Strategy Themes and Outcomes - MEND and NOAMI

MEND Manitoba Workshop
June 4, 2008

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

Presentation Highlights

Consortia

MEND

- Background
- Work plan
- Global Alliance

NOAMI

Current Trends in Canada

- Enlightened sustainable development policies
  - Mining recognized as a sustainable industry
  - Environmental problems can be prevented
  - No public $
- New mining and waste technologies
- Site - specific solutions and criteria
- Recent legislation in Canada
  - Metal Mine Effluent Regulations
  - Provincial
- Cooperative problem solving
  - Consortia

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

- The original MEND program (1989-1997) and its successors contributed enormously to understanding of acidic drainage and its prevention, and to increasing the transfer of knowledge to improve environmental management

MEND Program

- 1989 – 2008
- Extensive national and international Network
- ~$20M in 19 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

Joe Fyfe - Xstrata

Bill Price - NRCan

Doina Priscu, Province of MB

Chris Hamblin – Province of ON

Wade Strogan – NA Tungsten

Gilles Tremblay – MEND Secretariat, NRCan

Maxine Wiber – BHP Billiton


Where metal leaching / acidic drainage is a concern, mining is usually not a temporary use of the land
Waite Amulet

MEND Supported Technologies

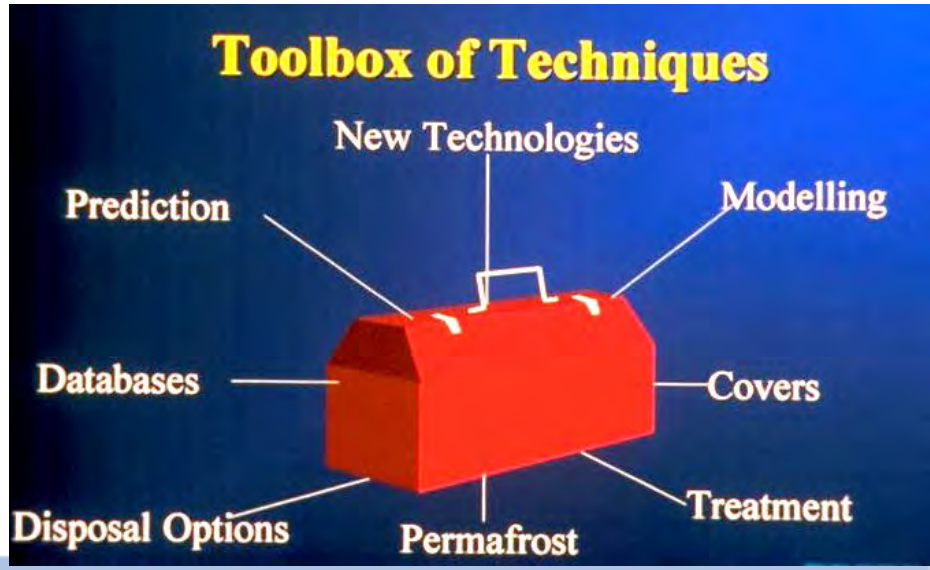
- Prediction techniques
- Water covers for unoxidized and partially oxidized wastes
- Dry covers using soils/tailings, organic materials and geomembranes
- Mine waste management options for tailings, waste rock and treatment sludges
- Active and passive treatment
- Cold climate issues (permafrost)


Rabbit Lake, CAMECO

MEND Results

- Toolbox of methods to reduce environmental impacts of mining
  - Prevention best strategy
  - Increased understanding of acidic drainage (AD)

- Consensus building among government, industry and NGOs
- Recognition for Canada's leadership role in addressing AD for metal mines



Current Work Plan

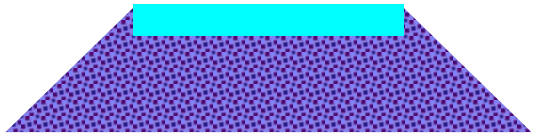
Addresses top ranking priorities identified by Canadian experts.

