

# Experience of Canadian Partnership Programs - MEND and NOAMI

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## **Abstract**

Sustainable development has become a driving force in how the mining industry approaches all existing and future activities. Progress has been made to advance environmental performance and stewardship and provide benefits to civil society. Mining companies, governments and consultants have acquired a great deal more capability to deal with environmental and societal issues such as water contamination from mine wastes, including acid generation. In Canada, multistakeholder programs were set-up to develop technologies and approaches to deal with mining concerns. The successes of the Mine Environment Neutral Drainage (MEND) Program and the National Orphaned/Abandoned Mines Initiative (NOAMI) have come through the collaborative efforts of the partners, the sharing of experiences and the thorough evaluation of technologies and practices. Through these efforts a significant advancement in environmental management has been achieved and thus has contributed to the long-term sustainability of the mining industry and the environment.

## **1 Introduction**

Mining with environmental stewardship involves not only optimizing the technical performance of mining and extraction processes so as to maximize the profitability of an operation, but also entails leaving a positive environmental and social legacy. Up until the 1970s, the focus was primarily on generating profits. Since that time, there has been a growing awareness of the need to minimize the negative imprint that mining has left on the natural environment. In the 1980s a collective approach to problem solving emerged in Canada. Multi-stakeholder initiatives that address technical issues of national importance have been models for cooperation among industry, various levels of government, NGOs (non-governmental organizations) and First Nations (i.e. aboriginal Canadians).

Programs are frequently launched to focus research efforts into areas of concern, and also to obtain information for formulating sound policy. It is especially important in the environmental area to ensure that government policy is underpinned by sound science. The benefit of the collaborative programs has come through the sharing of experiences, the thorough evaluation of technologies and their incremental improvement.

The Mine Environment Neutral Drainage (MEND) initiative was the first international multistakeholder program to develop scientifically based technologies to reduce the effect of acidic drainage. The MEND model of collaboration is now being used by both Canadian and international programs to address issues of national importance. The National Orphaned and Abandoned Mines Initiative (NOAMI) adopted the MEND framework to develop a policy-based program for remediation of orphaned and abandoned mine sites in Canada.

## **2 Mine Environment Neutral Drainage (MEND) Program**

### **2.1 Background**

Acidic drainage has long been recognized as the largest environmental liability facing the Canadian mining industry, and to a lesser extent, the public, through abandoned mines. Since 1987 the Canadian mining industry and governments have been cooperating to develop technology to prevent and control acidic drainage.

The original 9-year MEND Program (1989-1997) and its subsequent initiative MEND2000 (1998-2000) contributed greatly to the understanding of acidic drainage. Tremendous technical progress was made in the areas of prediction and modelling, prevention and control, disposal technologies, lime treatment, passive treatment and monitoring. Despite the progress, acidic drainage remains the most significant environmental issue facing the mining industry, governments and the public. Therefore in 2001, funding was provided to launch a renewed initiative, called MEND3 (recently renamed “MEND”), to identify Canadian national and/or regional information needs.

The first major activity was a “gap analysis” report (MEND 8.1) that identified opportunities to advance acidic drainage knowledge, along with a prioritized list of research needs. In April 2002, the recommendations of this study were reviewed during a multistakeholder Strategy Session held in Ottawa (MEND 8.2). This session developed and recommended a number of research activities for a multi-year program. A questionnaire was also distributed to the MEND Network to help define research priorities. The conclusion was that closure management, verification of technologies, metal leaching, passive treatment, early prediction and sludge management were viewed as the top priorities. Strong support was also given for more information on cold temperature effects and paste backfill. The need for guidance documents, technology transfer activities (e.g. workshops), and updates on emerging technologies was identified as a crosscutting theme within each of the priorities.

