

Synopsis

Title: Reducing Rib Failure Hazards in Underground Coal Mines by Improvement of the Coal Rib Control System: Integration of Rib Corner, Abutment Loading, and Multiple Seam Interaction

Organization: Missouri Science and Technology

Principal Investigators: Taghi Sherizadeh

Partnerships: ARCH Resources, American Consolidated Natural Resources, and Peabody

Topic: Health and Safety Interventions Priority Area: Ground Control

Research Need: Through advancements made in the past three years and the continuous progress of our completed and ongoing projects, the coal rib control system achieves a high level of capability in accommodating an extensive spectrum of mining conditions. However, while significantly advanced, this rib control system still has significant gaps in its ability to assess and mitigate certain critical conditions associated with rib stability in underground coal mines. Specifically, the system does not adequately evaluate the condition of *rib corners*, which are prone to higher stress levels and sloughing due to two free surfaces, leading to frequent rib failures. In addition, the developed and updated Coal Pillar Rib Rating (CPRR) and coal rib control systems simplified the rib conditions subjected to the development loading conditions with no multiple-seam interactions. When rib corners, abutment loading conditions, and multiple seam interactions deemed necessary for inclusion in the coal rib control system are collectively evaluated, it becomes evident that the current system can only assess one-fourth of the conditions associated with fatal incidents that occurred in the last decade, as reported by MSHA indicating the urgent need for further enhancements to the engineering-based coal rib control system.

Project Goals: Building upon the success of our recently completed and ongoing research projects focused on the development and enhancement of the coal rib control system, the research team at Missouri S&T possesses substantial expertise in coal rib control and will leverage this expertise for the success of the proposed research. Specifically, the project will involve conducting extensive rib corner surveys in collaboration with industry partners to gather data from at least 10 coal seams, instrumenting and monitoring selected mining operations with multiple seam interactions, and incorporating the mutual impacts of multiple seam interaction and abutment loading conditions. Additionally, we aim to expand the coal rib assessment methodology to provide rib corner support recommendations and finalize the development of the engineering-based coal rib control system, validating it through new case studies.

Impact of Research: The proposed research will significantly enhance the engineering-based coal rib control system's ability to assess and mitigate rib stability hazards in underground coal mines. By addressing rib corners, abutment loading conditions, and multiple seam interactions, the enhanced rib control system will be capable of evaluating most of the conditions associated with rib-related fatal incidents reported by MSHA over the last decade. This comprehensive assessment capability will enable more accurate identification and proactive mitigation of rib instability risks, ultimately reducing the frequency and severity of rib failure-related injuries and fatalities. The finalized coal rib control system will serve as a crucial tool for mine operators, enhancing safety and operational efficiency in underground coal mining operations.