

# Technical Manager's Report

April 2019

## **General Introduction**

INAP welcomed new Chairs during the reporting period. Michael Davies of Teck Resources as the Chair of the Board of Directors and Rosalind Green of Rio Tinto as Chair of the Operations Committee. 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. INAP also awarded a contract to review, assess and provide a summary of technologies of waste rock placement strategies and their closure performance. This project, with a focus on source control, 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. Work on populating the pit lake database with Nevada pit lake data was completed and discussions are underway for the next phase.

## **INAP Op Com Meeting**

The Q4 meeting was held in Vancouver on November 26 and 27, 2019. This was Claudio Andrade's last meeting as Chair after 3 years at the helm. First order of business was welcoming INAP's newest member Agnico-Eagle. The first half-day, November 26, was a general discussion on current projects by member companies and this was followed by a special presentation by Teck on their work on source control. These half-day meetings with a goal of information sharing in an open forum is found to be extremely valuable by members.

November 27 started with a review and discussion of the Technical Manager's report. A summary of ICARD 2018 was presented and a discussion followed on the relevancy of having IMWA involved with ICARD for future conferences. Mike O'Kane joined the meeting later to answer question on the "Building Better Waste Rock Piles" joint-proposals submitted to INAP. Members were supportive but several questions were raised, mostly on concerns for delivery, and some clarification was requested from the proponent before a contract would be let. During the Open Session, an update on the MEND program was provided. The Board Meeting followed that same day.

## **INAP Australia**

INAP Australia continues to be active in Australia. Main activities for Bruce in the reporting period include the following:

- Completed some follow-up work on the waste rock project in terms of the Phase I work
- Worked closely with Gilles and SMI on the preparation of the Brisbane INAP meetings and field trip planned for late April
- Bruce is chairing the bid for the Cooperative Research Centre on Mine Closure. A number of INAP companies are associated with this work which at this stage involves extensive consultation with industry, Government and research institutions on mine

closure and post mining transition. ARD management is a key technical focus within the bid.

- Bruce continues to provide input into the 2020 AMD Workshop organization
- He also continues to have regular interactions with the Technical Manager including phone calls and reviewing / editing documents on an as needed basis.

### **Global Alliance:**

**ADTI-MMS:** Monthly telephone meetings were held and an update on INAP activities was provided during these calls. The ADTI-MMS website is available at:

<http://community.smenet.org/adi-mms/home?ssopc=1>. Key activities for the reporting period include the following:

- 2019 Annual SME Conference – Denver, February 24-27. ADTI-MMS members put together four sessions in the Environmental Division. They are: Water Chemistry and Hydrology: Mine Water, Friend or Foe; Tailings, Surface Placement of Paste and Cemented Paste: Promising Technology or Pie in the Sky; Analytical, Innovating Analytical Measurements and Procedures Creating Solutions in Mining and Processing; and Pit Lakes, “Walk Away” Pit Lake Closure; Successes and Failures.
- At their face-to-face meeting at SME, ADTI-MMS in coordination with SME GPAC (Government and Public Affairs) committee agreed to work together to prepare technical briefing notes. These notes will be approximately 2 pages long and are envisioned as short and factual. Tailings will be the first technical note prepared with both David Williams (BLM, ADTI) and Devin Castendyk of Golder as lead authors.
- David also mentioned that SME is planning a new journal: Metallurgy and Exploration (MME). Repackaging the Mineral Processing Journal, broadening the scope with Springer. They are looking to produce special issues for 2020, 6 issues per year. 2019 will have one on critical minerals. Social license is another potential topic as a special edition. Virginia McLemore is heading up ADTI-MMS involvement.
- ADTI-MMS will also be involved in two SME Environmental Division sessions at the 2020 SME conference; Tailings and Abandoned Mine Lands.
- Some progress made with regards to INAP’s agreement with ADTI to pay for copies of the Modeling Workbook for reviewers. Some confusion at SME with regards to the actual number of copies distributed and David is following-up.
- A full set of workbooks has been ordered for INAP and will be available to members.

