

The Canadian MEND program

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Acidic drainage is the largest environmental liability facing the Canadian and international mining industry. Metal leaching and acidic drainage can result from the oxidation of minerals containing metals and sulphur (called sulfides), when in contact with both air and water. If this metal-laden acidic drainage enters natural watercourses, it may contaminate and damage the health of the receiving environment. Site-specific factors and conditions add to the complexity, and often necessitate site-specific research. Effectively dealing with acidic drainage and metal leaching is both a national and a global challenge.

In response to these high environmental liabilities, the Canadian mining industry, together with the federal and provincial governments, formed the Mine Environment Neutral Drainage (MEND) program in 1989. Since then, the MEND program and its successors have developed and continue to validate a toolbox of technologies to predict, prevent and control, and treat acidic drainage. MEND is a collaborative, multi-stakeholder partnership, directed by members from the mining industry, federal and provincial governments, and non-government organisations. MEND has spent over \$20 million Canadian on acidic drainage research since its inception.

In 2002, with a down-swing in the metal market, program funding was reduced. To maximise the benefits of limited resources, the program moved its focus onto Canadian national and/or regional priorities. An extensive network of Canadian experts was surveyed and they identified top priorities such as verification of full-scale MEND technologies, closure management, early prediction, neutral leaching, sludge management, passive treatment, and cold temperature effects. Strong emphasis was placed



FIG 1 - Mine site in interior British Columbia, Canada

on the need for case studies, guidance documents and technology transfer activities. A framework for a multi-year research plan was created, and serves as the basis for the MEND annual work plan. In contrast to the earlier MEND work related to control and limitation of liabilities, there was a shift to recognition of environmental and sustainable development issues.

Canadian and international experts recognise case studies as a valuable tool for technology transfer, as a means to compare predicted and actual field performance, to understand or verify technologies, to examine site specific issues, and as a resource for mining companies and educators.

In MEND 9.1, in-depth case studies were produced from three mines sites in British Columbia with significant metal leaching acid rock drainage (ML/ARD) concerns. The case studies illustrate the practical experience with different aspects of ML/ARD mitigation and assessment practices for these sites. Site-specific issues and key design and performance parameters are outlined, along with constraints, information gaps, problems and their management implications.

MEND 2.21.4, a Dry Covers Manual, is a working guidance document for the design, construction and performance monitoring for cover systems for waste rock and tailings. The manual integrates the best available technologies on cover systems from many sources, and includes Canadian and international case studies to highlight different aspects of the cover design process. MEND 2.21.5 Manual for Macro-Scale Cover Design and Performance Monitoring introduces design and monitoring guidelines for mine waste soil cover systems on a macro-scale or watershed scale, and discusses challenges that arise from increased size and complexity relative to the cover systems on a micro-scale (MEND 2.21.4).

Membrane separation technologies and their application to the treatment and management of mining effluents were investigated in MEND 3.15.1. Membrane separation processes, such as reverse osmosis and nanofiltration have been successfully applied for mine water and wastewater treatment. Several international case studies on the application of membrane separation in mining operations are presented, with an emphasis on

cost impacts and improvements in environmental performance.

An important highlight is the recent release of the Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (2009). Accurate and timely prediction of acidic drainage and metal leaching are key to preventing potential environmental impacts and minimising the high costs of mitigation. Prediction of drainage chemistry is a technically challenging subject, involving many methods, properties and processes. The Manual was developed to provide a comprehensive, in-depth level of understanding, for use by technical experts or practitioners to conduct a prediction program and/or review the results. It also serves as a reference document for the public, educators or students studying or reviewing drainage chemistry. An electronic version of the manual can be downloaded from: www.abandoned-mines.org/mend-e.htm.

Effective and timely transfer of information and new knowledge to stakeholders and the public is a critical component of the MEND program. MEND workshops, featuring key areas of technology, are the most efficient way to disseminate information. Other routes include the MEND website (www.mend-nedem.org, currently under construction), MEND reports and newsletters, and presentations.

MEND is also the Canadian partner in the Global Alliance (GA), an international partnership among organisations involved in acidic drainage research that is led by the International Network for Acid Prevention (www.inap.com.au). World-wide organisations partnered in the GA are located in Australia (ACMER), United States, Europe, South Africa, Canada, and more recently, Brazil, China and Indonesia. Benefits of this alliance are numerous, and include enhanced technology transfer capabilities and minimisation of research duplication. Working together, a major achievement is the publication of the "Global Acid Rock Drainage Guide" – a Wiki publication released in June 2009 that is available to all stakeholders at: www.gardguide.com.

MEND was recently selected to host the 9th International Conference for Acid Rock Drainage (ICARD) in Ottawa in May 2012. The ICARD is held every three years, and is the leading forum for state-of-the-art acidic drainage research and problem-solving. Previous ICARDs held in Australia and Canada include Cairns (6th ICARD, 2003), Montreal (2nd ICARD, 1991), and Vancouver (4th ICARD, 1997).

Tremendous progress has been made in reducing the liability of acidic drainage; environmentally sound technologies are in place to open, operate and decommission mines, for the short and the long-term. Mining companies and consultants have acquired a great

deal more capability to deal with water contamination from mine wastes, including acid generation. However, new challenges are emerging, and the success of the MEND program and network in Canada provides us with an effective means to face them.

References

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