- 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

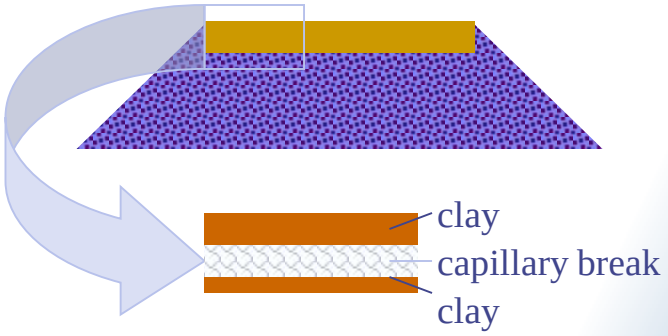
- Soil / Vegetation Cover
- Engineered Dry Covers
- Water Covers
  - Saturation (elevated water table)



Water covers

Isolation of reactive mine waste

- Separation and segregation
- Backfilling (in-pit) and co-disposal
- Permafrost



Dry covers

Engineered Dry Covers

Objectives

- Control the ingress of oxygen
  - High saturation layer
  - Multilayer design
- Control water infiltration
  - Low permeability layer
  - Store and release of moisture

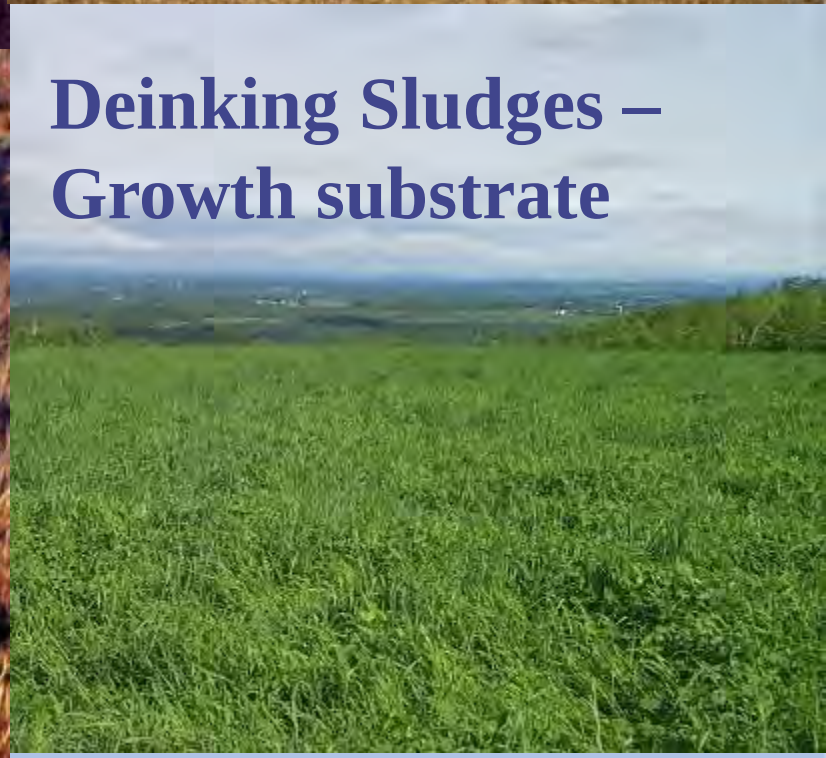
Types of Covers

- Soil/Tailings
- Organics
  - Wood waste, peat, municipal waste
  - Oxygen consuming barrier
  - Availability/economics site specific
  - Longevity
- Geomembranes

