

Experiences and Challenges with Selenium Treatment

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Selenium reduction of mine influenced water has been an issue in the West Virginia coal fields for over a decade. Is selenium reduction just a West Virginia issue? Is selenium just a surface mining issue? Selenium reduction is a problem that has been very difficult to solve, not only in WV but across the world. What technologies have been tried, what works and will they be sustainable? Many different technologies, techniques and methodologies have been investigated. Some solutions work in the “test tube”, but are they scalable?

What technologies have been investigated? Which reduction systems worked? Which technologies are scalable and sustainable? Most reduction techniques reviewed only address the reduction of selenium not as a turn-key solution to allow water to re-enter the environment. Solving one problem can create multiple other issues.

Selenium reduction is an issue in many countries with research ongoing across the globe. Many types of mining, mineral processing, electricity generation, solid waste landfills and oil refineries require selenium treatment. Different types of iron based systems, ion exchange, reverse osmosis and biological systems have been researched and pilot tested. Numerous technologies after the completion of pilot testing were eliminated due to inefficiency, cost and non-sustainability.

With the urgency for regulatory compliance, a few pilot studied technologies were advanced. Zero valent iron (ZVI) was first highlighted at this conference in a presentation by Dr. Ray Lovett in 2007. There are many forms of ZVI such as wound steel wool, sulfur modified iron (SMI), and powered iron. Zero valent iron and SMI has been used for decades in the reduction of many parameters of concern. ZVI and SMI will work on both selenite and selenate species of selenium.

Biological systems appear to be the technology that the West Virginia coal industry has adopted. There are many different biological systems that have been piloted tested as well as full scale systems installed. Full scale fluidized bed reactor (FBR) as well as moving bed bioreactors (MBBR's) were installed in the West Virginia coal fields. These systems have very high capital cost and very high operating and maintenance costs.

The biochemical reactor (BCR) systems are currently utilized extensively for selenium reduction throughout the coal fields. These systems are semi passive and have moderate capital costs. These units have a very complex self-contained biological system utilizing indigenous microbes. The types and numbers of microbes in these systems are continually evolving and have a very slow adaptation to loading changes (flow/concentration). There are many different approaches to the sizing and media compositions for these systems. There are many resultant issues that are created by these systems.

Has the selenium reduction solution been found? Time will tell.