Based on the widespread support received from all stakeholders, a recommendation was made to move ahead with a renewed MEND research program. The Mining Association of Canada (MAC), Environment Canada and Natural Resources Canada (NRCan) provided funding of more than \$350K, which supported a number of projects in 2003:

- **Underground Paste Backfill.** Compilation and review of available information pertaining to the geochemical characterization of paste backfill (using sulphide tailings) and methods used to predict environmental impacts.
- **Case Studies of Metal Leaching/Acid Rock Drainage (ML/ARD) Mines.** Case studies that illustrate site-specific application of ML/ARD mitigation and assessment at five mine sites in British Columbia, Canada.
- **Checklist of Potential Information Requirements in ML/ARD Assessments and Mitigation Work.** The document lists potential information requirements and factors to consider ML/ARD work and serves as a general guide for practitioners employed by the mining industry, regulators and the public reviewing their work, as well as educators and students.
- **Dry Covers Manual.** The objective of the manual is to incorporate and integrate the best available technology on dry covers. A summary volume and four technical documents on theory and background, site characteristics, cover design and modelling, field performance monitoring and case studies are available.
- **Covers for Reactive Tailings in Permafrost Regions.** A general review of covers for reactive tailings in permafrost regions. Factual information on three case histories is included.
- **Assessment of Disposal Options for Lime Sludge.** State-of-the-art review and assessment of available disposal options for lime sludge. Options are to be evaluated for feasibility, environmental impact and relative costs.
- **Review of Neutral Leaching.** A review of mining operations in Canada to scope out the priority metals and chemicals of concern related to non-acid generating mine waste.
- **Case Study Assessments at Canadian Mine Sites.** A study to assess and verify the effectiveness of acidic drainage pollution prevention and control techniques. In the first phase five sites were assessed. Phase II will include field studies at two of these sites. Case studies will be prepared.

Many of these projects are state-of-the-art reviews, the results of which will better define future research projects.

Another important activity for MEND in 2003 was its participation in the Sixth International Conference on Acid Rock Drainage (6<sup>th</sup> ICARD), held in Cairns, Australia in July. About 250 delegates from 19 countries attended the event. With a theme of *Application and Sustainability of Technologies*, the conference continued the tradition of previous ICARDs in presenting the results of cutting-edge research and innovative technologies relevant to acidic drainage.

For 2004, MEND has secured funds totaling approximately \$300K from MAC and NRCan. Projects this year will include further refinements to the dry covers manual, participation in the INAP (International Network for Acid Prevention) scale-up project at Diavik, updating the “draft” Prediction Manual and hosting two workshops (Sudbury in May; Vancouver in December).

## **2.2 Technology Transfer**

An integral part of MEND is technology transfer - the dissemination of information on developed technologies to the partners and the public. Information is transferred through a number of routes. A MEND web site (<http://mend.nrcan.gc.ca>) is regularly updated with report summaries, a publication list, case studies, newsletters, workshop and conference announcements and links to other relevant initiatives.

The MEND Manual (MEND 5.4.2), released in 2001, summarizes work completed in MEND in a format that provides practitioners in the Canadian industry and government with a manageable single reference document. The MEND Manual and the MEND technical reports are available from the MEND Secretariat in paper and/or electronic versions. In addition, over 160 of the MEND technical documents are available on three CD-ROMs.

## **2.3 Other Aspects of MEND's Success**

Aside from its technical successes, MEND has been described as a model way for industry, governments and NGOs to cooperate in technology development for advancing environmental management in the mining industry. Decisions are now being made based on sound science. Reasons for this include:

- The high return on the investment targeted and achieved, in terms of knowledge gained and environmental and technical awareness of the scope of the problem and credible scientific solutions.
- The partnership and improved mutual understanding developed between the two levels of government and the mining industry in search of solutions to a major environmental problem. MEND has also fostered working relationships with environmental groups, ensuring that they are an integral part of the process.
- The small dedicated secretariat group that coordinated activities, managed the accounting, reporting and technology transfer, and was the “glue” which held the program together. This Secretariat is located at NRCan/CANMET in Ottawa.
- The extensive peer review process that was both formal and informal, and resulted in enhanced credibility of the information base.
- The dynamic approach taken for transferring the knowledge gained during MEND.