Engineered Dry Covers

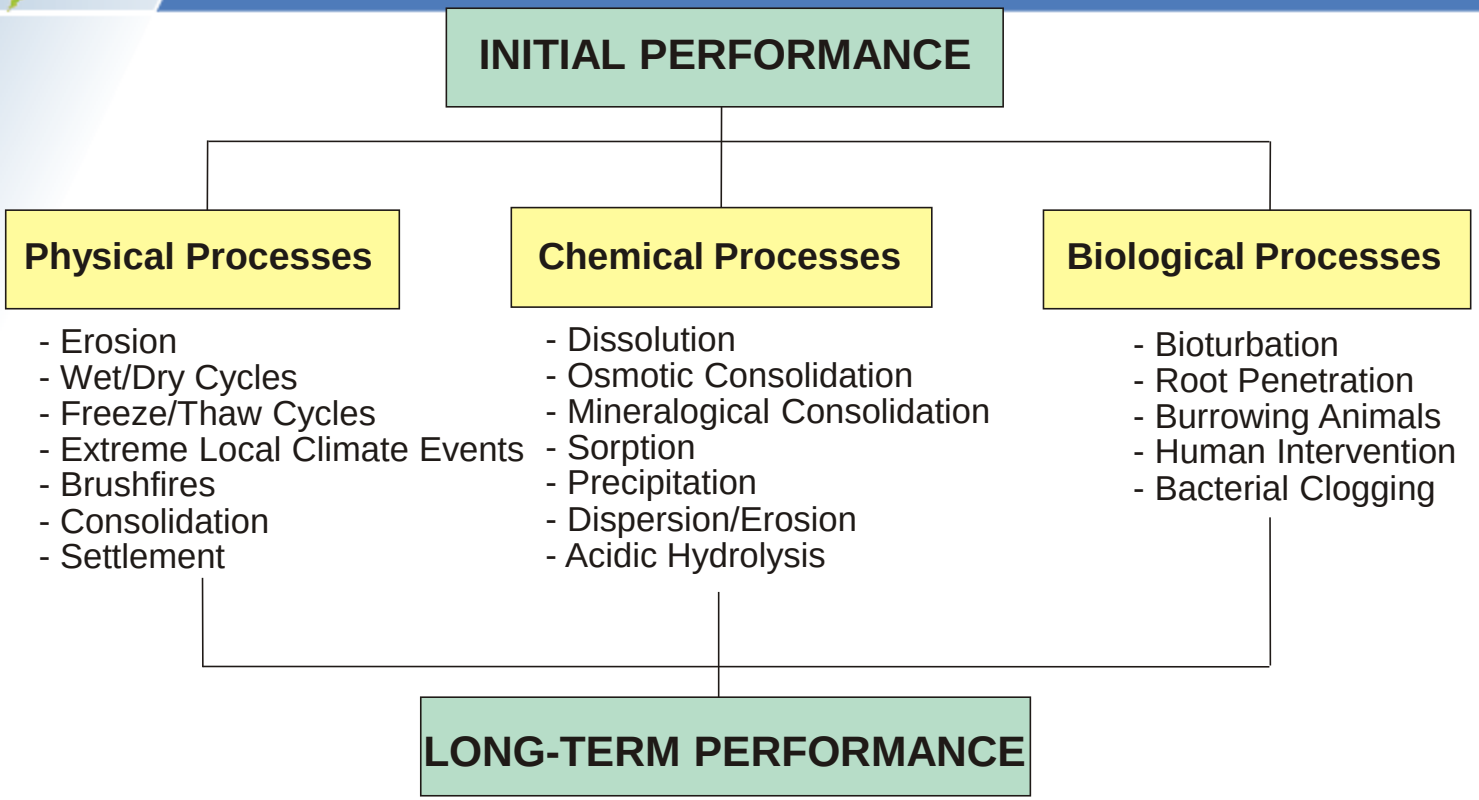
Equity Silver Mine, BC

Deinking Sludges – Growth substrate



Poirier 1998 - 2001

Unique solution using existing liner technology



Resulting In:

