Society of Mining Engineers Central Appalachian Section (SME-CAS) 2024

Speaker Schedule

Lexington, Kentucky

April-May 2024

TECHNICAL SESSIONS

Technical Session I: **Panel Discussion – Topic Pending**

Tuesday, April 30, 2024
2:00 – 4:00 PM

Technical Session II: **Geotechnical and Safety-Related Topics in Mining**

Wednesday, May 1, 2024,

9:00 – 11:00 AM

Presentation 2.1

Title: Geologic Assessment Tools – Simple but Effective

Presenters: Joe Wickline

                Senior Engineer

                Arch Resources, Inc. – Leer South

Abstract: Implementing simple but effective assessment tools can strengthen your understanding of complex geologic challenges faced in many operations.

- Implementing operational constraints in geotechnical mapping:
  o Minimum height requirements
  o Ventilation
  o Equipment limitations
  o Resource Access
- Roof Scoping
- In-Mine hazard mapping
- Adverse roof identification

- Longwall retreat mining assessments

Presentation 2.2

Title: Improving Operator Safety: Advanced Analytics for High Energy Loading Impacts

Presenters: Michael Redford and Stephen Redford

Matrix Analytics Group

Abstract: The long-term effects of repeated whole-body vibration (WBV) and high energy mechanical vibration and shock, during the operation of surface haul trucks, have not been extensively documented despite the high occurrence of back and neck pain complaints and related injuries reported by operators. Several epidemiological studies have evidenced a relationship between long-term exposure to vibration and the occurrence of musculoskeletal disorders. The challenge is that a manifest injury can take several years to develop, and so very little actual causal injury data exists. Through our integrated sensor technology solution and quantitative methodologies, we are contextualizing the dynamic forces exerted on operators, particularly during high energy loading events, to better characterize the stresses experienced. While most research to date has focused on WBV, our emphasis is on high energy events, resulting in severe impact exposures, and the benefit of rubber liner technology to reduce the force transmitted to the operator during a loading event.

Presentation 2.3

Title: Prediction of Dynamic Subsidence Over Longwall Panels – Calibration

for the Edge Effect Offset

Presenter: Zach Agioutantis, Jesus Romero, Ernesto Maldonado

Department of Mining Engineering

University of Kentucky

Abstract: Reliable prediction of dynamic deformations is important when planning to undermine important structures such as cell towers, power transmission structures, residential structures, etc., that cannot tolerate large relative three-dimensional displacements and/or large ground strains.

This presentation discusses examples of dynamic deformation profiles that include subsidence, horizontal displacements, and horizontal strain for a number of surface monitoring points over a retreating longwall panel in the eastern US. These points are located at different distances from the excavation rib and are shown to have different responses in terms of dynamic movements.

The formulation is based on the influence function method implemented in the Surface Deformation Prediction System (SDPS). Results show that the subsidence development curve may be reliably predicted for surface points in the middle of the panel. When surface points are close to the excavation rib, the calculation of ground deformation indices may be affected by the magnitude of the edge effect offset.

Presentation 2.4

Title: Reconstructing Laminated Shale Specimens/Cores for Numerical Modeling by Physics-Informed Image Processing

Presenter: Gaobo Zhao

Mining Engineering – West Virginia University

Abstract: An end-to-end physics-informed image processing methodology to construct the digital twin of laminated shale and extract the geometry information of bedding planes, such as coordinates, number, length, spacing, etc. will be presented. Specifically, based on the physics information (gradient difference between different pixels in the image due to the various mineral components of quartz, carbonate, or clay material), an edge detection algorithm is used to extract one-pixel-wide bedding planes from the shale image. Then, a depth-first search algorithm is utilized to collect the point coordinates of each line. The coordinates were used to generate the model of the laminated shale specimens/cores in UDEC. This work will improve the reliability of laminated shale modeling to investigate further the influence of bedding planes on the macro mechanical properties of shale rock mass.

Presentation 2.5

Title: Evaluating Novel Dust Controls

Presenter: Steven Schafrik, Ph.D.[1], Festus Animah[2], Emily Sarver, Ph.D.[2]

[1]Mining Engineering - University of Kentucky

[2]Mining and Minerals Engineering - Virginia Tech

Abstract: Mining is an inherently dust-generating process. There exists many different tools and techniques for controlling dust and or keeping it away from the workers and vulnerable machine parts. One of the dustiest processes in the mining industry is cutting coal with a continuous mining machine. Ventilation of the mining production face with fresh air, use of water sprays in and around the cutting head, and operation of a scrubber are all tools which are commonly used to control this dust. These controls have different pros and cons. This presentation will summarize the controls available and discuss results evaluating new dust filter technologies.

Presentation 2.6

Title: Tools and Methods Used to Predict Seismic Events Caused by Longwall Mining in Buchanan County, VA

Presenters: Stephen Morgan

               Senior Geologist

               Coronado Global Resources Inc.

Abstract: Over time, mine pillar design has evolved to not only more-efficiently extract coal, but also to improve safety. A combination of mapping methods, statistical modelling, and seismology serve as a 'well-equipped toolbox' to better predict the potential for seismic events to occur within a deep longwall mine in Buchanan County, VA. Let's touch on a few and discuss how this has led to more-informed decision making.

