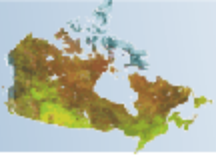


Update of the MEND and NOAMI Programs

14th BC-MEND ML/ARD Workshop
November 28, 2007

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





Presentation Highlights

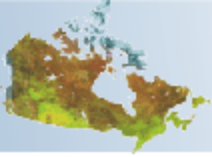
Consortia

MEND

- Background
- Work plan
- Global Alliance
- GARD Guide

NOAMI

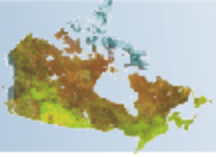




Consortia in Canada

- Co-operative initiative among industry, various levels of governments, non-governmental organizations and aboriginal Canadians
- Address issues of national importance
- Ensure that government policy is based on sound science
- Benefits
 - Open sharing for evaluation of technologies
 - Collaborative efforts result in a better perspective of the issues
 - Continuity
 - Avoids duplication

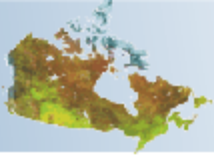




Mine Environment Neutral Drainage (MEND) Program

- 1989 – 2007
- Extensive national and international Network
- ~\$20M in 18 yrs
- Focused research work plan
- Technology transfer





MEND Steering Committee

Elizabeth Gardiner – Chair, MAC

Mike Aziz – Goldcorp

Kim Bellefontaine – Province of BC

Louis Bienvenu – Province of QC

Catherine Coumans - MiningWatch

Amy Crook – CSP2

Chris Doiron/Charles Dumaresq –
EC

Charlene Hogan – MEND
Secretariat, NRCan

Denis Kemp - INAP

Bill Price - NRCan

Doina Priscu, Province of MB

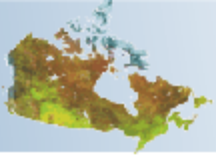
John Robertson – Province of
ON

Wade Strogan – Aur Resources

Gilles Tremblay – MEND
Secretariat, NRCan

Maxine Wiber – BHP Billiton





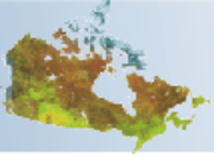
Key MEND Supported Technologies

- Prediction techniques
- Water covers for unoxidized and partially oxidized wastes
- Dry covers using soils/tailings, organic materials and geomembranes
- Mine waste management options for tailings, waste rock and treatment sludges
- Active and passive treatment
- Cold climate issues (permafrost)



Rabbit Lake, CAMECO

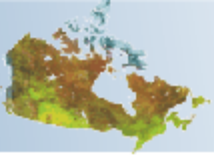




Environmental Responsibility

- Increasing emphasis on finding different solutions to mine waste management issues
- Solutions to be both environmentally sound and cost-effective
- Need to meet increasingly stringent regulatory requirements and public concerns, and to reduce environmental liability

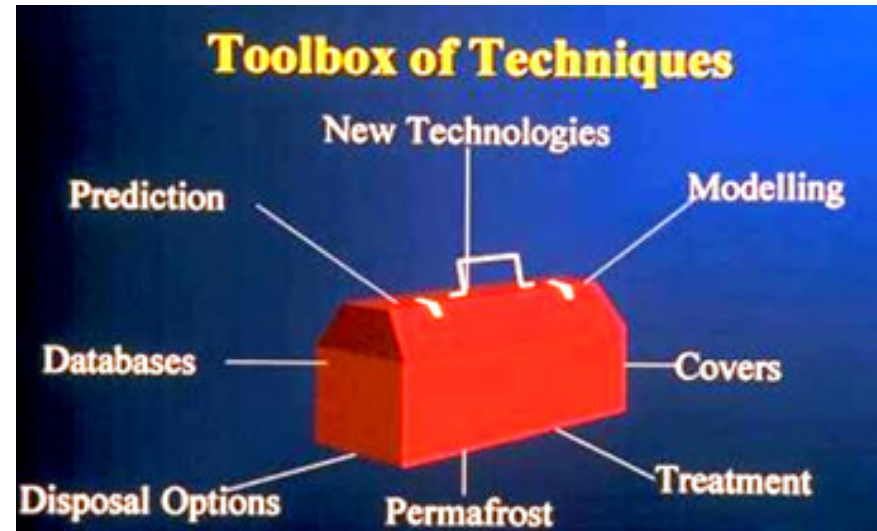


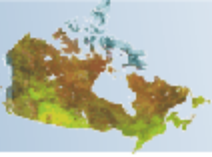


Current Work Plan

Program 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





Mine Waste Management Practices

Covers for Permafrost (MEND 1.61.4)

- Covers over reactive tailings in Canadian permafrost regions. Four case studies.