## **2.4 MEND Model**

The MEND model of collaboration has been used successfully by numerous other national and international programs. Examples of MEND-based programs directed towards environmental improvements include the Aquatic Effects Technology Evaluation (AETE-Canada) Program, the Toxicological Investigations of Mining Effluents (TIME-Canada) Network, the National Orphaned and Abandoned Mines Initiative (NOAMI-Canada) and the Acid Drainage Technology Initiative (ADTI-Coal and ADTI-Metal – USA).

## **2.5 Global Alliance**

The International Network for Acid Prevention (INAP) was formed in 1998 by a number of international mining companies dedicated to reducing the liabilities associated with sulphide-bearing mine materials. In 2002, INAP formally proposed the concept of an international model of interaction

among the various organizations involved in acidic drainage (INAP, MEND, ADTI, and the Australian Centre for Mining Environmental Research (ACMER) in Australia). A Statement of Mutual Intent was prepared and a formal announcement was made at the 6<sup>th</sup> ICARD. The Global Alliance partnership between INAP and the regional organizations brings numerous benefits to the partners, including additional resources, minimization of research duplication, worldwide links and enhanced technology transfer capabilities. The Global Alliance is seeking additional regional partners.

An immediate benefit to the alliance is a greater understanding of the activities of each organization and possible joint support of projects that are of mutual interest. For example INAP co-sponsored the 10<sup>th</sup> Annual ML/ARD Workshop held in Vancouver, December 2003 and MEND is providing funds to INAP's Waste Rock Scale-up project at Diavik.

### **3 National Orphaned/Abandoned Mines Initiative (NOAMI)**

#### **3.1 Introduction**

The assessment and remediation of orphaned and abandoned mine sites across Canada has received increased national attention over the past two years. With establishment of the NOAMI in 2002, Canadian Mines Ministers signalled their commitment to address this serious environmental issue. NOAMI is a co-operative Canadian program that is guided by an advisory committee consisting of the mining industry, federal/provincial/territorial governments, environmental non-governmental organizations and First Nations. The advisory committee's role is to assess key issues and put forward recommendations concerning collaborative approaches and partnerships in the implementation of remediation programs across Canada.

#### **3.2 Background**

Mining has been central to the Canadian economy for over 100 years and Canada is a supplier of mineral commodities worldwide. The long history of mining in Canada has resulted in more than 10,000 orphaned and abandoned mine (OAMs) sites requiring varying degrees of rehabilitation. The legacy of OAMs, with the associated environmental liability, human health concerns and the financial costs of clean up, is a serious issue facing Canada. OAMs exist within all mining jurisdictions in Canada. These sites, however, are not well documented with respect to their numbers or their associated physical, health, environmental impacts and liabilities. Further research and compilation of information on OAMs is necessary to enable sound decision-making, cost-efficient planning and sustainable rehabilitation. Such information is also necessary to ensure transparency of decision-making and access to information by governments, civil society, industry and other stakeholders.

Recent estimates (Tremblay, 2002) demonstrate the general scope of the problem in Canada. Wide variations in the reported numbers is noted:

- Canada - over 10,000 sites
- Ontario - 6,000 historic sites, many in public domain (Hamblin, 2003)
- Nova Scotia - over 6,000 mine openings
- Quebec - 89 tailings sites at an estimated cost of \$67 million (CAN) to rehabilitate
- BC - 1,898 sites
- Manitoba - 290 sites

In Ontario, Hamblin (2003) indicates that the number of known abandoned sites is approximately 6,000, containing approximately 18,500 individual hazards. He further states that the cost to rehabilitate all of the abandoned sites in Ontario has been estimated at approximately \$300 million (CAN). The cost to rehabilitate the 30 – 40% of sites that have reverted to the Crown (Government) has been pegged at approximately \$120 million (CAN).

