TUESDAY, APRIL 7

OPENING PLENARY

8:30am
Leveraging Artificial Intelligence to Unlock People Power
Stacey Koon, General Manager - Administration, Lia Walker, Manager - Innovation, Operational Improvement; Freeport-McMoRan

We are incredibly proud to be part of Freeport-McMoRan, a company long known for great people, excellent operations, and positive impact on our industry and the communities where we operate. We have a strong foundation and a long history of success to build upon. However, our industry is in flux: On one hand, demand for our products, especially copper, is increasing. On the other, declining grades means it costs more to produce a pound of copper. Building on our powerful legacy, Freeport-McMoRan’s high-performing culture, and innovative, tech-enabled people will set the gold standard for operational excellence and safety in our industry.

Now is the time to create our future. We can secure a sustainable future in the face of change, bring stability to our business, and safely increase our performance when we find smart, efficient ways to do our work. People and collaboration are key. The way we work together is the engine behind our success and people are our most valuable resource. To reach our full potential, we need to better leverage all the abilities and creativity of our people. Technology turbo-charges people power. We make better decisions, improve safety and efficiency and increase production when we use technology and act on data. This dramatically increases our ability to do more with what we have. It also means our people are developing cutting-edge skills.

Our Americas’ Concentrator project demonstrates what happens when people embrace new ideas, technologies and techniques. Advanced analytics and powerful new ways of working are giving our people “superpowers” that put us on track to deliver an entire new concentrator’s worth of additional capacity to the market: without spending billions of dollars in capital.

ENVIRONMENTAL

Chair: Michael Mayer; HDR Inc., Minneapolis, MN

12:30pm
Managing Cultural Risk for Mining Projects
Jennifer Bring and Anne Ketz; 106 Group, St. Paul, MN

How do you successfully identify and manage the cultural and environmental risks inherent with mining projects while complying with laws? A sound strategy is the starting point. This requires effectively navigating the legal processes, American Indian tribes, and stakeholders. Federal processes include National Environmental Policy Act and National Historic Preservation Act. Facilitating a productive and proactive dialog with American Indian tribes and communities will be key to building trust and partnering on projects.

Evolving Regulation of Waters of the US
Daniel DeJoode; Braun Intertec, Minneapolis, MN

Proposed changes under the Clean Water Act (CWA) include a proposal from the US Environmental Protection Agency regarding the Waters of the US (WOTUS) rule that would alter the definition of protected water bodies and wetlands and will have implications for industry and development nationwide. A case before the Supreme Court may affect how groundwater is regulated under the CWA. Locally, new Corps regulations for streams will require assessment and mitigation when streams are impacted in Minnesota and Wisconsin. This presentation will provide an update of regulations affecting streams, wetlands and groundwater and discuss implications of pending changes for industry.

TAILINGS MANAGEMENT

Chair: Al Trippel; ERM, Minneapolis, MN

1:00pm
The Changing Face of EPA Enforcement
Jeremy Greenhouse and William Hefner; The Environmental Law Group, Ltd., Mendota Heights, MN

The Trump Administration took several actions in 2019 that could result in significant changes to the way the U.S. Environmental Protection Agency (EPA) approaches enforcement. President Trump signed two Executive Orders limiting federal agencies’ reliance upon guidance documents and internal memos as bases for enforcement actions. Around the same time, the Department of Justice formally ended the practice of allowing Supplemental Environmental Projects in enforcement action settlements. And EPA has signaled its intent to increasingly shift enforcement responsibilities to states implementing authorized programs. This presentation will examine the reasons behind these actions, their current statuses, and their potential future implications.

