

# Solutions sought for SA AMD 'hot spots'



***The pollution of South Africa's scarce water resources through mining is arguably one of the greatest challenges facing the country. While South Africa is considered a global leader in mine-water treatment technology the magnitude of the problem threatens to engulf progress made to date. Lani van Vuuren attended the Water Institute of Southern Africa's recent Mine-water Conference where present challenges and possible solutions were discussed.***

**A**cid mine drainage (AMD) is not unique to South Africa. In fact, it is a truly international problem faced by all the major mining countries, with some arguing that it is perhaps the industry's most significant environmental legacy. The problem with South Africa is that the country does not have much water to begin with, thus any pollution could have serious future consequences.

More than 120 years of formal mining has left its mark on the South African landscape. The country is reported to have an estimated 10 000 km<sup>2</sup> of hydraulically interlinked coal mines in Mpumalanga alone, with about 300 km of interlinked gold mines on the Witwatersrand. Many of these mines were operated at a time when legislation was not cognisant of environmental management and

mine rehabilitation. Thousands of mining operations have been left unrehabilitated and ownerless as dwindling resources and changing markets forced their closure.

The Department of Minerals & Energy's abandoned mines database has recorded more than 4 770 derelict and ownerless mines across the country. This excludes abandoned

sand quarries and other small operations, which brings the number to about 8 000. These mines have now become the legacy of the State, and will take years, even decades, to fully rehabilitate. Meanwhile, all of these mines threaten the air, soil and water, and thus the health of the communities, around them.

**WINDS OF CHANGE**

Recent international trends have started to bring about change. As Dave Salmon of Anglo American’s Civil & Environmental Engineering Department pointed out: “There is increasing recognition globally, and at all levels of society, that management of water resources is essential to everything in life, such as food, energy, transportation, nature, leisure, culture, enhancing living standards and ecosystems health. Mining cannot afford to ignore this trend. ”

There has been some international collaboration in efforts to stem the problem of AMD through, for example, the International Network on Acid Prevention (INAP). This is an organisation of international mining companies dedicated to reducing the liabilities associated with sulphide mine minerals. Member companies have agreed to freely share information on issues of common concern. The network is supplemented with a Global Alliance of key research organisations (including South Africa’s Water Research Commission), which are actively developing management and treatment options for AMD. Present INAP initiatives include the development of a global guide to the management of AMD.

**AMD ‘HOT SPOTS’**

Meanwhile there are several AMD ‘hot spots’ in South Africa which require urgent intervention to prevent total ecological disaster. These hot spots have largely driven research into new

technologies for the management and treatment of polluted mine-water. Several areas were highlighted at the mine-water conference.

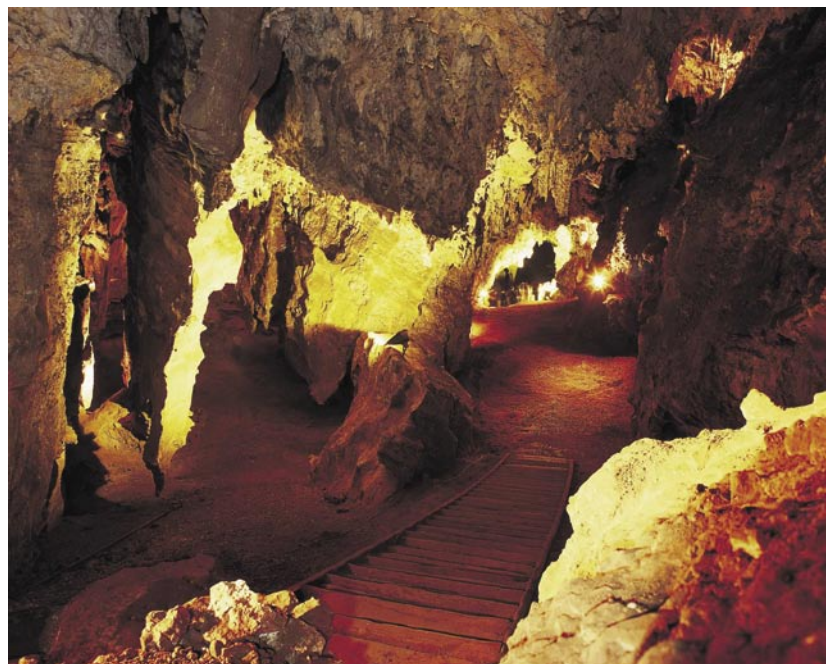
**“The country is reported to have an estimated 10 000 km<sup>2</sup> of hydraulically interlinked coal mines in Mpumalanga alone.”**

Delegates heard how radioactive and acid mine-water is threatening the health and well-being of communities and wildlife in the Western Witwatersrand Basin. Mine-water decanting from the 44 926 778 km<sup>3</sup> mined-out void has flowed into the headwaters of the Tweelopiespruit, which flows through the Krugersdorp Game Reserve. While some of the water is treated by Randfontein Estates, on whose property the decant is taking place, suggestions are that contaminated water is still entering the river.

