

1A3. Mine Safety Technology

Technology Overview

1. Background

According to the Mine Safety Technology Development and Long-term Technical Transfer Plan, the development of mine safety technology has been promoted with a focus on priority

topics. Based on the results of this development, international joint research and technical cooperation/transfers have made considerable progress.

2. Technologies to be developed

(1) Applying mine safety technology to overseas mines

Japan applies its mine safety technology to model coal mines in coal-producing developing countries, thereby reducing mining disasters, improving mine safety and promoting stable coal production.

[1] In China, Japanese gas explosion disaster prevention techniques have been introduced to the Zhang-ji mine of the Huainan Mining (Group) Co. Ltd. in Anhui Province through the Central Coal Mining Research Institute. Specifically, the following four improvements were made: installation of a gas monitoring system, enhancement of gas drainage efficiency with directionally controlled gas drainage boring technology, introduction of underground ventilation analysis software and the installation of an underground radio system.

[2] In Indonesia, Japanese spontaneous combustion disaster prevention techniques have been introduced at the PTBA Ombilin mine through the Mineral and Coal Technology Research and Development Center (TekMIRA), including CO and temperature monitoring technology, gas analysis, underground ventilation network analysis and wall grouting.

[3] In Vietnam, Japanese mine water inflow disaster prevention technologies have been introduced to Mao Khe coal mine and other sites through the National Coal and Minerals Group (VINACOMIN), including hydrological data collection and analysis, underground water flow analysis using hydrogeological models, advanced boring technology for water exploration and drainage, and a flow rate measuring/pumping system.

(2) Joint research on mine safety technology

Through domestic development and international joint research with coal-producing developed countries, Japan promotes the development and sophistication of mine safety technology. This joint research will help further raise mine safety technology standards in both developing and developed coal-producing countries.

[1] Techniques to prevent roof fall accidents in roadways or at working faces have been developed, including roof fall risk prediction and roof fall prevention systems. These techniques are subjected to evaluation and applied to mine sites. For the

purpose of developing systems, a site demonstration on long bolts was carried out at the Kushiro mine in Hokkaido. A series of basic site tests were also conducted at the same mine to collect measurement data on microtremors, roof/crack displacements, rock stress, acoustic characteristics and on elastic wave through the use of impact tests. Another study on roof fall prevention is underway to develop a system to identify roof conditions by analyzing machinery data during the drilling of rock bolt holes.

[2] With a view to developing comprehensive underground gas management technology, numerical analysis software, MGF-3D, which uses the stress variations that occur as digging proceeds, is being improved and subjected to model analysis. The software also has a gas-liquid, two-phase analysis function to improve analytical accuracy.

[3] An advanced monitoring and communications system for underground mine safety and stable production has been developed through joint research conducted with the Commonwealth Scientific and Industrial Research Organisation (CSIRO). The system has now reached the stage of being applied to mine sites. This joint research also aims to build a basic system for risk information management that allows the real-time evaluation of different disaster risk factors (relating to work, environment, devices and machinery). As an early detection technique, an odor sensor based on worldwide standards is now being studied in a joint research project with the Safety in Mines, Testing and Research Station (SIMTARS). At the Kushiro mine, a "man location system" and an underground communications system were tested during an on-site demonstration.

Centralized monitoring and management technology

All underground mine safety information, including different measurement data items and the status of machine operations (both received and sent data), is controlled as a single unit by a computer system in a centralized monitoring and control room located on the surface.



Centralized monitoring computers



Centralized monitoring and control room

Roadway support technique (rock bolting)

A rock bolting roadway support technique is based on rock mass evaluations and measurements to overcome Japan's soft soil conditions.



Data transmitting roof displacement gauge

Bolt-supported roadway

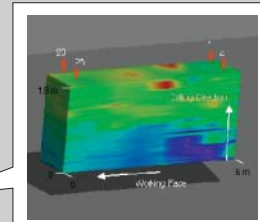


Geostructure data logging

Technology to determine roof conditions by compiling machinery data during the drilling of bolt holes



Drilling



Gas drainage technology

Gas drainage from coal seams and gobs is performed to prevent the emission of explosive methane gas. The drainage is safely controlled in terms of volume and concentration using the centralized monitoring system.



Gas drainage boring



Gas drainage hole



Gas drainage monitoring sensors



Gas drainage monitoring computer