Briefing the Portfolio Committee on Water and Sanitation on Acid Mine Drainage and its Implications to Ground Water, Rivers and Dams

05 November 2014
Venue: E 249, 2nd Floor, New Wing

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Introduction & Background

What is AMD?
- Associated with gold and coal mining when water reacts with ore body and becomes polluted
- Arises during active mining; more prevalent when mines cease operations and water management interventions are absent
- Characterised by water with low pH, high salinity and dissolved metals
- AMD usually unsuitable for the environment/beneficial use unless suitably treated
- Also associated with mine by-products such as tailings storage facilities & waste rock dumps

\[4\text{FeS}_2(s) + 15\text{O}_2(g) + 14\text{H}_2\text{O}(l) \rightarrow 4\text{Fe(OH)}_3(s) + 8\text{SO}_4^{2-}(aq) + 16\text{H}^+(aq)\]

- Isolate acid producing material from water and/or oxygen
- Treat water (high-density sludge treatment and/or de-salinisation)

Problem statement and risks associated with AMD/ Mine Water

- Considered one of the greatest environmental challenges
- Impacts water security (urbanisation, economic development, job creation and social risks)
- Negative impacts on surface- and groundwater quality (rivers, dams, boreholes)
- Emerging impacts on drinking water (Carolina, Emalahleni, communities relying on groundwater)
- Ecological destruction/impact on Heritage Sites e.g. Gold Reef City, Cradle of Humankind ???
- Flooding of neighbouring mines
- Ground stability impacts (subsidence and seismic activity)
- Lack of fund for environmental liabilities (such as US “superfund”)
- New mining in water-sensitive catchments
- Fragmented legislation

SA is a developing country and mining central to GDP – implication is that current and potential AMD challenges are perpetual – warrants sustainable management interventions!!!
South Africa's Mining-Energy-Water Nexus

Energy demand predicted to triple by 2030:
42,000 MW to ~84,000 MW
GDP/socio-economic development

Increased coal mining

Coal-fired power generation ~85% 

Nuclear ~4.5%

Increased uranium mining

Proposed "Hydraulic fracking"

Wind, Solar, Bio-fuels, Gas/Liquid fuels, Hydro-electric ~10%
(Infrastructure constraints)

Water demand
Mining/Social/Environmental

AMD/Mine water

The challenge erupts in the first known gold mine AMD surface decant
ca. 1 September 2002, Krugersdorp, GP (Western Basin)
AMD in the Wits and Implications for the Vaal Dam/ River System

- Uncontested evidence of AMD impacting the Vaal Dam/ River System (VRS)
- Unless mitigated, each m³ AMD requires 7-11 m³ dilution release from Vaal Dam to ensure downstream users are not compromised... expensive, unsustainable and water lost from VRS
- VRS Reconciliation Studies predict water security risks in VRS from 2016/17
- Potential catastrophic environmental and socio-economic impacts
- Even with LHWP-2 (planned commissioning in 2022), VRS may still face deficit

→ Challenge must be circumvented by de-salinating AMD thus:
  - Ensuring water security in VRS
  - Promoting beneficial use of purified AMD (water re-use as articulated in NWRS-2)
  - Enabling proposed additional mega-transfer augmentation scheme to be deferred

✓ Cost comparison: AMD de-salination “R10 billion vs “R40 billion mega-transfer augmentation scheme
Government’s actions to manage Wits AMD

- 1 Sep 2010: Inter-Ministerial Committee (IMC) on AMD and mine water management
- Situation assessment: DWS/DMR DGs appointed Team of Experts (DWS, DMR, CGS, CSIR, WRC, MINTEK and academics)
- ToE Report: "Mine Water Management in the Witwatersrand Gold Fields with Special Emphasis on Acid Mine Drainage" (AMD Report)
- 9 Feb 2011: Cabinet approval of AMD Report; and DWS tasked to action recommendations
- 6 April 2011: TCTA appointed Implementing Agent for "emergency works"

ToE Recommendations approved by Cabinet

- Prevent decant by pumping underground mine water to protect ECL
- Implement ingress control to reduce flooding rate & eventual decant + pumping volume & costs
- Treatment of AMD & water quality management
  - Neutralization & metal removal in the immediate short-term
  - Removal of salt loads from river systems in the medium/long-term (direct use or desalination to potable quality)
- Improve monitoring/research to inform better decision-making
- Monitor other AMD sources within Witwatersrand e.g. slimes dams
- Investigate & implement an environmental levy on operating mines to help cover the costs of mining legacies
Progress with “Emergency Works”
Immediate and Short-term solutions

Progress (emergency works)

1. Immediate solution – WESTERN BASIN
   - Rand Uranium (Gold 1) (Randfontein) AMD/ mine water plant upgraded and treating ~30 ML AMD daily
   - Improvement in surface and groundwater quality recorded
   - Additional refurbishment urgently required to eradicate decant (high rainfall ???)

2. Short-term solution – CENTRAL BASIN
   - New AMD pump-station, neutralisation and waste disposal facilities at the South-West Vertical Shaft, Germiston
   - Project commenced January 2013 and commissioned April 2014.
   - Pumping, treating (neutralising) and discharging ~56 ML AMD daily

3. Short-term solution – EASTERN BASIN
   - Project similar to the Central basin currently being developed at Grootvlei Mine No. 3 Shaft (Springs)
   - Project commenced June 2014 and commissioning projected for December 2015
   - Operational target to neutralise ~64 ML AMD daily
Western Basin

Immediate solution
Central Basin
Short-term solution