In October 2002, the Office of the Auditor General of Canada reported the estimated cost of clean up and closure for abandoned mines in northern Canada only (north of 60°) would be \$555 million.

These abandoned mines have historically been the responsibility of the federal government, although in some cases responsibility has been devolved to the provincial and territorial level.

Mining regions have become less associated with remote areas, and as populations grow, urban sprawl

increases, and more people seek a return to rural living opportunities, the risk of contact with hazards or environmental impacts associated with abandoned mines has also increased. As well, the number of injuries and deaths due to people entering abandoned mines has increased and as a result, public pressure to deal with these abandoned sites has mounted.

### **3.3 Response to the Problem**

In 1999 and 2000, a number of stakeholders put forth requests to the Canadian Mines Ministers to establish a joint industry-government working group, assisted by other stakeholders, to review the issue of orphaned and abandoned mines. The Ministers supported this initiative and requested that a multistakeholder workshop be organized to identify key issues and priorities.

In early 2001, a federal-provincial-territorial working group was set up to consider cooperative approaches to dealing with problematic orphaned and abandoned mines in Canada. The working group included several different stakeholders, and was developed to undertake planning for a multi-stakeholder workshop.

The Workshop on Abandoned Mines, held June 2001 in Winnipeg, reviewed the issues for orphaned /abandoned mine sites and identified processes to move forward. Five major themes were discussed: Building a National Inventory; Community Perspectives; Setting Standards and Rational Expectations; Ownership and Liability Issues; and Identification of Funding Models.

Participants developed, by consensus, guiding principles and recommendations that were presented at the Mines Ministers' Conference, September 2001. Ministers agreed on the importance of a large-scale program for the rehabilitation of orphaned/ abandoned mines sites, and requested that an Orphaned/Abandoned Mines Advisory Committee be established.

For the first two years NOAMI has worked with an annual budget of about \$100K, contributed through its government and industry partners. Four task groups were formed to address the following program areas:

- Information Gathering
- Community Involvement
- Legislative Barriers to Collaboration
- Funding Approaches

### **3.4 Brief Summary of Results to Date**

#### **Information Gathering**

A principal objective of the Information Gathering Task Group is to develop capacity for a national inventory of orphaned and abandoned mine sites based on compatible federal/provincial/territorial inventories.

The principal, and challenging, activity of the Task Group is to develop consensus on the definitions and to prepare recommendations for future work. The definition of OAMs varies between jurisdictions in Canada, and the Task Group realized that a "national" definition for NOAMI's use would be essential for the successful creation of a national inventory.

A set of "common parameters" and qualifiers would then be needed for designing and constructing a suitable database on abandoned and orphaned mineral sites. General parameters could include basic information such as type of mine, location etc., while more specific parameters might include specific hazards and risks at each particular site.

#### **Community Involvement**

The objective of the Community Involvement Task Group was to develop a plan to foster community involvement in decision-making on closure and reclamation, and to ensure that targeted end-use and reclamation standards are acceptable to local communities.

Case studies related to community involvement were completed for three Canadian mine sites, along with experiences in community involvement at abandoned mines in the United States. The "lessons learned" from these studies were developed into a series of guidelines and published in the pamphlet "Best Practices in Community Involvement".

The eleven guiding principles discussed in the pamphlet are:

- Communication
- Inclusiveness:
- Representation
- Fostering Confidence in Decision-Making
- Information Dissemination and Communication
- Participation and Representation
- Resources and Assistance
- Facilitation
- Integration
- Consistency of Involvement
- Respecting Local Cultures

These principles were developed for use by governments, industry, local communities and other parties as a template for the development of policy and citizen engagement plans prior to, during and after the rehabilitation of problematic sites. The final report and the pamphlet are available on the NOAMI web site ([www.abandoned-mines.org](http://www.abandoned-mines.org)).

While this program area has completed its objectives, NOAMI will continue to examine ways to foster meaningful community involvement and engagement in abandoned mine remediation.