1:30pm
Tailings Basins Are Not All Created Equal
Christie Kearney; Polymet Mining, Inc., Hoyt Lakes, MN

PolyMet’s tailings basin is the most studied aspect of the PolyMet Project. Our design has been through multiple rounds of regulatory and independent reviews, yet it continues to be subject to questions and concerns in the news and lawsuits. This presentation will go over tailings basin design information in general, PolyMet’s specific design, and how our design differs significantly from other tailings basins in the news.
1:30pm
Practical Methods for Reducing Tailings Storage Risk
Kurt Schimpke; Barr Engineering Co., Minneapolis, MN

Tailings storage can present significant risk to various stakeholders, including mine operators, investors, consultants, regulators, the public, and the environment. This risk became increasingly apparent following a series of recent high-profile tailings impoundment dam failures in Canada and Brazil, thereby highlighting the need for safe and responsible tailings management. Fortunately, there are a variety of ways to reduce risk during planning, design, construction, operation, and closure of tailings storage facilities. The presentation will offer several practical methods that can be employed by mine operators and consultants to reduce tailings storage risk.

MINING AND EXPLORATION

Chair: Roger Schulz; Big Rock Exploration, Minneapolis, MN

12:30pm
Hyperspectral Imaging of Bedrock Core from the Minnesota DNR Drill Core Library
Donald Olsenheimer; Minnesota Department of Natural Resources, St. Paul, MN, Cari Deyell-Wurst; Corescan Ltd, Montreal, Quebec, Canada and Lionel Fonteneau; Corescan Pty Ltd, Ascot, Western Australia, Australia

The Minnesota DNR and Corescan obtained 16,376 feet (4,991 meters) of hyperspectral core imaging (HCI) data from thirty-two (32) archived cores at the Hibbing Drill Core Library. Core came from five Northern Minnesota focus areas that highlighted distinct mineral resources. HCI is a non-destructive technique that preserves high-value limited core material and identifies mineral abundances and maps mineral textures at 500 micron resolution. Project results support DNR land management decisions on state mineral rights and promote mineral exploration and development. This project for the first time provides public access to hyperspectral imaging data archived within the Coreshed® Virtual Core Library.

1:00pm
Ore Characterization at the NRRI Mineralogy Laboratory in Coleraine, Minnesota
Rodney Johnson; UMD Natural Resources Research Institute, Duluth, MN, Matt Minar; UMD Natural Resources Research Institute, Coleraine, MN and John Heine; UMD Natural Resources Research Institute, Duluth, MN

The Mineralogy Laboratory conducts and supports research performed at NRRI and process improvement projects. In order to efficiently and effectively operate mining operations and conduct mineral related research it is essential to adequately characterize ore, products, and waste material. Ore characterization requires identification of minerals, their liberation characteristics, and their deportment throughout the beneficiation process. Comprehensive characterization includes analysis of ore, products, tailings and waste rock to reduce mine costs and to eliminate environmental impacts related to mining activities and mine waste management. An overview with examples of the methods and instrumentation used at the Mineralogy Laboratory will be presented.

1:30pm
The Reboot of MNDNR’s Aggregate Resources Mapping Program
Corrie Floyd and Heather Arends; Minnesota Department of Natural Resources, St. Paul, MN

Construction aggregate are critical natural resources relied upon in our daily lives. In Minnesota, local scarcity areas develop when utilization, sterilization, and other factors diminish supply of quality aggregate. The Minnesota Department of Natural Resources (MNDNR) provides countywide maps and data to help a broad audience consider aggregate resource conservation. Directed by Minnesota Statute §84.94, our program supports comprehensive land use planning and resource protections that enable responsible development of aggregate resources. New funding has rejuvenated MNDNR aggregate mapping projects in south-central Minnesota, but nearly 60 Minnesota counties remain unmapped and are at risk of unknowingly diminishing their supply.

PROCESSING

Chair: Moe Benda; University of Minnesota Duluth, Duluth, MN

12:30pm
A Comprehensive, Generic, and Predictive Model for Straight Grate Iron Ore Pelletizing Furnaces
Claire Velkonja, Jayant Borana, Ogeneborhie Enuogbedaro, Umesh Shah, Manuel Huerta, Janice Bolen, Jennifer Wolstyn, Jakov Gordon, and Tom Plikas; Hatch Ltd., Mississauga, Ontario, Canada

Pellet production, quality, and fuel consumption are critical parameters for induration machine operation; however, these parameters are commonly optimized by operators using trial-and-error. Therefore, there is a need for a comprehensive induration machine model to further operators’ ability to optimize existing machines. In this work, a three-dimensional model of the pellet bed has been combined with a one-dimensional model of the gas flow network for easy deployment of the model to a range of process gas flow configurations. The model was validated against plant operating data and then used to improve the operational efficiency of a straight grate induration furnace.

