



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 latest issue of the INAP Newsletter. The 11th ICARD is just around the corner and we hope to see many of you in South Africa in September. Join us for the INAP Plenary session to hear the 2018 award winners present their winning best practices approaches.

INAP is pleased to welcome two new members in the tiered membership category - Detour Gold and Lundin Mining. Another major Canadian gold producer is finalizing details to join INAP as a full member.

INAP and the ARD community received some sad news in the last few months with the passing of Paul Younger. He was a special person and will be sadly missed by all.

In addition to a tribute to Paul, you will find in this issue an article on INAP's new Global Alliance partner in South America, SMI-ICE-Chile, the re-establishment of the South American Network for Acid Prevention (SANAP), research work at CSIRO, the Sunnyside Mine closure, a successful field trip south of Perth, information on the Toward Environmentally Responsible Resource Extraction Network (TERRE-NET) and updates from WRC and ADTI-MMS.

Happy reading to all. Comments and suggestions welcomed.

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Gilles Tremblay
INAP Technical Manager
gilles.tremblay@inap.com.au
www.inap.com.au

2. Detour Gold and Lundin Mining Join INAP

INAP is happy to announce that **Detour Gold Corporation** and **Lundin Mining Corporation** have joined INAP as the first members in the newly-created tiered membership category.

The INAP Operating Committee and Board welcomes the expertise that both companies bring to INAP and looks forward to working together on AMD/ARD issues. Detour will be represented by Ruben Wallin, Vice President, Environment and Sustainability and Veronika Shirokova, Geochemistry, Research and Closure Coordinator. Lundin will be represented by Derek Riehm, Vice President, Environment and Camilo Martinez, Environmental Technical Director.

3. Paul Younger – A Tribute

Sad news for all. Paul passed away in April at the age of 55. He became internationally renowned as a research scientist and engineer for his work on mine water pollution, using his hydrogeology skills to pioneer developments in modelling groundwater rebound in abandoned mines but also, as an environmental engineer, leading the design of the first large-scale ‘passive’ treatment systems for acidic mine drainage in Europe. Paul received many accolades for his work on mining pollution and was routinely engaged by industry and government to provide technical advice. Paul’s contributions to INAP are numerous. He was instrumental in forming INAP’s Global Alliance Partner for Europe called PADRE (Partnership for Acid Drainage Remediation in Europe) and to the GARD Guide.

Paul will also be remembered for his engaging sense of humour, both professionally and socially. He had a fabulous talent for simultaneously informing and amusing an audience. His “joie-de-vivre” rubbed off on people who knew him and people in many parts of the world, enjoyed Paul’s company. He enriched the lives of countless students, academics and industrialists with his speaking and his music. He will be greatly missed by his many friends. Our condolences to his wife, Louise, and sons, Thomas, Callum and Dominic.



4. 11th ICARD / IMWA 2018 / MWD - Pretoria, South Africa

The **Eleventh International Conference on Acid Rock Drainage** (11th ICARD) and the **2018 International Mine Water Association** (IMWA) Conference is planned for September 10-14, 2018 in Pretoria, South Africa. Please visit www.ICARD2018.org and www.IMWA2018.info for additional information including registration for the event.

On behalf of INAP, IMWA and the WISA Mine Water Division, and the Organizing Committee for the 11th ICARD and 2018 IMWA, we are looking forward to seeing you in South Africa in September.



5. SMI-ICE-Chile, INAPs New Global Alliance Partner for South America

The Sustainable Minerals Institute International Centre of Excellence Chile (SMI-ICE-Chile) was created in late 2014 as a partnership between The University of Queensland and the Chilean Government through Corfo, an agency under the Ministry of Economy. The new office in Santiago was officially opened in October 2017 and not long after, Jacques Wiertz was hired into the position of Research & Development Manager for the initiative which includes organizing and administering the South American Network on Acid Prevention (SANAP) and to fully integrate it as part of the Global Alliance. An excellent opportunity for SMI-ICE-Chile to be a stable Global Alliance node for INAP in South America.

INAP's Technical Manager travelled to Chile in early May to meet with David Mulligan, the Executive Director of SMI-ICE-Chile, and Jacques to discuss the role of SANAP as a Global Alliance member. Discussions included possible structures and organization, frameworks used by other GA members, possible collaborative research through joint projects, establishing a contact list for South America, assisting INAP initiatives such as webinars, possible translation and distribution of newsletters and the creation of a SANAP website.

