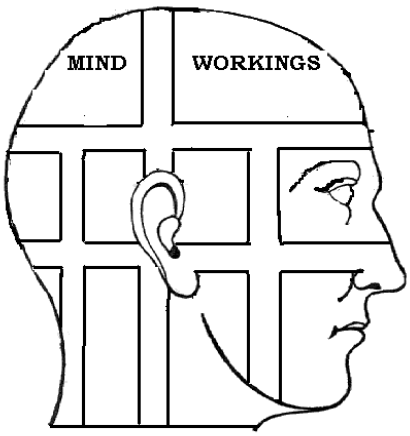

ACID ROCK DRAINAGE

By

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This issue of *MEM* once again examines acid rock drainage (ARD) still referred to as acid mine drainage (AMD) by many. The oxidation of sulphides leading to production of acidic drainage containing dissolved solids and metals remains the most tenacious environmental and economic issue facing the mining industry. The ecological and financial damage resulting from long-term ARD is a global phenomenon, the impacts of which affect primarily surface waters and associated ecosystems. ARD is not a new concept as discharges still occur from European mines opened by the Romans two millennia ago. ARD has no geographic boundary and arises from both anthropogenic activities and natural processes. It is associated with the mining of coal, industrial minerals, precious, and base metals. Further concerns have arisen as mining moves into wetter climates and relies more on lower grade ore deposits, opencast mines, heap leach pads, and surface disposal of waste rock versus the historical practice of waste disposal in underground mine workings and tailings storage facilities (TSF). The financial and legal aspects of long term ARD management have impacted the economics of proposed operations and hindered the ability of companies to secure necessary bonding due to anticipated increases in closure costs. The few widely publicised geotechnical failures and bankrupt heap leach operations have clearly tarnished the image of the mining industry internationally despite recent attempts to confront ARD in more realistic and transparent ways through mine life cycle assessments.

Aside from operating mines various sources of information indicate there are tens of thousands of abandoned mines in the world containing billions of tonnes of exposed tailings and waste rock with tens of thousands of kilometres of surface water impacted by ARD to varying degrees. Cost estimates for cleanup of abandoned mines are well into the tens of billions of dollars, much of which is funded with taxpayer's money.

Studies conducted in Australia and elsewhere have shown costs of mitigating ARD in abandoned mines can be 50-100% higher than controlling it during operations. Information published by the International Labor Organization (ILO) affiliated with the UN estimates 23,000 Mt of mined products including coal and construction materials are produced worldwide each year. Accessibility issues and high striping ratios mean that tens of billions of tonnes of waste rock and overburden are generated worldwide annually. It is commonly believed all of the waste material produced during mining is hazardous or can produce ARD. This incorrect perception is promoted unfairly through government programmes like the USEPA Toxic Release Inventory (TRI) which requires mining operations in the US to report annually individual metal constituent quantities within waste rock and tailings regardless of their hazardous potential. The result is the designation of mining as the "nation's number one polluting industry and waste generator".

Meanwhile, globalisation is quickly expanding economies of developing countries along with their demand for more mined products, often with minimal regard for the environment or worker health and safety. The example is China with its staggering growth rates and insatiable demand for coal and iron ore to make steel. In contrast in industrialised countries, mining is often declining or being subjected to increasingly more stringent regulations. Nonetheless, criticism of the global mining industry has led to the formation of many large not-for-profit businesses. Sensitivity to this negative publicity has prompted the mining industry to address ARD and other environmental and social issues through creation of the International Council on Mining and Metals (ICMM), the International Network for Acid Prevention (INAP), and the Acid Drainage Technology Initiative (ADTI). The ADTI was established in 1995 by the National Mining Association (NMA) in the US in co-operation with the Bureau of Land Management (BLM), the Army Corps of Engineers and the EPA. An ADTI website is maintained at the University of Nevada at www.unr.edu/mines/adti/index.html. INAP is a global alliance including the Australian Center for Mining Environmental Research (ACMER), ADTI, and the Mine Environment Neutral Drainage (MEND) programme in Canada. INAP recently sponsored the 6th International Conference on Acid Rock Drainage (ICARD) in Australia. ICARD has become the major venue and forum for presentation and discussion of the latest information on the formation and mitigation of ARD. INAP also maintains a website (www.inap.org.au).

There are literally thousands of documents and literature citations on the Internet regarding ARD, with hundreds of scientists and engineers in academia, government, and industry worldwide working in this field of study. The underlying causes of ARD are well established. Both laboratory and field test protocols have been created and standardised for ARD prediction. Mitigation and remediation techniques and technologies have been developed and implemented worldwide including chemical ameliorants, engineered covers, in-situ instrumentation, remote satellite sensing, and most importantly water management.

So with this major global commitment to manage ARD why does a pervasive attitude exist that it is out of control and the mining industry is not doing enough? Somewhere in this process lies a subtle disconnect. The history of mining during the early Industrial Revolution must be separated from the progress being made in the 1990s.

The awareness of environmental issues really began about the time of the first Earth Day in 1970. Prior to that time the collective human consciousness lay asleep. Although many people consider themselves environmentalists, their voting rarely reflects this view, as they demand more and more mined products. The tools presently exist to characterize and contain ARD. Although, industry must demonstrate it can deal with this issue, the public must realise their personal responsibility extends beyond an annual membership in an environmental organisation. Co-operation not confrontation is needed to move forward, as has been demonstrated by relationships such as the one between WWF and the Australian mining industry. The answer arises in an evolutionary change first in our attitude, then our awareness, and finally our actions.