1:00pm
NRRI Fixed Bed Dynamic DRI Process Simulator
Brett Spigarelli; UMD Natural Resources Research Institute, Coleraine, MN, Kevin Kangas; UMD Natural Resources Research Institute, Coleraine, MN, and Steve Schmit; Gradient Technology, Elk River, MN

Electric arc furnaces have increased demand for a new generation of pellets suitable for making direct reduced iron (DRI), but much of Minnesota’s iron industry still produces pellets for blast furnaces. Bench-scale R&D efforts for upgrading Minnesota’s iron resources and reserves have limited applicability. Thus, NRRI has launched a project to develop a new test method “Fixed-Bed Dynamic DRI Process Simulator” to bridge this gap and enable Minnesota’s iron producers to transition to DRI pellet production. The project was funded through the 2016 Minnesota Mining Innovation Initiative. This presentation includes an update on the project (thermal modeling and design fabrication).

1:30pm
Multicomponent Modelling for Mine-to-Mill Optimization of an Iron Ore Operation
Benjamin Bonfils, Walter Valery, Alex Jankovic, Bianca Andrade, Erico Taboca, Sergio Vianna, Peter Holtham, and Kristy Duffy; Hatch, Brisbane, Australia

The benefits of Mine-to-Mill optimization have been understood in the industry for many years. If well executed, with a structured methodology, the operation overall throughput can be maximized, costs per ton minimized and concentrate production optimized. Simulation tools such as JKSimMet and Limm have been integrated for Mine-to-Mill optimization of a large iron ore operation employing magnetic separation and flotation to recover hematite and magnetite. Multi-component modelling was used to track components like Fe, FeO, P and gangue. In this methodology, factors affecting penalty elements like phosphorous in final concentrate can be investigated and alternative flowsheet options can be evaluated.
**PROCESSING**

*Chair: Wiegou Xie; University of Minnesota Duluth, Duluth, MN*

**12:30pm**

**Potential Applications for Dry Beneficiation of Iron Ore Fines Using a TRIBO-Electrostatic Belt Separator**

Lucas Rojas-Mendez, Kyle Flynn, Frank Hrach, and Abhishek Gupta; ST Equipment & Technology, Needham, MA

ST Equipment & Technology (STET) tribo-electrostatic separator allows for the beneficiation of fine powders with an entirely dry technology. The STET separator is suited for separation of very fine (<1µm) to moderately coarse (500µm) particles. STET has successfully beneficiated iron ore samples including run-of-mine ores, taillings and flotation and experimental findings indicate that low-grade ores can be upgraded to commercial grades (58-62% Fe) while simultaneously rejecting silica. A compendium of experimental results and high-level flowsheets and economic evaluations for selected applications are presented. Challenges associated to the adoption of the technology and a comparison to available technologies are also discussed.

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**1:00pm**

**Innovative Two-Mass Screen Technology Meets the Demand for Larger Higher Throughput Screens**

Edward Wipf; Voestalpine, Portland, TX

The General Kinematics Two-Mass Screen technology is gaining global momentum in the Mining Industry. The STIM-SERIES™ Two-Mass Vibratory Screens are high throughput screens that, in the same footprint as an existing brute force banana screen, on an equal comparison basis, claim to handle up to a 30% - 40% throughput increase, with the same or better efficiency. General Kinematics STIM-SCREEN™ screens utilize GK’s proven Two-Mass, natural frequency drive design, which consumes much less energy to do this more significant task, to be inherently more reliable and offer a longer service life for the cost of ownership. General Kinematics’ unique technology and the solutions it offers to the mining industry will be discussed in detail with case study examples of these larger higher throughput screens.

