

MINING & ENVIRONMENT

Acid mine drainage single most significant threat to SA's environment

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Environmentalists have termed acid mine drainage (AMD) the single most significant threat to South Africa's environment and this is being driven home by the AMD problems being experienced at the East Rand operations of provisionally liquidated and JSE-suspended Pamodzi Gold.

The AMD challenge at Pamodzi Gold's Grootvlei mine, in Springs, reached desperate proportions recently when the cash-strapped Pamodzi Gold GM: East Rand operations **Graham Chamberlain** was close to the point of being forced to release untreated AMD water on the surface in order to save Grootvlei's underground pumping station from flooding, which would have far-reaching regional consequences.

A concerned Department of Minerals and Energy then came to the party with a R7,5-million subsidy for January, February and March.

A feisty Chamberlain, whose team had been battling the crisis for months on a shoestring, was delighted at having secured the R2,5-million-a-month water-pumping subsidy.

And none too soon because a water-treatment dosage mechanism failure earlier in the month had already resulted in the release of AMD into the nearby wetland, turning the water orange.

An engineer suggested to Mining Weekly that insufficiently treated AMD was threatening to pollute the Blesbokspruit river, which was fed water from the wetland and which eventually entered the Vaal river catchment.

When Mining Weekly passed on these comments to Marius Keet, the deputy director of water quality for Gauteng for the Department of Water Affairs and Forestry (Dwaf), he was distressed and raised it at the meeting of government's task team on mine water last week.

Pamodzi Gold East Rand's No 3 Shaft has to treat AMD with lime, flocculant and oxygen before releasing it on the surface, but was having to cut down on the amount of chemicals used because of its cash flow drying up.

Crucial is the removal of iron in the AMD, which is the ingredient that turns everything an orange colour and Grootvlei has been using about 25 t to 30 t of lime a day, at a cost of about R1 095/t, to neutralise the iron.

Grootvlei is, of course, merely one of several problem gold mines in South Africa. Another requiring the attention of the government task team is the nearby East Rand Proprietary Mine, in Boksburg, along with several on the West Rand.

AMD mainly manifests after a mine has closed its operations, although it can be produced during an operation. AMD results from the oxidation of sulphide minerals in mine orebodies, such as pyrite, which are exposed in a mine or are present in dust in underground shafts and tunnels.

As a result of its acidity, AMD dissolves rock material and may contain a range of toxic metals. Water can become saline when AMD is neutralised through its reactions with rocks and, when mixing with other resources, can contaminate underground and surface waters.

The question remains, while the acknowledgement of the seriousness of the issue is a step in the right direction, whether it is too late. Or, can South Africa deal with the challenge of AMD and rid the country of a threat to its socioeconomic development, the environment, people and a much-needed natural resource?

OUT OF CONTROL?

So, what is the current situation in the county's AMD challenge?

The Water for Growth and Development Framework (WGDF), launched earlier this year by Dwaf, explains that ground- and surface-water pollution, as a result of AMD from abandoned mines, poses a threat and an obstacle to securing water for growth and development.

Dwaf reports that, in the central and western basins of the Witwatersrand mine systems, this threat is “present and immediate”, and requires urgent intervention. But, it says, the problem also has a medium- and long-term scope, with potential for ingress of AMD into the water table for centuries to come.

The WFDG reports that AMD poses a threat to water quality in terms of salinity, levels of sulphates and heavy metals. While AMD discharge from the Witwatersrand basins currently accounts for only 5% of the volume of water in the Vaal river, it does account for 20% of the salinity that could include heavy metals.

The immediate crisis with AMD in the Witwatersrand started in 2002 with the flooding of the western basin at a rate of 20-million litres a day, which resulted in Dwaf issuing a directive to the relevant mining companies to treat the affected water to a specified quality.

However, Dwaf reports that, despite significant investment by the mines in treatment facilities, the water standards specified in the directive have not been met and partially treated water is currently discharged into the Tweelopiesspruit. The situation has already resulted in the contamination of downstream boreholes and other environmental damage, which, if continued, is likely to result in significant claims for compensation.

As a consequence, Dwaf explains that, in the absence of operational pumping facilities, the central basin has flooded to within 900 m of the surface, threatening the perched aquifer above the AMD. The WGDF states: “Various studies predict that AMD will entirely decant into the central basin within three-and-a-half years. This situation not only represents a potential environmental catastrophe, but also threatens the structural integrity of the Johannesburg city centre.”

Potable water resources in and around the Witwatersrand basin are under increasing threat of contamination from AMD.

Environmental group the Western Basin Environmental Corporation (WBEC), and the Western Utilities Corporation, a subsidiary of Watermark Global, report that, unless the AMD challenge is effectively dealt with, potential exists for the water to enter and damage the Sterkfontein caves, which form part of the 3,5-million-year-old Cradle of Humankind, and the nearby Krugersdorp Nature Reserve.

