



The International Network for Acid Prevention

An organization of international mining companies that seeks the prevention of acid rock drainage (ARD) and metal leaching in support of responsible mineral development.

1. SUMMARY

Welcome to the first issue of 2019. Congratulations to the organizers of the 11th ICARD. This was the first ICARD held in South Africa and was attended by many international delegates that truly enjoyed the event and the opportunity to listen and learn about new happenings. An announcement followed that the 12th ICARD will be held in Brisbane, Australia in 2021. Congratulations to the Sustainable Minerals Institute at the University of Queensland for their successful bid.

Membership continues to grow as INAP welcomes a new member – Agnico Eagle Mines Limited. And INAP has recently announced new Chairs for both its Operation Committee and Board.

INAP is also pleased to announce a recently awarded contract on building better waste rock piles. Phase I will provide information on alternative construction techniques from conventional that are available and how these techniques can benefit operators on a site-specific basis when managing acid and metalliferous drainage.

This issue also features articles on the ARD Best Practice Awards, the 25th BC MEND ML/ARD Workshop, a program on climate change adaptation in Canada, an upcoming scale-up short course based on the Diavik project and a recently released report on biological effects of tailings disposal.

Happy reading to all. Comments and suggestions are welcomed!

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2. Agnico Eagle Mines Limited Joins INAP

INAP is happy to announce that **Agnico Eagle Mines Limited** has joined INAP.

The INAP Operating Committee and Board welcomes the expertise that **Agnico Eagle** brings to INAP and looks forward to working together on acid and metalliferous drainage/acid rock drainage (AMD/ARD) issues. Agnico Eagle will be represented on the INAP committees by Chris Kennedy, Technical Specialist Geochemistry and Mine Closure.

3. INAP Operation Committee and Board Welcomes new Chairs

INAP is pleased to announce the nomination of Michael Davies of Teck Resources as the new Chair of the Board of Directors and Rosalind Green of Rio Tinto as Chair of the Operations Committee (Op Com). Special thanks to Claudio Andrade of Barrick as former Chair of Op Com for his contributions to INAP for the past three years and to Jenni Lightowers, INAP Secretary and Legal Counsel for Chairing the Board on an interim basis. Welcome to the new chairs and congratulations to Claudio and Jenni for a job well done.

4. INAP Awards Contract for Building Better Waste Rock Piles

INAP has awarded a contract to Earth Systems (Australia) and O’Kane Consultants (Canada) to review, assess and provide a summary of technologies of waste rock placement strategies and their closure performance. It has been shown that waste rock materials are responsible for the majority of the water pollution from mine sites. Conventional waste rock pile construction methods have a net effect of optimizing the physical setting for sulphide oxidation while minimizing acid neutralization. There are alternate construction methods that have been developed and applied that offer a better approach for managing acid and metalliferous risks.

INAP members are excited about this project; with a focus on source control, it has the potential for a better understanding of how relevant waste rock issues can be managed in the long term. This is the first phase of what could be a much larger project in this important research area.

5. ICARD returns to Australia in 2021

INAP is very pleased to announce that the next International Conference on Acid Rock Drainage (12th ICARD) will be held in Brisbane in 2021.

The Sustainable Minerals Institute (SMI) of the University of Queensland presented the Australian bid at ICARD 2018 in Pretoria, alongside another strong bid from Canada. SMI received much positive feedback on their proposal from INAP members and other ICARD 2018 attendees. After some consideration the INAP Board selected Australia, with Canada awarded the conference for 2024.



The bid video that was presented in Pretoria and future notices about the 2021 ICARD can be found on the Australian AMD web site at <https://amdworkshop.com.au/>

Looking forward to seeing many of you in Brisbane in 2021.

6. 11th ICARD Held in Pretoria, South Africa



The **11th ICARD** conference was held in Pretoria, South Africa in September 2018. Hosted jointly by INAP, IMWA and WISA, this event attracted 331 delegates from 34 countries. There were over 150 presentations, 25 posters, 3 short courses and a trade show over the three and half-days. In addition, there were pre- and post-conference tours. INAP member companies were well represented; and, Terry and Andrea Chatwin attended as INAP's guests of honour, as a thank you for their hard work and dedication to INAP over the years. INAP also sponsored the Gala Banquet, with the theme "Taste of

Africa" where both IMWA and INAP recognized their respective award winners. A wonderful evening was enjoyed by all participants.

