Update on MEND and NOAMI

16th BC/MEND Workshop
December 2 and 3, 2009

Gilles Tremblay and Charlene Hogan
MEND, NOAMI and GARD Guide Secretariats

MEND Program

- 1989 – 2010
- Extensive national and international Network
- ~$20M in 21 yrs
- Focused research work plan
- Information transfer

MEND Mission

Maintaining the momentum….

…to provide leadership and guidance on priority AD issues in Canada

MEND Research Themes

- Mine waste management practices
- Emerging challenges
- Prediction and post-closure management
- Case studies at Canadian mine sites
- Guidance documents
- Information transfer

Current Work Plan

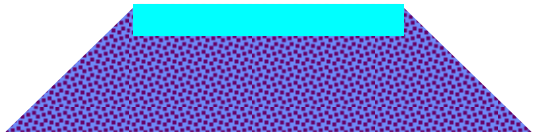
Addresses top ranking priorities identified by Canadian experts.

- Closure Management/Case Studies
- Verification of Technologies/Case Studies
- Metal Leaching - Neutral pH
- Passive Treatment
- Sludge Management
- Early Prediction
- Cold Temperature Effects
- Paste Backfill
- Guidance Documents/Manuals

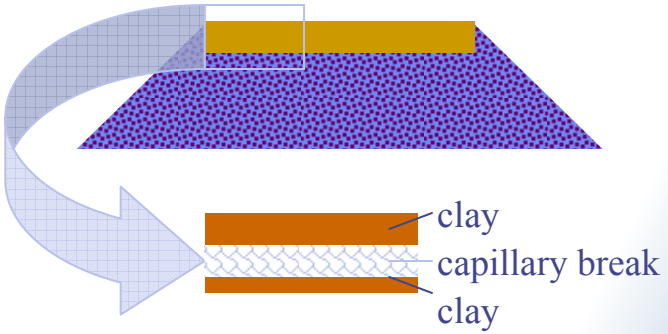
Closure Management

Cover Technologies

- Soil / Vegetation Cover
- Engineered Dry Covers
- Geomembranes
- Water Covers
  - Saturation (elevated water table)



