Thursday, June 11, 2026

Health, Material Transfer, and Engaging with Tribal Nations

12:30 PM Open Zoom Seminar (Authors only)

1:00 PM Opening remarks

1:05 PM **Beyond Compliance: Meaningful Tribal Engagement as Strategy for Project Success** by Erin Linn, Office Principal, Chronicle Heritage

Abstract: The global demand for critical minerals is accelerating rapidly, driven by energy transition goals, technological expansion, and national strategic priorities. A significant proportion of these resources are located on or near Indigenous lands, making engagement with Tribal Nations an increasingly critical consideration for mining and infrastructure development.
Within the mining sector, cultural heritage and Indigenous engagement are often treated primarily as compliance obligations or project risks. At the same time, investors, regulators, and the public increasingly expect companies to demonstrate strong Environmental, Social, and Governance (ESG) performance. In this context, how companies engage with Tribal Nations has become a material factor influencing project viability, reputation, and long-term success.

While formal Tribal consultation in the United States is typically the responsibility of government agencies, this does not preclude project proponents from establishing meaningful, early relationships with affected Tribes. In fact, proponents that integrate Tribal engagement into project planning from the outset—engaging early, often, and with genuine intent—are better positioned to identify risks, avoid delays, reduce conflict, and improve project outcomes.

The consequences of failing to do so can be severe. Rio Tinto's destruction of the 46,000-year-old Juukan Gorge rockshelters in Western Australia remains one of the most significant recent examples of how failures in Indigenous engagement can trigger reputational damage, shareholder backlash, executive resignations, regulatory scrutiny, and major financial consequences.

This presentation examines why meaningful Tribal engagement should be understood not as a peripheral compliance activity, but as a core project strategy. Participants will leave with practical insights into how early, relationship-based engagement can reduce risk, strengthen project delivery, and contribute to more durable outcomes for both proponents and Tribal Nations.

1:25 PM **Air Induction Characteristics of Enclosed Water Spray Systems for Mining Dust Control** by Hua Jiang, Ph.D., Associate Service Fellow, Health Hazards Prevention Branch, Pittsburgh Mining Research Division, NIOSH

Abstract: Water spray dust suppression systems have played a crucial role in reducing respirable dust exposures in the mining industry for many years. One such technology, the water-powered scrubber, has shown how enclosed spray nozzles can control airborne dust and provide localized ventilation to dilute explosive gases at mining faces. However, its effectiveness is constrained by its air flow induction capacity. To extend the capacity and improve the efficiency of water-powered scrubbers, it is essential to gain a comprehensive understanding of air induction characteristics across different spray configurations, including spray type, spray angle, and orifice size, as well as their performance in-series configurations. A specialized spray air inducement testing apparatus was developed to assess the air inducement performance of both single and in-line series sprays. Key parameters, such as spray power and entrainment ratio, were evaluated for six spray nozzles across three categories, with tests conducted over a pressure range from 100 psi to 1000 psi. Addition-ally, dust capture efficiency under various operating conditions was calculated using vali-dated theoretical models. These fundamental water spray characteristics can improve spray applications and drive advancements in the development of water-powered scrubbers for more effective dust control in mining operations.

1:45 PM **Control of Exposure of Underground Miners to NO_2 Emitted by Diesel-Powered Mobile Equipment** by Aleksandar Bugarski, Ph.D., Mechanical Engineer, Pittsburgh Mining Research Division, NIOSH

Abstract: Wide implementation of certain diesel engine and exhaust aftertreatment technologies and promulgation of more stringent regulations in selected jurisdiction made the control of exposures to nitrogen dioxide (NO_2) emitted by diesel-powered equipment one of the most pronounced occupational health challenges for the underground mining industry. The results of NO_2 emission measurements for three contemporary and single traditional diesel engines, and measurements of the effectiveness of adsorbent filtration elements were used to investigate the issue and potential solutions. The results showed that providing adequate quantities of "fresh" air to dilute NO_2 found in the exhaust of two evaluated contemporary engines in the concentrations substantially exceeding those observed in the exhaust of the evaluated traditional diesel engine could be technologically very challenging and potentially cost-prohibitive. Therefore, the selection of the viable diesel engine technologies is critical to sustainability of underground mining operations. The NO_2 emissions data for a wide range of engine operating conditions was found to be the essential piece of information for the success of the selection process. The strategy of enclosing operators of mobile equipment in the environmental enclosures fitted with the filtration and pressurization systems with incorporated adsorbent filtration elements was found to have the potential to substantially reduce exposures of underground miners to NO_2.