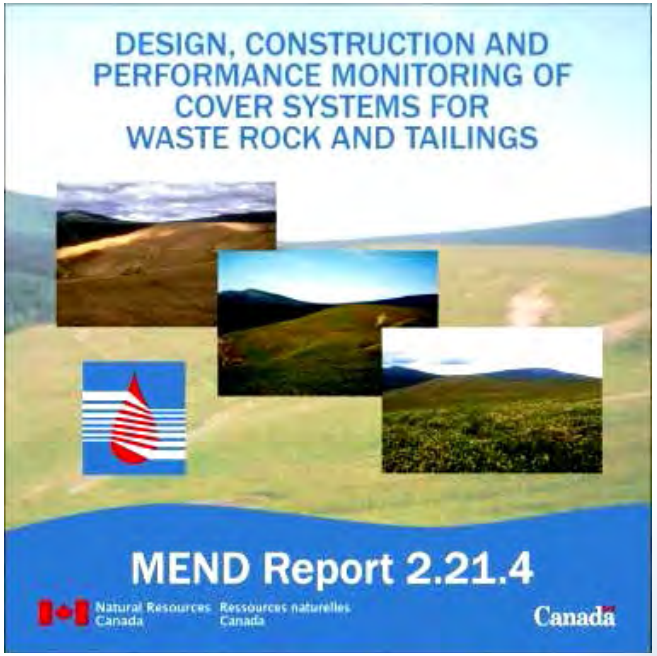
- ***Change in Field Hydraulic Conductivity***
- ***Change in Moisture Retention Characteristics***
- ***Change in Oxygen Diffusion Characteristics***
- ***Change in Physical Integrity of Cover System***

Dry Cover Manuals

Dry Covers Manual (Micro-scale)

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

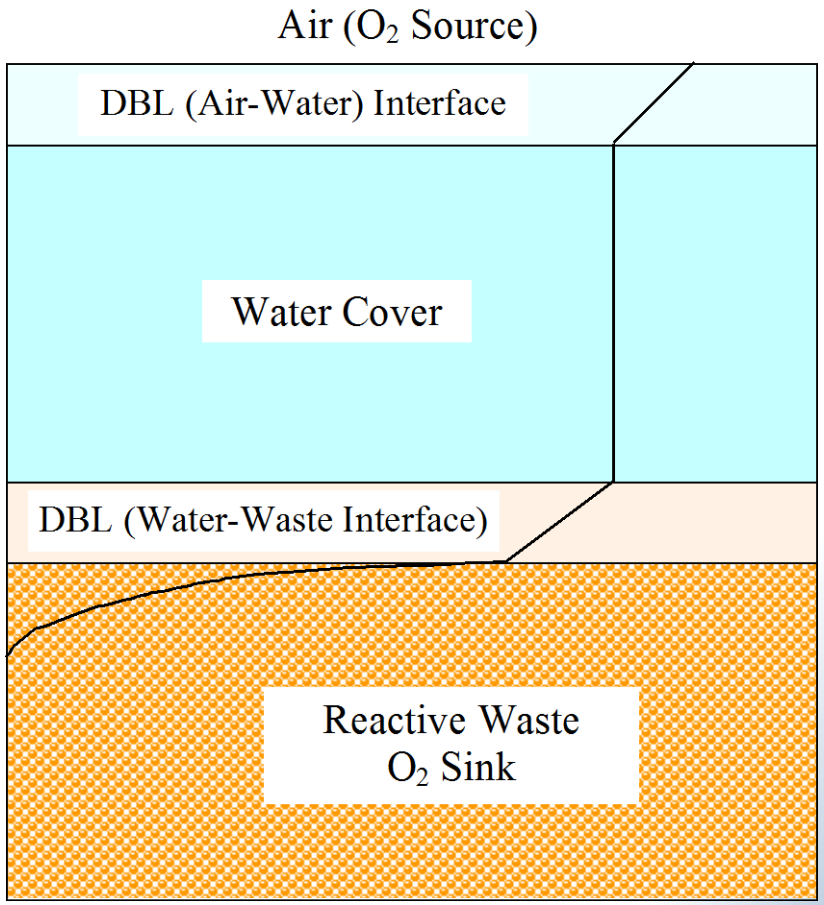
1. Summary
2. Theory and Background
3. Site Characterization, and Numerical Analyses of Cover Performance
4. Field Performance Monitoring, Sustainable Performance of Cover Systems
5. Case Studies



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

Water Covers

- Water covers - oxygen limiting
- Diffusion barrier to both oxygen in the water cover and contaminants in the submerged waste
- Development of Diffusion Barriers Layers (DBL) at the water-waste and water-air interfaces



