

TREATMENT OF SELENIUM-IMPACTED WATER

The Selenium Challenge

Selenium is a redox sensitive metalloid that can exist in the environment as different Se species. Water treatment options that address one species may not work for others. By-products of Se treatment are challenging to detect using conventional methods and they can pose an increased risk to the environment. Regulatory standards for Se in water are extremely low. The investigation and treatment of impacted water require an innovative, adaptable, and educated team—a team actively involved in research and capable of developing and optimizing new technologies to provide treatment performance, offer cost-effective solutions, and gain stakeholder acceptance.



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Overview of Selenium-Related Services

Geosyntec has significant expertise in designing and implementing of Se treatment technologies for industrial wastewater, surface water, and groundwater. Geosyntec's pioneering work developing treatment technologies and successfully operating treatment systems provides clients with innovative, cost-saving solutions. Our Se-related services include the following:

- Knowledge and expertise in state-of-the-art Se analytical techniques and developments
- In-house biological and physicochemical treatability testing: batch mesocosm and column studies
- In-house microbial characterization services
- Biological fixed-film process expertise and optimization
- Pilot- and full-scale treatment system design, construction, and operation

In-House Treatability Testing



SiREM, a division of Geosyntec Consultants, has extensive experience in the design, execution, and interpretation of treatability studies for contaminants including metals and metalloids, such as Se. These studies can evaluate different remedial technologies, including bioremediation, chemical reduction, and oxidation. The can also assess site-specific parameters that support Se treatment systems.

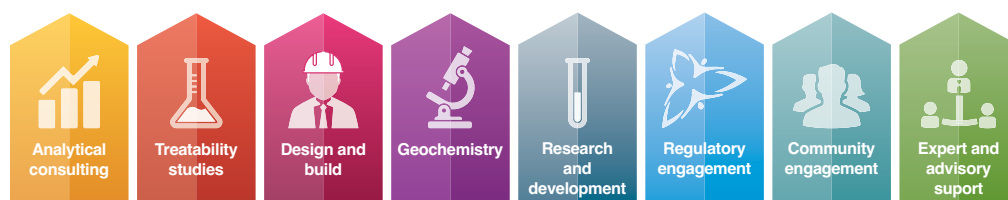
BIOLOGICAL TREATMENT

- Geosyntec specializes in biological treatment of Se using both passive and active treatment systems.
- Geosyntec has developed and designed several different types of bioreactor systems with key design elements: (1) ORP control, (2) fixed media support of biofilm, (3) small footprint, and (4) simple and inexpensive design.
- Several passive gravel bed reactors (GBRTMs) and active fixed-film reactors have been successfully operated to achieve stringent discharge requirements for Se (< 5 parts per billion).

PHYSICOCHEMICAL TREATMENT

- Physicochemical pre-treatment of complex industrial wastewaters is often required.
- Geosyntec specializes in treatability testing, and pilot and full-scale treatment system design for total suspended solids, sulfate, nitrate, and other dissolved co-contaminant species removal in Se impacted water to enable high treatment performance in downstream biological reactors.
- Geosyntec has experience removing organic Se species from wastewater through oxidation and adsorptive methods.

CORE SERVICES



TREATMENT OF SELENIUM-IMPACTED WATER

The Geosyntec Difference

WE OFFER:

- More than 15 Years of experience in Se treatment technology development
- In-house treatability testing capabilities
- Hands-on technology implementation experience and expert advisory
- A peer-reviewed publication record and investment in Se research

Relevant Projects and Client Service Offerings



GRAVEL BED REACTOR™ FOR TREATMENT OF SE IN AN URBAN STREAM

Geosyntec conducted long-term column studies, developed a design concept, and was a significant contributor to the detailed design and implementation of a below ground GBR system for treating water in an urban stream impacted by Se. The treatment system achieved less than 5 µg/L (micrograms per liter) Se in the effluent. This was accomplished within a small 2-acre footprint below ground, allowing ground-level footprint reuse.



FIXED FILM REACTOR FOR TREATMENT OF SE IN GROUNDWATER

Geosyntec operated a fixed film reactor for the biological treatment of Se and perchlorate as part of a groundwater treatment program at an industrial site. The system incorporated standard plastic bioreactor packing material as the media for growing a stable biofilm.



GBRTM FOR TREATMENT OF SE FROM GROUNDWATER SEEP AT A COAL MINE SITE

Geosyntec installed a GBR in an excavation beneath an existing parking lot to minimize the impact on other operations at the site. The excavation was lined with a geomembrane and then backfilled with gravel. The oxidation-reduction potential within the GBR is monitored to allow for adjustments in electron donor to maintain optimal conditions for removal of selenium below 5 µg/L. Reactor was placed below ground to allow for repurposing of the aboveground footprint as a parking lot.



EVALUATION OF SE AND NITRATE TREATMENT IN MINING WASTEWATER

Geosyntec evaluated GBRTM performance in a temperature-controlled flowthrough column and operated the system for a period of approximately 1 year. Operational conditions tested included influent concentrations of Se ranging from 150 to 1,000 µg/L; electron donor underdosing and overdosing; and water temperature ranging from 4° to 8 °C. Se specialization and microbial characterization were completed and demonstrated effective treatment via active Se reducers.

About Geosyntec

Geosyntec is a consulting and engineering firm that works with private and public sector clients to address new ventures and complex problems involving our environment, natural resources, and civil infrastructure.

With a combined staff exceeding 2,800 engineers, scientists, and related technical and project support personnel, we serve our clients from more than 130 offices in the United States, Canada, the United Kingdom, Ireland, Sweden, Finland, Spain, Saudi Arabia, the United Arab Emirates, and Australia.

For More Information

Silvia Mancini
Senior Principal
(416) 637-8745
smancini@geosyntec.com

Andrew Holmes
Senior Engineer
(519) 515-0857
aholmes@geosyntec.com

Geosyntec
consultants