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**1:30pm**

**Characterizing Carbon Formation in a MIDREX Direct Reduction Process**

Michelle Godoy; Colorado School of Mines, Lakewood, CO and Emmanuel De Moor, Christopher Harris, Wolfgang Sterrer and Victor Romor; Voestalpine, Portland, TX

An alternative to traditional Blast Furnace (BF) iron ore reduction is the Electric Arc Furnace (EAF) scrap re-melting. Recycled steel scrap contains impurities such as copper which can be reduced by charging Direct Reduction Iron (DRI) in EAFs. Improved thermal efficiency of EAFs are claimed to be achieved with high carbon DRI. Carbon formation in DRI and Hot Briquetted Iron (HBI) produced in voestalpine’s MIDREX plant was investigated with analysis of reaction thermodynamics and kinetics. X-ray diffraction, Mossbauer spectroscopy and Leco Carbon/Sulfur analysis were used to determine carbon content.

**ENVIRONMENTAL**

*Chair: Joel Asp; SEH, St. Cloud, MN*

**3:00pm**

**From Mining to Mainstream: Mitigation for Transportation Corridors**

Kevin Eisen; Barr Engineering Co., Minneapolis, MN, Meaghan Blair; Barr Engineering Co., Duluth, MN and Denise Levitan, Stephanie Theriault and Ward Swanson; Barr Engineering Co, Minneapolis, MN

Thorough characterization of host deposits of potentially acid-generating materials is imperative to developing proper management protocols. Although acid-generating material is often associated with mining-related activities, transportation corridors may intersect sulfide-bearing deposits that also require characterization and management. The Minnesota Department of Transportation, along with Barr Engineering Co. and the Natural Resources Research Institute, recently developed a manual for transportation projects to evaluate and manage rock and borrow sources. Specifically, the manual describes the process of screening, characterizing, evaluating, and mitigating materials that may be acid generating, as well as providing an outline for environmental monitoring.

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**3:30pm**

**On the Road Again: Mitigation and Monitoring Following Construction of an In-Road PAG Rock Repository**

Meaghan Blair; Barr Engineering Co., Duluth, MN and Jason Richter; Minnesota Department of Transportation, Maplewood, MN

Reconstruction of Hwy169 from Tower-Ely cut through significant exposures of potentially acid-generating (PAG) rock. Implementation of a mitigation plan during construction resulted in a design that minimized fragmentation, exposure and oxidation, and leaching of PAG rock. Site limitations included a narrow working corridor, blasting/rock placement schedules, and equipment capabilities. Site-specific amendment, mixing/blending techniques, and screening methods were developed to achieve the mitigation design criteria. Subsequent to cover placement, post-construction groundwater monitoring detected a drain-down response and rebound in adjacent groundwater quality due to unusually wet conditions. Ongoing groundwater sampling and site inspection is anticipated for 5-10 years.

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**4:00pm**

**Innovative Pavement Repair with Taconite and Microwave Technology**

Lawrence Zanko and Sara Post; UMD Natural Resources Research Institute, University of Minnesota Duluth, Duluth, MN

Since the mid-2000s, the Natural Resources Research Institute at the University of Minnesota Duluth has performed research on the integration of iron ore (taconite) mining materials and mineral byproducts into pavement repair technologies, focusing on how they fit into a sustainable pavement infrastructure. Today’s presentation describes that effort and summarizes recent and ongoing research related to: 1) a rapid-setting pavement patching mix made with taconite tails and other mineral-based components and 2) potential microwave technology applications. Laboratory testing and the outcome of field trials conducted between 2016 and 2019 at multiple locations and in various pavement types are highlighted.
MANAGEMENT
Chair: Larry Kramka; Foth Infrastructure & Environment, LLC, Duluth, MN

3:00pm
Radical Productivity
Erika Garms, WorkingSmarts, Inc.

