



Briefing Paper 310

December 2012

Acid Mine Drainage A Legacy of Mining in South Africa

1. Introduction

South Africa has derived immense economic gains from its mining activities, and mining still plays an important role in ensuring the country's global trade position. However, the 1970s saw large-scale closures of mines within the Witwatersrand (Wits) region. Subsequent to the shutting down of mining operations there was a halt to the extraction of underground water from mines, leading to a phenomenon whereby this water (which is at this point acidic due to various chemical and geochemical reactions between mine rock, wastes and oxygen) decants or flows to the surface area. This is what we have come to know as Acid Mine Drainage (AMD). On 28 November 2012, the Catholic Parliamentary Liaison Office (CPLO) in collaboration with the Goedgedacht Forum for Social Reflection and Justice and Peace, organised a roundtable discussion entitled *Acid Mine Drainage: A Legacy of Mining in South Africa*, to explore this issue further. The speakers at this event were Professor Ewa Cukrowska, Chemistry Professor at Wits University; and Mr Fortress Netili, Hydrologist at the Council for Geoscience. This briefing paper will cover some of the issues discussed at the event.

2. A 120-year Mining Legacy

Professor Cukrowska gave us a history of gold mining in the Wits region and how we have come to find ourselves in the current position. She pointed out that gold mining commenced in the Johannesburg area in 1886, the gold being won from conglomerate layers of the Witwatersrand Supergroup. Mining activity transformed Johannesburg into a boomtown which today accommodates millions of people. Apart from

gold, 70 different ore minerals have been identified in the conglomerates, with the most abundant, after pyrite, being uraninite, brannerite, arsenopyrite, cobaltite, galena, pyrrhotite, gersdofite and chromite. Any of the metals in these ores may be toxic depending on the period of exposure and the concentration of the metal to which an organism is exposed.

More than 50 000 tons of gold have been mined throughout the mining cycle, leaving behind some 244 mine tailings dumps (mine dumps) containing 4 – 6 billion tons of waste. Mine dumps are an end result of mining and they cover hundreds of km² of the land in the Wits region. Unpleasant as they may be, they are an enduring aspect of mining, so it is important for the mine dumps to be set up properly with suitable barriers, lining and vegetation to minimise dust as well as water and soil pollution.

Some of the metals contained in AMD effluent such as uranium, thorium, radium, polonium, and some isotopes of lead are, in addition to being chemically toxic, also radioactive. The chief toxin of concern released by the gold mining industry is uranium, which has a very long lifespan and is radioactive and chemically toxic. Uranium and its derivative products have a long-term impact on the environment due to the fact that these elements accumulate in sediments and will continue to leech out of the mine tailings and slimes dams for centuries.

3. Institutional Challenges and Advances

Mr Netili made us aware that the first time the rising water levels in the Wits region were brought to the relevant government department's attention was in 1998, but no substantial action

was taken to prevent the decanting of acid mine water from the various mining basins. In 2009 an inter-ministerial committee (IMC) including the ministers of Water Affairs; Mineral Resources; Science and Technology; and Finance, as well as the Minister in the Presidency, was convened to deliberate on the AMD issue. The IMC's objectives were to understand the facts and science behind the AMD situation; to ensure consistency and calmness in explaining and communicating what was happening; and to regain and maintain the trust of citizens.

A team of experts comprising specialists from various government and academic institutions was appointed by the IMC. This team was tasked with reappraising the risk attributable to AMD; assessing what had been done by various institutions; considering available solutions and technology; examining the viability and costs of critical short-term interventions; and proposing integrated and sustainable medium- and long-term solutions to the problem. In all this they were to take into account the requirements for ongoing maintenance and explore possible partnerships with the private sector.

The report produced by the IMC and its task team declared that AMD extensively contaminates surface streams and could have devastating ecological impacts. The rising water levels are concerning because they could flood urban areas and result in geotechnical impacts that may jeopardise the integrity of urban infrastructure. Water levels have also been found to be rising in the mine voids (empty mines and mine-shafts). Such build-ups of huge, heavy masses of water could lead to an increase in seismic activity, presenting serious safety risks to deep underground mining, as well as to people and property on the surface in the vicinity of the mines. The report stated that the groundwater resources adjacent to overflowing acid mine water are also in danger of being polluted. Flooding may result in inter-mine water migration, and may threaten neighbouring operational mines.¹

Mr Netili pointed out that the main challenges to resolving the AMD predicament include a lack of sufficient funding; problems with environmental and other authorisations; a lack of reliable data; the mining industry distancing itself from its responsibility with regard to AMD; the identification of a suitable entity to operate and maintain infrastructure; and the impact of neutralised mine water on watercourses.

However, he noted that political will and government support, along with internal co-operation between the public and private sectors could go a long way in resolving these challenges.

4. Social Implications of Acid Mine Drainage

A recurring theme during the roundtable discussion was that of the often neglected social implications enveloping the entire AMD saga; this neglect is all the more serious in the case of poor and marginalised members of society because it is their homes that are built in and around the mine dumps where toxic water flows, and their immediate atmosphere is filled with dust and radioactive particles. The identified radioactive hot-spots remain occupied, unmitigated and in need of rehabilitation through intervention from the mines or government. It is an alarming reality that the people in the midst of the crisis, those from the majority of affected communities, are still excluded from the consultation process and are not engaged enough on the subject – curiously, this is in direct contradiction of one of the IMC's objectives. There are civil society organisations which have AMD awareness campaigns, but the need for government communication in this regard should really be prioritised.

