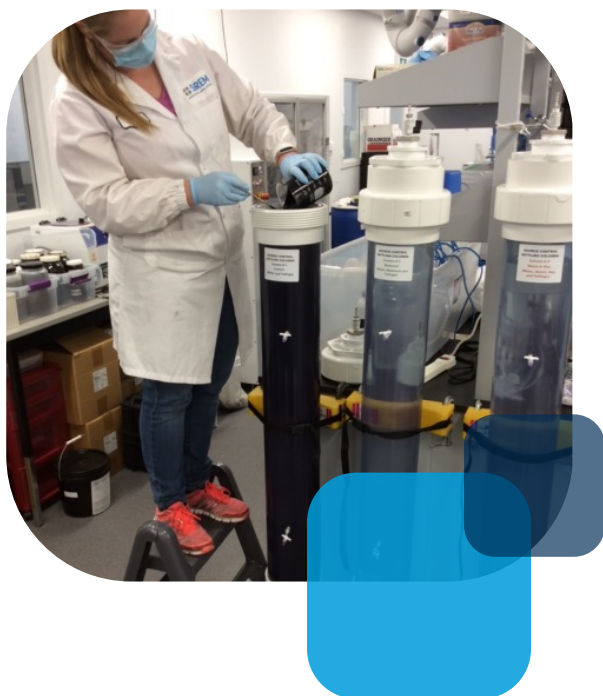


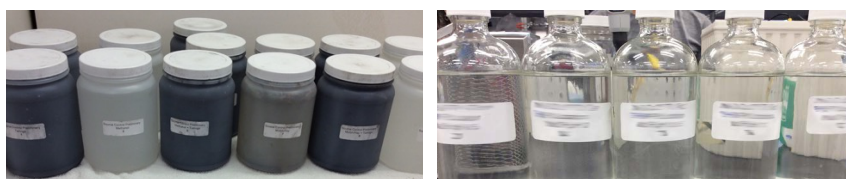


# Innovative Treatment and Monitoring Solutions for Mine-Influenced Water



Please contact SiREM for more information on our mining-related services cost quotation.

**SiREM knows that mining operations can have large and complex water treatment challenges. Turn to SiREM for solutions to your metals and other inorganic treatment and monitoring needs. We partner with you and draw on our deep experience to find new and innovative ways to treat mine influenced water.**



## **Understand and evaluate solutions for your site before picking the best treatment.**

Using batch microcosm and column studies in our state-of-the-art laboratories, we can evaluate biological and physical-chemical treatments, help you assess the feasibility of monitored natural attenuation, or find effective ways to treat common mine-related metals and other inorganic related constituents. Depending on your site, we can conduct adsorption tests to determine the bulk capacity, evaluate treatment kinetics, and assess microbial communities. Years of laboratory-to-field research show that these rigorous studies in the laboratory create successful projects in the field. All studies are conducted on a fixed-fee basis per test or treatment, to allow us to be flexible as work progresses.

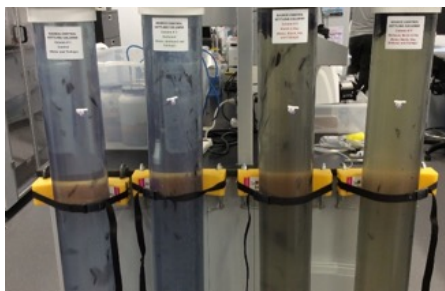
## **Plan, implement, and monitor effective bioremediation.**

We provide more than 50 targeted quantitative polymerase chain reaction (PCR) tests to assess processes involving sulfate-reducing/oxidizing bacteria, selenium-reducing bacteria, and iron-reducing bacteria, as well as to understand perchlorate and nitrogen-compound metabolism. Our Gene-Trac® next generation sequencing (NGS) characterizes microbial communities, highlighting iron, sulfur, arsenic, and magnesium metabolic pathways and identifying microbes relevant to mine-influenced water and tailings.

## **Investigate surface and bulk solid chemistry.**

Relying on our experience and industry partnerships, SiREM is adept at investigating solid-phase residuals. For example, we can evaluate the stability of sequestered constituents through sequential extraction and optical and spectral analyses to provide qualitative confirmation of solid phases.

# MINING RELATED SERVICES



**Below are some of the ways SiREM can help you address mine-influenced water at your site:**

- **Assess microbially mediated water treatment:**
  - Evaluate acclimation periods for natural microbial populations.
  - Optimize electron donor or acceptor additions (type and concentration).
  - Estimate site-specific enhanced contaminant degradation rates.
  - Assess the need for, and benefits of, bioaugmentation.
- **Evaluate adsorption:**
  - Compare different sorptive media.
  - Evaluate loading rates and distribution coefficients using isotherm testing.
  - Assess the stability of the adsorbed dissolved constituents under various geochemical conditions using desorption testing.
- **Evaluate chemical precipitation:**
  - Understand how geochemical conditions (e.g., pH and oxidation reduction potential manipulation) could be altered to promote precipitation of dissolved metals as carbonate, hydroxides, oxides, or sulfide solid phases.
  - Assess different media that could be used to promote precipitation.
- **Evaluate chemical reduction:**
  - Test zero-valent metals (ZVI) products to measure chemical-specific reaction rates.
  - Evaluate rate and extent of chemical reduction using other commercial amendments, such as sodium sulfide or sodium hydrosulfide.
- **Understand whether microbial populations are degrading, or could degrade, target compounds:**
  - Determine the impact of amendments on the microbial community.
  - Identify inhibitory conditions for specific microorganisms.
  - Determine the impact of electron donors, pH buffers, nutrients, and bioaugmentation.
- **Decide whether monitored natural attenuation is an option:**
  - Evaluate monitored natural attenuation and distribution coefficients using isotherm testing.
  - Assess stability of the adsorbed dissolved constituents, under various geochemical conditions using desorption testing.
  - Evaluate the nature, rate, and extent of intrinsic biological and abiotic degradation.
  - Determine bioavailable and mobile concentrations of dissolved metals and inorganics with SPeepers™ passive samplers.

Please contact SIREM for more information on how our mining related services can help solve your concerns or to obtain a cost quotation for our services.

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