Water covers



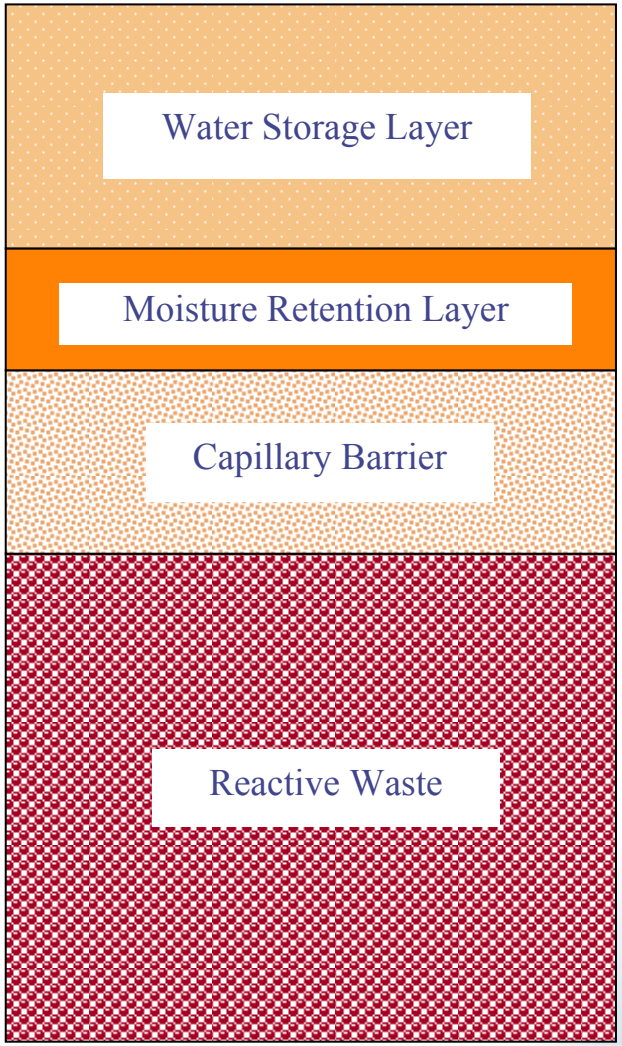
Dry covers

Vegetation Cover – Successes and Challenges

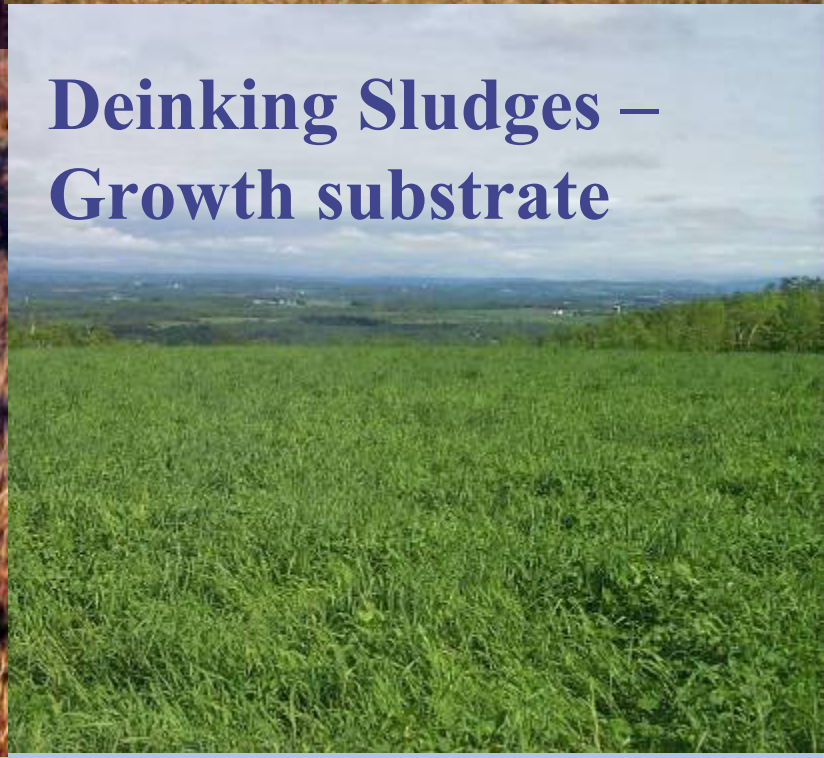
- Successful site remediation
- Surface stabilization, and wind and water related erosion control
- Greatly improved site aesthetics
- Acidic drainage continues unabated
- Limited growth period and availability of native seed species in colder regions
- Ongoing effluent collection and treatment required on a long-term basis (perpetuity)
- Sludge collection, disposal and management required

Engineered Dry Covers

- Simple soil to composite engineered covers to limit both oxygen diffusion and moisture infiltration
- Factors affecting economic and feasibility of a cover system:
  - Site climatic conditions
  - Availability of cover materials
  - Distance to borrow sources
  - Cover and waste material properties and conditions
  - Surface topography and hydrology
  - Cost ~ $50k to $100k / ha; may be more in the north



Deinking Sludges – Growth substrate



Poirier 1998 - 2001

Unique solution using existing liner technology

Dry Covers - Summary

- Small foot print and low and to medium overall risk of catastrophic failure (depending on dam heights and water table elevation)
- Cover selection, design and placement dependent on site specific conditions
- Inclusion of local landforms conditions in overall cover design
- Local availability of cover materials is a prerequisite
- Most engineered dry cover sites are still at experimental stages and no integrated, long-term performance record is available

Dry Covers - Summary

- Long-term cover integrity, effects of geological movement, root penetration and animal activity unknown
- Implications of freeze-thaw heaving, ice lens formation, differential thermal or mechanical deformations and winter desiccation on cover integrity in the northern regions are yet to be fully evaluated
- Longevity of membrane covers at persistently low temperatures, specifically thermal shrinkage/stretching and cracking, is yet to be established
- Progressive reclamation may not be always possible and the waste may be partially exposed during the operating phase
- Permafrost encapsulation is very promising for the north, however, its applicability is most impacted by the global warming trend

Dry Cover Manuals

Dry Covers Manual (Micro-scale)

