Water Quality

Effective and Economical Solutions

Background

The availability of quality water has always been important to human, animal, plant, and aquatic life. In the latter part of the 20th Century it became apparent that extensive population growth, coupled with industrialization and changing agricultural practices, was degrading environmental quality. In the United States, the Clean Water Act and the Safe Drinking Water Act created a regulatory framework to protect both groundwater and surface water quality and to insure that drinking water was safe. As we enter the 21st Century it has become apparent that our approaches for maintaining water quality can also impact long-term economic sustainability. Thus, providing solutions to water quality issues that are both effective and economical is crucial.

There are several current and emerging water quality issues requiring effective and economical solutions.

Modern life creates water quality issues

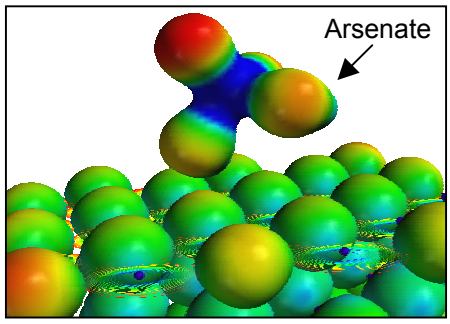
- A large portion of the groundwater in the Western United States contains high levels of naturally occurring arsenic.
- Fluoride also sometimes occurs naturally at high concentrations, which can lead to public health problems.
- M*t*BE (Methyl *tert* Butyl Ether), a gasoline additive, has begun to contaminate ground water supplies.
- Similarly, perchlorate has recently been discovered to be present in high concentrations at various manufacturing sites and drinking water supplies in California, Nevada, and Arizona. This contaminant from rocket fuel is highly mobile in groundwater.
- The EPA is investigating whether drinking water concentrations for pharmaceuticals and endocrine disrupting chemicals should be regulated.
- Current agricultural practices that focus on large feed lot and dairy operations are producing large fluxes of nitrates to both surface and groundwater.
- There are numerous rivers, harbors, and coastal areas where sediments are contaminated by historical industrial practices. Effective remediation strategies rely on understanding whether non-frequent events such as hurricanes and floods will disturb the contaminated sediments sufficiently to impair water quality.

Approach

Effective and economical approaches for maintaining water quality are needed if long-term economic sustainability is to be maintained in the 21st Century. Sandia will utilize and leverage its internationally-recognized waste management programs and expertise, unique laboratory and testing capabilities, and nanoscience and advanced manufacturing skills to generate solutions to water quality problems. Sandia will communicate extensively with water users, suppliers, and regulators to best understand the issues and to optimize proposed solutions.

Research and Existing Projects

Arsenic Treatment



Nanomaterials for arsenic water treatment

Sandia's contributions to understanding, predicting, and modifying radionuclide transport at the Waste Isolation Pilot Plant (WIPP) and proposed Yucca Mountain repository are directly applicable to water treatment. The treatment goal is to implement cost-effective filter media using "sorbent" materials that selectively capture contaminants. Sorbents are being emphasized since they can be deployed at multiple scales (e.g., large municipal, industrial, or home filter applications). Moreover, utilization of several sorbents in a filtration system allows for selective treatments for more than one contaminant.

Sandia has used nanoscale modeling and synthesis expertise to identify and engineer several promising sorbent materials for arsenic treatment. These advanced materials improve arsenic removal selectivity, capacity, and efficiencies as compared to standard filter media. In conjunction with CH2M-Hill and the University of New Mexico, the sorbents will be pilot-tested for large municipal applications. Sandia is also working collaboratively with the New Mexico Rural Water Association to verify applicability for rural New Mexico use.

Going beyond arsenic treatment, Sandia's strategy is applicable to a wide range of contaminants, including fluoride, perchlorate, M*t*BE, and others of interest.

Contaminated Sediment Transport Studies

As part of studies for the WIPP project, Sandia has established unique capabilities for assessing contaminated sediment transport during non-frequent events such as floods and hurricanes. Contaminated sediment transport studies are being performed for the Housatonic River in Massachusetts and for ocean dumping dredging operations associated with Boston Harbor and Cape Canaveral. Sponsors are the U.S. Army Corps of Engineers and the EPA.

Related Sandia Water Activities

This is one component of Sandia's Water Safety, Security, and Sustainability Initiative. Other areas include: Water Infrastructure Risk Assessment, International Water, Water Quantity, and Water Use Management.

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