2:05PM **Slicklines, Droplines, Diverter Boots—A Monograph** by Ralph R. Sacrison, PE, SME-RM, Sacrison Engineering

Abstract: Pipeline or borehole free-fall transfer of solid or slurry material has long been done in underground mining. This paper addresses some characteristics and design elements in selecting systems suitable to the transferred media and the mine requirements. Though overall system aspects are discussed, principal attention is directed to the slickline/dropline/transfer line and the discharge diverter/rockbox/energy dissipator/boot. These terms are common to these systems, often used interchangeably, and used here as appropriate to the material, equipment and construction. A principal distinction in the authors' experience being that slicklines refer to slurry transfer and droplines to dry transfer. Following several design sections, fabrication and construction, and system operating and maintenance procedures are discussed.

2:25 PM **General Q&A**

2:45 PM **Session close**

Thursday, June 18, 2026

Ground Control and Vertical Air-Blocking Ring for Dust Control

---

12:30 PM Open Zoom Seminar (Authors only)

1:00 PM Opening remarks

1:05 PM **Evaluating Roof Stability in an Underground Stone Mine Under High Horizontal Stress: Insight from Numerical Modeling and Field Observation with Mitigation Strategy** by Gamal Rashed, Ph.D., Senior Service Fellow, NIOSH

Abstract: High horizontal stress has been identified as a critical factor affecting roof stability in underground mines, particularly when the immediate roof consists of weak or laminated rock. Numerical models were employed to better understand the influence of caprock thickness, cutting sequences, and the orientation of driving direction relative to maximum horizontal stress on roof stability in underground stone mines. These models were calibrated using LIDAR scans of roof falls from the study mine. The findings of this study enhance our understanding of roof stability under high horizontal stress and contribute to reducing the risk of roof falls in underground stone mines.

1:25 PM **A Case Study of the Impact of Longwall Mining on Casing Deformations and Stresses of the Shale Gas Wells at a Longwall Recovery Barrier Pillar** by Peter Zhang, Ph.D., General Engineer, Mining System Safety Branch, Pittsburgh Mining Research Division, NIOSH

Abstract: The presentation is about a case study to simulate longwall-induced casing deformations for three shale gas wells located in a longwall recovery barrier pillar. Using a calibrated FLAC3D model developed by NIOSH researchers, this study set up a site-specific model with the mining conditions and overburden geology at the gas well site. The purpose of this study is to simulate potential impact of longwall mining on gas well casings to evaluate potential locations for longwall recovery. The results of this case study on modeling comparable conditions suggest that, under the same depth of cover, overburden geology, and gas well casing construction, it may be feasible to mine by these wells without undue yield to the production casings.

1:45 PM **Vertical air-blocking ring - lab evaluation for drill shroud dust control** by Yi (David) Zheng, Ph.D., Mechanical Engineer, Pittsburgh Mining Research Division, NIOSH

Abstract: Respirable dust from surface drilling remains a challenge due to leakage from the drill shroud. While dry dust collection systems are widely used, their effectiveness can be limited by

dust leakage. A vertical air-blocking ring (VAR) was developed as a simple, low-cost solution to improve dust containment. Fabricated from a standard 55-gallon drum, the VAR is installed around the drill stem beneath the deck. Laboratory testing using NIOSH's full-scale drill shroud simulator evaluated two VAR heights under different airflow ratios and gap conditions. Results showed dust reductions of up to ~99% when the shroud gap was small, with performance strongly influenced by gap size and airflow. The VAR offers a practical and easily implemented approach to improve dust control in surface drilling operations.

2:05 PM **General Q&A**

2:25 PM **Session close**

Tuesday, June 23, 2026

Processing and Pillar Pressure Monitoring Across Barriers in a Longwall Coal Mine

---

12:30 PM Open Zoom Seminar (Authors only)

1:00 PM Opening remarks

1:05 PM **Mechanical Activation of Underclay for Enhanced Lithium Extraction and Amorphous Silica Production** by Toluwalase Segun Ogunsunlade, Ph.D. Candidate, Department of Energy and Mineral Engineering, Pennsylvania State University

Abstract: Lithium-bearing coal underclays represent an underutilized unconventional resource for both critical mineral supply and low-carbon cementitious materials. Lithium is structurally bound within phyllosilicate lattices (e.g., kaolinite, muscovite, cookeite), limiting its accessibility to direct leaching. This study evaluates high-energy mechanical activation as a low-temperature pretreatment to induce structural disorder, amorphization, and particle-size reduction in Pennsylvania Mercer underclay, with the dual objective of enhancing lithium extraction and producing reactive amorphous aluminosilicates for supplementary cementitious material (SCM) applications.