Underground Paste Backfill (MEND 10.2)

- Geochemical characterization of both cemented and uncemented paste backfill.

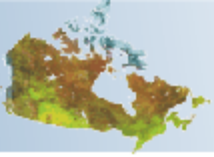
Update on Cold Temperature Effects on Geochemical Weathering (MEND 1.61.6)

- Geochemical processes at low temperatures. Includes compilation of 14 case studies.

Disposal Options for Lime Sludges (MEND 3.42.3)

- Conventional and alternative technologies for management and disposal of AD treatment sludges.





Mine Waste Management Practices

Near completion...

Northern Soil Covers (SRK)

- Study on cold region phenomena that could impact on the performance of soil covers.

Chemical Treatment Plant Survey (CANMET)

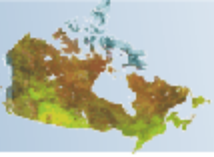
- Develop comprehensive database containing treatment and sludge management information for mine sites in Canada or worldwide

In progress...

Diavik Diamond Mine Waste Rock Scale-Up – 5 yr study

- To evaluate and prevent the possible ML/AD from waste rock





Emerging Challenges

Review of Water Quality Issues in Neutral pH Drainage (MEND 10.1)

Near completion...

Literature Review on Impacts of Mo and Se on Terrestrial Environment (EcoMetrix)

PJV – Encapsulation (EcoMetrix)

- Laboratory study on encapsulating acid-generating tailings between two acid-consuming tailings

Membrane Separation Technology (CANMET)

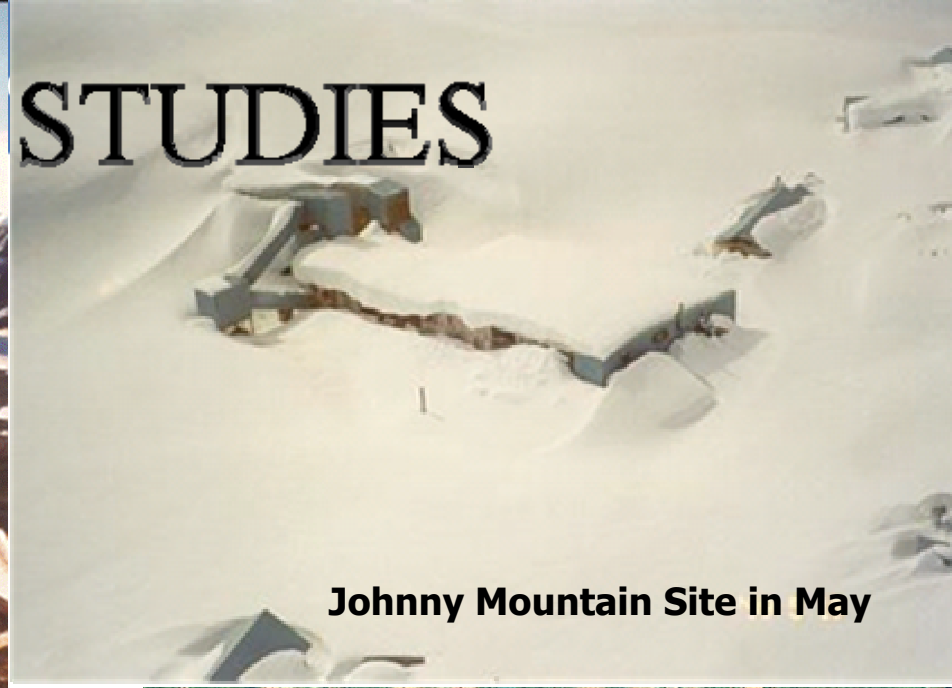
- Review on the feasibility of different membrane separation processes for the mitigation of ARD



