

# Acid mine drainage – can it affect human health?

Acid mine drainage has known adverse effects on the environment. But can it affect human health? **Rebecca Garland** discusses the issues.

**A**s you saw in an article in *QUEST* 7(2), acid mine drainage (AMD) can be formed in some of the mining areas of South Africa by the reaction of water and air with reactive minerals containing sulphur. The resultant AMD is an aqueous mix of inorganic compounds and heavy metals, although the exact composition of the AMD can vary from site to site. AMD is found around some coal, gold and copper mines in South Africa.

## The release of acid mine drainage into the environment

AMD is created at mining sites or areas where tailings dumps are present and if it is not contained or treated in the mining area, it can be released into the environment as polluted water.

This polluted water, once it is decanted from the mines, can then travel through the ecosystem through

both surface waters and groundwater. This release has the potential to have a serious impact on both the ecosystem and on any humans who may come into contact with it. However, while there is research documenting the adverse effects of AMD in the ecosystem, much less is known about the potential impact on human health.

In order for humans to be affected by the pollutants in AMD, they first need to be exposed to the pollutants. AMD enters the environment as polluted water, either through surface water such as rivers or through groundwater. As the water moves through the ecosystem, the pollutants in AMD can then enter other parts of the ecosystem. For example, AMD pollutants in a river could be deposited and end up in the river beds. Also, if AMD-contaminated water is used for irrigating crops, then there is a risk that the soils and



A warning sign near an open-cast mine. Image: Rebecca Garland

plants can become polluted. And, if an animal drinks the polluted water or eats the polluted plants, then there is a risk that the animal can take up the pollution as well.

Thus, there are many ways that people can potentially be exposed to the AMD pollutants. However, it is not fully understood if and how people are exposed in South Africa. People could be directly exposed by swimming in polluted water or soil or by consuming polluted water. And people can indirectly be exposed to AMD by consuming contaminated plants or animal products such as meat and milk.

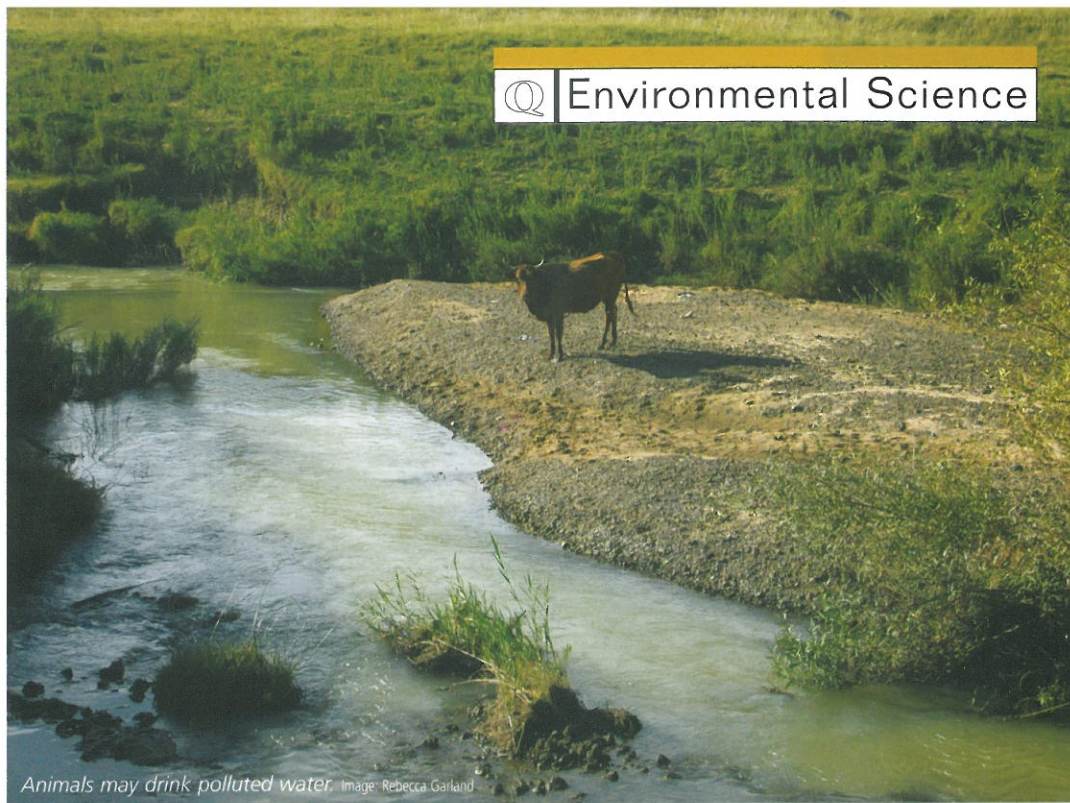
There are many potential exposure pathways. However, very little is known about how AMD pollutants move through the environment and how much risk there is of human exposure and if that exposure will cause health problems. We also do not know if people's health could be affected at specific concentrations of pollutants.

### Cause for concern

What we do know is that many of the components and pollutants in AMD are dangerous to humans. For example, AMD can contain contaminants such as arsenic, cyanide, mercury, lead and uranium. These are known to be very dangerous to humans, causing illnesses ranging from skin irritation, kidney damage and neurological diseases to cancer. We also know that many of the heavy metals that may be present in AMD are known to accumulate in plants and animal tissue as you move up the food chain. For example, arsenic has been found to concentrate in the leaves of plants near mining sites. This accumulation can be dangerous because continued exposure leads to high levels of the pollutant in the organism's tissues, potentially causing damage.

This is still an area of research with many questions and current projects are concentrating on how people can be exposed to AMD, and if they are, what the health impacts could be. □

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Animals may drink polluted water. Image: Rebecca Garland



Surface waters can transport acid mine drainage. Image: Rebecca Garland

### Bioaccumulation

Bioaccumulation is the word used for the accumulation of a substance (e.g. chemicals, pesticides, heavy metals, etc.) in an organism. This accumulation occurs when the organism absorbs the substance at a higher rate than it is lost. The high levels of mercury that can be found in fish is an example of bioaccumulation. Mercury that has been released into the environment can be converted into methylmercury by bacteria in soils and plants. Methylmercury can then be taken up by aquatic plants and animals. And when fish eat these smaller organisms, the methylmercury can build up in that fish's body. Then when an even bigger fish eats these smaller fish, the methylmercury can build up in the bigger fish's body. This can continue up the food chain, eventually impacting human health when contaminated fish are eaten. The US Environmental Protection Agency says that eating contaminated fish accounts for almost all of the human exposure to methylmercury in the US.

For more information on mercury exposure, see the article 'Mercury exposure – are we at risk' in *QUEST* 6(1) 2010.