Investigations of the hydrochemistry of the surface water of the Tweelopies through the Krugersdorp Nature Reserve has confirmed that the water quality has deteriorated to such an extent that it is unfit for human and animal consumption. In fact, the river is now considered a Class V river with a “very high acute hazard.”

Downstream communities have little to no access to piped water, and are thus very vulnerable. These include the Sterkfontein informal settlement and Krugersdorp Brickworks hostel dwellers. The Tweelopies further flows through a camp site used by church and youth groups. It has been reported that groundwater quality in the area is also deteriorating.

Of concern is the fact that the Tweelopiespruit flows through the Cradle of Humankind. Contaminated water, especially water with a low pH, could affect the natural water resource base of several sections of this World Heritage Site, which includes the Sterkfontein Caves. A working group has been established



Courtesy: SA Tourism

*The future of the Sterkfontein Caves, a World Heritage Site, could be in the balance if decanting mine-water on the West Rand is not brought under control.*





*Pollution due to mining remains one of the greatest threats to South Africa's water resources.*

to investigate possible solutions. It comprises Harmony Gold (which owns Randfontein Estates); Department of Water Affairs & Forestry; Department of Minerals & Energy; Department of Agriculture; Council for Geoscience; independent consultants, Mogale City and the Gauteng Department of Agriculture, Conservation and Environment.

### COLLECTIVE ACTION

In the Klerksdorp-Orkney-Stilfontein-Hartbeestfontein (KOSH) area, Simmer and Jack, Harmony Gold and AngloGold together with the Midvaal Water Company are collaborating to formulate a long-term water strategy to deal with AMD in the area. The underground mine systems of these gold-mining companies are all interconnected, and they all rely on responsible and collective mine-water management to sustain their individual operations.

Most water is pumped out at Margaret Shaft, located on Stilfontein Gold Mine. While the mine itself is no longer in use, about 37 Mℓ/day is pumped to the surface to allow surrounding mines to continue to operate deep underground. At the time of

writing, Chemwes Limited, which is reworking some of the old Stilfontein tailings dams, was using 18 Mℓ/day from Margaret Shaft; while another substantial amount was being conveyed to Buffelsfontein Gold Mine for general potable and process use. A small fraction of the water is stored and chlorinated before distribution to a number of farmlands in the area.

**“Downstream communities have little to no access to piped water, and are thus very vulnerable.”**

The remainder of the water is released into the Koekemoer Spruit, a tributary of the Middle Vaal River. It has been reported that the deteriorating water quality from the Koekemoer Spruit is impacting on the treatability of the water from the Midvaal.

A study was undertaken last year to assess a number of different mine-water scenarios, and to establish the amount of available water for reclamation and reuse from Margaret Shaft. Dr Ralph Heath from Golder Associates, the firm responsible for the study, indicated that the most

probable future scenario would be the establishment of a softening/membrane desalination plant to treat the Margaret shaft water before blending it with Midvaal water for distribution to municipal, industrial and mining water users.

An independent Section 21 (not-for-profit) company will most likely be established to manage the water from Margaret Shaft. The new company will be responsible for the operation of the shaft and the operation of all pumping equipment at the shaft to transfer all fissure water to surface on a daily basis. Each of the mining companies have agreed to provide one-third of the start-up capital required on loan account to the new water company. It is expected that the proposed water company will operate for the next 18 years or so while the existing mines remain in operation.

### SOUTH AFRICAN FIRST

In Mpumalanga, excess water from more than a century of coal-mining has led to the first initiative in South Africa where treated mine-water will be sold to a local municipality. A R300-million joint initiative between Anglo Coal and Ingwe Collieries will see the neutralisation and treatment of 20 Mℓ/day of AMD from three collieries using mainly membrane technology for sale to the Emalahleni Local Municipality (Witbank) – for more details about the process, see the May/June 2006 issue of *the Water Wheel*.

According to Anglo Coal senior project manager Peter Günther, the treatment plant was fast nearing completion, with commissioning expected by March. Meanwhile, a similar project has been initiated in the Steve Tshwete municipal district (Middelburg), and initial studies into the best process to treat mine-water from those coal mines have begun. 