



Update on MEND and NOAMI

20th BC-MEND ML/ARD Workshop

Gilles Tremblay and Charlene Hogan

MEND and NOAMI Secretariat

Natural Resources Canada



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Presentation Highlights

- Mine Environment Neutral Drainage (MEND)
- National Orphaned and Abandoned Mines Initiative (NOAMI)



MEND Program Overview

- MEND Mission: To provide leadership and guidance on priority ARD issues in Canada
- Extensive national and international MEND Network
- 1989 – 2013
- ~\$21M in 24 yrs
- Current research budget ~ \$100K/yr
- Guided by multi-stakeholder steering committee
- Focused research work plan
- Technology transfer



Solbec



Recent Publications

MEND 3.43.1 Review of Mine Drainage Treatment and Sludge Management Operations (March 2013) (NRCan)

- Survey of mine drainage treatment and sludge management practices
- Data collected on over 100 sites; national and international
- Majority base metal mines (46%), followed by precious metal (23%), coal, uranium and others
- Examined effluent characteristics, treatment type, reagents, treatment issues



Recent Publications

MEND 3.44.1 Characterization and Prediction of Trace Metal Bearing Phases in ARD Neutralization Sludges (May 2013) *(Lorax Environmental)*

- Investigated the geochemical composition and environmental stability of high density neutralization sludge from 7 mine sites
- High-resolution microscopy techniques in combination with influent/effluent characterization
- Define nature of metal phase associations and link between ARD influent/effluent chemistry, treatment process and sludge composition



Projects on the Go

In-Pit Disposal of Tailings and Waste Rock (SENES)

- 10 case studies detailed - based on available information

Diavik Diamond Mine Waste Rock Study

- Scale-up study in cold climates
- To evaluate and prevent the possible generation of ML/AD from waste rock



Vegetative Covers in Canada (OKC)

- Enhance predictive modelling capability to predict the influence of vegetation on cover system performance

Role of Nitrate in the Remobilization and Attenuation of Selenium in Coal Mine Waste (Lorax and SRK)

- Assess the potential links between explosive-derived nitrogen compounds and the remobilization and attenuation of selenium associated with coal mine waste materials



New Projects for 2013

Study to Identify Best Available Techniques Economically Achievable (BATEA) to Manage and Control Effluent from Mines (*Hatch*)

Scope:

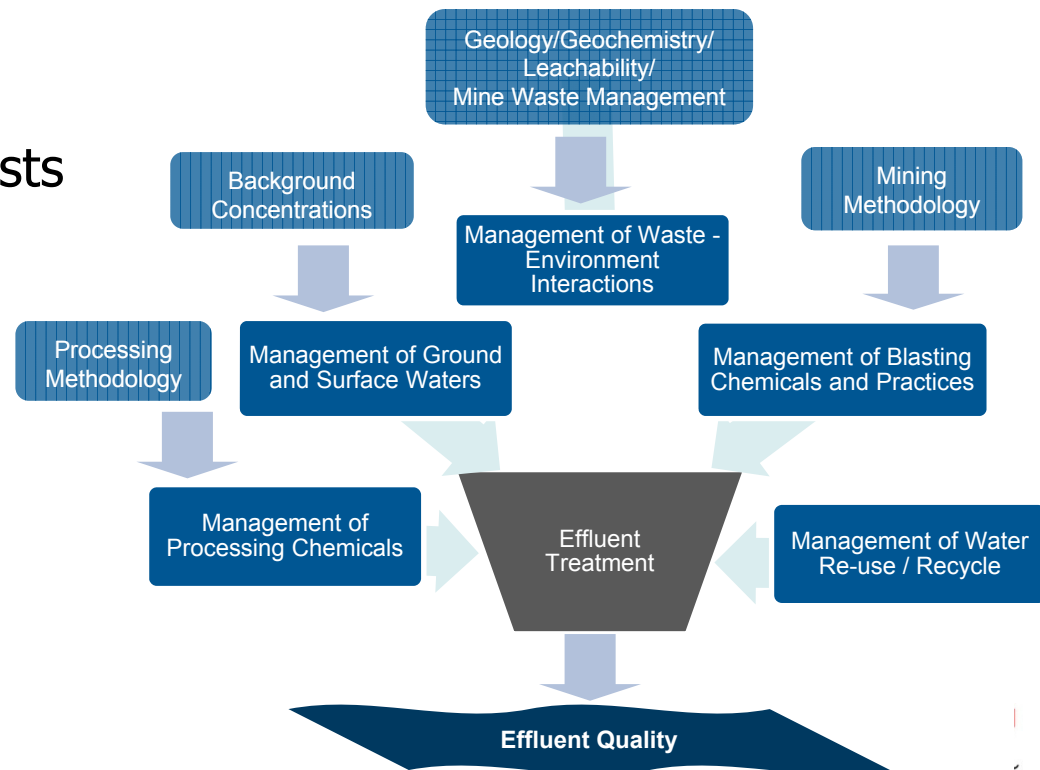
1. Review and identify effluent management and control techniques at metal, coal, and diamond mines in Canada, via:
 - Operations Questionnaire
 - Vendor Questionnaire
 - Research
2. Identify and pre-screen BAT
 - Develop sub-sector model sites