**IMWA:** All of IMWA's efforts since the 11th ICARD/IMWA/MWD 2018 conference, is on the preparation for the 2019 IMWA conference planned for July 15-19 in Perm, Russia ([www.IMWA2019.info](http://www.IMWA2019.info)).

IMWA was informed by letter in February that a decision will be made at the INAP Brisbane meeting in April on continuing the joint relationship between INAP and IMWA for future ICARDs. Many questions were raised as to the on-going relevance of such joint meetings. Only response received was from the IMWA Secretary who is suggesting that we adopt two different abstracts due dates and separate proceedings which would defeat the purpose of the joint meetings.

**MEND:** The report titled "How to Assess Potential Biological Effects of Subaqueous Disposal of Mine Tailings: Literature Review and Recommended Tools and Methodologies" (MEND 2.19.1) is now available from the MEND Website ([www.mend-nedem.org](http://www.mend-nedem.org)). 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. A presentation on the report was also given at the 25th BC-MEND workshop in Vancouver.

A study is underway titled "In situ Application of In-pit Treatment for Water Management at Closed Mine Sites". In-pit treatment of metals has been used at several mines in Canada; however, the removal of arsenic with ferric sulphate has not yet been applied to in pit treatment. Laboratory studies are completed, and the field study is underway at the Nighthawk Pit, near Timmins, Ontario. Batch treatment of arsenic and other constituents in an open pit may represent a low-cost alternative to conventional treatment. Data from the second round of sampling has been incorporated into the report; and the contractor is currently developing a simple model to predict frequency of batch edition. They plan to submit the draft report for review in May, with the final report completed by summer.

The 25th Annual BC-MEND ML/ARD Workshop was held on November 28 and 29 in Vancouver, attracting over 210 participants to learn from case studies and technical presentations from leading practitioners. All presentations are posted on the BC MEND workshop website at <http://bc-mlard.ca>.

Charlene Hogan, MEND Secretariat, Natural Resources Canada (NRCan) has recently announced her retirement in June of this year. I met with Patrick Chevalier, Director at NRCan and MEND Manager, in March to discuss NRCan's plans going forward. No decision taken but Patrick did mention that NRCan is reviewing their interest in continuing to look after program secretariats such as MEND and NOAMI. I also spoke to Charles Dumaresq, current Chair of MEND and more discussions are planned.

**SMI (Australia):** SMI were pleased to have been selected to host the 2021 ICARD in Brisbane and have started advertising the conference via announcements and a web site was created at <https://amdworkshop.com.au/>. Several sessions to discuss INAP expectations with SMI and also INAP's involvement in helping make ICARD 2021 a success are planned during the INAP meetings in April in Brisbane. The field trip being organized prior to the meetings could also

mirror one of the tour options for ICARD 2021 and would give the INAP members a sense of what could be offered and provide some feedback. INAP would like to recognize and thank SMI for all their help with the organization of the INAP field trip, the meetings and the technical session in April/May.

Planning for the **10<sup>th</sup> Australian Workshop on Acid and Metalliferous Drainage** has also started. Two possible locations are being discussed – Blue Mountains area outside of Sydney and the Hunter Valley region. The AMD Workshop is planned for late March early April 2020. The INAP Q1/Q2 meetings will also be planned in conjunction with the AMD Workshop.

One deliverable that is of interest to INAP is the webinar series and discussions with SMI, as hosts of the “Zoom” platform for the webinars, are planned. SMI has also continued to distribute various information from Global Alliance partners and INAP to the Australian mailing list during the reporting period.

**SANAP Chile (SMI-ICE-Chile).** In the last report, the successful meeting held prior to the Planning for Closure Congress last November in Santiago where more than 60 people attended was mentioned. The 3 presentations given during the meeting are now available from the SMI-ICE website (<http://www.smiicechile.cl/descargables/>).