Representative samples were subjected to controlled planetary ball milling at 400–600 rpm for 30–120 min. Structural and physicochemical evolution was characterized using X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), thermogravimetric analysis (TGA/DTG), scanning electron microscopy (SEM), and BET surface area analysis. Lithium extraction using mild lixiviants was quantified by inductively coupled plasma optical emission spectroscopy (ICP-OES), while cementitious reactivity was evaluated through amorphous phase development and isothermal calorimetry (ASTM C1897).

Mechanical activation progressively disrupted long-range crystallographic order, evidenced by peak broadening, intensity loss, and amorphous hump formation, alongside hydroxyl-band attenuation and silicate framework distortion. These changes coincided with particle fragmentation and increased surface area, enhancing lithium liberation during leaching. Lithium recovery increased with milling intensity and duration, reaching up to 97%, while activated samples achieved cumulative heat release of ~450 J/g at 600 rpm and 120 min, confirming strong dependence on the degree of amorphization.
This study demonstrates that mechanical activation is an effective, low-temperature strategy for the dual valorization of coal underclay, simultaneously enhancing lithium extraction and generating reactive amorphous silica for sustainable cementitious use.

1:25 PM **Scale-Aware Graph Neural Coarse-Graining for Stirred Mills** by Ayuk Corlbert Ayuk, Ph.D. Candidate, Department of Energy and Mineral Engineering, Pennsylvania State University

Abstract: Stirred media mills are characterized by strongly heterogeneous bead motion, localized force transmission, and boundary-dominated stressing, which together govern grinding performance and energy utilization. Although discrete element method (DEM) simulations provide detailed access to particle kinematics and contact mechanics, most analyzes remain restricted to global indicators such as power draw, collision frequency, or stress intensity, thereby limiting spatially resolved interpretation of the grinding environment.

A central difficulty is the absence of a scalable framework that converts dense, time-resolved DEM contact data into continuum fields without relying on arbitrarily chosen averaging windows. Goldhirsch's exact coarse-graining formulation provides a rigorous basis for obtaining stress, stress asymmetry, and couple-stress fields from discrete systems at a prescribed resolution, while recent physics-guided coarse-graining studies emphasize the need to move beyond ad hoc neighborhood selection in multiscale modeling.

In this work, a physics-guided graph neural network framework is proposed for learning continuum stress closures directly from time-resolved DEM data of a vertical stirred mill. The method uses particle positions, velocities, angular velocities, and both particle-particle and particle-wall contact information to construct dynamic heterogeneous graphs. Ground-truth supervisory labels are generated from Goldhirsch-style coarse-grained stress fields, augmented with boundary contributions from particle-wall interactions. The model is trained to predict spatially resolved stress tensors, dissipation proxies, stress asymmetry, and couple-stress-related quantities on query cells distributed throughout the mill domain. A temporal extension is further introduced to learn the evolution of these fields between consecutive timesteps. The proposed framework establishes a physically consistent and computationally efficient route from DEM microstructure to continuum field prediction, with potential applications in stirred-mill analysis, design optimization, and scale-up.

1:45 PM **Electrochemical Investigation of Organic–Oxidant Systems for Copper Extraction from Chalcopyrite** by Melissa Gonte, Ph.D. Candidate, Department of Energy and Mineral Engineering, Pennsylvania State University

