ENVIRONMENTAL: Health and Safety

2:00 PM • Wednesday, February 26

Chairs: **M. Lutz,** *University of Arizona, Tucson, AZ*
J. VanLandingham, *Twin Metals Minnesota, LLC, St. Paul, MN*

2:00 PM

Introductions

2:05 PM

Pilot-Scale Application of Using Traditional and Novel In-Ear Noise Exposure Monitoring in Active Shaft Mining to Evaluate Noise Controls

E. Lutz and R. Reed; College of Public Health, The University of Arizona, Tucson, AZ

Despite over 30 years of noise regulation, there is a 76% prevalence rate of miner over exposure. This is the highest rate in any work sector. Traditional evaluation of effectiveness for noise control interventions is accomplished using noise dosimeters coupled with instantaneous noise surveys (octave band analysis) and time-motion study. This study evaluated these standard-of-care noise exposure monitoring methods compared to novel sound pressure level measurement taken at the ear drum. The relationship between time-weighted average noise levels and peak noise levels had highly significant positive correlations indicating consistency in noise exposure measurements and device performance ($p<0.002$). The time-weighted noise reduction was also studied, which was calculated as the time-weighted average dosimeter measure minus the time-weighted average in-ear measure. The average noise reduction level ranged from 0 to 38.4dBA, with mean 8.60dBA and SD 8.56dBA. This pilot-scale study indicates that in-ear noise measurement, in tandem with traditional dosimetry, may prove an effective strategy for assessing noise control effectiveness. However, further study is warranted.

2:25 PM

Occupational Heat Strain in Deep Shaft Metal Mining

E. Lutz and R. Reed; College of Public Health, The University of Arizona, Tucson, AZ

A single heat strain incident increases miners' sensitivity to subsequent heat exposures. With technology moving operations deeper, the potential for excessive thermal loading among miners poses a significant challenge. Forty-five miners ingested core body sensors and wore heart rate monitors during day, swing, and graveyard shifts while performing deep shaft-sinking tasks where ambient rock-face temperatures ranged from 32.5-60°C. Ninety-eight percent of miners' temperatures were measured below recommended limits (38°C), with mean temperature of 37.2°C. Most values for maximum 10-minute averages were above this limit (mean 38.15°C). Workers reached 72%, 74%, and 81% of their maximum heart rate during maximum 60-, 30-, and 10-minute averages, indicating moderate to high activity levels. Of the eight most common tasks, welding and cutting were associated with significantly increased maximum10-minute average temperatures. Swing shift miners had higher median core body temperatures ($p=0.008$). Employees in the Obese Level 1 BMI category had higher maximum 10-minute average core body temperatures than miners in the 'Normal' BMI and 'Overweight' categories ($p=0.017$).

2:45 PM

Characterization of Dust in Underground Coal Mines and Implications for Occupational Health

R. Sellaro and E. Sarver; Mining and Minerals Engineering, Virginia Polytechnic Institute and State University, Blacksburg, VA

It has long been understood that extended occupational exposures to respirable mine dusts can lead to chronic lung disease. In underground coal mines, CWP and silicosis are major concerns. While there have been many studies aimed at understanding total dust concentrations, and silica content, associated with different mining conditions (e.g., locations/occupations within a mine, cutting methods, geologic strata), little research has been completed to comprehensively characterize respirable dust (i.e., by particle composition, size distributions, shapes). This preliminary study sought to characterize dust from an underground coal mine in Central Appalachia using scanning electron microscopy with energy dispersive x-ray. Respirable dust samples were collected from various locations in the study mine, and individual dust particles were identified and categorized by mineral type. A continuous personal dust monitor was also used to estimate total respirable dust concentrations at each location during sampling. Here we report results of this preliminary work, and discuss advantages and challenges of particle-level characterization of mine dusts in terms of occupational health research.

3:05 PM

Leadership Mentoring in the Mining Community: A Case Study

M. Lutz[1] and J. VanLandingham[2]; [1]Freeport McMoRan, Sahuarita, AZ and [2]Twin Metals Minnesota LLC, St. Paul, MN

This session will present the findings of our study that looked at the outcomes of a leadership mentoring program created for front-line supervisors. Participants in this program were given one day of training on mentoring and advanced leadership skills and then asked to spend six months mentoring a miner from another mine company. We will highlight the challenges and successes of this unique program that encourages cross-company mentoring to increase the leadership and mentoring skills across the mining industry, not just within one company.

3:25 PM

Fatigue Risk Management Systems in Mining; Current Status and Lessons Learned

W. Sirois; Circadian Technologies, Inc., Stoneham, MA

Some 47% of mining incidents have now been identified as being fatigue-related. As a result, most Global mining companies have embraced Fatigue Risk Management "Systems" (FRMS) towards achieving the next "step change" in HSE. This session will review progress to date, share difficulties encountered, and provide implementation guidelines for achieving the full benefits of this breakthrough approach for improving safety and occupational health in the mining industry.

ENVIRONMENTAL: Legal-Water Quality Challenges

2:00 PM • Wednesday, February 26

Chairs: **G. Robinson**, *R Squared, Inc., Sedalia, CO*
J. Bolders, *Olsson Associates, Golden, CO*

2:00 PM

Introductions

2:05 PM

Speciation of Cyanide and Metal-cyanide Complexes Using Flow Injection Gas Diffusion Amperometric Methods of Analysis

W. Lipps; OI Analytical, College Station, TX

The toxicity of cyanide is determined by its chemical form. The chemical form of cyanide is controlled by solution pH and the presence of transition metals. Given this, it makes sense to analyze aqueous samples using methods that enable the accurate quantitation of cyanide species present. While "free cyanide" is the most toxic form of cyanide in the aqueous environment, most analytical methods are designed to determine "total cyanide" that includes free cyanide along with relatively non-toxic metal cyanide complexes. This presentation describes ASTM standard test procedures that quickly and accurately quantify cyanide as three groups; free, WAD, and total. Recoveries of the metal cyanide complexes by each method will be presented.

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Trends in Water Quality Regulation

G. Racz; Vranesh and Raisch, LLP, Boulder, CO

Early in the U.S. Clean Water Act's fifth decade, the "low hanging fruit" of water quality issues have largely been addressed. The mining industry faces challenges as regulators tackle ever more complex problems with potentially extreme compliance costs. For example, the U.S. Environmental Protection Agency has prioritized nutrient regulation, raising difficult scientific and policy questions. E.P.A. and states continue efforts to develop standards for substances like selenium and arsenic that are common in the environment in many areas. The regulatory

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