SANAP, while Jacques Wiertz is no longer working for SMI-ICE-Chile, he is still keen to assist and be a part of the SANAP Chile chapter. He is receiving some support from SMI-ICE-Chile staff. Plans going forward in 2019 is to have a SANAP-Chile meeting every 2 months, starting in April/May. The idea, according to Jacques, is to meet during the afternoon (5:00 pm to 7:00 pm) and have a short presentation (45 minutes) on some topic of interest followed by an open discussion on that topic. The meetings would be held at the University of Chile, where Jacques teaches part-time. The first such meeting is planned for April 25<sup>th</sup> and the topic is on “Hydraulic barrier, contact water and natural water” and is linked with a regulatory issue that some mining companies are now facing in Chile. Jacques explained that mining companies are required to pump infiltrated solutions (tailing water or mining drainage) to limit the advance of the pollution plume. But, because the infiltrated water may mix with natural underground water, they must get the water use rights for the natural water fraction. They must then present a study to estimate the natural and infiltrated water fractions. The workshop will address this complex problem and the different techniques that can be used to differentiate infiltrated and natural waters.

A second SANAP event will take place prior to Gecamin’s Watercongress 2019 on May 15. The topic will be “Sulfate control and removal from mine effluents and drainage”.

In terms of SMI-ICE-Chile itself, David mentioned that they were successful in completing the transition to Stage 2 which means that they continue to get access to Chilean Government funds (provided matching funds are obtained). A review of projects was completed and a couple of projects that are relevant to AMD and INAP activities are in the areas of:

- Prevention and control of acid rock drainage through the microencapsulation of sulphides, and
- New methodologies for rapid, reliable and low-cost geochemical characterization to reduce environmental risks in the handling of mining waste

David also mentioned that SMI-ICE are interested in hearing of any areas INAP members with Chilean interests may have identified where filling knowledge gaps or introducing new technologies for testing/validation/ implementation is a need that they would co-fund and support.

I also mentioned previously the organization of the First Brazilian ARD Congress. The organizing group were to meet on April 15 to select a date for the event – November 2019 or May/June 2020. In my response I mentioned that INAP would prefer the 2020 date but emphasized that before a decision is taken on INAP's participation, we would need to know more about their expectations from INAP.

I reached out to Alessandro (Nepomuceno) who is in Belo and asked if he was aware of the event. He had heard about it at ICARD in Pretoria from Flavio but nothing since and was going to try to reach Flavio and report back to INAP in Brisbane. Jacques was also going to contact Flavio regarding SANAP- Chile's participation.

### **Global Cover Guidance Document**

An overview presentation was given by the contractor at the 2018 BC MEND Workshop and the electronic files used to create the figures found in Appendix A will be sent to members. Concept Draw's MINDMAP software program would need to be purchased to use the files.

### **ARD Best Practice Award**

The first recipients of INAP's international ARD Best Practice Award, Kinross Brazil and Rio Tinto were featured in an article in the Q1 2019 INAP Newsletter.

One action item from the Vancouver Op Com was to identify possible candidates that would be interested in participating on the selection committee for the next set of awards. Met with Jim Robertson recently in Toronto, former Op Com Chair and now retired from Detour Gold and he is interested in helping if needed.

Finalizing the criteria and starting the advertising process to generate more interest for future submission in planned for Q3 2019. Bob Kleinmann, editor of the IMWA's Journal Mine Water and the Environment is planning to include it in his editorial later this year.

### **GARD Guide Update/Website**

Chapter 7 Treatment will be the first chapter of the GARD Guide that will be updated. It was last done in 2011 and there has been a lot of progress on field-tested treatment technologies since then in addition to several key reports produced (e.g. BATEA Study (MEND)).

A call with Teck took place in March to discuss the approach they followed for a recently completed review of Treatment Technologies. Louiza Bell is the contact person for Teck. More discussions are planned on key areas that Teck could possibly contribute to the GARD Guide. Also spoke to Kristin Pouw, SRK in Toronto recently about her possible participation in Chapter 7. Kristin was a major contributor to the MEND BATEA study. And have received other suggestions on possible contractors that could help with Chapter 7.

### **Pit Lake Database (Golder)**

Phase I to continue to develop and populate the pit lake database is complete. The original contract, plus amendment was for \$21,528US and \$20,646US was spent. Budget for the project was \$50,000US.

Phase I involved the collation and inclusion of Nevada pit lakes into the database. As mentioned in previous highlights, there is no public access to the database and funds will be needed to make changes to database access, storage location, and functionality, Phase II.