CANMET Mining and Mineral Sciences Laboratories

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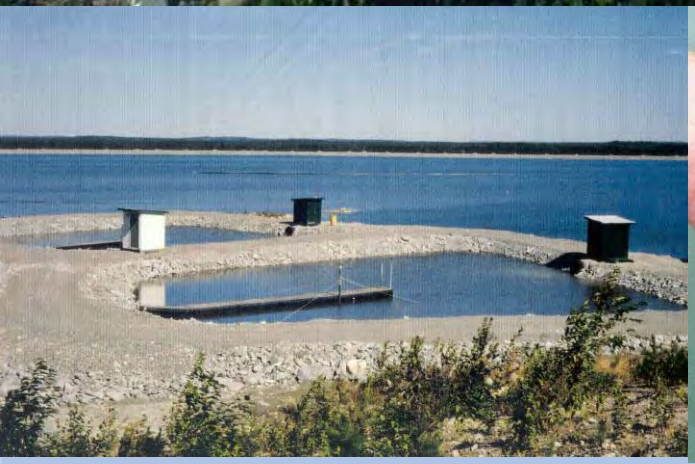
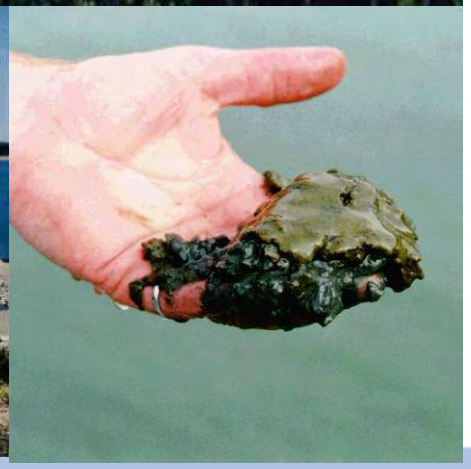




Shallow Water Cover at Louvicourt

- 1994 – 2004
- 28% pyrite (average)
- 45% of tailings deposited in man-made tailings impoundment
- 4.7Mm^3 capacity in pond
- Design for 1m cover

Louvicourt - Results

- Shallow water covers are effective
- Oxygen penetration typically less than 1cm
- Overall effect of periphyton biofilm positive

MEND 2.12.2 Long Term Performance of a Shallow Water Cover to Limit Oxidation of Reactive Tailings at Louvicourt

Man-made Impoundments – Water covers

Mine Water Treatment Technologies

Chemical Treatment Technologies

- Acidic Effluents
- Neutral Effluents
- As, Se and Mo Removal

MEND 3.42.3 Review of Disposal, Reprocessing and Reuse Options for Acidic Drainage Treatment Sludge

MEND 10.1 Review of Water Quality Issues in Neutral pH Drainage

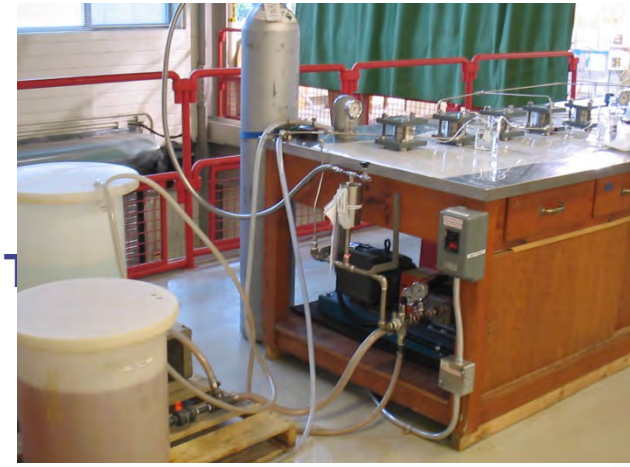
MEND 10.1.1 Environmental Management Criteria for Se and Mo

Mine Water Treatment Technologies

- Membrane Separation Technologies

Near completion....