Congratulations to the organizers for this successful event. The venue was excellent and the South African entertainment will be remembered for many years, especially the opening ceremony with over 300 delegates playing the drums in unison, at least trying to!



ICARD 2018 individual papers and/or the full ICARD proceedings (2-volume set) can be downloaded from the following link:

<https://www.imwa.info/imwaconferencesandcongresses/proceedings/303-proceedings-2018.html>

7. Kinross and Rio Tinto Presented with ARD Best Practice Awards at ICARD



The first recipients of INAP's international ARD Best Practice Awards were Kinross Brazil for their operation in Paracatu, and Rio Tinto's Iron Ore Pilbara operations. The awards are in recognition of the implementation of best practice in the identification, planning and management of potentially reactive geologic materials at a mining site and at the corporate level; and were presented to the winners at ICARD in Pretoria. Alessandro Nepomuceno of Kinross and Rosalind (Ros) Green of Rio Tinto were on hand to accept the awards on behalf of their companies. Congratulations to both.

The next set of awards will be presented at ICARD 2021 in Brisbane. Submission details are being developed and further information will be on the INAP website in the coming months.

8. INAP Participates in Successful ICARD Field Trip

Delegates were treated to an excellent field trip following ICARD. It included a visit to Barberton which had its origin in the 1880's gold rush. Mining has significantly declined since then and the main activities are now timber harvesting and grazing. Some of the oldest rocks in the world (>3.6 billion years) are found in the Barberton Greenstone Belt and it became a UNESCO World Heritage Site in 2018. This was followed by a visit to the Nkomati Nickel Mine, an open pit operation that began in 2003. The Nkomati Mine represents one of the largest nickel reserves in South Africa, having estimated reserves of 408.6 million tonnes of ore grading 0.33% nickel. Discussion centred on water management of the 1,200mm/year rainfall and on pit lakes and on mine closure. The site also encapsulates their acid forming material during operations. The Fanie Nel Discharge near Carolina was the last stop where an acidic discharge is generated from an abandoned flooded underground coal mine. A reducing limestone treatment system is being trialled at the site. The South African scenery and wildlife was an absolute highlight for the delegates and the tour ended with a visit to the Kruger National Park and seeing the Big Five.



9. Program on Climate Change Adaptation for the Mining Industry in Canada

Changes in average temperature, precipitation, sea level rise and extreme weather events are altering the environment and increasing the challenges faced by mine operators. In collaboration with industry, academia and regulators, CanmetMINING, Natural Resources Canada is leading a five-year research project on climate change adaptation for the mining industry in Canada, focusing on mines operating south of 60°N. The research is focussed on the assessment and mitigation of mine waste and water management risks, tailings management reclamation challenges under a changing climate and potential downstream ecosystem effects.

Ongoing projects include:

- Tracking dust under a changing climate: coupling biogeochemistry, mineralogy, and remote sensing to assess cumulative mine site impacts
- Water balance modeling and assessing the effect of a changing climate on water chemistry and recycling on the mineral processing operation
- Development of guidance on the use of organic covers in the remediation of acid-generating mine tailings including the mineralogical, geochemical and microbiological stability
- Assessing the efficiency of saturated covers and variations in tailing oxidation rates in response to water table and temperature variations
- Input to the development of remote water quality sensors for monitoring impacts to watersheds in a changing climate
- Development of water quality indicators to assess shifting baselines at reference sites in mining environments
- Evaluating climate change risks to tailings impoundment areas from extreme weather events

For more information, please contact: Dr. Philippa Huntsman (Philippa.Huntsman@canada.ca)

10. Proceedings of the 25th BC MEND ML/ARD Workshop

The **Proceedings of the 2018 BC MEND ML/ARD Workshop** are now available at: <http://bc-mlard.ca/workshop-proceedings/2018-workshop1>

The workshop was held November 28th and 29th in Vancouver, and was attended by over 200 delegates. The event featured 27 presentations and included technical issues at mine sites in Sweden, United States, Australia, and across Canada. The most common topics for this year were waste rock, dry covers, and case studies of new and notable older mines. Tools to examine characteristics of waste rock and biological effects of subaqueous disposal of mine tailings were outlined. An excellent presentation was given on First Nation involvement in mine review and mine planning.