CASE STUDIES



Sulphurets



Johnny Mountain Site in May



East Kemptville, BHP Billiton



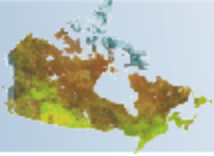
Mandy Lake, HBMS



Natural Resources
Canada

Ressources naturelles
Canada

Canada



Case Studies and Post-Closure Management

List of Factors to Consider in ML/ARD Assessment and Mitigation (MEND 5.10E/F)

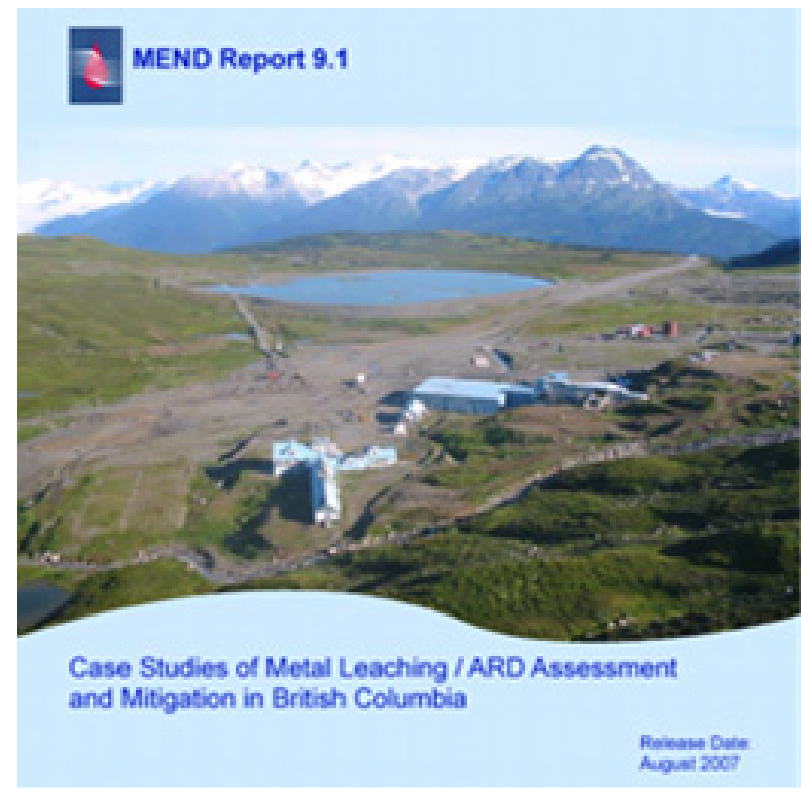
Case Studies in BC (MEND 9.1CD-ROM)

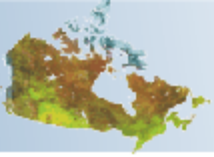
- Johnny Mountain Mine
- Snip Mine
- Sulphurets Mine

Near completion....

Case Study Assessment (SNC-Lavalin)

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





Case Studies and Post-Closure Management

Performance of Water Cover at Louvicourt Mine (MEND 2.12.2)

- Investigation of the long-term performance of the shallow water cover. 7 years later

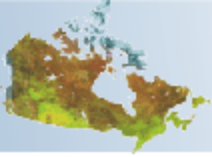
Near completion...

Investigation of Predictions for Acidic Drainage at Vangorda Mine (Faro) (CCSG)

Literature Review of Assessing the Potential Biological Impacts of Submerged Tailings (CANMET)

