Acid mine drainage on the Witwatersrand

Gold mining in the Witwatersrand

The Witwatersrand has been mined for more than a hundred years. More than 120 mines have worked in the area. It is the world's largest gold and uranium mining basin.

A total of 43 500 tons of gold has been removed from the Witwatersrand area. Between 1953 and 1995, a total of 73 000 tons of uranium was mined. This has left about 400 km^2 of mine tailings dams (waste material from mining left on the surface of the ground) and 6 billion tons of pyrite (iron sulphide). Pyrite is one of the substances, which, when exposed to air and water, produces acid mine water (see Fact Sheet 1).

The word 'basin' is used to describe the area into which water polluted by acid mine drainage (AMD) will flow naturally. The Witwatersrand Mining Basin covers an area of 1600 km^2 (see map below). It consists of the Far East Basin, Central Rand Basin, West Rand Basin, Far Western Basin, KOSH (Klerksdoorp, Orkney, Stilfontein and

Hartebeetsfontein) and the Free State gold mines.

Map showing the part of the Witwatersrand Mining Basin – from Krugersdorp and Randfontein in the west to beyond Springs in the east (Source: Mine Water Reclamation Project, background information document, Western Utilities Corporation, April 2009)

Threat of uncontrollable acid mine drainage

The recent crisis on the West Rand

In 2002, awareness was raised about acid mine water flowing out of the old mining area called the West Rand Basin. The mining companies operating in the area, Rand Uranium, DRD Gold and Mintails SA began pumping out and treating the water to stop it flowing uncontrollably into the nearby streams. When acid mine water flows uncontrollably onto the ground surface, it is called *decanting*.

Each day, the amount of water being pumped out varies between 18 and 38 Ml (1 mega litres = 1000 litres). This is about as much water as 360 – 760 suburban swimming pools being emptied each day!

An unknown amount of acid mine water escapes into streams and other water resources through the movement of groundwater through the natural cracks and holes in the underground rocks.

Note: mining companies only treat surface water, or water pumped from the mines to the surface. They do not treat, or monitor acid mine drainage into water underground.

On the Witwatersrand, by the end of June 2009, only one company, Rand Uranium, was still taking its responsibility seriously and pumping and cleaning the water from the West Rand Basin. By the end of June, the water in the West Rand Basin was only 0.6 m below the surface. This meant that there was a serious risk of the acid mine water reaching the surface and flowing out uncontrollably into streams and rivers (decanting).

Note: One of the reasons that DRD Gold and Mintails SA had stopped pumping water from the West Rand Basin was because the Department of Water Affairs had said that they had to treat the water to drinking water quality. The mining companies said that they could not do this as it was too expensive. This led to an ongoing legal battle between the government and the mining companies.

Polluted Tweelopiespruit

There is evidence that acid mine water is already finding its way into nearby streams and rivers. There is continuous discharge of acid mine water (from both surface flow and groundwater) into the Tweelopiespruit, a stream in the Krugersdorp area.

For one day in June 2009, water that was a bright blue colour was seen flowing into Hippo Dam, which is the first dam in the Tweelopiespruit. Acid mine water in this area is a bright orange-red colour because of the iron in it. However, on this particular day the blue colour of the water indicated that the water was very alkaline (the opposite of acid). This suggested that the mining company had noticed the leakage and tried to remedy it by adding lime to the water. The Tweelopiespruit flows through the Krugersdorp Nature Reserve. Observations suggest that the health of the animals in the reserve may be at risk from the water in the stream.

Lack of effective action from mining companies and government
Since 1996, the mining companies and the Department of Water Affairs, have been aware of the fact that the acid mine water in the West Rand Basin was in danger of decanting in the near future. The crisis point reached in 2009 was a direct result of the inability of the government and mining companies to take responsibility and address the issue effectively.

On 1 July 2009, the Department of Water and Environmental Affairs (DWEA) ordered all the mining companies in the West Rand (DRD Gold, Mintails SA and Rand Uranium) to start pumping again. However, why was the situation left to get to this critical point before the DWEA took action? What is the government's long-term solution to this problem?

