

History with the selenium problem in Idaho mining

By Mark Mendiola

After it was discovered in 1997 that horses and sheep grazing near phosphate mining operations in Southeast Idaho were dying from selenium poisoning, the J.R. Simplot Company and other mining companies spent millions of dollars to prevent the problem from recurring and to clean up contaminated areas.

Bruce Winegar, Simplot's environmental engineering manager, said selenium obviously was present when strip mining in the region first started in the 1950s, but it was never recognized as a problem until several horses died after grazing near Agrium's Mabey Canyon Mine in Caribou County on pasture at the base of a mine dump. Selenium, a mineral that sometimes acts as a metal, naturally occurs in the environment and is used by the body as a nutrient in tiny amounts. "It doesn't take a lot of selenium to become toxic," Winegar said.

The canyon near where the horses were grazing was filled with overburden from a [nearby](#) phosphate strip mine. Water passed through it, collecting selenium and creating higher than normal levels in vegetation as well as the water. The horse kill was the first manifestation of the toxicity.

Phosphate typically lies in a bed with as much as 90 feet of overburden material over it that does not contain any selenium. That chert or overburden material is removed to mine the phosphate ore. Up to 80 feet of low grade shale typically is below the ore. It's removed and mixed with the overburden. It's the shale, not the ore, which usually has the higher concentration of selenium.

Historically, because the shale breaks down and contains phosphate, it was preferred by regulatory agencies as a growing medium instead of top soil. The shale would be spread on top to reclaim the land, and vegetation was planted in it and grew very well, but the agencies didn't realize the shale had high levels of selenium in it, Winegar said. Virtually all of the mines that were mined before 2000 had reclaimed areas with vegetation higher than background selenium levels, he noted.

"So, once it was recognized that there was a problem and what it was, we immediately began changing our practices on how we mined," he said. "We started to put those shales back in the bottom of the pit and cover them up with four to eight feet of chert and then put top soil on top of that. That helps keep the water away and the oxygen out."

[When shale is exposed to](#) oxygen and water, selenium [can](#) begin to oxidize and become mobile. The chert insulates the vegetation from the shale so roots don't go deep and absorb a lot of the shale's selenium. Different species of grass and vegetation absorb selenium at different rates. Some are considered "hyper accumulators, which can really suck up the selenium," Winegar said.

Sheep fatalities near Simplot's Conda Mine perplexed Simplot officials because the sheep had been grazing in the area for only short periods. More sheep added to the site also died. After rigorous evaluations of vegetation and water were conducted by the University of Idaho and Utah State University, it was determined that Aster and Gum Weed common in the area were hyper accumulators growing directly in "hot shales" that had a lot of selenium.

Their consumption of selenium of hyper accumulators could almost be measured in percentages – as opposed to parts per million. "It amazed everyone," Winegar said. "Normally, sheep won't eat those particular plants. They're not very palatable, but early in the spring when they first come up, and they're still kind of tender, the sheep will eat them."

It was in the early spring when sheep herds were run through that area. "That was the worst time to do it because that's the *only* time the sheep would eat those things. With that much selenium in them, they're just really toxic. So, it was just like eating a poisonous weed."

Simplot, Monsanto, Agrium, FMC/Astaris and Rhodia, which all operated phosphate mines in Southeast Idaho, voluntarily conducted a joint area-wide selenium study that later was formalized under the Idaho Department of Environmental Quality's direction. State and federal regulatory agencies, the Shoshone-Bannock Tribes and the consortium of mining companies signed a memorandum of understanding and a consent order to study the effects of selenium and phosphate.

As a result, two documents were produced – an areawide risk assessment for human health and environment management plan and a risk management plan for a territory stretching from the Gay Mine on the Fort Hall Reservation to Montpelier and a small mine on Bear Lake. Each of the five mining companies spent up to \$1 million each on the areawide study, Winegar said.

The risk assessment showed no serious risk to human health, any wildlife or the environment on a population basis due to selenium, but it did identify areas of high concentrations that could be detrimental to individual wildlife or water fowl. Those 14 sites were identified for further study on a site specific basis. The Smoky Canyon Mine was a top priority because it was a cross valley fill with a stream flowing through it. The North Mabey Mine had already been made a Superfund site.

Simplot signed a consent order with the U.S. Forest Service and a separate assessment on a tailings pond under the state's direction. U.S. Fish & Wildlife was concerned about waterfowl nesting near the pond and bald eagles feeding on them. No risk was found to the eagles, Winegar said, but potential risk to resident waterfowl nesting on the pond and raising young was identified. There was no threat to transient waterfowl coming through the area.

“We revised the management plan and agreed to destroy wildlife habitat around the tailings pond,” Winegar said.

Simplot also revised its abandonment and closure plan so that when it closes and leaves, the tailings pond is covered and water is routed around it so it doesn’t collect selenium. Simplot spent another \$2 million on a site investigation plan contracted out to an independent researcher without turning a shovel of dirt, winegar said. The site investigation report was finished in June 2005. A draft engineering evaluation and cost analysis was published in November 2005.

Simplot also negotiated a second consent order with the state regarding the Conda Mine after Smoky Canyon issues were resolved. However, IDEQ and the EPA got into disagreements regarding jurisdiction, delaying Conda’s mitigation for two years, Winegar said. They reached an agreement in the spring of 2006 to jointly take the lead. That paved the way for later finalizing an administrative order of consent for the Gay Mine -- jointly run by Simplot and FMC.

“Just the fact we have mined for nearly 50 years and selenium never manifested itself as a problem was indicative that this was not a real serious problem,” Winegar said. “I think we’ve got a pretty good handle on it now, and there’s still a lot to learn. We’re doing a lot of work and [investing](#) a lot of money [in site investigations](#).” Mining companies have been eager to rectify the selenium problem, he said, while regulatory agencies have adopted a conservative approach to make sure it’s done correctly. Both are cooperating to ensure there is no threat to people, wildlife or the environment.