Louvicourt





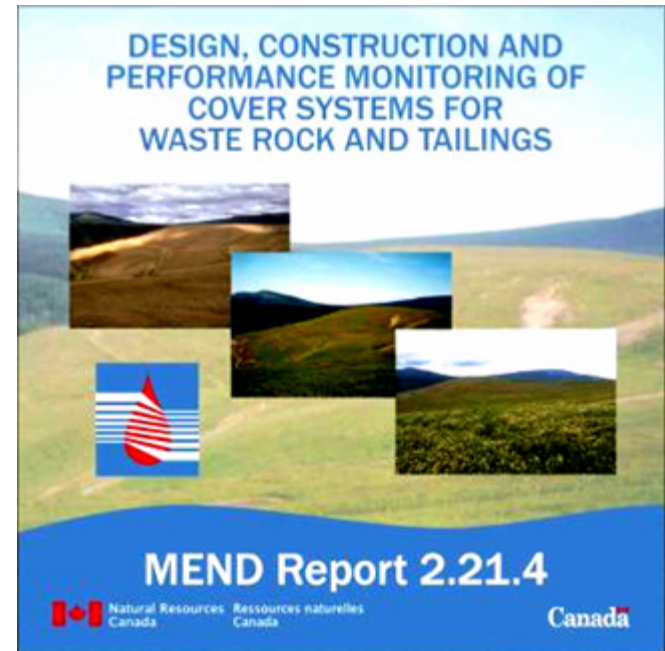
X-cutting - Guideline Documents

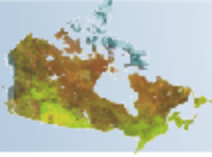
MEND Manual (MEND 5.4.2)

Dry Covers Manual (Micro-scale)
(MEND 2.21.4)

Macro-Scale Cover Design and
Performance Monitoring i.e. watershed
scale (MEND 2.21.5)

Prediction Manual - Update of the Draft
“BC Prediction Manual” to be published
as national document (NRCan)





X-Cutting – Technology Transfer

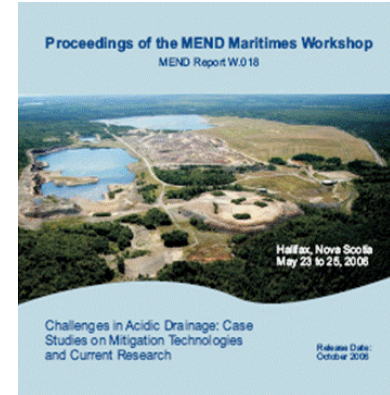
The MEND Monitor

Workshops

- Annual BC/MEND ARD/ML Workshops Halifax 2006; Central Canada 2008 (?)
- MEND Technology Transfer Workshops to Community Groups
- Symposium 2008 – Rouyn Noranda

MEND Website at: mend.nrcan.gc.ca

MEND Reports
Global Alliance



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 355,000 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.

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

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/Meihing Environmental Management Inc.

13th BC MEND MLARD 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.btmn.ca or books@btmncb.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.trr.bc.ca for additional information on the technical program, felptrip and registration.

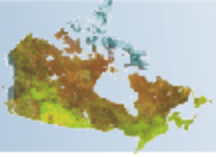
Sudbury 2007 Mining and the Environment Conference, October 20-27, 2007, Sudbury, ON. The conference will address mine rehabilitation and environmental protection issues with a focus on sustainability. (www.sudbury2007.ca)

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 Collector 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/con2008

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

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



Global Alliance



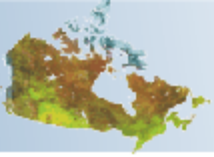
Acid Drainage Technology Initiative



Water Research Commission

www.inap.com.au





Global Alliance Project

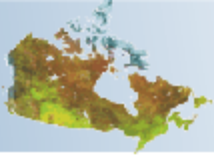
Global ARD Guide (GARD GUIDE)

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

The guide will become a reference document for all stakeholders involved in ARD and waste management issues