Work continues on finalizing the “white paper” during the reporting period. This document can be looked at as a value statement on “future development” of the database. A meeting was held in Denver on March 28 between Jacob Croall (Newmont) and Devin Castendyk (Golder) to discuss the current and future phases of the pit lake database, including completing the white paper. Had a telecon with Devin on April 5 for an update to the March 28 meeting.

I met with Jake in Toronto during the Water in Mining Conference and we agreed that the best approach going forward would be to request a Phase II proposal from Golder and this would be to migrate the current database to the cloud, develop portal access for INAP members from the members website, making sure there is no loss of functionality during the transfer, and minor editorial changes. A request to Golder for a Phase II proposal was made on April 11 and received April 19. The costs for Phase II are somewhat higher than expected and I plan on following-up with Golder to discuss.

There was also some discussion on a Phase III which would be intended to provide proof of concept of the white papers. This work could be entertained following Phase II completion later in 2019.

### **Building Better Waste Rock Piles Project (OKC and ESI)**

On December 17, 2018 INAP 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. This is Phase I of what could be a multi-phase project.

Phase I was approved at the Vancouver Op Com with conditions. Based on the history of project delivery for past projects, members were concerned on the proposed delivery schedule and the

proponent. Mike O’Kane, was asked to confirm the availability of their resources to complete the work and revisit their schedule to ensure that delivery will be on time and budget. An addition to the Scope of Work, the development of a generic base case acid generating model for a conventional end-dump method using data from an existing mine site as a baseline was also requested. All conditions were met and the contract was awarded and the final report will be presented at the Brisbane Op Com meeting.

A schedule of deliverables, including monthly project presentations was followed and found to be informative and also provided an opportunity for members to comment on progress. All presentations were recorded and made available for those who could not participate in the live meeting. The FMEA workshops were also made available for INAP’s participation, and also recorded. Hard copies were distributed to all INAP members. Comments from members in terms of progress, have been positive to date.

#### **Diavik Waste Rock Project – Final Update**

In January, a USB of the latest compilation of publications from the Diavik project that are currently in the public domain was produced for INAP by Richard Amos (Carleton University). The USB has been distributed by mail to members who will not be in Brisbane and for others, will be made available at the Op Com in Brisbane.

#### **Toward Environmentally Responsible Resource Extraction Network (TERRE-NET)**

A teleconference was held in December to discuss INAP’s committee representative on TERRE-NET’s Board of Director’s now that Claudio has stepped down as Chair of Op Com. It was INAP’s belief that this seat on the Board was associated with the Chair of INAP’s Op Com committee. It turns out that the Board position is not associated with the INAP Chair and Claudio was happy to continue as member of the Board for Barrick and report back to INAP via the Op Com. Ros, as new Chair of Op Com, was in full agreement as it would be difficult for her to participate in the calls because of the different time zones and to travel to participate in the Board meetings at the AGM, which is seen as a requirement for Board members by NSERC, the funders.

In March, David Blowes and Steve Holland of the University of Waterloo called to let me know that some of the partners in TERRE-NET have not reached their level of in-kind support as promised and the Natural Sciences and Engineering Research Council of Canada (NSERC) are concerned. INAP was one of those organizations. To date our in-kind support has consisted of Claudio’s time for teleconferences, Board attendance and review of the Annual Report plus the Technical Manager’s time to participate in the Annual General Meetings. Added to this is expenses associated with travel for both. No other requests for INAP’s participation in toehr activities was ever received.

During the call, I suggested that INAP could review student manuscripts from TERRE-NET research activities as a solution to meet our in-kind objectives and David Blowes was quite happy to adopt this idea. Documents that INAP will be asked to review will be in their final stages, that is they will have been reviewed by the theme leads and ready for final review by journals. I would not expect to see major changes being suggested for these documents as a

result of INAP reviews. And the turn-around time for the review would also be reasonable for members.

There are seven integrated research themes in TERRE-NET, all related to waste management. I am sure that INAP members will find something of interest and be happy to provide feedback on some of these papers. As Technical Manager, I will coordinate the reviews. Time spent on these reviews will count towards our in-kind commitment to TERRE-NET.