Study to Identify Best Available Techniques Economically Achievable (BATEA) to Manage and Control Effluent from Mines (*Hatch*)

3. BATEA characterization

- Achievable effluent concentrations
- Process reliability
- Waste streams
- Risks and opportunities
- Capital costs
- Incremental operating costs



Operations Questionnaire

- Questionnaire run through SurveyMonkey
- Closed October 21, 2013
- Scope:
 - Practices that may impact effluent generation and quality
 - Permitted limits
 - Effluent treatment plant design, performance, and costs
- One questionnaire per site with up to 6 discharge points and 2 effluent treatment systems per discharge point
- Responses to be aggregated and generalized across sub-sectors into model sites



Operations Questionnaire – Progress as of October 31

Sub-Sector	Number of Companies	Number of Sites (Number subject to MMR in 2012)	Number of Sites Submitted	Expressed Intent to Submit	Will Not Submit	Missing/ No Response
Coal Mines	12	28 (0)	13 (46%)	5	6	4
Diamond Mines	5	5 (0)	3 (60%)	0	1	1
Base Metals	31	57 (48)	31 (54%)	10	5	11
Precious Metals	33	55 (43)	18 (33%)	8	7	22
Iron Ore	4	6 (6)	2 (33%)	2	1	1
Uranium	4	13 (5)	7 (54%)	0	6	0



Vendor Questionnaire

- Scope:
 - Proprietary or signature effluent treatment technologies
 - Applications at the full, pilot, and bench scale per industry sub-sector and jurisdiction
 - Performance data
 - Costs (capital, operating, licensing)
- Distribution:



Vendor Questionnaire – Progress as of October 2013

Number of Vendors Contacted	Submitted	Expressed Intent to Submit	Will Not Submit	Missing/ No Response
21	13 (62%)	2	1	5



Next Steps and Key Dates

- Review and compilation of operations and vendor questionnaires
- Development of sub-sector model site flowsheets
- BAT screening and BATEA characterization
- Cost estimation
- Reporting

Activity	Date
Operations and Vendor Questionnaires Released	17 September 2013
Operations and Vendor Questionnaires Complete	21 October 2013
First Draft of Report – Uranium Sector	Early December 2013
Final Draft of Report – Remaining Sectors	Late December 2014
Final Report	Late January/February 2014



MEND Website - Refreshed

Advanced Search Functionality (Kimbo Design)

CEN-led project: Enhance accessibility of MEND reports to civil society

Phase I: Plain language summary of reports (Maya Stano)

Phase II: Increased search capacity for MEND reports

Website: www.mend-nedem.org

MEND / NEDEM

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Acid Drainage is the largest environmental liability facing the Canadian and International mining industry. Since 1999, the Mine Environment Neutral Drainage (MEND) program has worked to develop technologies to prevent and control acidic drainage. The program is directed by a multi-stakeholder committee, with members from the mining industry, federal and provincial governments, and non-government organizations. Tremendous technical progress has been made in the areas of prediction and modeling, prevention and control, regional technologies, liner treatment, passive treatment and monitoring and verification of technologies.

In 2002, a renewed MEND initiative was created that focused on Canadian national and/or regional information needs. A network of Canadian experts helped to identify the top priorities that included verification of full-scale mitigation technologies, closure management, early prediction, neutral and alkaline pH drainage, sludge management, passive treatment, and cold temperature effects. Strong emphasis was placed on the need for case studies, guidance documents and technology transfer activities.