In 2011, a report by the regional authorities of Gauteng Province confirmed that 1.6 million people were living in townships near to, or even in, one of the 400 zones marked as being affected by mining waste.² Some communities living in the rural areas adjacent to the mines in western Gauteng and North West Province are dependent on groundwater from boreholes, owing to the lack of municipal water. The surrounding farming communities and people living in informal settlements use groundwater and surface water for drinking purposes, to water livestock, and to irrigate crops. In cases where the water used for irrigation is contaminated by acid mine water, the potential exists for metal bio-accumulation in crops with a consequent human health risk. For example, the presence of uranium has been reported in the Wonderfonteinsspruit and in the Tweelopiespruit. This is a worrying revelation because plants absorb these metals readily through their roots, and from there they are passed on into the rest of the food network. The absorption of metals through the skin, gills, or digestive tract may cause necrosis, tumours, cancer, and the impairment of several organ systems and, of course, death.³

In the worst case, AMD's impact will be felt much further afield than just the Witwatersrand if polluted water reaches the Vaal River in significant quantities. Not only does the Vaal dam supply millions of people with domestic water, but the river flows into the Orange. A seriously polluted Vaal River system could thus lead to our largest river also being affected.

5. Legal Solutions

There appears to be a troubling absence of legal solutions when it comes to the entire AMD situation. Many gold mines were abandoned or became insolvent before the full environmental and socio-economic impacts of their operations became evident; this leaves us with a multitude of 'ownerless mines' due to past owners being untraceable and new owners blaming the problem on the previous mine owners. Needless to say, this makes it almost impossible for the mine custodians (past or present) to be legally compelled to remedy the negative impacts for which they were responsible.

Acts of Parliament are usually focused on the effects of activities,⁴ while the basis of common law remedies lies in considerations of negligence and nuisance. As such, those remedies are available to the party that has suffered harm and not usually to third parties. The common law applies to all mining operations, whenever the licences or permits were obtained, unless modified by legislation. Thus, in common law the landowner stands under no obligation to clean up contamination caused by another party on his or her property; nor is there a power vested in a local authority to order the landowner to clean contamination caused by another party. However, in the event that a landowner allows hazardous material that has accumulated on his or her property to escape and damage the

property of another, the first landowner would be liable to the second as per the judgment in *Lascon Properties (Pty) Ltd v Wadevill Investment Co (Pty) Ltd and Another 1997 (4) SA 578 (W)*.⁵

The occupants in the affected regions have the option to litigate or to request relocation to a safer place. Litigating against either the mining companies (where the liable entity still exists and can be brought before court) or public authorities would bring often poor communities up against opponents with very deep pockets and access to powerful legal teams; a risky gamble, extremely time-consuming and with no guarantee of success. Likewise, with current housing shortages and long lists of people waiting to be allocated land and houses, the option of relocation is not very attractive.

6. Conclusion

The relationship between mining companies and the government has historically been a mutually beneficial one, especially in the early years of the industry; as a result, many environmentally and socially harmful practices of the mines tended to be overlooked. This has to change. It is the moral duty of government – especially under a rights-based Constitution like ours – to look first and foremost at the well-being of its citizens and the preservation of the environment before indulging the financial interests of local or multinational corporations. The time for turning a blind eye to the social ramifications of AMD is long gone, and we have to face the fact that past ignorance and neglect has shifted the burden of dealing with it onto our shoulders.

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¹ Mine Water Management In The Witwatersrand Gold Fields With Special Emphasis On Acid Mine Drainage - Report To The Inter-Ministerial Committee On Acid Mine Drainage.

² S Hervieu, *Poor South Africans Living On Toxic Remains Of Defunct Gold Mines*.

<http://www.worldcrunch.com/culture-society/poor-south-africans-living-on-toxic-remains-of-defunct-gold-mines/tudor-shaft-radioactive-spoil-tips/c3s9958/#.umx5--rtino>

³ ES van Eeden, M Liefierink, and JF Durand, 'Legal Issues Concerning Mine Closure And Social Responsibility On The West Rand' *The Journal for Transdisciplinary Research in Southern Africa*, Vol. 5 no. 1, July 2009.

⁴ The National Environmental Management Act 107 of 1998 (NEMA); the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA); and by implication the National Water Act 36 of 1998 (NWA) respectively deal with the responsibilities of holders of mining rights and permits. The holder of such rights, whose mining causes or results in ecological degradation, pollution, or environmental damage that may be harmful to the health or well-being of anyone, will be deemed responsible for any environmental damage, pollution or degradation as a result of his or her operations and which may occur inside and outside the boundaries of the area to which such right, permit or

permission relates. These Acts also allow for liability to be specifically extended to the director of the mining company concerned in his or her personal capacity (i.e. personal liability).

⁵ ES van Eeden, M Liefferink, and JF Durand, 'Legal Issues Concerning Mine Closure And Social Responsibility On The West Rand' *The Journal for Transdisciplinary Research in Southern Africa*, Vol. 5 no. 1, July 2009.

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