The inaugural TERRE-NET Newsletter was distributed to members in March. I also mentioned during the call that the website has no information on projects, just a short write-up on the seven themes, and this three-years in (<https://terre-net.ca>).

The 3<sup>rd</sup> TERRE-NET Annual General Meeting is planned for Edmonton at the University of Alberta in June. Information received for the meeting will be distributed to members.

### **ICARD2018/IMWA2018/MWD**

At the last Op Com meeting in Vancouver, a summary was presented by Gilles on ICARD 2018 which included comments from INAP members who attended and from the general survey of all delegates. Strengths and weaknesses and where things can be improved for the 2021 ICARD were included and discussed and more importantly, the relevancy of having IMWA involved with ICARD for future conferences was brought up then and a final decision will be made at the Brisbane meeting.

A final report by the event coordinators is expected shortly. Last communications with them was early April with a promise to send.

### **12<sup>th</sup> ICARD (2021)**

Brisbane, Australia. Hosted by Sustainable Minerals Institute (SMI) of the University of Queensland. Planned dates are from August 30 to September 3, 2021 (TBC).

I will be working closely with Mansour and the organizing committee in helping with the preparations for the 2021 ICARD using my experience with the overall organization of the 9<sup>th</sup> ICARD in Ottawa in 2012 and in Vancouver in 1997. In addition to the discussions on ICARD 2021 at the INAP Op Com and the special session the following day, I will be meeting with Mansour on May 3 to discuss generalities like scheduling etc. INAP will be represented by Bruce on the organizing committee (TBC) with Gilles providing assistance from a distance.

### **13<sup>th</sup> ICARD (2024)**

CIM have been in touch about their possible attendance in Brisbane at ICARD2021. They believe that a CIM representative should attend, given that they will be hosting in 2024. In her note she comments that “there is so much intelligence and nuances in planning that are captured at a ‘previous edition’ that it often makes the difference between transitioning towards our edition or working in the dark.”

An excellent idea and I recommend a presentation by CIM during the closing session on what could delegates expect from the 2024 event.

### **Technology Transfer Activities**

The following activities were completed by INAP members during the reporting period:

- 2018 November BC MEND – Presentation titled “Brief Update on INAP”
- 2019 Q1 INAP Newsletter
- Attended the Water in Mining Conference in Toronto, April 9-10.  
<https://waterinmining.net/>

Activities planned for the next reporting period include:

- 2019 May 17. Presentation on environmental issues for the mining industry at the “Mineral Processing Course”, McGill University.
- 2019 June 19. Leading an ARD Short Course at the University of Newcastle, NSW, Australia. Short course is part of the Mine Rehabilitation Workshop  
<https://www.minedlandrehab.com.au/>
- 2019 September. Mine Closure Conference. Perth. Ros Green is on the organizing Committee and Jeff Taylor will be presenting a paper on INAP’s Building Better Waste Rock Piles Project.

### **INAP Website**

Updates have been completed throughout the reporting period. At the last Op Com there was discussions on how to improve the look of the site as it was seen as dated and some key information difficult to locate. I chatted with the webmaster and changes to the layout/design can be made quickly with colors, homepage banner photos, and other elements. A complete refresh can also be done. He also added that he believes it’s time to consider a move to “responsive design” — that’s a programming style that allows page layouts to change (respond) according to the width of the device. It would make a much better experience on mobile devices. Examples of what members would like to see would be welcomed.

In terms of populating the website with current information, the following was completed in the reporting period:

- Updates to company representatives on committees and to Chairs
- Updates to ICARD page and ARD Events, 2019 Q1 Newsletter added
- More information added to meetings from 2018 on to include
  - Agenda, Minutes and presentations, and Technical Manager’s report for Op Com
  - Agenda and Minutes for Board and AGM meetings.
- Members home page highlights updated to 2018 and highlights prior to 2013 removed.
- Now working on presentations/papers page and INAP database page.

The site has also been secured to the HTTPS protocol (SSL (Secure Socket Layer) website certificate).