5-volume set available in **hard copy** or **CD-ROM:**

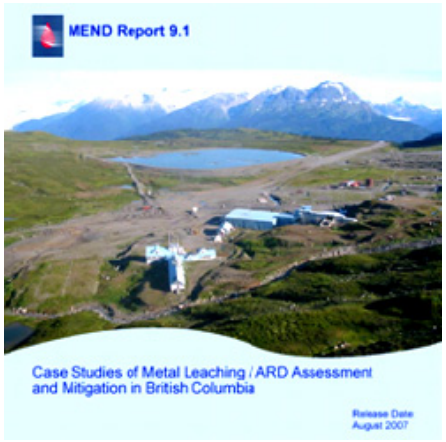
1. Summary
2. Theory and Background
3. Site Characterization, and Numerical Analyses of Cover Performance
4. Field Performance Monitoring, Sustainable Performance of Cover Systems
5. Case Studies

Macro-Scale Cover Design and Performance Monitoring Manual (MEND 2.21.5)

Case Studies at Canadian Mine Sites

Case Studies in BC (MEND 9.1CD-ROM)

- Johnny Mountain Mine
- Snip Mine
- Sulphurets Mine



Case Studies in Cold Regions

Case Study Assessment

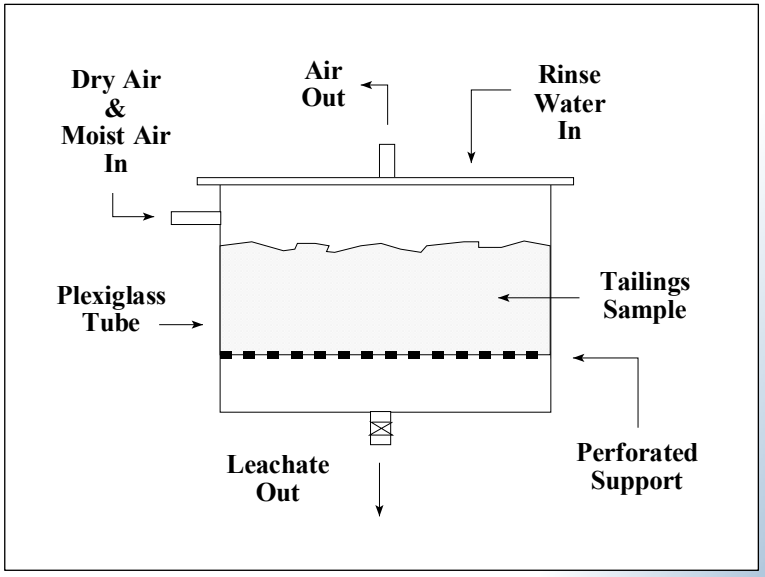
- Dona Lake, ON (Placer Dome)
- Heath Steele, NB (Xstrata)
- Mandy Lake, MB (HBMS)
- East Kemptville (BHP Billiton)
- Mine Poirier (BHP Billiton)
- Mine Louvicourt (Teck Resources)

Prediction Manual

Prediction Manual for Drainage Chemistry from Sulphidic Geological Materials (NRCan)

- The objective of this Manual is to provide the comprehensive, in-depth level of understanding needed to conduct a prediction program and review the results.
- 21 chapters plus a Glossary

Available for Christmas 2009



X-Cutting – Technology Transfer

The MEND Monitor

Workshops (>30)

- Annual BC/MEND ARD/ML Workshops
- Sudbury (2004); Halifax (2006); Winnipeg (2008)
- MEND Technology Transfer Workshops to Community Groups

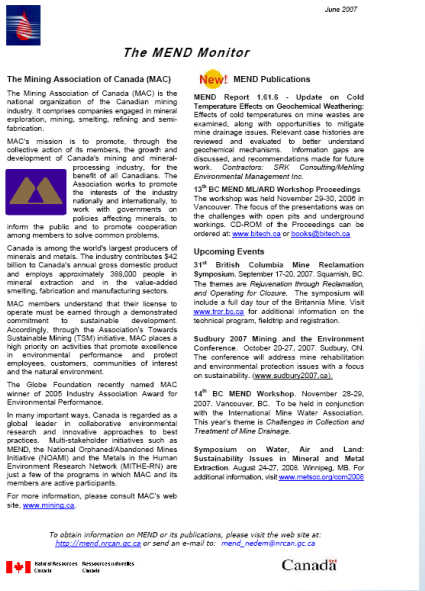
MEND Website at: **mend.nrcan.gc.ca**

MEND Reports (>210)

MEND Manual

Global Alliance

- GARD Guide



June 2007

The MEND Monitor

The Mining Association of Canada (MAC)

The Mining Association of Canada (MAC) is the national organization of the Canadian mining industry. It comprises companies engaged in mineral exploration, mining, smelting, refining and semi-fabrication.

