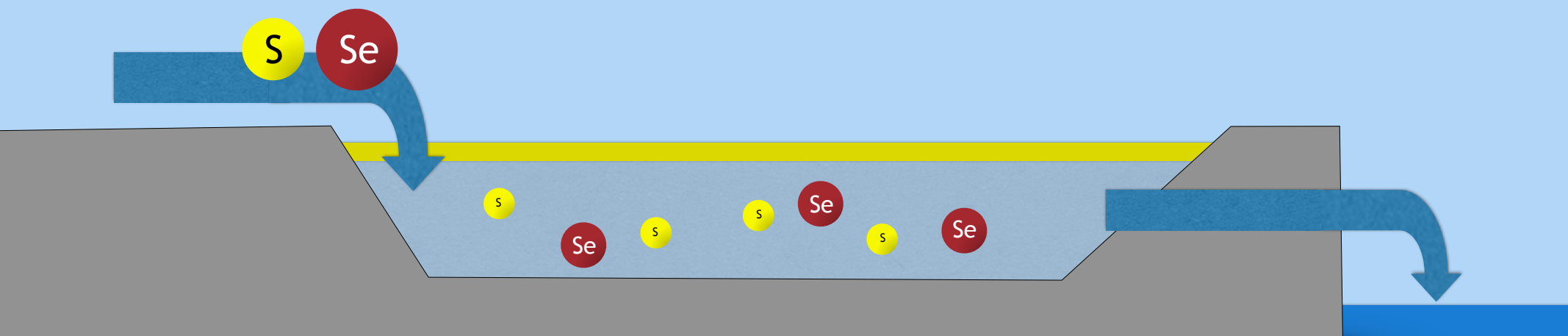
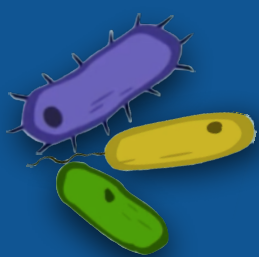


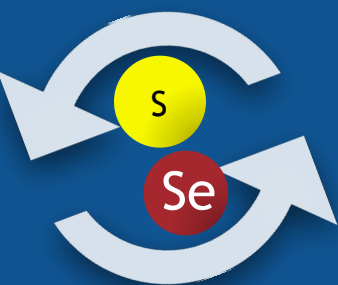
Selenium release is a critical environmental concern for the mining industry. Selenium is an analog of sulfur and a minor but more toxic component of sulfide minerals. Metal and coal mines in Canada released ~20 tonnes of Se to water in 2012.



OBJECTIVES



Identification and characterization of sulfur- and selenium-reducing microbial communities



Model of the stability of sulfur and selenium bioprocesses

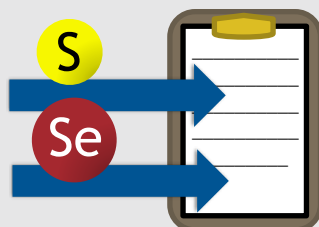


Characterization of relevant enzymes in selenate- and selenite-reducing bacteria



Database of process, operational, analytical, and microbiome data for bioprocesses

METHODS



Functional screening of selenium- and sulfur-active enzymes

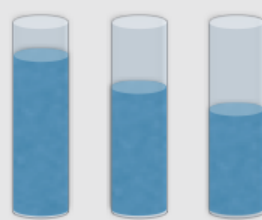


Metagenomic analysis of microbial communities



Bioprocess modeling and techno-economic assessments

INDUSTRY ENGAGEMENT



- Wastewater samples

- Integration of process in current operations



- Process data

- Data for techno-economic analysis

DELIVERABLES

The following will feed into the development of selenium and sulfate treatment technologies from mine process waters.

- ▶ Collection of selenite-reducing cultures capable of treating selenium-contaminated waste water
- ▶ Correlation between microbial population function and process variables
- ▶ Standard operating procedures, reactor designs (bench and field scale), and microbial communities for treating selenium- and sulfate-contaminated waters.

Year 1

Year 2

Year 3

Year 4/5



Operate laboratory-scale bioreactors for biological reduction of oxyanions

Operate continuous pilot and full-scale wastewater treatment reactors on-site for biological reduction of oxyanions

Develop options for stabilization and disposal of Se-containing biosludge

Develop improved standard operating procedures (SOPs) and tools for stabilizing wastewaters containing selenium and sulfate

Enrich selenate-reducing bacteria from coal-mine environments with high specificity and tolerance to high salinity

Characterize relevant enzymes in selenate- and selenite-reducing bacteria

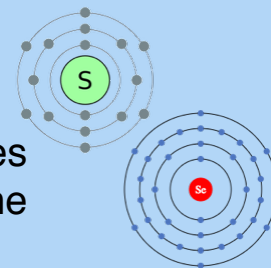
Identify enzymes required for the formation elemental Se and S, and polysulfides and selenides

Database for all process, operational, analytical, and microbiome data

Novel bioprocess modelling and control approaches

Techno-economic impact evaluation and LCA of Process 1

Process 3
Bioprocesses
Treating Mine
Waters



Enabling Technologies