6. Inaugural SANAP Workshop Held in Santiago

The inaugural meeting for SANAP was held on May 9th in Santiago with more than 80 people in attendance. The main objective was to gather people involved in ARD/AMD and who would be interested to be part of SANAP. The 2.5-hour meeting included an overview presentation by Jacques of the main challenges that ARD represents for the mining industry in Chile and in South America followed by an overview of INAP activities and future plans with a special focus on the activities of Global Alliance partners. A discussion followed on the objectives of SANAP, funding mechanisms, structure and membership.

Good overall support was received for the establishment of SANAP and several participants committed to take part in a meeting to discuss a strategic plan to formalize the Network. It was agreed that the network would initially focus on Chile, then expand to other South American jurisdictions. Work is ongoing on the path forward and the first official meeting of SANAP is planned in conjunction with the Planning for Closure 2018 Conference in Santiago, November 7 to 9, 2018.

7. Successful Mine Closure at the Sunnyside Mine in Colorado

Sunnyside Gold Corporation (SGS) was formed and acquired the Sunnyside Mine, located near Silverton, Colorado in 1985. It operated the underground Sunnyside Mine for a brief five years, from 1986 until 1991 under modern environmental regulations using modern mining techniques.

Reclamation of the Sunnyside Mine was a priority for SGC, and the Company spent \$30 million on reclamation and remediation over 30 years, with a focus on improving water quality in the Animas River, an area which is highly mineralized, and acid rock drainage and poor water quality were prevalent long before the advent of mining.

The Sunnyside Mine has effectively been closed using best management practices and improvements are noticeable. Substantial research on a variety of topics pertaining to the Silverton Caldera, SGC's reclamation activities, and water quality in the Animas River can be found at <http://www.sgcreclamation.com>

8. Combined Hydrotalcite Formation and Biotechnical Treatment for Contaminant Removal from Mine Waters

Research undertaken over the past decade by the CSIRO, Australia's National Science Agency has combined the use of a method to form hydrotalcite minerals as a broad-spectrum cation and anion sorbent (the Virtual Curtain technology) with high rate bioreactor processes to remove remaining contaminants yielding a softer, highly polished effluent often suitable for release or reuse. To date the utility of rapid hydrotalcite formation with high solute recovery has been exploited in commercial projects in Australia (*in situ* treatment of acid mine pits), China (coal to chemicals plant effluents) and the US (groundwater treatment). Hydrotalcite formation has been successfully combined with high rate bioreactors for biological sulphate reduction and denitrification to treat acid mine drainage and high nitrate-containing hydrometallurgical waters, respectively. The CSIRO Team has also developed high rate selenate-reducing bioreactors that have potential for selenium removal. The combination of hydrotalcite formation with bioreactors offers a viable alternative to lime treatment in a variety of applications (in-pit, pump and treat) and scales.

For further information, please contact Dr Grant Douglas at grant.douglas@csiro.au (Virtual Curtain Technology) and/or Dr Anna Kaksonen at anna.kaksonen@csiro.au (Biotechnical Treatment).

9. INAP Field Trip to Collie and Mandurah in Western Australia

After two days of meetings in Perth, INAP members were treated to an interesting field trip to the Collie Mine Lake District, 3 h south of Perth, where numerous rehabilitated and unrehabilitated pit lakes can be found. Underground and open cut coal mining has been ongoing in the Collie Coal Basin since 1898 resulting in a number of open cut legacy sites. Two sites, Black Diamond (pictured) and Lake Stockton were developed as ad hoc recreational resources after the pits filled with water creating a lake. Both are used for activities such as waterskiing, camping, and swimming and crayfish fishing. Both of these sites are not regulated and do have their risks such as high pit walls at Black Diamond and low pH water in Lake Stockton and very steep shorelines to depth at both.



