

# How It Works

## Biological Treatment of Selenium

Selenium poses one of the world's conundrums. It was identified in the 1950s as an essential nutrient when consumed in trace amounts. However, it is toxic at higher concentrations and capable of causing myriad health problems for humans and wildlife. It is particularly problematic for aquatic animals, because it bioaccumulates and enters the food chain.

Selenium has become a significant regulatory concern in the fossil fuel and mining industries. In the 1970s, the U.S. Environmental Protection Agency began regulating it, setting the maximum contaminant level for water in the parts per billion. As knowledge of the chemical characteristics, fate in the environment and

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analysis has improved, the regulatory control has become increasingly stringent.

"Many of our clients are concerned about regulatory liabilities associated with selenium," says Brian Foy, industrial water/wastewater director in the Burns & McDonnell Water Group. "The tightening regulatory environment is forcing organizations to consider improvements to wastewater and stormwater management systems."

As a natural element, selenium cannot be destroyed. The effectiveness of physical, chemical and biological treatment options is dependent on the selenium state, which also affects mobility and toxicity in the environment. Biological treatment is promising because it converts selenium to a less toxic form, concentrating the dissolved

selenium as a solid. Both mechanical and natural treatment systems have been used to biologically reduce selenium in water.

Biological treatment of selenium works by bacteria using selenate and selenite as electron acceptors. Dissolved selenium is reduced to elemental selenium, which becomes associated with the microorganisms and can be removed from water using gravity settling and/or filtration.

"Biological treatment of selenium provides a cost-competitive option to meet regulatory limits," Foy says. "While biological treatment is not feasible for every project, it has proved to be a useful tool in protecting the environment while balancing the cost of regulatory compliance."

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