Johannesburg at risk from acid mine drainage from the Central Rand Basin
The flow of acid mine water into the Central Basin threatens the water resources and the land around Johannesburg.

The level of the acidic underground water affected by mining in the Central Basin is rising fast. Every day the level of acid mine water in the basin rises by almost 1 meter (60 ML a day – that's enough to fill 1200 suburban swimming pools a day!).

Yet, no action is being taken to pump out and treat the water. Without a way of 'catching' and cleaning this water before it decants, the water will contaminate the ground and river system in the whole area. It will first decant into Wemmer Pan in Boksburg and from there spread via the Klipspruit through Soweto and into Johannesburg.

There is potential for acid mine water to seriously affect residents, through health risks related to the accumulation of toxic metals in the food chain, and damage to the city's buildings, roads and other infrastructure(see Fact Sheet 1).

Acid mine drainage threat on the East Rand
Water is filling up the East Rand Basin at a rate of 80 Ml per day. The company Pamodzi Gold has stopped mining and is being closed down. It is still pumping and treating the water, and is being subsidised by the government. But, how much longer will it continue to pump out and treat 80Ml of acid mine water a day, at a cost of about R3,5 million per month?


Mine water being pumped from the Eastern Basin

Without this pumping it is estimated that, within two years, the polluted water will flow into the Blesbok Spruit which is an internationally protected area (RAMSA site) – at a rate of 18 Ml a day.

The danger in Robinson Dam

In 2002, water flowing out of the West Rand Basin was very acidic (with a pH of 2.2). As an emergency measure the water was allowed to flow into the Robinson Dam, a popular recreational area. Chemical reactions with the other substances in the lake resulted in a high concentration of uranium in the lake water -16mg/l. This was 40 thousand times higher than the natural (background) level of radiation for that area.

The National Nuclear Regulator (NNR) said the lake was a dangerous radiation area. Usually, the background uranium concentration in freshwater is 0.0004mg/l. The DWEA regulations for drinking water say that the uranium concentration should be less than 0.07mg/l and less than 0.01mg/l for water used for irrigation.

In the Krugersdorp-Randfontein area, there is seepage of acid mine water into the Wonderfonteinspruit during heavy rain storms.

The Afrikaans word 'wonderfonteinspruit' means miraculous fountain. In the early 1930s the water bubbling up from this stream was considered to be one of the seven wonders of South Africa. Today, the contaminated orange waters of the Wonderfonteinspruit warn us of the dangers of acid mine water.

What other areas could be affected?

The West Rand Basin lies on land that drains into two the catchment areas of two big river systems – the Vaal River to the south and the Limpopo River to the north. If the polluted water is allowed to flow uncontrollably into the streams that flow into these rivers the effect would be disastrous for the water supplies and food security of millions of people. It would also damage large areas of wetlands.

The agricultural and tourism industry would be very badly affected. Farmers would not be able to use their groundwater for irrigation or drinking water. Areas that are important for wildlife and tourism, such as the Cradle of Humankind World Heritage Site would be damaged. See also Fact Sheet 1.

What you can do

If you are concerned about acid mine drainage:

- Spread the word: talk to your friends and colleagues about the issue
- Tell your local councillor and other government officials about your concerns
- Join Earthlife Africa Johannesburg (ELA Jhb) and support it's Acid Mine Drainage Working Group (see below)

ELA Jhb's *Acid Mine Drainage Working Group* seeks to:

- Raise awareness of the issue of acid mine drainage, especially amongst communities that are most affected
- Hold government and mining companies accountable for the negative consequences of their actions

- Encourage those companies that do take their responsibilities seriously and implement good practice
- Promote practical action, such as rehabilitation projects that members of the public can participate in
- Stimulate debate about the need for South Africa to diversify its industrial base and develop cleaner, more sustainable industries

If you would like to contribute to our work – through offering your comments, ideas, volunteering your time, or making a donation – contact us at: amd.workinggroup@gmail.com.