### **Membership**

The current membership of INAP includes the following mining companies:

Agnico Eagle Mines	Anglo American
Barrick Gold Corp.	BHP
Kinross Gold Corporation	Newcrest Mining Ltd.
Newmont Mining Corp.	Rio Tinto Ltd.
Teck Resources Limited	Detour Gold
Lundin Mining	

At the last Op com meeting it was agreed that INAP information would continue to be provided to Anglo and hopefully Anglo would come through with their membership dues. Comments from Anglo participants were positive for their continued participation. And Anglo at that time were in the process of hiring a geochemist in Australia. Richard Marton, former BHP representative on Op Com, was hired in that position and will be attending the meeting in Brisbane as the Anglo representative and hopefully, will be able to inform the group on Anglo's future plans for INAP.

Preliminary discussions on possible membership took place with several other companies during the reporting period including HBMS, New Gold and most recently Boliden. Follow-ups are planned.

### **Budget**

The Op Com continues to provide research and information transfer programs within the budget generated by INAP. The table below summarizes the state of the budget through March, 31 2019.

Projected Bank Balances for Period Ending March 31, 2019				
	Consolidated USD\$	AUS\$ 0.7087	USD\$	CDN\$ 0.7476
<b>Assets</b>				
Cash at Bank (actual)	393,233	220,992	129,418	42,823
<b>Non-Current</b>				
ANZ Term Deposit	201,615	284,485		
Total Cash Reserve	594,847			
Actual/Estimated Income for 2019	123,501			
Estimated Expenses for 2019	367,506	42,790	295,716	29,000
Expenses Carry Forward	8,500		8,500	
Estimated Cash Balance at Year End	342,342			

## **Projects and Project Proposals**

A summary of current and proposed INAP projects is provided below.

<b>Project</b>	<b>Researcher</b>	<b>INAP 2019 Budget</b>	<b>Status</b>
GARD Guide Chapter(s) Update(s)		US\$50,000	On-going – Proposed Chapter 7 Treatment first chapter to be updated.
Update to Pit Lake Database with State of Nevada data	Golder	US\$20,646 of US\$50,000 budget	Completed. Proposal for Phase II expected.
Workbook on Mathematical ARD Models is being finalized for publication in November 2017	ADTI	US\$2,000	Workbooks provided to reviewers. Waiting for confirmation of numbers (US\$1449.00).
Building Better Waste Rock Piles – Phase I	Earth System / O’Kane Consultants	US\$62,016	Ongoing.
Continuation of Country Rock Test Pile Program	Diavik, U of Waterloo, U of BC & U of Alberta	CDN\$0	Latest compilation of publications obtained and will be distributed.
TERRE-NET	Various universities	CDN\$2000 In-kind for Year 3	Year 3, 50% completed. INAP represented by Claudio on Board. Important link for INAP.

## **Members of the INAP Board and Op Com Leadership and Secretariat**

### **INAP Board and Op Com Leadership and Secretariat members are:**

Board Chair: Michael Davies, Teck

Op Com Chair: Rosalind Green, Rio Tinto

Op Com Vice Chair: John Mudge, Kinross (announced his retirement April 1, 2019)

Technical Manager: Gilles Tremblay

Technical Advisor: Bruce Kelley

Administrative Assistant: Open

**INAP Board & Op Com members and participants in 2018 INAP activities:**

Agnico Eagle Mines: Chris Kennedy – Board/Op Com, Jean Cayouette

Anglo American: Hubert Fleming – Board, Richard Marton, Caius Priscu

Barrick: Claudio Andrade – Board/Op Com

BHP: Joanne Heyes – Board, Open – Op Com

Kinross Gold Corporation: John Mudge – Board/Op Com, Alessandro Nepomuceno

Newcrest Mining Limited: Blair Sands - Board, Ben Wither – Op Com

Newmont Mining Corp: Scott Miller - Board, Thiess Lindsay – Op Com, Jacob Croall, Rynhard Kok, Paul Ritchie

Rio Tinto: Rosalind Green – Board/Op Com

Teck Resources Limited: Michael Davies – Board, Troy Jones – Op Com

Detour Lake Gold: Ruben Wallin and Veronika Shirokova – Op Com

Lundin Mining: Derek Riehm and Camilo Martinez – Op Com