But the WBEC will be governing the process of environmental water rehabilitation associated with AMD, which includes rehabilitating the contaminated water that is decanting from the underground voids of the Witwatersrand Basin, reducing further contamination of the potable water resources, and lessening AMD to sensitive areas by lowering the water levels in the underground voids.

Political scientist Dr **Anthony Turton**, also the director of TouchStone Resources – a company committed to uplifting South Africans’ survival and health – says that all the gold-mining areas in the country present an AMD threat, but that the Witwatersrand Basin’s massive mine void overlain by dolomite presents the biggest threat.

He adds that the next major decant will take place around Wemmer Pan, followed by Nigel.

“We don’t know the exact timing because it all depends on the water that is pumped underground and the volumes of precipitation, which is the so-called ingress water. This means that the small rivers draining the Johannesburg area – the Blesbokspruit and the Klip – flowing into the Vaal, will face a rapid decline in water quality in the near future,” Turton points out.

Also a cause for concern is the impact of the expansion of chrome- and platinum-mining in Limpopo and Mpumalanga provinces on the Olifants river, where crocodiles **are dying as a result of AMD, agricultural chemicals and sewage from urban settlements.**

The Federation for a Sustainable Environment tells *Mining Weekly* that it opposed the opening, by mining group Xstrata, of five coal mines in Mpumalanga, citing it as a threat to aquatic and terrestrial biodiversity as well as the long-term sustainability of irrigation projects.

Centre for Sustainable Mining in Industry (CSMI) director **May Hermanus** says that tackling AMD becomes a much higher priority as the scale of mining increases and once there is closer proximity between communities and mining. “If we look at the projections we need in terms of clean water, we still have a big problem. We have not stabilised our water delivery system,” Hermanus says.

The current global economic squeeze could result in the pumping being neglected. In the Witwatersrand Basin, for example, if pumping stops, the decant will be unavoidable as the mine void fills. This could occur within 36 months of the pumps being switched off.

Turton says that the current financial crisis is likely to result in marginal mines closing earlier than planned, and that it will hasten the decant as pumps are shut down and the void starts to flood.

However, Dwaf local government and water institutions deputy director Musekene Nndanganeni insists that the

current financial crisis should not be used to divert attention from the threat of AMD. "It's a normal business practice to make financial provisions for whatever risk arises, particularly a predictable one like AMD," he says.

THE AWAKENING

Media reports in recent months suggest an awakening of both government and the mining industry to the scale of the AMD problem.

At the WFGD summit, Chamber of Mines spokesperson **Nikisi Lesufi** said that AMD was a growing problem in the mining industry, and that it required "significant attention".

He added that, while the industry had made significant progress in reducing the contamination of the country's water resources, it needed guidance in resolving the problem.

Hermanus points out that a challenge faced by government is that the responsibilities for the different facets of the mining industry, such as licensing, industry impact or oversight, rest with different government departments.

Turton concurs, but adds that the cooperative governance clause in the Constitution does not allow for any department to challenge another and that government has never regulated mining efficiently. "Government has collaborated with mining to gain access to revenue streams, which means that the role of the regulator has been blurred. This is a hangover from the apartheid era and has not really changed since the advent of democracy," he adds.

Both Turton and Hermanus agree that the solution lies in the country's science, engineering and technology assets being leveraged, an approach that would require the involvement of all major participants in the energy and mining sectors, as well as government.

Turton is confident that South Africa can solve the AMD challenge through the adoption of a national water quality programme. "This would provide the vehicle in which the AMD solution would be nested," he says.

SIGNIFICANT BREAKTHROUGH

In March this year, Turton appeared on SABC3's Interface, and got the Minister of Environmental Affairs and Tourism, **Marthinus van Schalkwyk**, to agree that the AMD challenge could be solved in five years.

This, says Turton, is significant, as it is an acknowledgement by government that AMD is a limiting factor, which, if left unresolved, will severely impact on future economic development.

"If government recognises the strategic importance, this can result in technical teams being mobilised to really apply their minds to the solution, and result in investment starting to flow into the research community, and the commercial sector, where joint ventures will be possible," says Turton.

In solving the AMD challenge, Turton, like Hermanus suggests that the mine voids should be used for strategic alternative storage.

"The coal-based AMD is linked to our national energy strategy. We have masses of coal in reserve, but increasingly, we cannot use these reserves because of the externalised costs of mining the reserves. The Olifants river basin case is one that requires serious monitoring as massive irrigation schemes that employ thousands of people come under threat, and crocodiles start to die from Pansteatitis, driven in part by AMD. The AMD-related treatment price is too high as things stand now, but if we solve the problem, the obstacles are removed," augurs Turton.

TECHNICAL CHALLENGES

Challenges include the actual process of neutralising the water, and removing the harmful elements has to be cost-effective and sustainable without requiring support from the South African taxpayer.

Turton says that a second challenge is that the public has to trust the solution as being viable and non-harmful. He adds that the engineering aspects of possible seismic activities that could arise if the void is filled and emptied repeatedly need to be understood and resolved, and that the issue of rehabilitation becomes pertinent, as it is "massively" costly and technically complete.