Radical Productivity addresses both time-saving and quality-building techniques for getting more out of the hours you have. It involves learning not only new mental habits, but also new physical and emotional habits. As it turns out, we can’t be optimally productive if we leave out any one of those three realms. Based on current research and tested on thousands of professionals in a variety of industries, Erika will share the “Top 10 Activators of Radical Productivity” to show you exactly what you can do to boost your own productivity, your staff’s, and to shape a high-performing work culture.

3:30pm
Sustainability: Prosperity, People, Planet
Melissa Martinie, Carneuse NA, Duluth, MN

4:00pm
Using Sustainability Tools to Certify Renewable Energy Projects at a Mining Operation
Rachel Walker; Barr Engineering Co., Golden Valley, MN; Joffrey Wilson; Mortenson MA, Golden Valley, MN and Matt Metzger; Barr Engineering Co, Bloomington, MN

Mining operations, and the utilities that serve them, are increasingly exploring microgrid solutions and sustainability metrics to evaluate the options for power supply at mines. Grid connected mining operations have an opportunity to work with utilities to determine the best mix of energy that maximizes cost savings and contributes to sustainability goals. Just as buildings can be evaluated and receive green building certification such as LEED, more tools and processes are available to similarly evaluate large and complex infrastructure projects, such as large mining operations, to include and plan for renewable energy options. There are several types of tools and metrics. We examine a case study of a mining operation in Minnesota and consider a range of options regarding a mix of energy supply including microgrid, solar, wind, pump-storage and battery solutions. We present information regarding how these tools are designed, the criteria they evaluate and measure, and some of the details regarding how projects receive certification. Finally, we discuss how to effectively communicate results to a range of stakeholders.

RECLAMATION
Chair: Kris Benusa; Foth Infrastructure & Environment, LLC, Lake Elmo

3:00pm
Redeveloping Abandoned Quarries as Public Amenities
Joel Asp; SEH, St. Cloud, MN

Central Minnesota is known for its quantity and quality granite. Multiple granite companies have operated in the St. Cloud areas for decades. Abandoned granite quarries are present throughout the area and are becoming community amenities versus waste areas. The City of St. Cloud restored a 680-acre area into Quarry Park and Nature Preserve with hiking, biking, fishing, swimming and rock-climbing opportunities for the public. The City of Waite Park used a 20-acre abandoned quarry and adjacent land donated by the local quarry owner and created a 4000+ seat open air community amphitheater. This presentation will discuss the collective community and operations work together to repurpose these quarries through the planning, funding, and ownership aspects needed to make the areas into public, community amenities.

3:30pm
Mining Legacy on Pine Island
Julie Marinucci; St. Louis County, Hibbing, MN

Historic mine workings from mining activity in the late 1800’s leave behind two large mine shafts and a public safety concern. A collaborative effort led by St. Louis County worked to understand the history and mitigate the hazard.

4:00pm
Preventing TSF Failures with Design and Digital Monitoring Techniques
Nathan Manser; Michigan Technological University, Houghton, MI

Tailings Storage Facilities (TSF) are one of the most visible lasting signs of mining activities, that together with mine waste rock dumps and the ultimate open pit, are recognized as the "legacy" impacts of mining. TSF failure can have disastrous consequences to nearby communities, the environment, and to the mining companies, who may face high financial and reputational costs. This work presents an update on the latest TSF failures worldwide and links best practice design parameters with innovative digital sensing techniques in an effort to reduce them.

PROCESSING
Chair: Brett Spigarelli; University of Minnesota Duluth, Coleraine, MN

3:00pm
Bond Work Index – How Does it Work?
Kyle Bartholomew; Metcom Technologies Inc., Grand Rapids, MN

Since its publication in British Chemical Engineering, 1960, Bond’s Third Law of Communion has been used as a design, benchmarking, and optimization tool by metallurgists worldwide. This presentation is a refresher on the Bond Equation, and how it remains a powerful, standard method for evaluating grinding circuit performance, even as grinding equipment has evolved over the decades. The equation is broken down and explained to improve insight, and to help avoid common mistakes, misapplications, and misconceptions about the Bond method.