Abstract: Organic acids such as methanesulfonic acid (MSA) and citric acid (CA), used with hydrogen peroxide (H_2O_2) as an oxidant, are increasingly being investigated as potential alternatives to traditional mineral acid lixiviants due to their perceived lower environmental impact and strong metal-binding capabilities. However, H_2O_2 suffers from several limitation that hinder its adoption while other oxidants; molecular oxygen (O_2) and the ferric/ferrous system (Fe^{3+}/Fe^{2+}), have not been systematically investigated in these organic acid media. This study characterizes the electrochemical behavior of H_2O_2, O_2 and Fe^{3+}/Fe^{2+}, in MSA and CA on an inert platinum electrode to establish the fundamental solution chemistry that both underpins and

occurs concurrently with chalcopyrite oxidation. Both acids exhibited negligible redox activity in the absence of oxidants. H_2O_2 enhanced electrochemical activity in a concentration-dependent manner, particularly in MSA, whereas its effect in CA was weaker and less predictable due to partial decomposition and peracid formation. O_2 showed limited influence due to low solubility, producing minimal currents. Fe^{3+}/Fe^{2+} increased the oxidation–reduction potential (ORP) in both media, with higher currents and more reversible behavior in MSA, while complexation in CA reduced free Fe^{3+} availability and electrochemical response. Chalcopyrite electrochemical leaching tests showed lower mixed potentials than platinum due to anodic mineral oxidation. H_2O_2 produced the largest increase, Fe^{3+}/Fe^{2+} moderate effects, while O_2 caused negligible change. These results indicate that MSA provides a more electrochemically favorable environment for oxidant-driven chalcopyrite oxidation and highlight the importance of oxidant selection in designing sustainable organic acid leaching systems.

2:05 PM **Coal Preparation and Its Economic Impact** by Rick Honaker, Ph.D., Professor of Mining Engineering, University of Kentucky

Abstract: For more than a decade, the prevailing belief among the public, policymakers, and even some leaders within the coal industry was that U.S. coal production would continue its long-term decline. This outlook contributed to a reduced emphasis on operational optimization and, in some cases, fostered a mindset of maintaining existing practices rather than pursuing continuous improvements in efficiency and profitability. As a result, opportunities to enhance coal preparation plant performance and maximize product value often received less attention than in previous decades.

Recent developments in the energy sector have challenged these assumptions. Rapid growth in electricity demand driven by data centers, advanced manufacturing, electrification initiatives, and concerns regarding grid reliability, coupled with shifts in carbon reduction policies and timelines, have reinforced the importance of coal as a dependable component of the nation's energy portfolio. Consequently, coal producers must renew their focus on maximizing operational efficiency and economic performance to remain competitive in an evolving energy market.

Coal preparation plants play a central role in determining mine profitability through their impact on product quality, yield, recovery, transportation costs, and customer satisfaction. Even modest improvements in plant operation can generate substantial economic benefits when applied across large production volumes. This presentation will review fundamental coal preparation optimization principles and discuss the relationship between plant performance and mine economics. Practical examples will be presented to demonstrate how relatively small operational change, including process control adjustments, circuit modifications, maintenance practices, and product quality management, can produce significant gains in revenue, cost reduction, and overall profitability. The discussion will highlight the continuing importance of efficient coal preparation as a key contributor to the long-term success and sustainability of U.S. coal mining operations.

2:25 PM **Pillar Pressure Monitoring Across Barriers in a Longwall Coal Mine** by Zoheir Khademian, Senior Mining Engineer, NIOSH

Abstract: This presentation describes a field instrumentation study in a deep longwall coal mine aimed at understanding pillar loading, stress transfer, and floor heave as mining progresses. It uses borehole pressure cells and site-specific monitoring in the pillar system to quantify how stresses redistribute between adjacent panels and how that redistribution relates to yielding and ground response. The overall goal is to support hazard forecasting by combining field measurements with geomechanical interpretation in order to better manage seismic and ground control risks.

2:45 PM **General Q&A**

3:00 PM **Session close**

Thursday, June 25, 2026

Lithium Battery Failure, Fiber Optic Monitoring for Mine Roof, and Gob Gas Flow

---

12:30 PM Open Zoom Seminar (Authors only)

1:00 PM Opening remarks

1:05 PM **Reduced-Order Modeling for Automated Hazard Mitigation During Lithium-Ion Battery Thermal Runaway in Underground Mines** by Khadija Omar Said, Ph.D. Researcher, Department of Energy and Mineral Engineering, Pennsylvania State University