The group then visited sites affected by acid sulphate soils near Mandurah, specifically in Yangerup. These soils are found at depths of less than 3 m and contain the equivalent of 90 tonnes of stored acidity per hectare. In addition to these soils, substantial amounts of sulphidic dredge spoil have been deposited in foreshore areas. These materials are oxidising and are releasing metals and acidity into waterways in the area. A housing estate was built on top of the dredged soils resulting in urban drains flowing with pH 2, and a proposed new residential development in South Yunderup has been put on hold after the discovery that the construction fill used is highly acidic. INAP members were struck by the similarities with our own industry, including the stakeholder issues.

INAP wishes to extend a special thank you to Cherie McCullough of Mine Lakes Consulting and Steve Appleyard of the Western Australian government for leading this successful field trip.

10. INAP a Partner in TERRE-NET

The Toward Environmentally Responsible Resource Extraction Network (TERRE-NET) is a multi-institutional and multi- and trans-disciplinary research Network comprised of 15 co-investigators from 7 universities across Canada, with the overarching goal of ensuring the “environmentally responsible, socially acceptable extraction of mineral and energy resources using cutting-edge approaches and technologies”. This five-year initiative is led by Dr. David Blowes of the University of Waterloo and is supported by numerous partner organizations, as well as Canadian and international research collaborators.

Now in its third year, TERRE-NET’s research projects are organized under seven themes, each with a defined overall research objective that is directly relevant to the needs of the network’s partner organizations and in-line with environmentally responsible resource extraction. Constituent themes include: Abandoned Mine Site Remediation; Predictive Tools for Mine-Waste Management; Cross-Cutting Methods and Technologies; Indigenous Knowledge Integration for Understanding Risks and Costs/Benefits of Resource Extraction; Innovative Treatment Technologies for Mine-Impacted Water; Remediation Strategies for Mine Wastes; and Mine-Waste Design.

More information is available from the web site at <https://terre-net.ca> or by contacting Steve Holland, Network Manager at steve.holland@uwaterloo.ca.

11. South African Mine Water Atlas Updated

The Water Research Commission (WRC) has released an updated South African Mine Water Atlas. This document is a vital decision-making tool in making available the necessary knowledge to reduce the impact of mining on water resources. In South Africa, the mining sector is a large user of water in certain areas, with the water pollution problems associated with mining being well publicised in recent years.

The Atlas is intended as a comprehensive reference of the true extent of mine-influenced water in the country, on both the surface and underground. Now published, it is the most comprehensive document of its kind worldwide. The Atlas consolidates data on mineralogy, water quality, water flow, present ecological state, and hydrogeological information, thereby assisting water resource managers from all sectors to understand where the vulnerabilities are, which should lead to more coordinated decision-making.

The web-enabled atlas is found at <http://www.wrc.org.za/Pages/MineWaterAtlas.aspx> and the paper atlas (WRC Report No. TT 670/16) can be ordered at orders@wrc.org.za.

12. ADTI-MMS at 2018 SME in Minneapolis

The 2018 Annual SME Conference was held in Minneapolis, Minnesota February 25-28. Over 5,000 attendees were present for the conference. ADTI-MMS hosted two environmental sessions. Devin Castedyk (Golder) hosted a session on Geochemical Modeling notable for two presentations by the co-authors of the new ADTI-MMS Modeling volume, Kirk Nordstrom and Andrew Nicholson. David Williams (BLM) and Linda Figueroa (Colorado School of Mines) hosted a session on Climate Change and Reclamation Modeling. The ADTI-MMS group also held their annual face to face meeting. Topics discussed included possible updates to the Mine Influenced Water volumes and what might work best, the upcoming 2018 ICARD in South Africa, ADTI-MMS sessions ideas for the 2019 SME Conference in Denver and a continuation of discussions for the 2021 ICARD in Central America.

13. Up-Coming Events

Don't miss the following upcoming events:

- **11th ICARD/IMWA 2018/MWD**
September 10-14, 2018. Pretoria, South Africa
- **Northern Latitudes Mining Reclamation Workshop**
September 10-13, 2018, Whitehorse, Yukon. Canada
- **41st Annual BC Reclamation Symposium**
September 17-20, 2018. Williams Lake, BC. Canada
- **Tailings and Mine Waste 2018**
September 30 – October 2, 2018. Keystone, Colorado. USA
- **25th Annual BC/MEND Workshop**
November 28-29, 2018. Vancouver, BC, Canada

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

INAP MEMBERS



BHP



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Teck



lundin mining