MAC's mission is to promote, through the collective action of its members, the growth and development of Canada's mining and mineral-processing industry, for the benefit of all Canadians. The Association works to promote the interests of the industry nationally and internationally, to work with governments on policies affecting minerals, to inform the public and to promote cooperation among members to solve common problems.

Canada is among the world's largest producers of minerals and metals. The industry contributes $42 billion to Canada's annual gross domestic product and employs approximately 368,000 people in mineral extraction and in the value-added smelting, fabrication and manufacturing sectors.

MAC members understand that their license to operate must be earned through a demonstrated commitment to sustainable development. Accordingly, through the Association's Towards Sustainable Mining (TSM) initiative, MAC places a high priority on activities that promote excellence in environmental performance and protect employees, customers, communities of interest and the natural environment.

The Globe Foundation recently named MAC winner of 2005 Industry Association Award for Environmental Performance.

In many important ways, Canada is regarded as a global leader in collaborative environmental research and innovative approaches to best practices. Multi-stakeholder initiatives such as MEND, the National Orphaned/Abandoned Mines Initiative (NOAMI) and the Metals in the Human Environment Research Network (MITHE-RN) are just a few of the programs in which MAC and its members are active participants.

For more information, please consult MAC's web site, www.mining.ca.

New! MEND Publications

MEND Report 1.61.6 - Update on Cold Temperature Effects on Geochemical Weathering: Effects of cold temperatures on mine wastes are examined, along with opportunities to mitigate mine drainage issues. Relevant case histories are reviewed and evaluated to better understand geochemical mechanisms. Information gaps are discussed, and recommendations made for future work. *Contractors: SRK Consulting/Mehling Environmental Management Inc.*

13th BC MEND ML/ARD Workshop Proceedings The workshop was held November 29-30, 2006 in Vancouver. The focus of the presentations was on the challenges with open pits and underground workings. CD-ROM of the Proceedings can be ordered at: www.bitech.ca or books@bitech.ca

Upcoming Events

31st British Columbia Mine Reclamation Symposium, September 17-20, 2007 Squamish, BC. The themes are *Rejuvenation through Reclamation, and Operating for Closure*. The symposium will include a full day tour of the Britannia Mine. Visit www.trcr.bc.ca for additional information on the technical program, fieldtrip and registration.

Sudbury 2007 Mining and the Environment Conference, October 20-27, 2007, Sudbury, ON. The conference will address mine rehabilitation and environmental protection issues with a focus on sustainability. (www.sudbury2007.ca).

14th BC MEND Workshop, November 28-29, 2007, Vancouver, BC. To be held in conjunction with the International Mine Water Association. This year's theme is *Challenges in Collection and Treatment of Mine Drainage*.

Symposium on Water, Air and Land: Sustainability Issues in Mineral and Metal Extraction, August 24-27, 2008, Winnipeg, MB. For additional information, visit www.metsoc.org/iom2008

To obtain information on MEND or its publications, please visit the web site at: http://mend.nrcan.gc.ca or send an e-mail to: mend_nedem@nrcan.gc.ca

