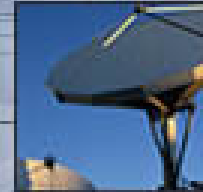


# Update of MEND & NOAMI Programs



CANADA'S NATURAL RESOURCES

NOW AND FOR THE FUTURE

[www.nrcan.gc.ca](http://www.nrcan.gc.ca)

Gilles Tremblay  
Charlene Hogan

MEND and NOAMI Secretariat  
MEND-Maritimes Workshop  
Halifax, May 2006



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# Presentation Highlights

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



# MEND: Key Message

MEND is a Canadian partnership with industry, the federal and provincial governments and non-governmental organizations to cooperate in technology development and to transfer knowledge to improve environmental management





# Mine Environment Neutral Drainage (MEND) Program

- **1989 – 2006**
- **Volunteer participation**
- **17 years ~\$20 M**
- **Research and Technology Transfer**



# MEND Steering Committee

- Kim Bellefontaine – BC
- Gilles Tremblay (Secretariat) - NRCan
- Ernie Armitt – Manitoba
- Louis Bienvenu - Québec
- John Robertson - Ontario
- Maxine Wiber – BHP Billiton
- Bill Price – NRCan
- Vincent Martin - Barrick
- Elizabeth Gardiner - MAC
- Mike Aziz - Goldcorp
- Chris Doiron - EC
- Catherine Coumans - MiningWatch Canada
- Denis Kemp – Falconbridge
- Amy Crook – Center for Science in Public Participation
- Charlene Hogan (Secretariat) - NRCan



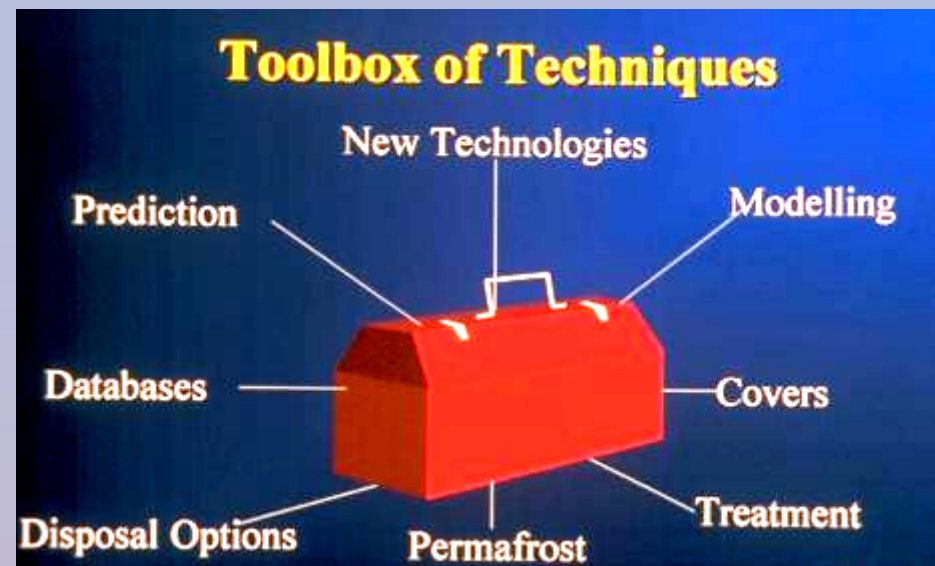
# MEND Supported Technologies

- 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)



# MEND Highlights

- Toolbox of methods to reduce environmental impacts of mining
  - Prevention best strategy
- Over 200 technical documents available
- 3 CD's with over 160 reports
- 30 workshops completed
- Video
- MEND Manual
  - Six volume set





Solbec



**FIND THE MINE**



**Panel**

**Man-made  
Impoundments –  
Water covers**

Equity Silver



Louvicourt



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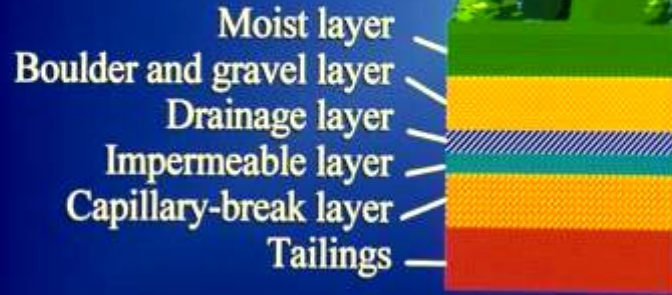
# Engineered Dry Covers