MEND Report – Application of Membrane Separation T for Mine Effluents



- Passive Treatment Technologies
  - Wetlands
  - Limestone Neutralization Channels
  - Permeable Reactive Barriers

Treatment Plant Survey

- Most sites employ some form of chemical treatment to address acidic drainage issues
- Currently there is no single, comprehensive database containing treatment and sludge management information for mine sites in Canada or worldwide
- MEND survey to address
  - Treatment processes, reagent/flocculant usage, solid/liquid separation
  - Sludge management practices, sludge production and metal leaching/monitoring data
  - Costing

CASE STUDIES

Sulphurets

Johnny Mountain Site in May

East Kemptville, BHP Billiton

Mandy Lake, HBMS

Case Studies and Post-Closure Management

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

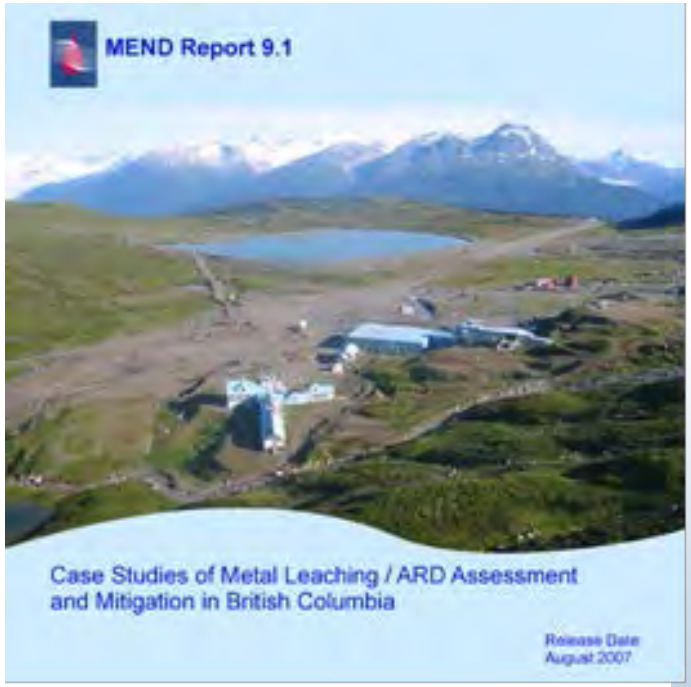
Case Studies in BC (MEND 9.1CD-ROM)

- Johnny Mountain Mine
- Snip Mine
- Sulphurets Mine

Near completion....

Case Study Assessment (SNC-Lavalin) CD

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



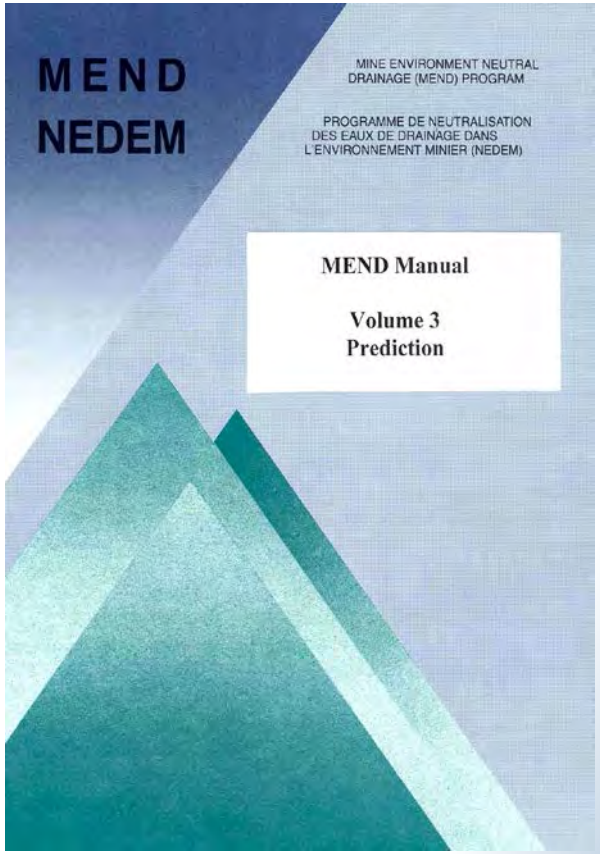
X-cutting - Guideline Documents

MEND Manual (MEND 5.4.2)

- Volume 1: Summary
- Volume 2: Sampling and Analyses
- Volume 3: Prediction
- Volume 4: Prevention and Control
- Volume 5: Treatment
- Volume 6: Monitoring

In Progress....