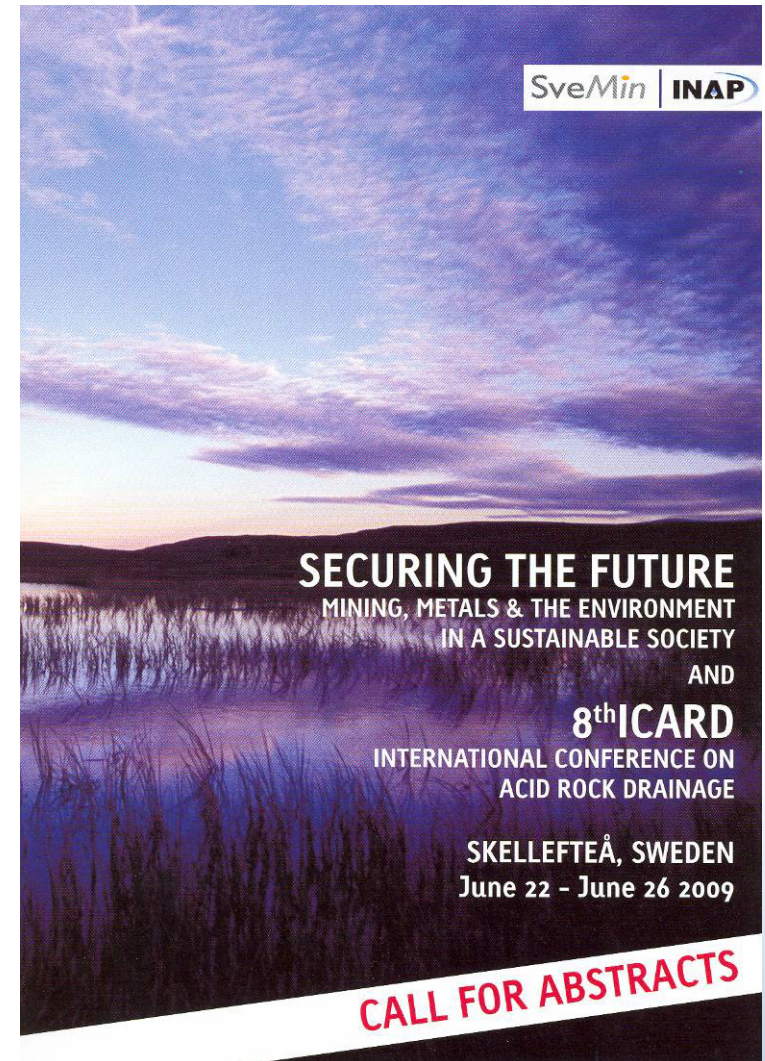
Secretariat functions for GARD Guide at MEND Office,
Natural Resources Canada





8th International Conference on Acid Rock Drainage

Skellefteå, Sweden
June 22-26, 2009



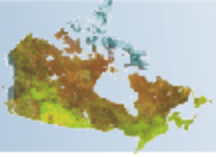
Abandoned Mines in Canada



Natural Resources
Canada

Ressources naturelles
Canada

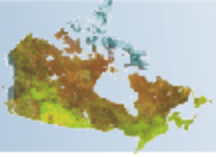
Canada 



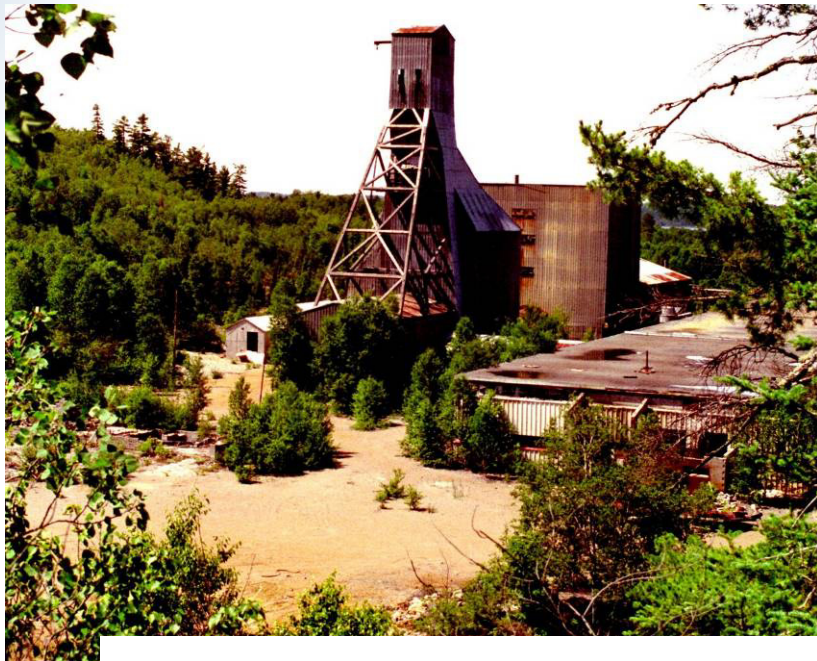
Health and Safety Issues

- Mine openings
- Abandoned Infrastructure
- Subsidence



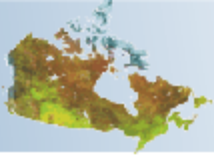


National Orphaned / Abandoned Mines Initiative - (NOAMI)