## Use of Tailings in Covers



M E N D / N E D E M

D E S I G N

## Geomembrane



Albert



Paper mill sludge

Poirier



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Active treatment



Passive treatment





# MEND in the 21<sup>st</sup> Century

- Completed Gaps Analysis, Strategy Session and Survey in 2002 to develop list of research priorities
- Research projects developed initially were state-of-the-art reviews
- Emphasis on technology transfer carried forward



# MEND Projects - Completed

**Covers for Permafrost (MEND 1.61.4)**

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

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

**Case Studies in BC (MEND 9.1)**

- 9.1a Johnny Mountain Mine
- 9.1b Sulphurets Mine
- 9.1c Snip Mine



Raglan



# MEND Projects - Completed

## Disposal Options for Lime Sludges (MEND 3.42.3)

## Underground Paste Backfill (MEND 10.2)

Summary of current practices in geochemical characterization and methods used to predict environmental impacts to water quality

## Dry Covers Manual (MEND 2.21.4)

Five-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





# MEND Projects - Completed

## Case Study Assessment

- Dona Lake, ON (Placer Dome)
- Heath Steele, NB (Falconbridge)
- Mandy Lake, MB (HBMS)
- East Sullivan, QC (Québec)
- Lorraine, QC (Québec)



Heath Steele

## MEND Technology Transfer Workshops to Community Groups

- North American Indigenous Mining Summit, Edmonton  
July 2005



# Ongoing MEND Projects

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

**Macro-Scale Cover Design and Performance Monitoring**  
i.e. watershed (O`Kane)

- Watershed Scale Monitoring Methods
- Tracking Cover Evolution with Time

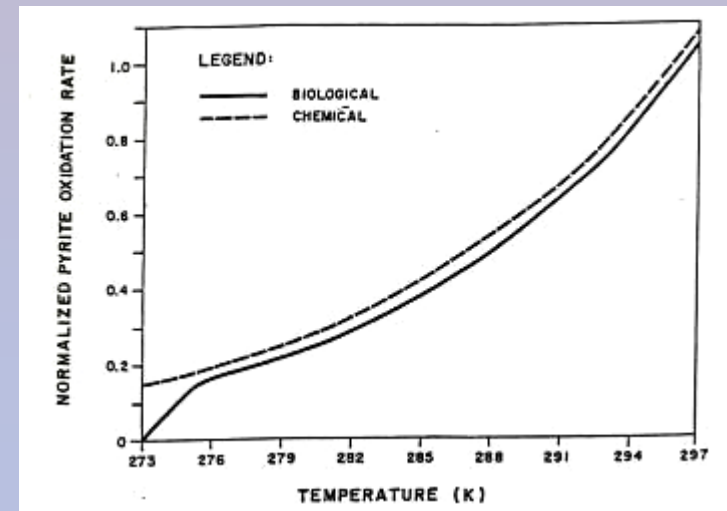
**Literature Review on Impacts of Molybdenum and Selenium on Terrestrial Environment**  
(EcoMetrix)



# Ongoing MEND Projects

## Cold Temperature Effects on Geochemistry (SRK)

- Evaluation of case histories to better understand geochemical mechanisms



## Northern Soil Covers (SRK)

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

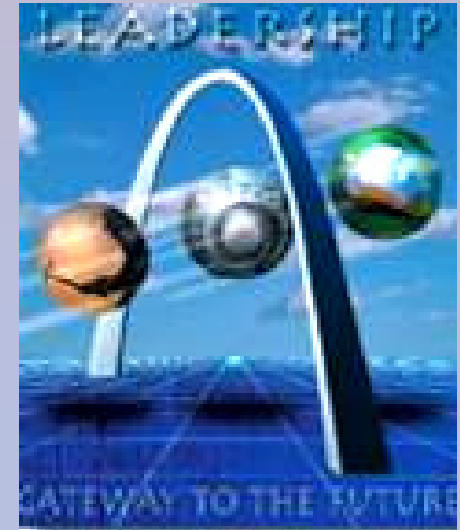




# MEND 2006 Activities

## Projects

- Louvicourt Water Covers (CANMET)
- PJV – Encapsulation (EcoMetrix)
- Membrane Separation Technology (CANMET)
- Treatment Plant Survey (CANMET)
- Inventory Website (NRCan – Secretariat)



