Case Study

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Microseismic Monitoring of underground coal mining in Anhui Province, China

MSHA approved intrinsically safe microseismic systems for use in coal mines were installed at two sites in Eastern China. The ability to monitor microseismic activity in the mine provides insight into longwall geomechanics and will improve mine safety.

Fig 1: Wan Fang Gun coal mine in Huainan City, China

Currently operated by the Huainan Coal Mining Group, the Xin Zhuang Zi and Wan Fang Gun coal mines in Huainan, China recently incorporated ESG microseismic monitoring systems into their operations. These systems are used to assess the microseismic activity associated with underground longwall coal excavation, and play a significant role in the management of hazard and risk associated with coal mine operation.

Background

Longwall mining is a commonly used method of underground coal extraction, where a long segment of coal is removed in a single slice or panel, using large equipment called shearers. As the coal is removed, hydraulic supports are used to maintain the roof behind the coal

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Fig. 2: Sensor installation.

face. These supports are removed once the coal extraction has reached its limit and once the shearers have moved farther along the shaft, allowing for the roof rock to fall in a controlled manner. This helps to reduce the stress in the coal face and adjacent pillars.

Recently, the use of microseismic monitoring has been incorporated into underground coal mine operations to gain further insight into the rock failures and geomechanics associated with coal excavation. However, due to the potential build-up of combustible gasses in the mine, electrical equipment could pose an ignition risk. Therefore, systems must be contained in special casings which isolate the electrical equipment from the mine, and are certified by the Mine Safety and Health Administration (MSHA), in order to be used in underground coal mines.

ESG Solution

MHSA approved intrinsically safe microseismic systems were installed in each of the Xin Zhuang Zi and Wan Fang Gun coal mines in 2009. An array of uniaxial geophones was distributed throughout each mine in hard rock layers surrounding the longwall panels, at depths ranging from 570 to 725 meters below the ground surface.

The two ESG microseismic systems were installed with the goal of monitoring seismicity in the regions surrounding the coal seams. By observing the size, location and frequency of seismic events ahead of the longwall face, the mines seek to manage the occurrence of coal gas outbursts. In addition, monitoring the seismic activity associated with the roof collapse in previously mined areas helps to ensure better control of this process by providing information on the stress distribution and creation of the failure. Incorporating a well distributed, intrinsically safe microseismic monitoring system can accurately provide real-time information about the size, frequency and extent of fractures in the coal seam, thereby demonstrating their use in hazard mitigation.

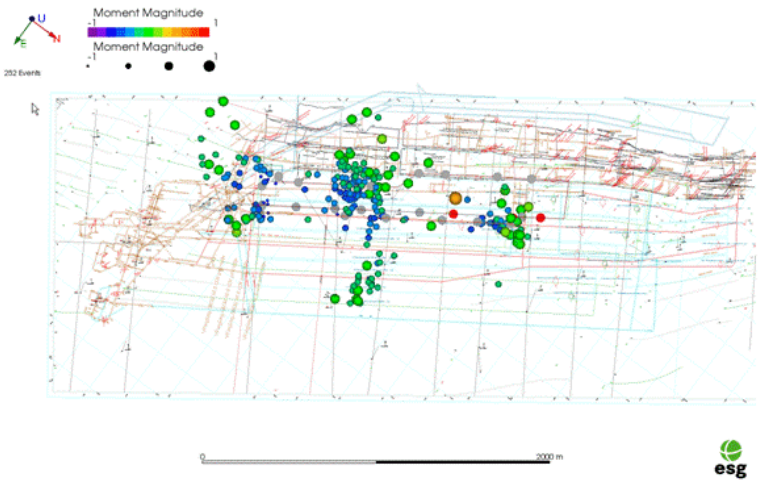

Fig. 3: Sensor array geometry for the Xin Zhuang Zi coal mine in Huainan, China.

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