North Coldstream Mine - Burchell Lake, ON





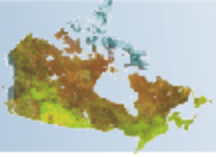
NOAMI

National Orphaned/Abandoned Mines Initiative

- Multistakeholder partnership
- Five task groups overseeing prioritized projects:
 - Information Gathering (Inventory)
 - Community Involvement
 - Barriers to Collaboration
 - Funding Approaches
 - Jurisdictional Legislative Review

www.abandoned-mines.org





National Inventory



www.abandoned-mines-inventory.org



Web-Based National Inventory

National Orphaned/Abandoned Mines Initiative (NOAMI) Advisory Committee

one studies and oral presentations, and further discussed in plenary sessions. A final discussion considered the highlights to each theme, and verified gaps and future priorities for NOAMI.

Inventory of Orphaned/Abandoned Mines in Canada

The NOAMI Advisory Committee was formed in 2005 at the request of Canadian Mines Ministers through a multi-expertise national committee to set up a 10-year national review and process leading to the development of partnerships in the implementation of remediation programs across Canada.

Assessing Liabilities and Funding Options Workshop – Ottawa, ON

Significant work has been accomplished in a number of areas and the following provides an update for these activities.

Background

A key objective for NOAMI is to identify existing approaches and to assess whether actions that could be derived from the success of each jurisdiction to fund the remediation of orphaned/abandoned mine sites across Canada.

Commit Report

The report, *Assessing Funding Approaches for Orphaned/Abandoned Mines in Canada* (August 2007), reviewed and recommended a variety of funding options for consideration in the design or management of funding related to orphaned/abandoned mines (OAMs).

The Workshop

A multi-expertise workshop on Assessing Liabilities and Funding Options (ALFO) was held in Ottawa on November 2 and 3, 2007. The objective of the workshop was to compare funding and/or cost recovery approaches and address issues for OAMs with other Canadian stakeholders. The workshop was well-attended and enabled by over 70 participants from industry, Aboriginal Canadians, two provincial governments, and non-Aboriginal and federal governments. A variety of presentations were made on the findings of the funding approaches report. Key themes of technical concerns for site assessments, accounting for and operating on liabilities, inventory consistency and health impacts, and funding options were examined through