3:30pm
The Evolution of Primary Comminution Technologies and Improvements to Reduce Costs and Energy Consumption
Boyd Eisenbraun; Nick Soralla and Dennis Murr; Barr Engineering Co., Hibbing, MN

Crushing and grinding processes have undergone significant changes over the last 20 years. These adjustments have focused on lowering costs, increasing production, and improving energy efficiency. As technology continues to change, the benefits and costs associated with each technology needs evaluation for ore type and facility. Today, energy reduction for new and existing mine locations has become a significant factor in project evaluation. This presentation will review the current and historical technologies used in primary grinding of ore and the energy consumption associated with each technology with the goal of identifying possible opportunities to improve and optimize the comminution processes.

4:00pm
The Applications of Electrical Resistance Tomography for Multiphase Flows in Mineral Processing
Weiguo Xie; University of Minnesota, Duluth, MN

The research aimed at solving the problem of measuring instantaneous local physical quantities for multiphase flows in mineral processing, which are common in minerals industry and with significant challenges. A compact Electrical Resistance Tomography (ERT) probe was built and then used to measure within a few flotation machines for the change of liquid content (high conductivity fluid distribution) and turbulence energy distribution. ERT is a powerful technique that has the potential to be used for a wider range of applications, such as leaching process, high temperature flows in further downstream production chain (steel making process and alloy manufacturing process).
MINING AND EXPLORATION
Chair: Dean Peterson; UMD Natural Resources Research Institute, Duluth, MN

3:00pm
Western Mesabi – Iron Resources of the Future
Rodney Johnson; University of Minnesota, Duluth, MN, Matt Milnar; UMD Natural Resources Research Institute, Coleraine, MN and Marsha Patelike and John Heine; UMD Natural Resources Research Institute, Duluth, MN

The NRRI is conducting a long-term comprehensive geometallurgical program to characterize the taconite and partially oxidized and oxidized Biwabik Iron Formation along the western end of the Mesabi Iron Range. The purpose of the program is to provide the fundamental geometallurgical data necessary to guide research directed at extending the life of taconite operations, to influence research directed at optimizing iron recovery, and to identify the characteristics of the resource that will provide the feed for new value added iron products of the future. This talk will present examples of the types of data that are being collected.

3:30pm
US Mining and the Circular Economy
Margaret Durenberger, Oreval, South Saint Paul, MN

4:00pm
V-flow: Vanadium Charged with Amping Up Green Energy Storage Solutions
Aubrey Lee; Big Rock Exploration, Minneapolis, MN

The world’s sluggish mass-adoption of renewable energies is bottlenecked by energy storage constraints. Storage limitations inhibit the supply, stability, and flexibility of green energy, but breakthroughs in vanadium redox flow battery technology (V-flow) have it poised to supplant pumped-hydro in the utility-scale stationary storage market. V-flow could render solar power the most deployable energy resource - capable of superseding all other electricity sources on the grid. US demand for V is currently met by foreign sources where it is produced primarily from vanadiferous titanomagnetite (VTM) deposits. Regionally, there is potential for widespread VTM resources in the midcontinent rift terrain of the Precambrian Canadian Shield.

WEDNESDAY, APRIL 8

ETHICS
8:00am - 9:00am
Foundation of Ethical Principles for Professional Engineers and Geologists
Kristine Kubes

This year’s ethics talk will include the history and foundation of the ethical principles underlying the MN rules as well as recent rule updates and how they apply to engineering and geology practice. The talk will include case studies applicable to geologists and engineers. This year’s speaker is Kristine Kubes, the principal of the Kubes Law Office in Minneapolis. Ms. Kubes concentrates her work on professional liability defense/litigation, contracts, and proactive construction counseling, which involves addressing and cooperatively resolving project management, risk management, payment and surety issues. Integrated with her legal practice, Kristine is a qualified neutral who mediates and arbitrates construction and design disputes. Governor Pawlenty appointed Kristine to serve as a public member on the MN State Board of AELSAGID in 2005; she served as the Board’s Chair from 2009 to 2011 and completed eight years of service on the Board in 2013. Ms. Kubes was the Board Chair when rules requiring ethics professional development hours were implemented and has a unique perspective on ethical principles for licensed professionals. Attendees will be provided with a CE certificate for one professional development hour (PDH) dedicated to professional ethics for the 2018 to 2020 biennium.