## Workshops

- 13<sup>th</sup> BC/MEND Workshop, Vancouver, November 29 and 30, 2006
- **MEND-Maritimes Workshop in Halifax, May 23 and 24, 2006**



# Louvicourt Water Cover



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



# 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





# Mine Site Inventory Website



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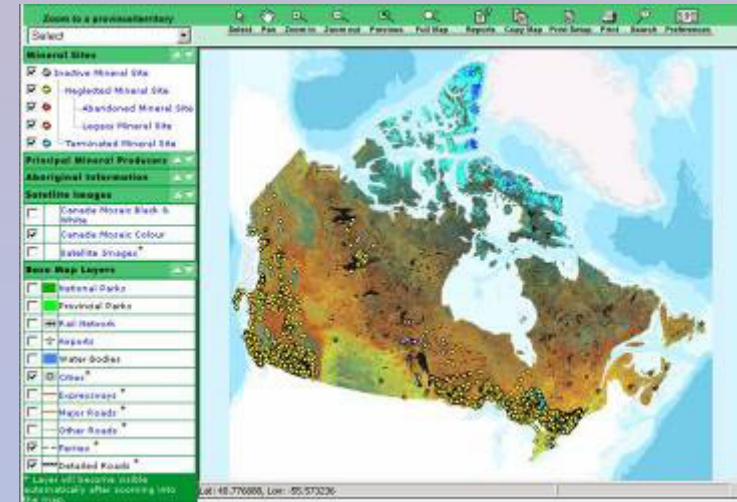
<b>Français</b>	<b>Contact Us</b>	<b>Help</b>	<b>Search</b>	<b>Canada Site</b>
<b>Home</b>	<b>About Us</b>	<b>What's New</b>	<b>MMS Site</b>	<b>NRCan Site</b>



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Documents
Members
Discussion Board
Contacts
Links

## Links

- [NOAMI](#) - National Orphaned /Abandoned Mines Initiative
- [Mine Environment Neutral Drainage](#)



Select Province | Select Province/Territory

Submit

Mine Site	Prev. Site Name	Province	Lat.	Long.	Metals	Owner	Operator	Site ID	Comp	Status Active	Status Inactive	Status Core Maint.	Tailings Tonnes	Tailings Hectares	Tailings Method	Tailings Acid
Zenmac		Ontario			Cu, Zn				?		1		165	20	raised stack	1
Young Davidson		Ontario			Au, Ag				?		1		6200	80	cross valley	2
Wright Hargreaves		Ontario			Au, Ag				1		1		10000	88	cross valley	2
Winston Minnova		Ontario			Zn, Cu				1		1		2100	100	water covers	1
Wilmar		Ontario											760			
Williams		Ontario			Au	Williams Operating Corp		S-52005000	1	1			10000	50	underwater	1
White		Ontario			Au				1	1			10000	50		2
Wendigo Gold		Ontario			Au (Cu, Ag)				1		1		200	2	uncontained beach	1
Vipond		Ontario			Au (Ag)				?		1		1500	24	side hill	2
Upper Canada		Ontario			Au, Cu (Au)				1		1		5000	150	cross valley	2



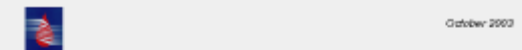
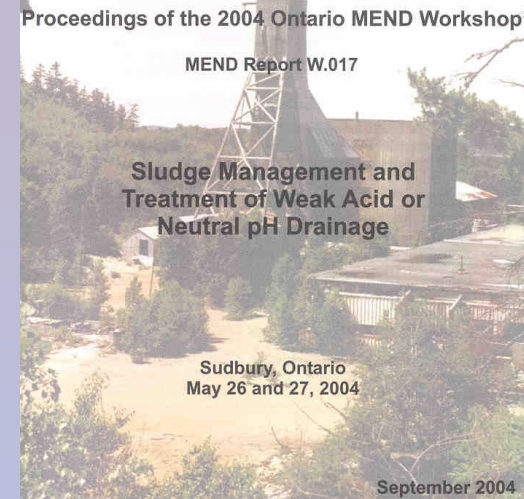
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# Technology Transfer

