Acid Mine Water Reclamation using the ABC Process

(Alkali Barium Calcium Process)

M de Beer, J Maree, J Wilsenach, S Motaung, L Bologo, V Radebe
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Outline of presentation

- **Background**
- **AMD treatment**
- **CSIR’s ABC desalination process**
- **Results – water stage**
- **Sludge processing stage**
- **Conclusions**
- **Acknowledgements**

Background

Mining activities in SA
- Important sector of the SA economy

Abandoned mines
- Threatening the environment
  - Water not pumped from closed mines
  - Converted to AMD

Effectively treat AMD
- Reduce the impact on the environment

AMD Treatment Options

Physical processes
- Reverse Osmosis, Ion exchange

Biological processes
- Sulphate reduction

Chemical processes
- Precipitation reaction

Disadvantage of chemical processes
- High operating costs
- Disposal of bulky sludge

AMD Treatment

AMD characterized by one or more or the following:
- Low pH
- High heavy metals
- High TDS and sulphate

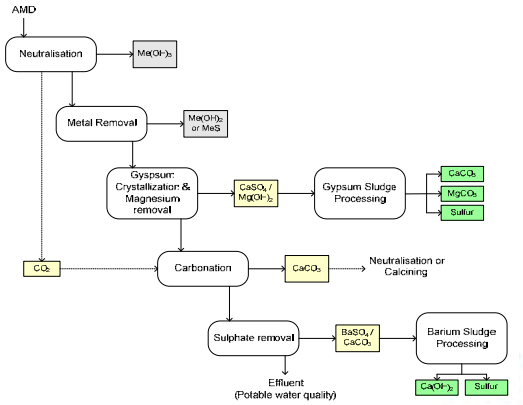
Treatment unit operations
- Neutralization
- Metal removal
- Desalination and or sulphate removal

ABC Desalination Process

Chemical precipitation process
- Neutralize acidic water
- Remove metals
- Remove sulphate

Water treatment section is integrated with a sludge processing section to recover:
- **A**lkali as $CaCO_3$ and $MgCO_3$
- **B**arium as $BaCO_3$
- **C**alcium as $Ca(OH)_2$

ABC Desalination Process



Technology Demonstration

Project initiated to treat 360 ML/day AMD
- Reclamation of excess mine water

Ultimate goal
- Create a zero-effluent discharge plant
- Treat contaminated mine drainage to potable water quality

Pilot scale demonstration unit (1m³/day)
- Treat water to drinking water quality standards
- Design and costing of a full-scale plant (75 ML/day)

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Demonstration plant

Results

Parameter		Feed	Treated
pH		3.3	7.9
Total Acidity	mg/L as $CaCO_3$	714	0.6
Sulphate	mg/L as SO_4	1910	90
Magnesium	mg/L as Mg	124.6	1.0
Calcium	mg/L as Ca	205	75
Iron (II)	mg/L as Fe	180	0.3
Aluminium	mg/L as Al	2.97	0.01
Manganese	mg/L as Mn	63.69	0.09

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Barium Recovery Stage

Sulphate removal
- $SO_4^{2-} + Ca^{2+} + BaCO_3 \rightarrow BaSO_4 + CaCO_3$

Barium sludge processing
- $BaSO_4 + 2C \rightarrow BaS + 2CO_2$
- $BaS + H_2O + CO_2 \rightarrow BaCO_3 + H_2S$

Barium recovery stage
- Eliminate the high cost of barium salts
- Eliminate environmental toxicity of barium

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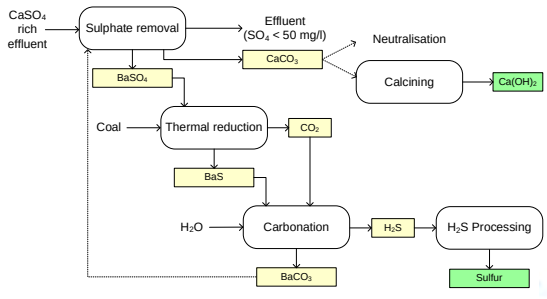
Barium Sludge Processing

Option 2



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Conclusions

AMD is the most critical environmental problem created by mining

Treatment of mining waste should be conducted in a sustainable manner

Sustainable solution is:
- Economical viable
- Generates little or no waste
- Energy efficient
- Not a source of pollution

Conclusion

CSIR’s ABC Process
- Provide SA and the rest of the world with an effective, affordable and therefore sustainable solution to the hazard of polluted water caused by mining activities

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Thank You