ENVIRONMENTAL
Chair: Vikas Tandon; Foth Infrastructure & Environment, LLC, Lake Elmo, MN

9:30am
Dissolved Versus Total Metals: Which Should I Measure?
Justin Brown; Foth Infrastructure and Environment, LLC, Duluth, MN and Allison Haus; Foth Infrastructure and Environment, LLC, DePere, WI

Measuring baseline total and dissolved metals at groundwater monitoring wells and at surface water monitoring sites will yield different results. Total metals measures both the soluble fraction and those metals bound to larger colloids and suspended solids, while dissolved metals measures soluble metals, and metals that pass through a nominal 0.45 micron filter. This presentation will discuss why one method may be preferable over another at given sites and review recommendations from the EPA regarding applicability of total versus dissolved metals, review the structure of relevant Midwest groundwater and surface water standards, and conclude with a comparison of project data and examples.

10:00am
Biological Removal of Sulfate from Water: Current Status and Outlook for Mine Water Treatment
Ali Ling; Barr Engineering Co., Minneapolis, MN and Scott Kyser; Minnesota Pollution Control Agency, St. Paul, MN

This presentation will describe regulatory pressures, factors affecting performance, and future outlook for biological sulfate removal technologies for mine water treatment in Minnesota. Membrane separation is the only technology applied at full-scale to consistently achieve less than 250 mg/L sulfate, but are expensive and require brine management, which also incurs high expense. Regulatory uncertainty associated with Minnesota’s wild rice standard increase the urgency of developing viable biological sulfate removal technology. Factors influencing effectiveness include reactor configuration, temperature, carbon source, and nutrient supply. Bench-scale research is underway at the University of Minnesota to develop pilot-scale technologies for demonstration studies.

10:30am
Why Treat Water When You Can Control the Source
Paul Eger; Global Minerals Engineering, Woodbury, MN

Effective antimicrobial source control techniques were first shown to be effective over 30 years ago, but the lack of consistent, well documented case studies and application challenges have limited its use. New control and application methods and a better understanding of mechanisms merit reassessment of this approach. Proof of principle source control tests were conducted on a waste rock sample from the Barite Hill superfund site; three waste rock saturation conditions were simulated. Treatment was successful in eliminating the acidophilic bacteria, but a different approach was required for each condition.

DATA
Chair: Erik Boleman, Barr Engineering Co., Duluth, MN

9:30am
Harnessing Mobile Field Data Collection for Construction of a Tailings Pond Embankment
Michael DeVasto; GZA GeoEnvironmental, Grand Rapids, MI

Using ESRI’s Collector and Enterprise platform, we implemented field data collection of field observations and construction quality control tests of an embankment at the MN State Board of AELSAGID in 2005; she served as the Board’s Chair from 2009 to 2011 and completed eight years of service on the Board in 2013. Ms. Kubes was the Board Chair when rules requiring ethics professional development hours were implemented and has a unique perspective on ethical principles for licensed professionals. Attendees will be provided with a CE certificate for one professional development hour (PDH) dedicated to professional ethics for the 2018 to 2020 biennium.
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The introduction of commercial LTE in North America promises great benefit, from long distance coverage to true Quality of service (QoS) and high network security. With a pricing model based on the amount of data transmitted, LTE can however rapidly become out of reach for those mines looking to access all their data, all the time. In this presentation, we will discuss how a fast roaming hybrid LTE/Mesh client can break the last barriers LTE faces in the market by providing complete coverage, higher throughput and peer-to-peer connectivity by better managing the amount of data travelling through the LTE network at any one time.

