# WEF Workshop 2016 – Activities in Water Research

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Panel 5

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# Water Research - Areas of Interest

1. Treatment of Mine Impacted Water (MIW) using Biological Sulphate Reduction (BSR)
    - Active systems
        - Low cost waste as substrate
    - Passive systems

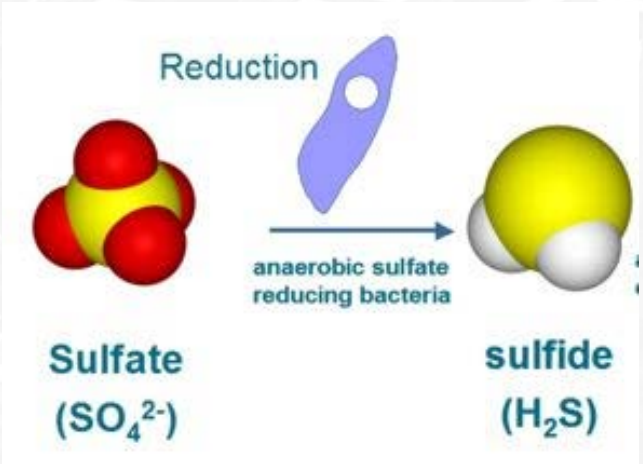
2. Water Reuse
    - Reuse of MIW in agriculture

# Background

- South Africa is a water scarce country - currently rated 30th driest country in the world
- MIW from coal & gold mining industries is a threat to quality of water supplies
- Recent stricter regulations for discharge of sulphates globally & in SA
- Current treatment methods include:
  - **HDS lime precipitation** (large volumes of sludge, high sulphate concentrations discharged) – method of choice for govt for AMD treatment
  - Reverse osmosis (large volumes of brine produced and high opex costs)
- Limitations, unsustainable in the long term

# Biological Sulphate Reduction (BSR)

- Dire need for alternative, sustainable, low opex and capex processes for treatment of MIW
- Biological Sulphate Reduction identified as an option



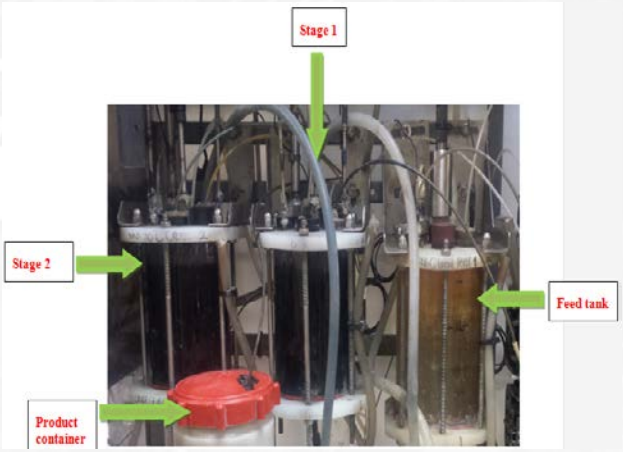

- Require organic substrate
- Anaerobic process
- Also application for low-cost ‘post mine closure’ treatment of MIW

# Advantages of Biological Sulphate Reduction

- Both [sulphate] and [metals] can be reduced to very low levels
- Less solid waste with less toxicity & increased stability compared to chemical precipitation methods
- Capex cost relatively low
- Potential to reduce opex costs by:
  - Formation & selective recovery of commercially profitable metal sulphides
  - Potential to recover saleable $S^0$
  - Can utilise inexpensive carbon sources
- Produce alkalinity
- Eliminate/reduce financial surety required for closure & rehabilitation

# Active Biological Sulphate Removal

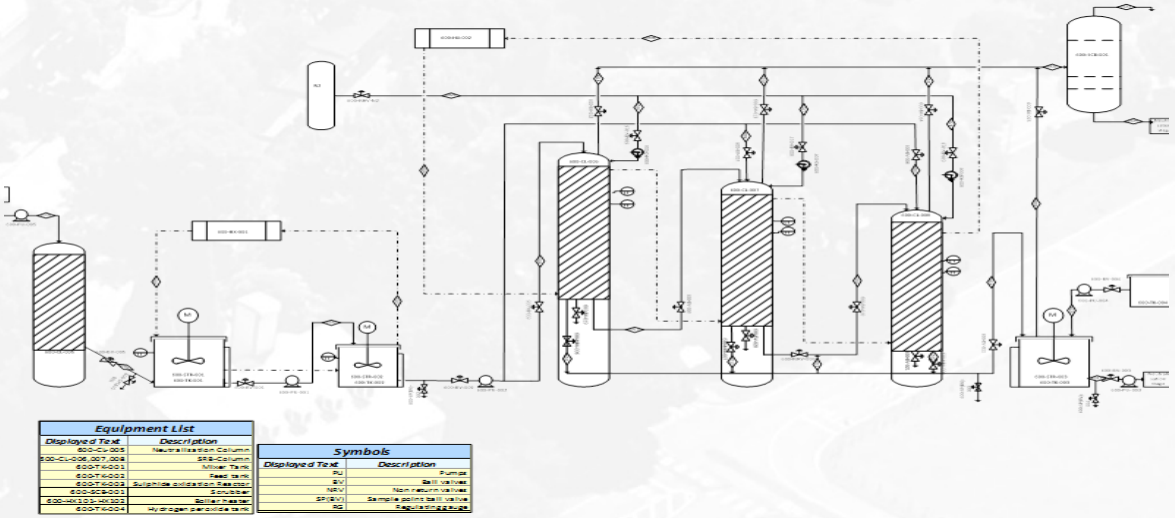
1. Lab-scale optimisation of active systems for treatment of AMD from both the coal and gold mining industries
   - the use of crude glycerol, a waste product, as substrate demonstrated
   - >90% sulphate reduction achieved