This website, <http://bc-mlard.ca/workshop-proceedings> also contains presentations from past ML/ARD Workshops that are searchable by key words, mine site, author and year. Please visit this extensive library of workshop presentations.

Comments and suggestions regarding interesting case studies, research and field data for future workshops are always welcome, and should be sent to Bill Price at nrcprice@telus.net. The 2019 BC-MEND ML/ARD Workshop will be held on December 4th and 5th in Vancouver, BC.

11. Diavik Waste Rock Research Scale-up Short Course at GAC-MAC-IAH Conference in May 2019

INAP, in collaboration with Diavik Diamond Mines Inc., the Natural Sciences and Engineering Research Council of Canada (NSERC) and the Mine Environment Neutral Drainage (MEND) program (MEND) sponsored the Diavik Waste Rock Research program. A goal of the program was to develop more robust methods for predicting effluent water quality from waste-rock stockpiles. Since inception of the research program in 2004, the research team from the University of Waterloo, Carleton University, University of Alberta and University of British Columbia have conducted in-depth investigations of waste-rock characteristics and physical and geochemical processes at various scales of study from humidity cells to field-scale waste-rock piles. This research has led to the development of a mechanistic approach to scale-up using the results of humidity cell experiments to characterize effluent geochemistry from large-scale waste-rock piles.



The short course will provide an introduction to the scaling method developed at Diavik, and specifically the implementation of the method using reactive transport models. The intent is to provide industry with an overview of the method and an impetus for testing and employing the method at other mine sites to improve the reliability of scale-up predictions.

Short course details can be found at: <https://gacmac-quebec2019.ca/scientific-program/short-courses/scaling-predictions-mine-waste-geochemistry-reactive-transport-modelling/>

12. MEND Releases Report on Potential Biological Effects of Subaqueous Disposal of Mine Tailings

MEND recently released a report *How to Assess Potential Biological Effects of Subaqueous Disposal of Mine Tailings: Literature Review and Recommended Tools and Methodologies*. The report provides an update on previous literature reviews conducted in 1993 (MEND 2.11.2a) and 2009 (MEND 2.11.2b) that considered biological aspects of subaqueous disposal of mine tailings. Based on the data reviewed in the report, underwater disposal of sulphide-rich mine tailings has been successful in suppressing sulphide oxidation, preventing the development of ARD and greatly reducing the release of metals. Information is also provided about the sensitivity of aquatic organisms that have colonized the subaqueous tailings pond to the metals of concern. Guidance is provided regarding recommended tools and methodologies to be used to predict and/or monitor the biological and ecological effects of submerged tailings. The report, MEND 2.19.1, can be downloaded from the MEND-NEDEM website at <http://mend-nedem.org>

13. Up-Coming Events

Don't miss the following upcoming events:

- **Water in Mining**
April 9-10, 2019. Toronto, Ontario. Canada
- **Geological Association of Canada, Mineralogical Association of Canada and International Association of Hydrogeologists (GAC-MAC-IAH)**
May 12-15, 2019. Quebec City, Quebec. Canada
- **ICOLD (International Commission on Large Dams)**
June 9-14, 2019. Ottawa, Ontario. Canada
- **Sudbury Mining and Environment Conference 2019**
June 23-28, 2019. Sudbury, Ontario. Canada.
- **International Mine Water Association Annual Conference (IMWA 2019)**
July 15-19, 2019. Perm, Russia.
- **Mine Closure 2019**
September 3-5, 2019. Perth, Western Australia, Australia
- **Tailings and Mine Waste 2019**
November 17-20, 2019. Vancouver, BC, Canada
- **26th Annual BC/MEND Workshop**
December 4-5, 2019. Vancouver, BC, Canada

Please let us know of other events that would be of interest to INAP and GA members.



INAP MEMBERS



BHP



RioTinto

Teck



lundin mining



AGNICO EAGLE