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PROCESSING

Chair: Matt Mlinar; UMD Natural Resources Research Institute, Coleraine, MN

9:30am
Development on The Mechanistic Model Structure for Tumbling Mills
Weiguo Xie; University of Minnesota, Duluth, MN

A mechanistic model structure for tumbling mills has been developed with the sub-models such as appearance functions, breakage rate functions, energy distribution, transport, and multicomponent grinding interaction model. The strengths and capabilities of the model structure as achieved to date are presented. It is proposed that the approach developed in this research provides a structure that can accommodate future mechanistic, dynamic mill model evolution that can incorporate the latest research outcomes and provide a platform to test modelling improvements. This can assist in substantially improving the predictive mill modelling capability for mineral processing in the industry.

10:00am
An Update on Hydrometallurgical Processing of Minnesota Titanium Deposits
George Hudak; UMD Natural Resources Research Institute, Duluth, MN, Jonathan Chen; Process Research Ortech, Mississauga, Ontario, Canada, Shashi Rao; UMD Natural Resources Research Institute, Coleraine, MN, V. I. Lakshmanan and Ram Sridhar; Process Research Ortech, Mississauga, Ontario, Canada

In 2017, the Natural Resources Research Institute and Process Research Ortech (PRO) conducted a collaborative batch process pilot-scale study on a Longnose deposit bulk sample. Results indicated that a novel, flexible, hydrometallurgical process (PRO Process) was capable of producing high purity (>99%) titanium- and iron-oxides which historically were not achieved by conventional titanium processing methods due to elevated impurity contents within the processed oxides. Over the past year, the NRRI and PRO conducted a second pilot-scale study comprising systematically integrated unit operations and recycling of process streams to examine impurity build-up effects and process robustness. Results will be presented.

10:30am
Advanced Bulk Materials Transfer Technology
Gregory Clark; TASSCO, Murfreesboro, TN

Advanced design technology, next-generation abrasive resistant materials, and cutting-edge manufacturing techniques, are combined to provide the best-available technology in bulk material transfer systems

Advanced design technology for the precision flow of bulk material through transfer systems, provides assurance of: Ability to meet design capacity
Minimized:
- Risk of pluggage
- Accumulated material residing inside chutework
- Material impact, degradation, dust generation, spillage

Maximized:
- Performance
- Safety
- Service life

Advanced Bulk Materials Transfer Technology... dependable service, extended equipment life, improved risk profile for personnel and equipment, and reduced O&M costs... Technology Embedded in Equipment

CLOSING PLENARY

10:45am
Building Brain-Friendly Workplaces
Speaker: Dr. Erika Garms, CEO, WorkingSmarts, Inc.

The mining industry faces twists and turns, conflict and uncertainty. Professionals in the field are required to be able to stay sharp and calm in the midst of these factors, and to maintain strong stakeholder relationships despite diverging perspectives and value sets. Learn a handful of brain-friendly ideas for keeping performance and morale high in the workplace. De-mystify why others act the way they do and how to approach them in such a way that engages them, not riles them up. Learn about your pre-frontal cortex and how it likes to operate best in order to increase focus, concentration, and performance even when emotions may be running high. Hear why communication “misses” are so common and what is needed for better understanding and less conflict. Discover why the change management strategies of decades past are due for a major overhaul, given how the brain responds to threats in the workplace and how to introduce change so that it will be accepted and championed. This session is lively, fun, memorable, applicable for both work and personal lives.

Dr. Erika Garms helps bright leaders and teams work, manage, and innovate smarter. She uses her gift for translating powerful scientific theory to everyday workplace practice, to shape healthier and higher-performing organizations. Erika has played a number of consulting and leadership roles in organization development, change management, and talent development. She has served public sector and private sector organizations across many industries, across the U.S. and internationally. Garms is the author of, “The Brain-Friendly Workplace: Five Big Ideas from Neuroscience That Address Organizational Challenges.” She speaks regularly at conferences, company meetings, and management retreats and is a professional member of the National Speakers Association and past Dean of the NSA Speakers Academy.