- The MEND Monitor
  - 4 issues in 05/06
- Presentations
- Workshops
- MEND Reports
  - Over 400 sold in 05/06
- Global Alliance
- 7<sup>th</sup> International Conference on Acid Rock Drainage, St-Louis, MO
- MEND Website at: [mend.nrcan.gc.ca](http://mend.nrcan.gc.ca)
- Environment and Mine Wastes Management – Industrial NSERC Chair



## The MEND Monitor

### Sixth International Conference on Acid Rock Drainage (ICARD)

The 6<sup>th</sup> ICARD was held in Cairns, Australia from July 14-17, 2003. With its theme of "Application and Sustainability of Technology", the conference sustained the tradition of previous ICARDs in providing an outlook of cutting-edge research and innovative technologies relevant to acid drainage.

The conference proceedings provide a timely review of the innovative approaches that have been developed for the prediction, prevention, treatment and remediation of acidic drainage. Proceedings, available only on CD-ROM, can be obtained from [www.mend.nrcan.gc.ca](http://www.mend.nrcan.gc.ca). Consult their web site at [www.mend.nrcan.gc.ca](http://www.mend.nrcan.gc.ca).

The Global Alliance for acidic drainage research between INMP and Regional Organizations was announced at ICARD. Representatives from the partnering groups attended the conference and presented at the plenary session. Partners include, from left to right, Charles Stammers (METS), Bruce Hobbiger (INMP), Chris Copeland (Canadian), Doug Hill (Mining), Bruce Bultman (INMP), Clair Dussart and Gilles Tremblay (METS).

**Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities:** Published by The Mining Association of Canada (MAC). Copies can be obtained through the MAC web site at [www.mining.ca](http://www.mining.ca).

### Further MEND Projects for 2003

**Assessment of Disposal Options for Lime Sludge:** Risk-related costs and potential of available disposal options for lime sludge. Options to be evaluated for feasibility, environmental impact and relative costs. Contractor: Stantec Consulting Ltd.

**Neutral Leaching:** A review of mining operations in Canada to scope out the priority metals and chemicals of concern, potential challenges and cost implications associated with neutral leaching under non-acid conditions. Contractor: Stantec Consulting Ltd.

**Case Study Assessments:** An Environment Canada sponsored study to assess and verify the effectiveness of acidic drainage prediction, prevention and control techniques. Phase 1 consists of assessing alternatives for five Canadian mine sites. Phase 2 will consist of open field investigations at two of these sites. Contractor: SNC-Lavalin Environmental.

### MENDS Steering Committee Members

- Mia Aze - Fluor Daniel Canada Ltd.
- Ken Babin - Environment Canada
- Lee Bennett - Minerals and Petroleum Services, 36 to 39 Ave. of the Arts, Québec
- Collette Coombs - Metallurgic Canada
- DWY (Dale Green) - Chair, Ministry of Northern Development and Mines
- Ray Cook - Governmental Mining Council of BC
- Peter Fry - Environment Canada
- Tom Goffey - BHP Billiton Metals
- Elizabeth Goffey - The Mining Association of Canada
- Dore Hump - Minerals Inc. - Peterborough, ON
- John Mathews - Borealis
- William B.O. Peck - Metallurgic Canada (METS)
- Charles-André (Jack) Van Der Kraak - INMP
- Gilles Tremblay (METS) - INMP

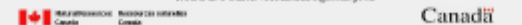
Please contact any of the above members for further information on MEND.



### Upcoming Events and Announcements

**10<sup>th</sup> Annual British Columbia MLWARD Workshop:** Characterization of Wastes, changes in AMD Generating Wastes and Fiscal MENDS Projects. December 2 and 3, 2003 / Vancouver, BC. Additional information and the registration form are posted on the MEND web site.

To obtain information on MEND, or its publications, please visit our web site at the following office:  
[mend@nrcan.gc.ca](mailto:mend@nrcan.gc.ca) or [mend@nrcan.gc.ca](mailto:mend@nrcan.gc.ca)  
[www.mend.nrcan.gc.ca](http://www.mend.nrcan.gc.ca) or [mend@nrcan.gc.ca](mailto:mend@nrcan.gc.ca)



# MEND Global Alliance Projects

- **Waste Rock Scale-up Project at Diavik Diamond Mines**
- **Global ARD Guide (GARD GUIDE)**
  - the development of a worldwide guide that captures and summarizes best science and a risk based approach to ARD management.