### **Barriers to Collaboration**

A review was undertaken to examine existing legislative requirements in Canada, and selected international jurisdictions, on regulatory or institutional barriers, liability disincentives, and collaborative opportunities regarding voluntary abatement, remediation, and reclamation of OAMs. Particular emphasis was placed on four approaches: 'Good Samaritan' legislation; permit blocking; allocative versus joint and several responsibility; and non-compliance registries. The final report titled "Barriers to Collaboration: Orphaned/Abandoned Mines in Canada" was completed in 2002.

The report findings provided background for a multistakeholder workshop in Ottawa, 2003 that assessed the key barriers and developed approaches to overcome them. The report and the Workshop Proceedings are posted on the NOAMI web site ([www.abandoned-mines.org](http://www.abandoned-mines.org)).

### **Funding Approaches**

A report titled "Potential Funding Approaches for Orphaned/Abandoned Mines in Canada" (Castrilli, 2003) was prepared that outlined a variety of funding approaches to be considered for the clean up or management of liabilities related to OAMs. Individuals with expertise in this area were surveyed, and the report incorporated their views as well as those of the authors. Advantages and disadvantages of each approach were evaluated and preferred options were recommended for consideration by governments. It was concluded that no single funding approach would constitute a complete solution; a combination of a number of approaches would likely be required. Mechanisms to further discuss and develop funding approaches are underway. The final report is also posted on the NOAMI web site.

### **3.5 Action Framework 2004**

Recommendations from the key program areas were integrated into an "Action Framework". Implementation of the "Framework" will require the ongoing support and in working toward the common goal of OAMs remediation. Key elements of the framework include:

- Development of a policy framework that addresses legislative/regulatory issues commitment of all stakeholders over the next several years. A cornerstone of this approach will be the continued commitment of Canadian Mines Ministers associated with specific challenges presented by orphaned and abandoned mines.
- Development of intergovernmental cost-sharing arrangements to address remediation at high priority sites.

- Development of a series of guideline documents to facilitate OAM reclamation across Canada. These include:
  - Guidelines for legislative review with respect to collaboration, liability and funding;
  - Guidelines for facilitation and co-ordination of voluntary reclamation; and
  - Guidelines for site assessment and prioritization.

As NOAMI moves into 2004 it's role is shifting from broad scope recommendations into more direct interaction with the jurisdictions on policy development. The recommendations put forward by NOAMI were endorsed by the Mines Ministers.

### **3.6 Guidelines for Legislative Review**

The Task Group on Guidelines for Legislative Review was formed in 2004 with the objective “to complete guidelines for jurisdictional legislative reviews with respect to collaboration, liability and funding to ensure that approaches across jurisdictions are consistent, certain, transparent, coordinated and efficient for OAMs in Canada”.

The role of NOAMI is to provide guidance on the issues to consider, and these guidelines will be used by the jurisdictions to evaluate their own policies with respect to collaboration, liability and funding.

### **3.7 Information Transfer**

Dissemination of information to the partners and the public in a timely manner is an important function for multistakeholder programs.

NOAMI has been very active in its transfer of information and uses a number of routes. An abandoned mines Internet site ([www.abandoned-mines.org](http://www.abandoned-mines.org)) has been established and is regularly updated with information, reports and newsletters. The Secretariat issues communication documents, such as newsletters, outlining the activities of NOAMI and related topics. These newsletters are posted on the web site, as well as electronically distributed to the Secretariat's mailing list. One workshop has been held, and more are planned as the program moves forward.

## **4 Conclusions**

Canada is well known for establishing multistakeholder initiatives to address issues of national importance. This model of cooperation among industry, various levels of government, NGOs and First Nations is now applied both nationally and internationally. MEND and NOAMI are two of many successful multistakeholder initiatives.

Through these multistakeholder initiatives, a significant advancement in environmental performance and the understanding of sustainable development as it relates to mining and society is achieved.

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