The priorities provided the framework for a multi-year research plan, and serves as the basis for the annual work plan. While the earlier MEND work related to control and limitation of AcidDrax, there has been a broadening of the program's mandate to include other environmental and sustainable development issues.

Strong linkages were forged among MEND and international industry and government programs. MEND is the Canadian partner in the Global Alliance (GA), an international partnership among organizations involved in acidic drainage research that is led by the [International Database for Acid Prediction](#).

Much progress has been made in reducing the liability: initially with acidic drainage and later expanded to cover the whole range of drainage pit. Environmentally sound technologies are now available 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, many challenges remain, and the success of the MEND program in Canada is demonstrating significant progress in addressing them.

ABOUT US | PUBLICATIONS | NEWSLETTERS | CONTACT US | FRANÇAIS

Advanced Search

To narrow your search of the MEND report database, please select the checkboxes that apply to your matter. Note that this advanced search function is built on an "and" basis and will return only those results that apply to all of your selection(s).

Once you have made your selection(s), click the "Search Reports" button below for the MEND reports that apply to your selection(s). The search results will provide a brief summary of the report contents, along with a link to the executive summary and the report itself.

Report Type

- | | |
|---|--|
| <input type="checkbox"/> Guidance/User's Manual | Field & Lab |
| <input type="checkbox"/> Literature Review | <input type="checkbox"/> Field Monitoring and Sampling |
| <input type="checkbox"/> Workshop Notes | <input type="checkbox"/> Field Tests |
| <input type="checkbox"/> Case Study | <input type="checkbox"/> Lab Tests |
| <input type="checkbox"/> Modelling | |
| <input type="checkbox"/> Critical Review / Assessment | |

Study Location

- | | |
|---|---|
| <input type="checkbox"/> Location - General | <input type="checkbox"/> Central Canada |
| <input type="checkbox"/> Applicable across Canada | <input type="checkbox"/> Canadian Maritimes |
| <input type="checkbox"/> Northern Canada | <input type="checkbox"/> Outalde Canada |
| <input type="checkbox"/> Western Canada | |

Type of Mine Operation

- | | |
|---|---|
| <input type="checkbox"/> Mine Operation - General | <input type="checkbox"/> Open Pit Mine |
| | <input type="checkbox"/> Underground Mine |

Stage of Mine Life

- | | |
|--|---|
| <input type="checkbox"/> Mine Life - General | <input type="checkbox"/> Closure to Post-Closure |
| <input type="checkbox"/> Exploration | <input type="checkbox"/> Orphaned and Abandoned Mines |
| <input type="checkbox"/> Design to Operation | <input type="checkbox"/> Mineral Processing |

Mine Component

- | | |
|---|--|
| <input type="checkbox"/> Mine Waste - General | <input type="checkbox"/> Tailings |
| <input type="checkbox"/> Waste Rock | <input type="checkbox"/> Mine Workings |

Prediction of Acidic Drainage

-
- Prediction of Acidic Drainage

Monitoring

- | | |
|---|---|
| <input type="checkbox"/> Monitoring - General | <input type="checkbox"/> Drainage Monitoring |
| | <input type="checkbox"/> Geophysical Monitoring |

Mitigation Technologies

- | | |
|--|---|
| <input type="checkbox"/> Blending, Separation, & Layering | Subaqueous (Under Water) |
| <input type="checkbox"/> Addition of neutralising materials (ex. lime) | <input type="checkbox"/> General Subaqueous Disposal/Water Covers |
| <input type="checkbox"/> Liners | <input type="checkbox"/> Floodings of Underground Workings |
| <input type="checkbox"/> Dry Covers | <input type="checkbox"/> Dams, Ponds, Impoundments |
| <input type="checkbox"/> In-pit Disposal | <input type="checkbox"/> Lake Disposal |
| <input type="checkbox"/> Paste Backfill | |
| <input type="checkbox"/> Thickened Tailings | |
| <input type="checkbox"/> Study of Bacterial Activity | |
| <input type="checkbox"/> Revegetation | |

Treatment Technologies

- | | |
|---|---|
| <input type="checkbox"/> Treatment - General | <input type="checkbox"/> Water Collection & Treatment |
| <input type="checkbox"/> Passive Treatment / Wetlands | <input type="checkbox"/> Sludge |
| <input type="checkbox"/> Lime Treatment | |