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



Also available on CD

X-Cutting – Technology Transfer

The MEND Monitor

Workshops (>30)

- Annual BC/MEND ARD/ML Workshops
  - 15th 2008: Tailings Management
- Sudbury (2004); Halifax 2006; Winnipeg 2008
- MEND Technology Transfer Workshops to Community Groups
- Symposium 2008 – Rouyn Noranda

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

MEND Reports (>210)

MEND Manual

Global Alliance

- GARD Guide


The MEND Monitor

The Mining Association of Canada (MAC)

New! MEND Publications

Upcoming Events

SYMPOSIUM 2008 • ROUYN-NORANDA
SUR L'ENVIRONNEMENT ET LES MINES
MINES AND THE ENVIRONNEMENT

DU 2 AU 5 NOVEMBRE 2008
NOVEMBER 2ND TO 5TH 2008

Sunday, November 2: Short course

Monday and Tuesday, November 3 and 4: Technical program

- Tailings
- Backfill
- Waste Rocks
- Policies and Regulations in Mining in Society
- Contamindated Water
- Site Restoration
- New Trends

Tuesday, November 4: Plenary

Wednesday, November 5: Sites visit

Ressources naturelles et Faune Québec

Association minière du Québec

NEDEM - MEND

Chaire CRSNG Polytechnique – UQAT
en environnement et gestion des rejets miniers

ÉCOLE POLYTECHNIQUE MONTRÉAL

URSTM
Unité de recherche et de service en technologie minérale de l'Abitibi-Témiscamingue