Natural Resources Canada Ressources naturelles Canada

Canada

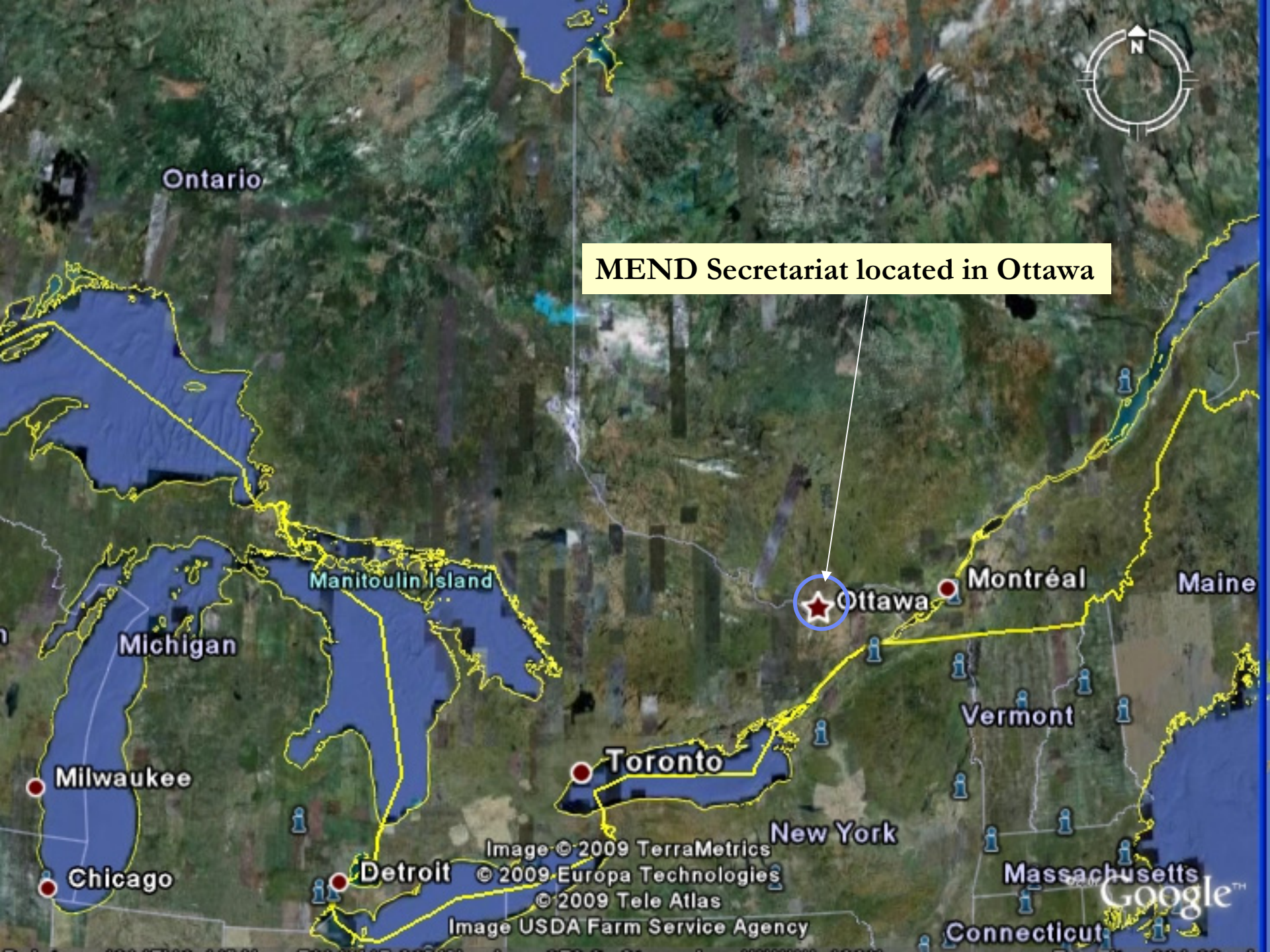
9th International Conference on Acid Rock Drainage

Ottawa, Ontario Canada

"In the birthplace of MEND"

Conference Dates - May 21-26, 2012

- Monday, May 21 – Short Courses
- May 22 to 24 – Technical Program
- May 25 and 26 – Field Trips
  - Dates tentative; conference hotel pre-reserved
  - 300 rooms per night
  - Expect over 500 people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Westin Hotel

National Orphaned / Abandoned Mines Initiative - (NOAMI)

NOAMI National Orphaned/Abandoned Mines Initiative
INMOA Initiative nationale pour les mines orphelines ou abandonnées

Brewery Creek – near Dawson Creek, Yukon

The Action Plan

The overarching goals of NOAMI are to provide tools to remediate existing orphaned and abandoned properties and to prevent the occurrence of new orphaned and abandoned mines in the future.