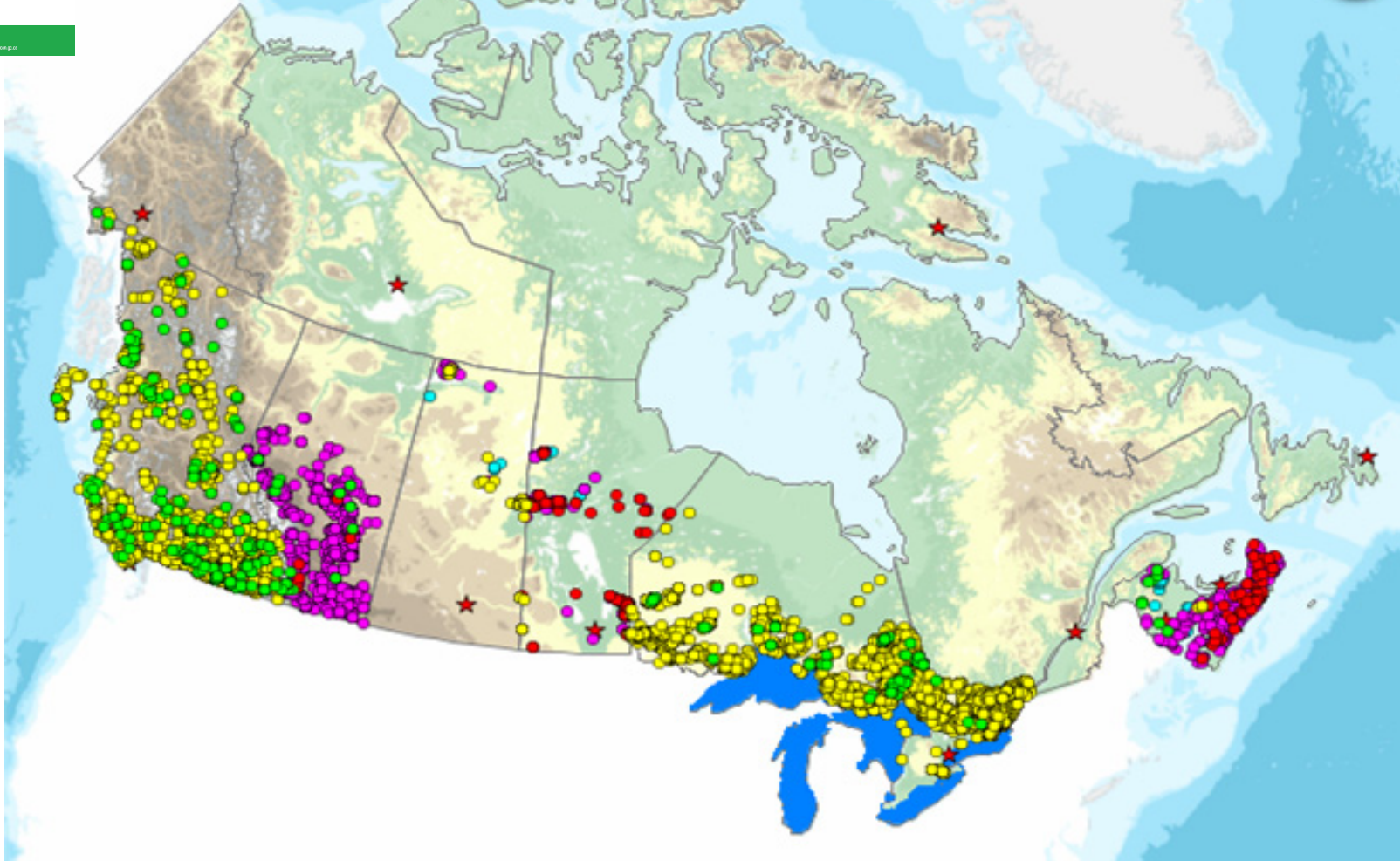
case studies and oral presentations, and further discussed in plenary sessions. A final discussion considered the highlights to each theme, and verified gaps and future priorities for NOAMI.

The report *Capacity Building for a National Inventory of Orphaned/Abandoned Mines in Canada* (July 2007) reviewed Canadian, US and international efforts to inventory orphaned/abandoned mines. Recommendations were made for an inventory that would include all known mine sites, a web-based and has a user interface. The system would act as a portal to existing resources maintained within the provinces, territories and federal agencies. Use of a web interface would allow one of an internet-based knowledge of inventory data systems.

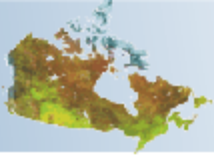
NOAMI Portal
Three options were reviewed to determine the most suitable host for the NOAMI internet portal. The information being sought is a Department of Natural Resources Canada (NRCan) web service to host the portal. NRCan maintains several data and information base technology, which deal with several industries and related areas, such as Aboriginal communities. These sites can be visited at:
- <http://www.nrcan.gc.ca/aboriginal>
- <http://www.nrcan.gc.ca/indigenous>

A mandate has been given to NRCan by NOAMI to develop a working model of the database capabilities with OAMs to assist jurisdiction. Subsequent phases would integrate datasets for the other industries and datasets to build a national web inventory.

Proceedings of the ALFO workshop, the Commit and Call Data reports, and other publications can be downloaded from our web site at: <http://www.abandonedmines.org>