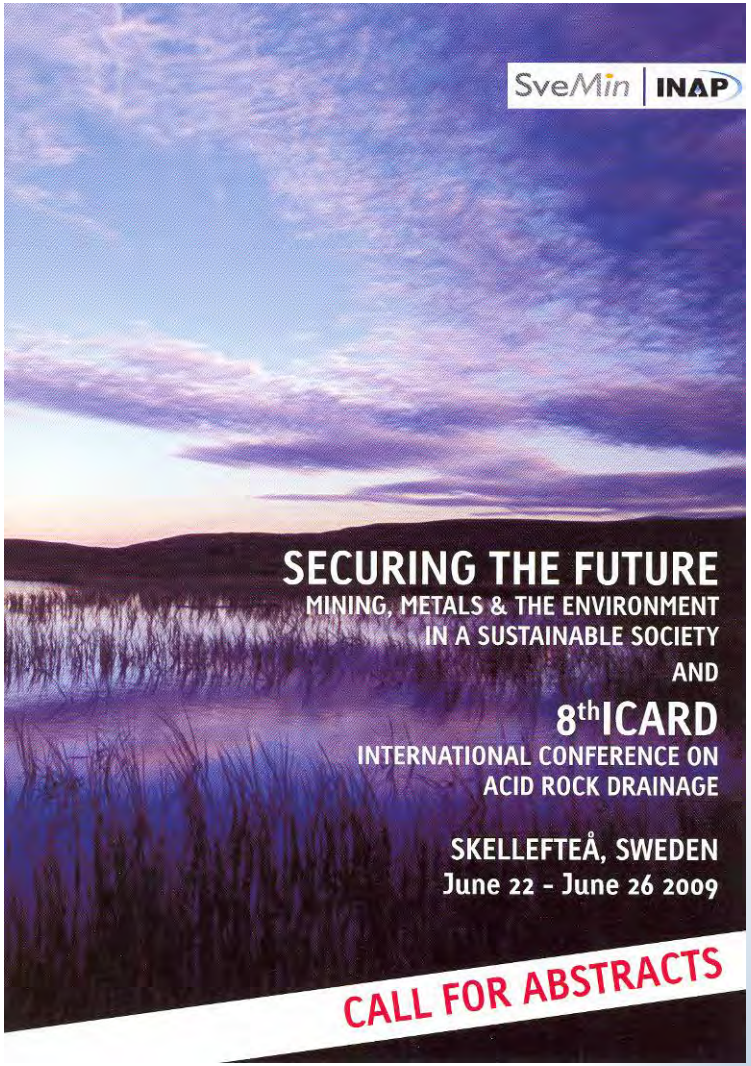
CIM ICM

Info : http://www.cim.org/rouyn-noranda2008/index_B.cfm

Université du Québec en Abitibi-Témiscamingue

8th International Conference on Acid Rock Drainage

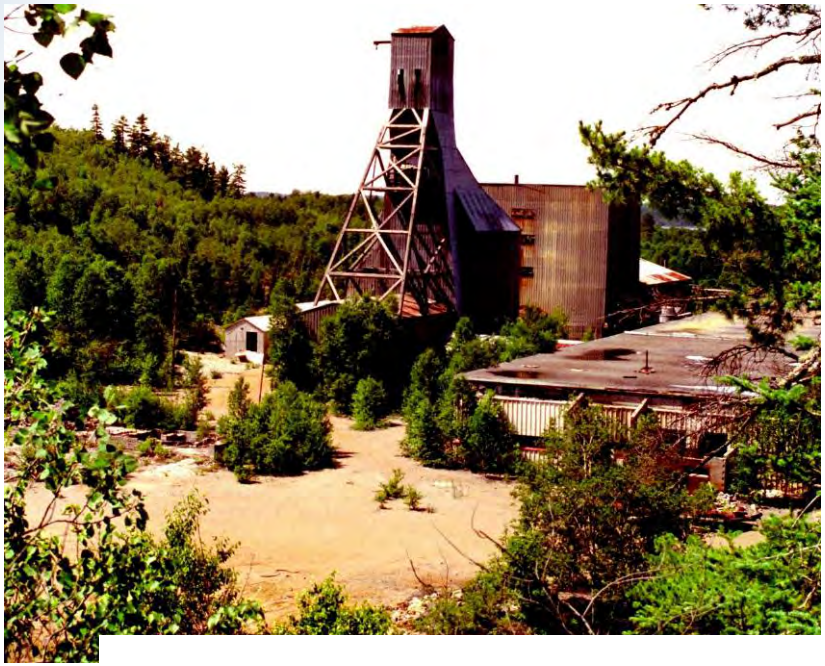
Skellefteå, Sweden
June 22-26, 2009



Abandoned Mines in Canada

National Orphaned / Abandoned Mines Initiative - (NOAMI)

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



North Coldstream Mine - Burchell Lake, ON

- 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

NOAMI
National Orphaned/Abandoned Mines Initiative

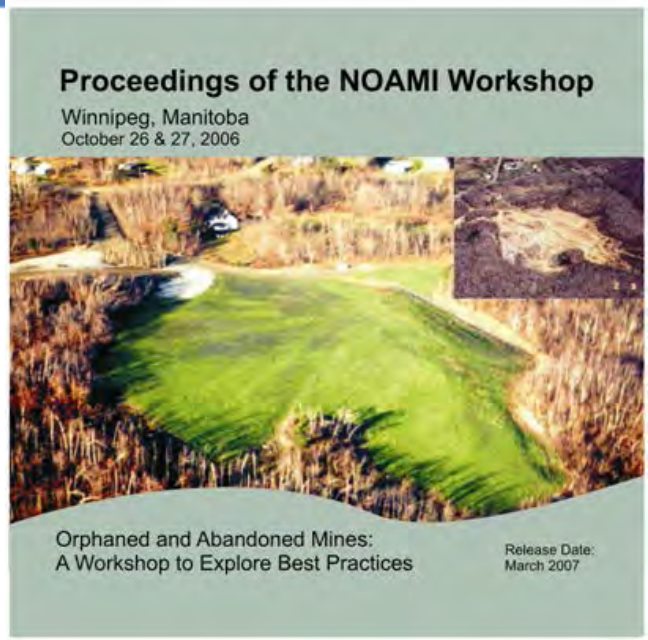
www.abandoned-mines-inventory.org

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



Looking Forward - NOAMI

- Six-year performance report underway
- A Workshop to Explore Perspectives on Risk Assessment (by invitation)
- Community “Pilot Project”
- Jurisdictional Legislative Review Toolkit

Mine Environment Neutral Drainage (MEND)

mend.nrcan.gc.ca

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