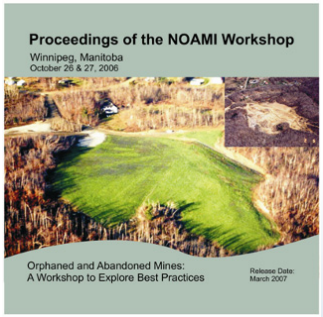
Task groups were formed to address five key issues:

- Information Gathering Towards National Inventory
- Community Engagement
- Legislative Barriers to Collaboration
- Funding Approaches
- Jurisdictional Legislative Review

Information Sharing is an integral part of NOAMI

NOAMI Highlights

- Working model of web-based National Inventory of orphaned/abandoned mines (OAMs)
- Guidelines and Toolkits:
  - Pamphlet on Guiding Principles in Community Involvement
  - A Toolkit of Funding Options for Abandoned Mine Rehabilitation
  - Toolkit on Community Engagement
- Information Sharing
  - Four workshops including:
    - Best Practices (Winnipeg, 2006)
    - Perspectives on Risk Assessment (Vancouver, 2008)
  - NOAMI website www.abandoned-mines.org and Newsletters

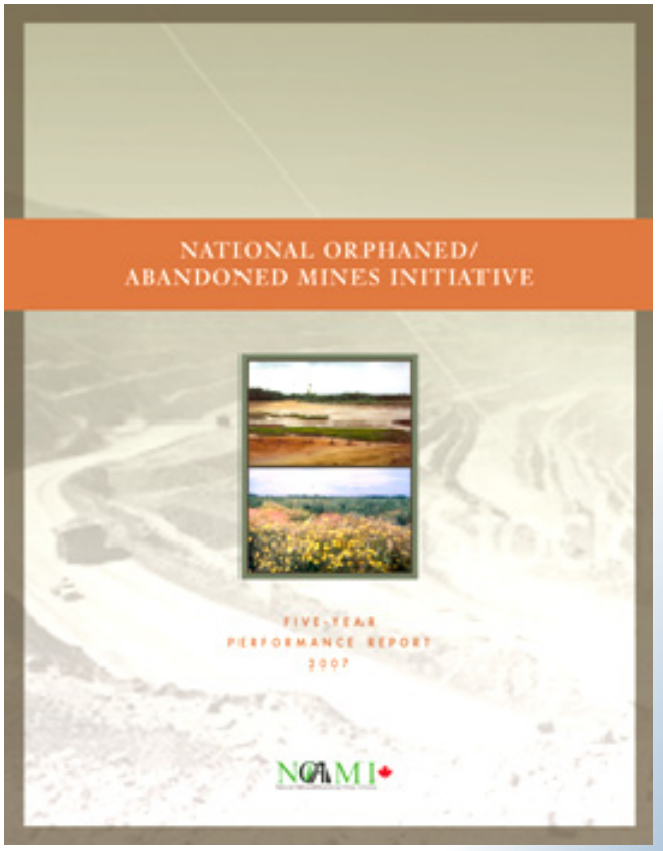


NOAMI Highlights

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

Performance Report (2002 – 2008)

- Summarizes the work of NOAMI since its inception, including publications and activities
- Outlines its impacts and benefits, and the role of the stakeholders
- Includes the accomplishments of the jurisdictional partners
- “Looking Ahead” section notes remaining challenges and future recommended activities



NOAMI Conclusions

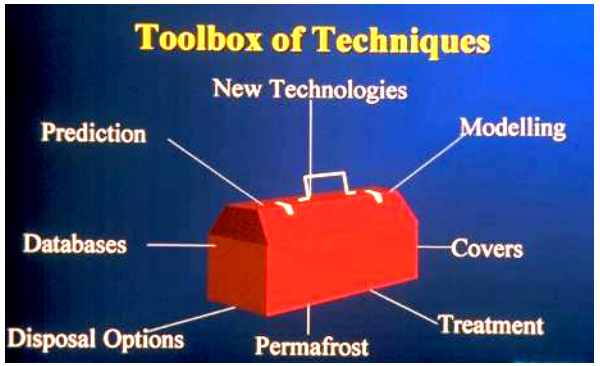
NOAMI is….

- A forum for multi-stakeholders to work together.
- Making a difference in policy and program development, both nationally and internationally.
- A meeting place for exchange of information and practical examples.
- The only initiative of its kind in the world.

Jurisdictions across Canada are cleaning-up many of these legacy sites and acting to prevent new ones.

Mine Environment Neutral Drainage (MEND)

mend.nrcan.gc.ca



National Orphaned/ Abandoned Mines Initiative (NOAMI)

www.abandoned-mines.org

NOAMI
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INMOA
Initiative nationale pour les mines orphelines ou abandonnées

Merci
Thank You

La cité de l'or
Val d'Or , Québec