2. Verification of optimised conditions in 1m columns

3. Flowsheet development

4. Demonstration on pilot-scale (2016)

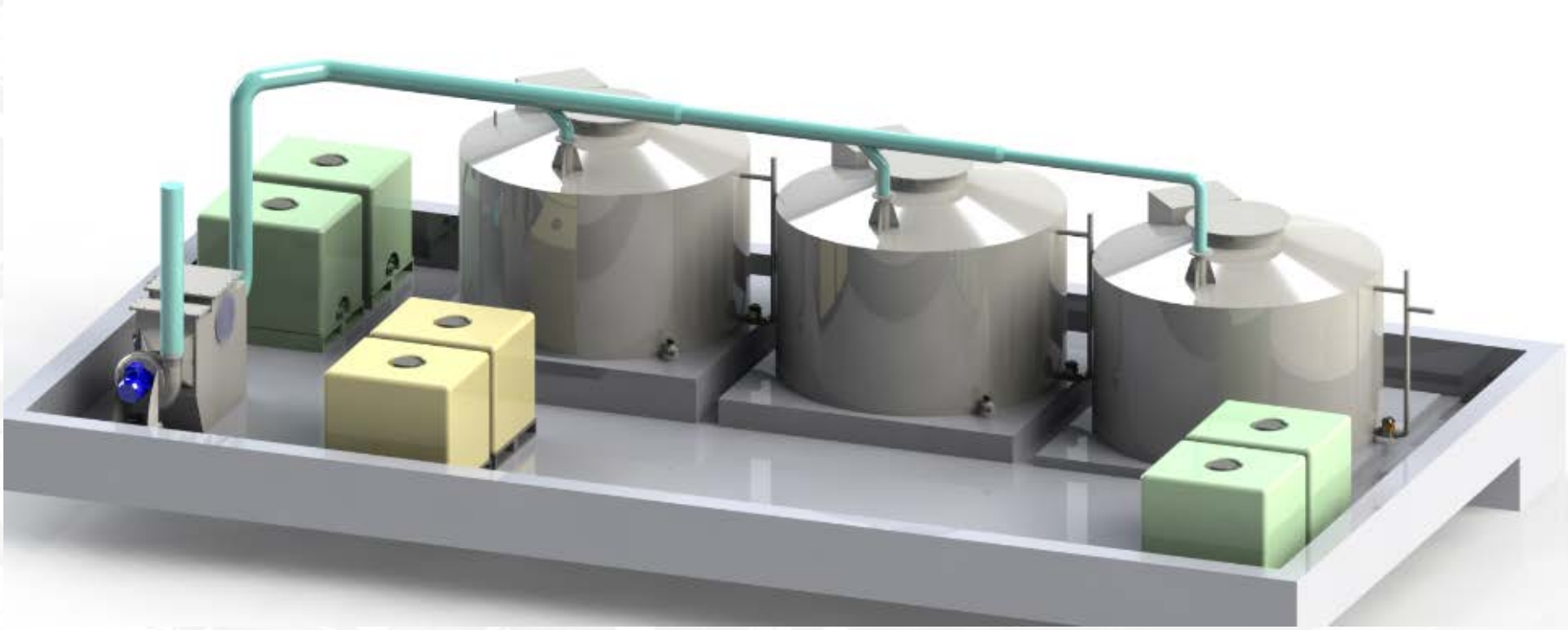


| Equipment List | |
|---|---|
| Displayed Text | Description |
| 600-CV-005 | Neutralisation Column |
| 600-CL-006_007_008 | SRB-Column |
| 600T-M001 | Mixer Tank |
| 600T-0002 | Feed tank |
| 600T-0003 | Sulphide oxidation Reactor |
| 600-SCB-001 | Scrubber |
| 600-HX103-HX102 | Boiler Heater |
| 600T-M004 | Hydrogen peroxide tank |

| Symbols | |
|---|---|
| Displayed Text | Description |
| PU | Pumps |
| BV | Ball valves |
| NRV | Non return valves |
| SP-BV | Sample point ball valve |
| RG | Regulating Valve |

# Passive Biological Sulphate Removal

Collaborative project with European partners to develop passive systems for treatment of AMD from both the coal and gold mining industries in Europe and South Africa.



- >90% Sulfate removal efficiency
- Demonstration at pilot scale at a local colliery from January 2017

# Water Reuse

- Agriculture accounts for 60% of freshwater withdrawals in SA (1000L/kg cereal grain; 43 000L/kg beef)
- The National Development Plan (NDP) has identified agriculture as a key driver of food security, job creation & social capital in rural communities.
- Planned increase in irrigated land by 2030 ~33%
- Will result in an increase in demand for water in the agriculture sector from 8.9 $km^3/y$ to 9.7 $km^3/y$ by 2035
- Govt predicts ~3.5 $km^3/y$ shortfall by 2030
- **Where will this water come from????**
- One of the commitments of the National Water Resources Strategy (Second edition) (2013) is “DWA (now DWS), with sector partners will explore use of new technologies for **re-using waste water and for using treated mine water**”.

# Water Reuse

- Mintek is in the process of designing an integrated treatment and reuse plan for MIW
- Will include (but is not limited to) our passive BSR technology coupled to the irrigation of food/energy crops


MINTEK