Climatic Impacts

- | | |
|--|-------------------------------------|
| <input type="checkbox"/> Climate Change | <input type="checkbox"/> Permafrost |
| <input type="checkbox"/> Seasonal Variations | |

X-Cutting – Technology Transfer

Guidance Documents

Workshops and Conferences(>35)

- Annual BC-MEND ML/ARD Workshops
- 9th ICARD - Ottawa (2012)
- Regional workshops
- MEND Technology Transfer Workshops to Community Groups/Academia

MEND Website at: www.mend-nedem.org

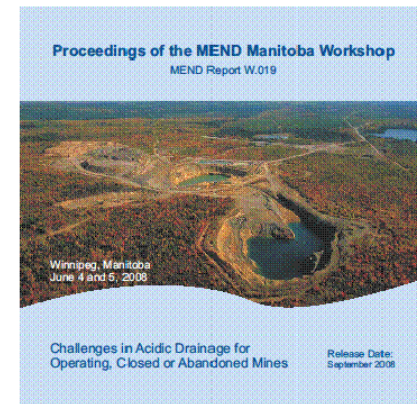
MEND Reports:

- Majority on website (> 200 reports)

Global Alliance

- GARD Guide: www.gardguide.com

Announcements to MEND/NOAMI e-Network



The Global Alliance



www.inap.com.au

Acid Drainage Technology Initiative



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GARD Guide

www.gardguide.com

“An international guide for facilitating world-wide best practice in prediction, control and mitigation of acid rock drainage”

- Most recent update: 9th ICARD - 2012, Ottawa
- Spanish and French translation Executive Summary
- Broaden global nature of GARD Guide
- Functionality upgrades
- Case studies



Conference Web Site



Proceedings papers and presentations on MEND website



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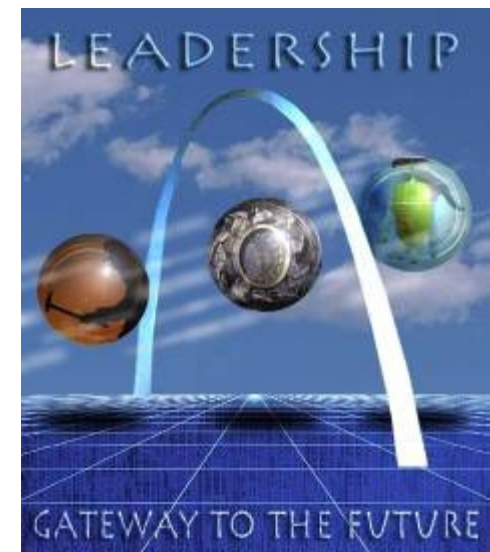
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NEXT ICARD

- 1988 Norway
- 1991 Montréal
- 1994 Pittsburgh (USA)
- 1997 Vancouver
- 2000 Denver (USA)
- 2003 Australia
- 2006 St. Louis (USA)
- 2009 Sweden
- 2012 Ottawa

- 2015 Santiago, Chile



National Orphaned / Abandoned Mines Initiative - (NOAMI)



North Coldstream Mine - Burchell Lake, ON



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- Multistakeholder partnership
- Projects carried out on :
 - Information Gathering (Inventory)
 - Community Involvement
 - Legislative Barriers to Collaboration
 - Funding Approaches
 - Jurisdictional Legislative Review
 - **Mine Closure/Return of Mining Lands**



NOAMI Highlights

Guidelines and Toolkits:

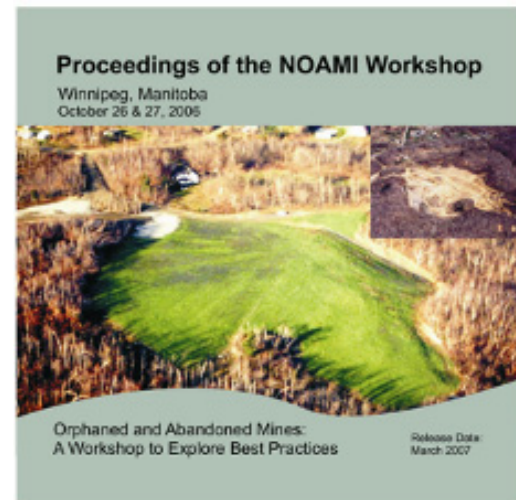
- Pamphlet on Guiding Principles in Community Involvement
- A Toolkit of Funding Options for Abandoned Mine Rehabilitation
- Guidance Document: Mine Closure and Management of Long-Term Liabilities

Published NOAMI Reports

- Reviews of national and international inventories, funding models, and barriers to collaboration
- Community case studies
- Jurisdictional legislative review relating to OAMs.

