Roanoke%20Sec%20B%20Chap%201.pdf (last visited Sept. 24, 2009).

According to Dr. Dennis Lemly, a U.S. Forest Service researcher, selenium poses unique problems because: 1) it accumulates rapidly in the fish chain; and 2) it has a steep toxic response curve for fish, meaning that small upward changes in its dose can cause rapid toxic responses. *See* Lemly, *supra*.

Another site commonly cited as the source of selenium-induced toxicity is the Kesterson Reservoir. It is a man-made marsh in the Central Valley of California into which was diverted water used to irrigate saline soils containing naturally high levels of selenium. Benson, S.M., *et al*., "Kesterson Crisis," 119 *J. Irrig. and Drainage Engrg*., Issue 3, pp. 471-483 (May/June 1993). The bioaccumulation of the selenium manifested itself in shorebirds, which experienced reproductive failures and embryo deformation. *Id.*

6 *See* W. Va. Code St. R. § 47-2-8.27 (1995). West Virginia also retains a 20 ug/l acute standard. Virginia, Kentucky, and Tennessee also each retain aquatic life selenium criteria of 5 ug/l (chronic) and 20 ug/l (acute). 9 Va. Admin. Code 25-260-140 (Virginia); 401 Ky.

recently, however, selenium was not known as a pollutant associated with coal mining operations in the east. As a consequence, its presence in waters draining mining areas was rarely tested with sampling and analytic methods capable of detecting concentrations less than 10 ug/l.[7] In 2002, though, the USEPA discovered selenium in the coalfields of West Virginia as a result of its work on the Mountaintop Mining Programmatic Environmental Impact Statement. Some of the sampling showed selenium at levels exceeding the in-stream criterion of 5 ug/l.[8]

§ 7.02. Selenium Discovered in the Central Appalachian Coalfields.

Soon after discovery of the in-stream selenium levels in West Virginia, mining opponents starting filing comments with federal and state agencies in

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Admin. Reg. 10:031 (Kentucky) and Rules of Tenn. Dep't of Env't and Conservation, 1200-4-3-.03 (Tennessee).

7 The technology-based effluent limitations for the coal mining industry require imposition of limits only for iron, manganese, total suspended solids and pH. 40 C.F.R. Part 434 (coal mining point source category). National Pollutant Discharge Elimination System (NPDES) authorities, though, are required to impose more stringent limitations to ensure that water quality standards are protected. Most NPDES permit holders are required to conduct sampling of a broad suite of parameters such as selenium once every five years upon permit issuance and renewal. It appears, though, that some of the past analyses were conducted with protocols insufficient to detect selenium below approximately 10 ug/l.

8 *See* Draft Programmatic Environmental Impact Statement on Mountaintop Mining/Valley Fills in Appalachia-2003, pp. III. D.6, 7 & n.16. The Mountaintop Mining Environmental Impact Statement was finalized in October 2005. It consists largely of the 2003 "Draft" document, which can be found posted on USEPA websites. It was conducted by USEPA and other federal agencies as a result of a consent agreement that resolved National Environmental Policy Act (NEPA) and Clean Water Act claims levied at the Corps of Engineers over "fill permits" issued for excess spoil valley fills in the first mountaintop mining case in West Virginia. *See Bragg v. Robertson,* 54 F. Supp. 2d 653, 657-58 (S.E. W. Va. 1999)(discussing elements of consent order). Later, the same district court ruled that a surface mining regulation known as the "stream buffer zone" rule prohibited most valley fills. 72 F. Supp. 2d 642 (S.D. W. Va. 1999). That ruling was later reversed on 11th Amendment grounds by the Fourth Circuit. Bragg v. W. Va. Coal Ass'n, 248 F.3d 275 (4th Cir. 2001). A 1980 study conducted by the United States Geologic Survey in eastern Kentucky revealed selenium concentrations over 1 ug/l in 30 of 105 surface water locations. However, the maximum level recorded was 6 ug/l. "Compilation of Concentrations of Total Selenium in Water, Coal in Bottom Material, and Field Measurement Data for Selected Streams in Eastern Kentucky," July 1980, USGS Open File Report 2005-1354.