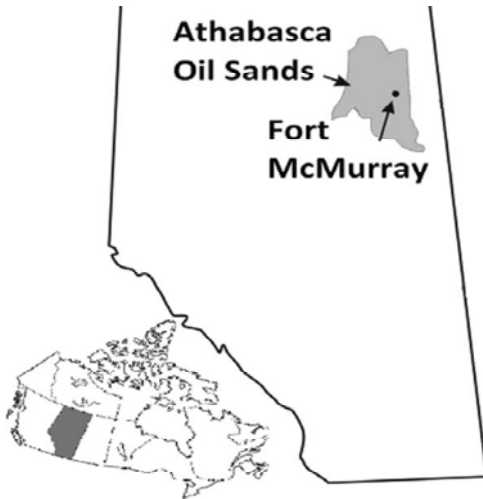


# Sulfur Cycling in Oil Sands Tailings Ponds

## Athabasca Oil Sands Development and Processing



Jonathan S. Price, 2009

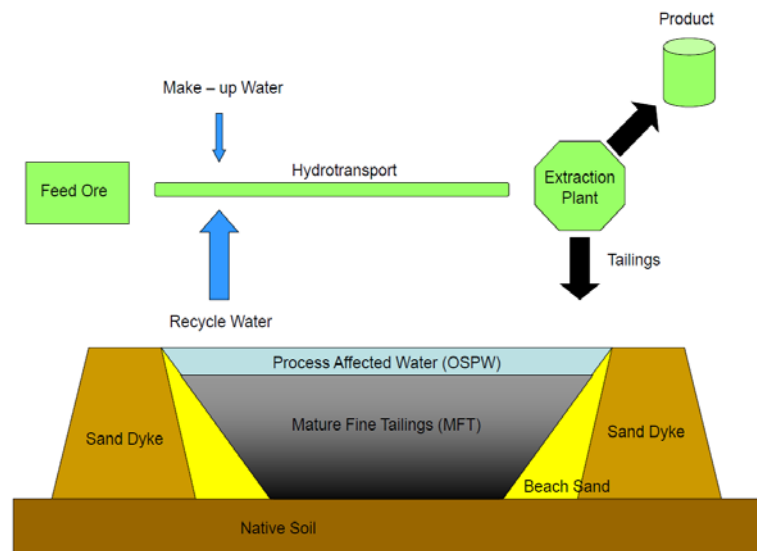
### Background

Large petroleum deposits were found in the Athabasca Basin around Fort McMurray (Alberta/Canada). Those areas are mined and processed for the **production of bitumen**.



### Upgrading process

**Bitumen** is separated from other constituents such as **clay, sand, dissolved metals** and **organic compounds**, including **PAHs** and **naphthenic acids (NAs)**. The tailings discharge is stored in on-site **tailings ponds**, where **toxic organic** and **inorganic** constituents are **concentrated**. Oil sands companies are held to a **zero-discharge policy** and are responsible for **reclaiming** the mining areas. Tailings ponds are considered to create **wetlands**.



BGC Engineering, 2010



# Sulfur Cycling in Oil Sands Tailings Ponds

## Importance of anaerobic MO in tailings ponds

Tailings ponds are **microbially active**, incl. sulfate-reducing bacteria (SRB) and methanogens. Thereby the microbial activity is **affecting tailings ponds properties** e.g. due to biodegradation, biofilm formation, surfactant-production, biocorrosion, toxicity, souring or biodensification. The knowledge about those processes is important for future **pond management** (release of porewater) and **reclamation strategies**.

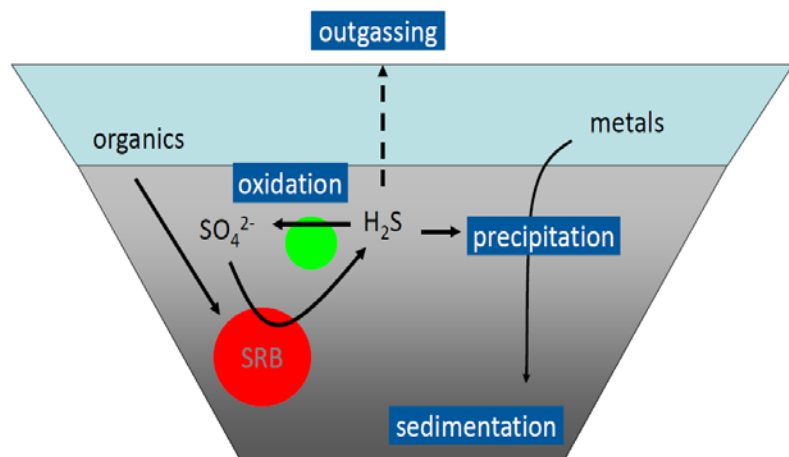
## Questions

Can SRB be used to **detoxify organic compounds**?

Can SRB be used to **decrease metal contamination**?

Do SRB have an **influence on sedimentation**?

How can we **reduce outgassing of H<sub>2</sub>S**?



## Aims and Methods

### Quantification of S - cycling within a tailings pond and characterisation of microorganisms that are involved

Characterization of a **microbial community** from a tailings ponds by culture-based (**MPN and microcosms**), **isotope** ( $^{35}\text{S}$  sulfate-reduction-rates and stable isotope approaches for quantifying S - cycling) and **molecular methods** (**DGGE fingerprinting, sequencing, FISH**) as well as the **enrichment and isolation** for phylogenetic and physiological characterisation. Furthermore different microbial activities, like the processes of **sulphate-reduction, sulphide-oxidation, iron-reduction and methan / CO<sub>2</sub> – production** shall be investigated by the use of different incubations and assays (microcosms) under certain conditions.

**Beside the laboratory work, biogeochemical gradients as a function of depth shall be determined in field studies**

e.g. **vertical profiles** of temperature, conductivity, pH, Eh, O<sub>2</sub>, H<sub>2</sub>S with a **multiparameter-probe**.

