9:00 AM
Introduction

9:05 AM
Sharing Safety Critical Control Measures – Bingham Canyon Case Study

B. Ross; Lowell Institute for Mineral Resources, University of Arizona, Tucson, AZ

All mining operations gain important safety and health learnings during the process of mining, sometimes at a high price in lives lost or significant injury. Applying these learnings is one of the key first steps to identifying the material unwanted events (MUE's) when using ICMM's Critical Control Management (CCM) method to prevent serious events. The CMM method relies on companies being able to identify MUE's as well as ways to control them – even if they have not previously occurred at a site or operation. One method to make the identify MUE's is to use what has happened at other companies and operations. Unfortunately, many companies are hesitant to share their experiences because of risk of legal or financial ramifications. This paper discusses the benefits of sharing health and safety experiences and learnings across the industry to improve the CCM process for all companies. The Bingham Canyon Manefay failure is used as an example of how critical control learnings have been shared and discusses how the industry has benefited. It then proposes a method for companies to share safety information without posing a legal risk to the company sharing the information.

9:25 AM
Attitudes and Beliefs of Hourly Miners and Salaried Managers Regarding Safety and Health in U.S. Metal and Non-Metal Mines

D. Myers[2], M. Wright[1] and N. Lessin[1]; [1]Health, Safety and Environment, United Steelworkers, Pittsburgh, PA and [2]Occupational and Environmental Health, West Virginia University, Morgantown, WV

The United Steelworkers (USW) is the predominant union in North American metal and non-metal mines, representing workers in more such mines than any other union, and more than are operated by any single company. In 2015-16, under a grant from the Alpha Foundation for the Improvement of Mine Safety and Health, researchers from the USW and West Virginia University surveyed local union leadership in 120 mines regarding the prevalence of, and barriers to effective safety and health programs based on finding and fixing hazardous conditions. This was followed by a survey of every hourly miner and salaried manager in four mines – two surface and two underground – mining four different commodities. One conclusion supported by several different survey items is that miners and managers have different beliefs about the nature of hazards in the mine, and about accident causation. If culture is defined as a shared set of attitudes, beliefs, norms and behaviors, then a single "safety culture" may not exist in these workplaces. It may be difficult to implement an effective and widely supported safety program can be built without first addressing these differences.

9:45 AM
Imminent Danger: Characterizing Uncertainty in Critically Hazardous Situations

J. Hrica, B. Eiter and D. Willmer; Pittsburgh, PA, CDC NIOSH, Pittsburgh, PA

Mineworkers are tasked with making critically important decisions of whether or not a hazard is considered imminent danger. NIOSH researchers collected formative data to investigate mine safety professional perspectives on workplace examinations which revealed a potential gap in how mineworkers are assessing risk and determining whether or not a hazard is imminent danger. During interviews, participants indicated having processes in place for what should be done once an imminent danger situation is identified. Critically, however, they report having no systematic methodology for mineworkers to use to determine if a hazard is considered imminent danger. While this is important for all imminent danger situations (e.g., LOTO), it is especially important for those situations that are not immediately recognizable as imminent danger such as ground control issues. In this paper, we discuss potential methodologies that can be used to improve reporting imminent danger situations. Finally, we identify potential leadership practices to incorporate into risk management efforts including effective feedback, communication, and collaborative correction of imminent danger situations.

10:05 AM
Usability Design Guidelines for Training in Mine Safety and Health

L. Brown and M. Poulton; Lowell Institute for Mineral Resources, University of Arizona, Tucson, AZ

For more than a decade, training practitioners have been calling for changes in the way new and experienced miners are trained. In this work, we propose 15 design guidelines to improve mine safety and health training, focusing on the training media and delivery methods. Our guidelines are derived from a multiyear needs assessment using a data-driven process called Contextual Inquiry. Over one thousand individual pieces of evidence were collected through observations, interviews, apprenticeships, and artifacts, covering a variety of required topics in MSHA new miner and annual refresher courses. Derivation and cross-validation of the design guidelines is provided through top-down and bottom-up analysis of inductive models. Our findings illustrate four principal themes of usability problems, which include limited accessibility, lack of context, lack of consequences, and absence of practicum. Example solutions are provided using active learning techniques and serious games.

10:25 AM
What Other Industries Are Doing About Fatigue, and What It Could Mean for Mining

T. Bauerle, Z. Dugdale and G. Poplin; National Institute for Occupational Safety and Health (NIOSH), Spokane Mining Research Division (SMRD), Spokane, WA

Worker fatigue is as complex as it is understudied. A 'psychosomatic' construct, fatigue lies somewhere between psychology and physiology, making the measurement and management of it difficult with no easy solutions for operators or workers. Answers to even basic questions such as what is fatigue, how is it measured, and how can organizational resources reduce fatigue, can remain elusive with no single clear path to action for the health and safety of the worker. This presentation supplements the growing body of interest in the industry by outlining ongoing research efforts at the Spokane Mining Research Division (SMRD) to synthesize lessons learned about fatigue management from other industries (e.g., transportation, aviation, construction) to determine their applicability to fatigue management systems for mining operations. Covered topics include: basic components of sleep and work from a psychological perspective; an overview of fatigue models, findings, and evidence-based solutions from other industries; and future plans to apply such findings to safety culture and leadership through the evaluation and implementation of fatigue risk management systems in the mining industry.