# National Orphaned and Abandoned Mines Initiative - (NOAMI)



**North Coldstream Mine - Burchell Lake, ON**



# NOAMI – Key Message

- Multistakeholder NOAMI Advisory Committee formed at request of Canadian Mines Ministers to assess key issues and put forward recommendations concerning collaborative approaches and partnerships in the implementation of remediation programs across Canada



# NOAMI



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





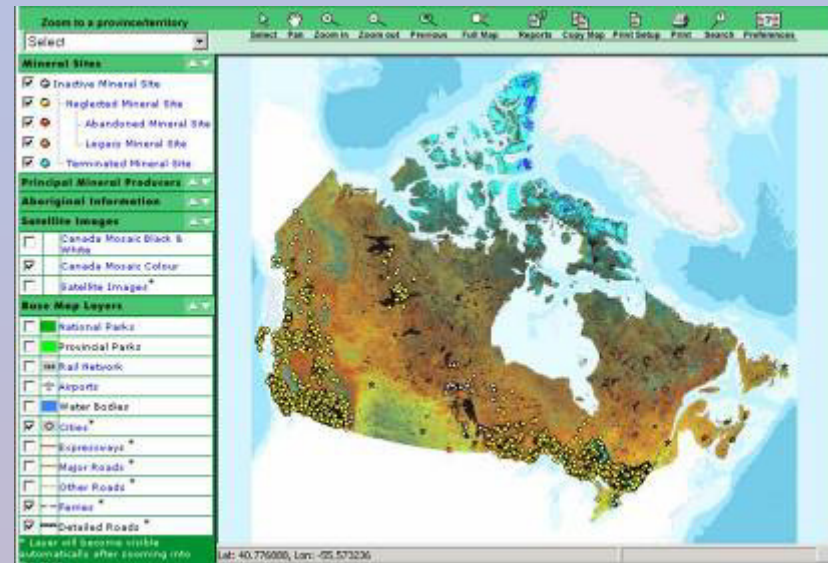
# NOAMI Highlights

- 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
- Workshop on Assessing Liabilities and Funding Options held (Ottawa, November, 2005)



# NOAMI in 2005/2006

- Report on Capacity building for a **national inventory**
  - Review of Canadian and international inventories completed
  - Database delivery model proposed
    - Web-based and map interface (MapGuide)
- Working Model of Inventory (portal) with data from three provinces
  - Visual, high-level summary of data
  - Interactive links to allow for near-transparent transition into more detailed information
  - Can include spatially related features and satellite imagery
  - User-friendly



# NOAMI in 2005/2006

- Best Practices workshop planned for Winnipeg in October 27 and 28
  - To explore and understand the best, emerging and innovative practices relating to the management of orphaned and abandoned mines
- Jurisdictional Legislative Review final report on CD-ROM to be released
  - Focused review of the legislative/ regulatory/policy framework for collaboration, liability and funding measures for mines in the various jurisdictions across Canada





# Information Transfer

- NOAMI News
- Presentations
- Pamphlet
- Reports
- Workshops
- Conferences
  - Trade exhibits
- NOAMI Web site at:  
[www.abandoned-mines.org](http://www.abandoned-mines.org)



[www.msha.gov](http://www.msha.gov)

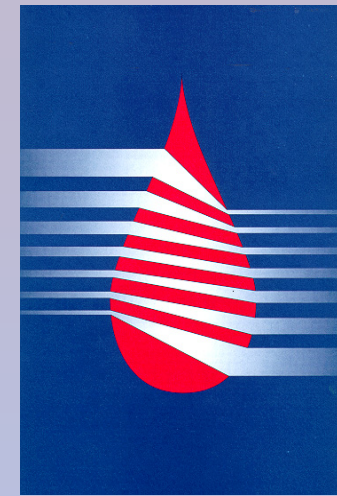


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Mine Environment Neutral Drainage  
(MEND)  
[mend.nrcan.gc.ca](http://mend.nrcan.gc.ca)



International Network on Acid  
Prevention  
[www.inap.com.au](http://www.inap.com.au)



National Orphaned and Abandoned  
Mines Initiative (NOAMI)  
[www.abandoned-mines.org](http://www.abandoned-mines.org)





*Merci!*

*Thank you!*



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