

Selenium and Phosphate Mining

In January, 1997, the U.S. Forest Service notified phosphate mining companies in southeast Idaho that elevated levels of selenium had been detected on and near phosphate mine sites. The Forest Service suspected the selenium of causing illness in some neighboring livestock. Phosphate industry representatives responded by joining federal and state agencies in an effort to collect pertinent data, analyze the situation, determine the extent of the problem, and to find a remedy.

Selenium

The element Selenium was discovered by the Swedish chemist Berzelius in 1817. A rare trace element, it is present in the earth's crust at only 0.09 parts per million (ppm), and ranges on average in soil from 0.2 to 0.4 ppm. Selenium is a metalloid, possessing both metallic and non-metallic properties. It can exist in an amorphous state or in any of three crystalline forms. Selenium behaves chemically very similar to sulfur.

Biological Effects

Adequate dietary selenium is needed to maintain health under stressful conditions such as (1) premature birth, (2) protein-energy malnutrition, and (3) tissue disorders caused by aging. Recent studies suggest that selenium may assist in prevention of certain cancers. The harmful effects of excess selenium in animal feed were first noted in the U.S. in 1860 among cavalry horses at Fort Randall in the Nebraska territory. Since that time, high selenium intake (Table 1) has been associated with acute (blind staggers) and chronic (alkali disease) toxicity. Ongoing research focuses on the effect of selenium on many other species. Selenium toxicity in water for aquatic organisms is believed to range from 3 parts per billion (ppb) for certain protozoa, to 5 ppm in some fish. For humans, the U.S. Environmental Protection Agency has established a primary standard for selenium in drinking water of no more than 0.05 ppm.

Phosphate Ore and Selenium

Selenium is unevenly distributed through the earth's crust (Fig.6). Certain mineral formations contain more selenium than others, and among those with higher concentrations is the Phosphoria Formation, from which phosphate ore is mined. In years past, neither the phosphate industry nor its federal and state regulators believed mining would cause elevated levels of selenium. Data collected in the early 1980's for the EPA, using established regulatory testing methods, suggested phosphate mine wastes do not leach selenium (Table 2). Average leachate test results in that 1983 study showed selenium from most phosphate mining materials at levels well below the primary drinking water standard.

In light of these data, the exact cause for elevated selenium levels detected near phosphate mines, and how they can best be reduced, are questions yet to be answered. The U.S. Forest Service, the Bureau of Land Management, the Idaho Division of Environmental Quality, the Idaho Department of Lands, and the Idaho Fish and Game

Department have joined with the phosphate industry in an Interagency/Phosphate Industry Selenium Working Group.

The Working Group

The Interagency/Phosphate Industry Selenium Working Group has, and will continue to, select and hire qualified research professionals. Montgomery Watson was hired as the consultant to compile available reports and to conduct the field sampling of water, soils, and vegetation. Samples are sent to the University of Idaho for analysis. The University of California at Davis serves as the quality assurance lab. Phosphate industry members have agreed to assist in underwriting research costs. The five participating companies on the Working Group are: Agrium, FMC, Solutia Inc (formerly Monsanto Co), Rhodia (formerly Rhone Poulenc), and the J.R. Simplot Company. All past and present mine sites have been thoroughly sampled and will continue to be sampled for at least one full year from the initial sampling taken in fall of 1997. The U.S. Geological Survey has collected detailed stratigraphic sections from the Meade Peak Phosphatic Shale Member with analysis for selenium to be conducted in early 1999 (Idaho Mining Association, 1997).

Extracted from Idaho State University Selenium archives - Field Guide to Southeast Idaho Phosphate District by Ray Petrun