10:45 AM
Do you really Care? Reflections from the Front Line

M. Routledge; H&S Division Board, Park City, UT

How do you show your team that you care more about their personal well-being than you do about any other imperative of the business? Why, when you get that right, does it drive the most spectacular performance you could hope for across all business objectives and targets? Let's talk through several case studies over a 25 year period and draw out the most consistent aspects of each we believe are responsible for performance improvement. Some themes and tools emerge that are clearly the same in each case study providing a basis for building a high performance culture on a solid foundation or risk management, disciplined approaches to critical controls and clear visibility of leadership activity in the field.

TECHNICAL SESSIONS

MONDAY, FEBRUARY 26
AFTERNOON

1:30 PM | ROOM L100A

Dreyer Lecture

Recipient and Lecturer: *Robert Schafer*

Lecture: TBD

MONDAY, FEBRUARY 26
AFTERNOON

2:00 PM | ROOM 200ABC

6th North American Iron Ore Symposium: Mining & New Projects

Chairs: *G. Hudak, University of Minnesota*
D. Gagnon, DRA Americas

2:00 PM
Introduction

2:05 PM
Advantages of Using UAVs in Pueblo Viejo
J. Ozoria; Mining, Dominican College Of Engineers, Architects and Surveyors (CODIA), Santo Domingo, Santo Domingo, Dominican Republic

The time in projects of any kind has always been a fundamental issue from the start of construction to the operation itself, when it comes to earthworks on a large scale such as an open-pit mining operation; it is when we realize how valuable it's the time. The main objective of this presentation is to expose the advantages that make the UAV technology in mining a valuable and important tool for the management of geospatial information more efficiently and the control of the different material types in a mine with space limitation asPV. it will show the benefits of managing a mining operation with UAV. Substantial improvements in Pueblo Viejo from the area of safety, efficiency, quality and planning once implementation began. Today in Pueblo Viejo there are many applications that are carried out day by day with the use of UAVs. From the end of month report, stockpile inventory, construction monitoring, mine plans, slope monitoring, blast analysis, chess reporting. Undoubtedly, the UAVs in Pueblo Viejo came to stay, since the limitation of space and having different material types being dumped on top or beside each other. With the incorrect tracking the control of grades will be lost.

2:25 PM
An Evaluation of Rock Weathering Experiments at the MN DNR Hibbing Laboratory and Field Research Site and Their Importancein Developing Geochemical Models
S. Koski and Z. Wenz; Minnesota Department of Natural Resources, Hibbing, MN

Since the mid 1970's, a focus of the DNR Hibbing laboratory and field research site has been the development and evaluation of the humidity cell kinetic test procedure and field scale rock weathering experiments. These experiments have allowed for the assessment of the relationship between sulfur concentrations, leachate pH and solute release rates for varying rock types and mine wastes along with the ability to understand rock weathering geochemistry over decades of monitoring. In 2014 an experiment was initiated to develop a laboratory rock weathering procedure that would allow leachate solute concentrations to become limited by mineral saturation and sorption. The experiment consisted of standard humidity cells, a variant of the humidity cell, and 4 kg rock filled columns. The different experiment methods using the same two rock types have shown that similar rock types may generate different leachate compositions when following different experiment protocols. This can provide insight into geochemical processes occurring in these experiments and may allow for more accurate representations of full scale mine waste weathering and data to be used in geochemical modeling.

2:45 PM
Automation Application Realities for North American Iron Ore Laboratories
B. McBain; IMP Automation Canada Ltd., Oakville, ON, Canada

Extensive experience has been gained in the mechanization and automation of iron ore laboratories since the mid-2000s, when the first series of IMP automated labs gained a foothold in the Australian mining sector. Because of the large scale operations that often handled sample streams from several mines, these labs feature front-to-back automation that manage several hundred to a few thousand samples per day. In addition, a stringent focus on safety and regulatory compliance resulted in design strategies to limit worker access and ergonomically-challenging demands. IMP's first North American iron ore lab opened in 2014 at the TATA Steel Mineral Canada site near Schefferville, Quebec, but for various reasons this lab is a hybrid of manual and pseudo-automated processes. For the North American market, there are automation considerations to be made on the basis of lessons learned in both Australian and Canadian labs. This presentation will review the practical importance of such factors as mine output and ore type, labour factors, safety requirements and specialty iron production. It will also discuss some of the aspects to be considered in port laboratory specifications.

3:05 PM
Dominga Iron Project Update – Andes Iron
M. Rojas[1], H. Alegria[1], F. Porcile[1], M. Mlinar[2] and B. Eisenbraun[3]; [1]Dominga Project, Andes Iron, Saniago, Las Condes, Chile; [2]Coleraine Labratories, Natural Resources Research Institute, Coleraine, MN and [3]Barr Engineering Company, Hibbing, MN

A Chilean mining company Andes Iron SpA owns and is developing the Dominga Mine and associated port project. This is a greenfield project located in La Higuera, some 70km from La Serena in Chile's Coquimbo region. Andes Iron SpA, founded in 2011, acquired the Dominga project from its former owner, Minería Activa. The mine design will be consist of two open pits and include a processing facility for the extraction and beneficiation of magnetic iron ore, with copper as a byproduct. The Dominga project is expected to have a 26-year project life span. The initial investment is expected at $2.5