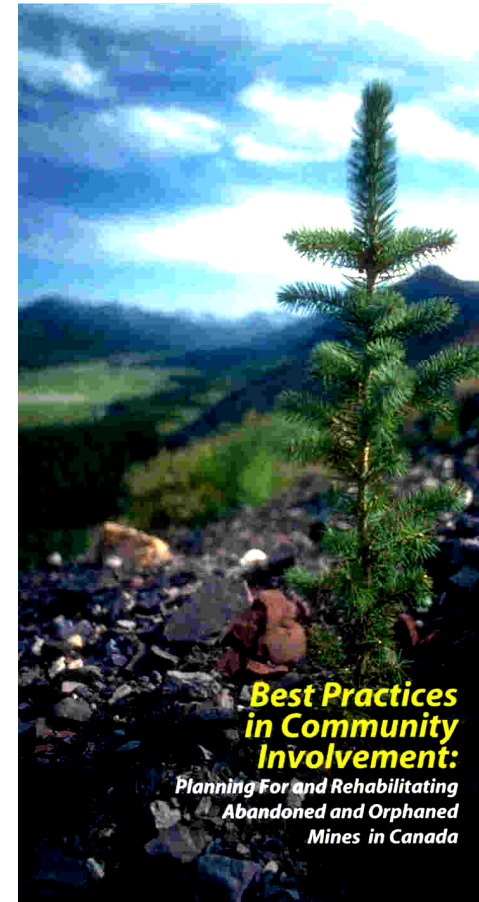


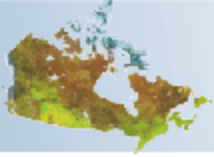
National Orphaned/Abandoned Mines Initiative
To further Abandoned Mines, visit our site: www.abandonedmines.org



NOAMI Highlights

- **Workshop on Assessing Liabilities and Funding Options held (Ottawa, November, 2005)**
- **Report on Capacity Building for a National Inventory**
 - **Review of Canadian and international inventories**
- **Report on case studies examining issues related to community involvement and publication of guidelines (pamphlet) for meaningful community engagement**
- **Report, workshop and summary recommendations on legislative and institutional barriers to voluntary remediation**
- **Report and summary recommendations on funding approaches for orphaned/abandoned mines**





NOAMI Highlights 2006/07

- Workshop to Explore Best Practices held (Winnipeg, October, 2006). CD-ROM available.
- A Toolkit of Funding Options Report
- CD-ROM of report on the legislative, regulatory, and policy framework for all jurisdictions in Canada

Proceedings of the NOAMI Workshop

Winnipeg, Manitoba
October 26 & 27, 2006



Orphaned and Abandoned Mines:
A Workshop to Explore Best Practices

Release Date:
March 2007



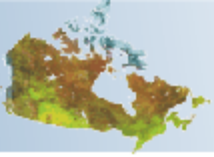
Jurisdictional Legislative Review



Report on the Legislative, Regulatory, and Policy Framework Respecting Collaboration, Liability, and Funding Measures in relation to Orphaned/Abandoned, Contaminated, and Operating Mines in Canada

Release Date:
November 2007





Green Mines – Green Energy Biosolids to Bioenergy

- CANMET – led consortium to examine use of “waste” organic materials to rehabilitate mine sites and establish energy crops (canola, corn, soy etc.) for the production of biofuels

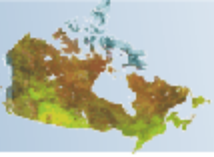
Biosolids + Mine Tailings + Energy Crops = Green Fuel

Now



Next??

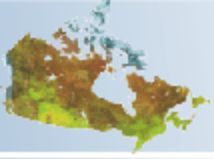




Green Mines – Green Energy

- Reclamation of mine tailings to a productive land use that represents a major contribution towards sustainable development and GHG reductions
- Beneficial management and reuse of bio-based wastes from municipal and industrial sectors
- Brownfield utilization for green energy production
- Potential for on-going cash flow to subsidize monitoring/ treatment costs
- Use of one industry's waste to remediate another and produce bio-energy

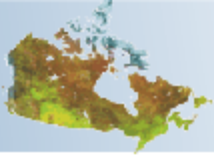




Metals in Soils Initiative

- Metal contamination of soil can be a problem in and around many mining sites.
- Extent and type of contamination not well understood
- Multistakeholder initiative to better quantify and assess the liabilities associated with metal contamination in terrestrial systems





Mine Environment Neutral Drainage (MEND)

mend.nrcan.gc.ca

National Orphaned/ Abandoned Mines Initiative (NOAMI)

www.abandoned-mines.org



Thank You!

Merci!



Natural Resources
Canada

Ressources naturelles
Canada

Canada 