Abstract: Lithium-ion batteries (LIBs) are increasingly adopted in underground mining due to their high energy density, elevated Coulombic efficiency, and reduced operational emissions. However, LIB failure can trigger thermal runaway (TR), a highly nonlinear exothermic process that releases intense heat, toxic gases, and dense smoke within confined underground environments. Under ventilation-constrained conditions, the transient propagation of these hazards poses significant risks to mine safety. Although high-fidelity computational fluid dynamics (CFD) models can accurately capture the coupled thermo-fluid behavior associated with LIB TR, their computational cost limits real-time deployment for emergency response. To address this limitation, this study develops reduced-order models (ROMs) in the form of control-oriented state-space models (SSMs) for predicting transient thermal and smoke transport during LIB TR events in underground mine drifts. CFD-generated datasets comprising temperature, smoke concentration, airflow velocity, and heat release rate (HRR) under varying ventilation conditions (0.5 – 3.0 m/s) were used for system identification and model development. The ROM framework preserves dominant spatiotemporal transport dynamics while significantly reducing computational complexity relative to full-order CFD models. The developed SSMs demonstrated strong predictive capability, with temperature prediction accuracies of ~81.0–89.0 % during training and ~82.0–98.0 % under unseen ventilation conditions. Smoke predictions achieved training accuracies of ~65.0–74.0 % and testing accuracies of ~60.0–81.0 %. The proposed framework establishes a computationally efficient foundation for real-time digital twins, online hazard tracking, observer design, and autonomous emergency response systems for underground mine safety.

1:25 PM **A systematic literature review on gas emission from lithium-ion battery failure** by Alyssa Lypson, Ph.D., Research Chemist, Pittsburgh Mining Research Division, NIOSH

Abstract: The presentation will disseminate findings from a systematic literature review on gas detection from lithium-ion battery failure with a focus on carbon monoxide and hydrogen fluoride generation. In addition, the presentation will highlight research gaps in the peer-reviewed literature regarding this topic. This will help to increase awareness of the health and safety risks associated with hazardous gas emissions from failing lithium-ion batteries. This task supports the

broader project goal to help the mining industry and mine rescue community better manage these hazards.

1:45 PM **Longwall mine ventilation network interaction with gob gas transport systems** by Todor Petrov, Ph.D., Associate Research Fellow, Ventilation and Explosion Prevention Team, Pittsburgh Mining Research Division, NIOSH

Abstract: The presentation will disseminate lessons learned from a case study and a modeling approach that NIOSH researchers developed for computation of Gob gas flow through longwall panels. The presentation is also intended to advance the understanding of ventilation system performance in longwall coal mining operations, both domestically and internationally. It aims to support methane control methodologies, facilitate the identification and mitigation of technical and operational barriers, when advancing coal mining operations underground. This effort aligns with the broader mission of the National Institute for Occupational Safety and Health (NIOSH) to enhance the safety and health of mine workers through the development and implementation of innovative, evidence-based solutions.

2:05 PM **Real-Time Fiber Optic Monitoring for Degasification Well Hydraulic Fracturing in Deep Coal Seams: From Fracture Detection to Gas Drainage Optimization** by Shimin Liu, Ph.D., Professor of Energy and Mineral Engineering, Pennsylvania State University

Abstract: Deep coal seam gas control remains one of the most significant safety and production challenges in underground coal mining, particularly in low-permeability, high-gas, high-stress coal reservoirs. Conventional evaluation methods for hydraulic fracturing of degasification wells, such as pressure curves, discrete stress measurements, and surface micro-seismic monitoring, often provide limited spatial coverage and delayed feedback, making it difficult to accurately characterize fracture propagation and evaluate stimulation effectiveness in real time. This presentation introduces a field-deployable distributed fiber optic sensing approach using Distributed Acoustic Sensing (DAS) and distributed strain monitoring for real-time evaluation of directional long-borehole hydraulic fracturing in coal mine degasification systems.
This talk focuses on practical implementation and operational value for deep coal seam gas drainage and hydraulic fracturing optimization. Field deployment strategies, including roadway-based fiber installation and grouted borehole fiber placement, will be presented together with monitoring concepts for staged fracturing of directional long boreholes. Key industry benefits include: (1) real-time monitoring of hydraulic fracturing and degasification performance over kilometer-scale distances; (2) continuous evaluation of fracture growth and stress evolution without dense sensor networks; (3) earlier identification of ineffective stimulation zones and abnormal fracture behavior; and (4) educed uncertainty in gas drainage effectiveness and enhanced outburst risk mitigation.

2:25 PM **General Q&A**
2:45 PM **Session close**