Information Sharing

- Six workshops
- NOAMI website www.abandoned-mines.org
- Newsletters
- Publications at conferences



New Publication

Case Studies and Decision Making Process for the Relinquishment of Closed Mine Sites (July 2013)
(*Cowan Minerals Ltd.*)

Part of multi-stage project “**Return of Mining Lands to the Crown**”

Study built on findings of :

Policy Framework in Canada for Mine Closure and Management of Long-Term Liabilities : A Guidance Document (Cowan Minerals, 2010)

NOAMI Workshop (2011)

NOAMI Advisory Committee - Strategic Planning Session (2011)



Case Studies and Decision Making Process for the Relinquishment of Closed Mine Sites (July 2013) (*Cowan Minerals Ltd.*)

Examined 6 case studies illustrating information relevant to relinquishment of mine sites to the Crown, along with “lessons learned”.

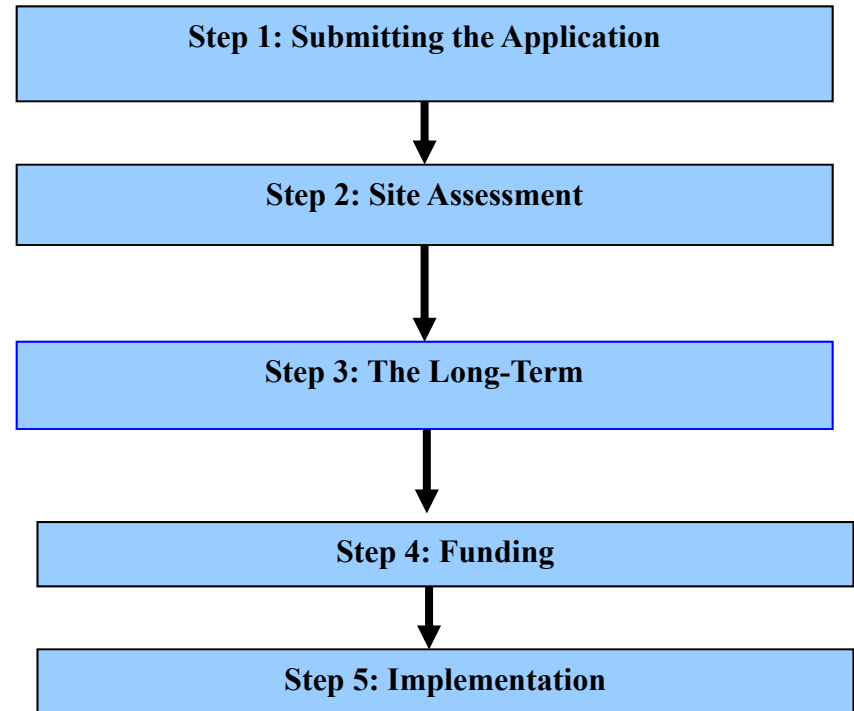
- Farley East Tailings Management Area, MB
- Quebec Lithium Mine, QC
- Renabie Gold Mine, ON
- Polaris base metal mine, NU
- Gregg River Coal Mine, AB
- Contact Lake Gold Mine, SK



Five-Step Decision Making Process for Relinquishment

- Decision Making Process constructed based on sum of information.
- Outlined key factors that need to be assessed to determine if a site could be returned, or should remain responsibility of the operator
- Starting point for jurisdictions to develop policy and regulatory program

- Next step in project under discussion by NOAMI Advisory Committee



Web-Based National Inventory of Orphaned/Abandoned Mines

To be launched August 2014

- Linked to jurisdictional databases through portal
- Legal-based classification (initial)
- Feature-based classification
 - 4 classes of risk level
- Classification for all jurisdictions complete
- Publically accessible, bilingual inventory
- At present
 - site enhancements
 - jurisdictional approval

Next step – Long term maintenance





Mine Environment Neutral Drainage (MEND)

www.mend-nedem.org

National Orphaned/ Abandoned
Mines Initiative (NOAMI)

www.abandoned-mines.org



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**Thank You
Merci**



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