Technical Session III: **Environmental and Ethical Issues, and the Search for Rare Earth and Critical Minerals in Appalachia**

Wednesday, May 1, 2024,

2:00 – 4:00 PM

Presentation 3.1

Title:	Overview & Advancements of the Evolve Central Appalachia Rare Earth & Critical Minerals Project
Presenters:	Dr. Richard Bishop
	Virginia Tech Mining & Minerals Engineering
Abstract:	The Evolve Central Appalachia (Evolve CAPP) project team is currently engaged in an exploration of rare earth and critical mineral resources within the Central Appalachian coal basin, spanning across Virginia, West Virginia, Kentucky, and Tennessee. This endeavor aims to uncover vital resources essential for the advancement of clean energy technologies and sustainable industries crucial for national security. Additionally, it seeks to catalyze downstream value-added industries, fostering economic growth in the Central Appalachian (CAPP) region. The team is actively assessing the effectiveness of geophysical detection instruments like XRF, LIBS, and Spectral Gamma to expedite the identification of potential sampling zones. This presentation will provide the background and introduction to the project, as well as an overview of recent achievements, milestones, and the latest technological advancements in the exploration of rare earth elements and critical minerals in the coalfields, contributing to the overall objectives of the Evolve CAPP project.

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Presentation 3.2

Title:	Wicking Wells – A New Method to Remove Total Dissolved Solids from Groundwater
Presenters:	Shane McDonald, PG
	Senior Technical Leader - Modeling and Hydrogeology

HDR, Inc.

Abstract: A newly patented method for removing total dissolved solids (TDS) from groundwater has been developed at HDR. This method, called 'wicking wells', uses capillary media on a frame that is positioned just touching the water table in a purpose-designed well. The well is designed to tap the most contaminated water, focusing on the highest TDS. The capillary media (think sponge) wicks the water to above the water table where heated dry air is passed across the media to evaporate the water. The moisture laden air is exhausted to the atmosphere and any solids that were dissolved in will precipitate and are captured on the capillary media. In this way, the most onerous water is removed from the groundwater reducing the constituent load downgradient of the wicking well. Once the capacity of the capillary media to hold solids is expended, it is retrieved and disposed of as a solid (not a brine or sludge). It is possible that some of the constituents that are captured could be valuable resources, such as arsenic, lithium, boron or rare earth elements. Because different solutes have different solubilities, these constituents may differentially precipitate on the media allowing further isolation of specific constituents of interest which could increase recovery efficiency. This talk will discuss the development of the idea into a prototype, bench-scale testing that has been conducted using prototype and the acquisition of a patent for the process.

Presentation 3.3

Title: Evolve-CAPP Rare Earth and Critical Minerals Update of Sampling, Screening, and Laboratory Test Work

Presenters: Kevin Andrews, CPG

Vice President/Principal Geologist

Marshall Miller & Associates

Abstract: The Evolve-CAPP team implemented a sampling and analysis plan for enhancing the abundance and quality of rare earth and critical mineral data associated with coal mining in the Central Appalachian Basin. The team planned and carried out a data collection operation that includes downhole geophysical logging using spectral gamma technology,

sample screening using portable X-Ray Fluorescence (XRF) technology, close correspondence with industry partners to collect samples, and ultimately laboratory analysis of samples by both commercial and academic laboratories. The data collected from this phase of the project is coupled with previous mapping of existing data to enhance the team's understanding of the distribution of potential rare earth and critical mineral resources in the basin. The data collection activities have resulted in increased capability to identify key resource potential but have also resulted in numerous observations important to the proper collection of samples, use of screening technology, and understanding of the laboratory analysis results.

Presentation 3.4

Title: When Molehills Become Mountains: Navigating Ethical Issues in Engineering

Presenters: Dana Howard

                Member

                Stoll Keenon Ogden, PLLC

Abstract: Engineers face a multitude of different challenges every day from clients, employers, the market, and the profession itself. Ever felt pressure to approve a design with problems? Not to admit a mistake made by you or a colleague? Alter results to obtain regulatory approval? Complete a project in less time than competence requires? Keep up with technology? Some pressures never manifest into anything more menacing than a molehill. Others seem to grow into mountains overnight. This session explores how to identify, address, and navigate common ethical dilemmas in engineering.

Presentation 3.5

Title: Carbon Management in Mining and Related Industries

Presenters: Dr. Nino Ripepi

                Virginia Tech Mining & Minerals Engineering

Abstract: The Virginia Center for Coal & Energy Research at Virginia Tech has been conducting carbon management research for the past 20 years. This presentation will provide an update of that research over

multiple mining and related sectors with various technologies that include carbon capture from power plants and other industrial facilities; carbon mineralization in-situ and ex-situ from mine tailings and fines; and blue hydrogen opportunities. The update will include results from three carbon storage field validation projects funded by the US Department of Energy that have been completed in Central Appalachia where carbon dioxide was injected in unconventional gas reservoirs for enhanced gas recovery and greenhouse gas mitigation reasons.