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In case of emergency

Technology, training and transparency play crucial roles in mine rescue scenarios

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Underground Mining > Operational-excellence

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Few components of a mine are as critical as its safety apparatus and procedures, and refuge chambers are arguably among the most important elements at underground operations.

The mining industry is increasingly aware of the necessity for these systems to be in place, and to be updated with the absolute latest technology and state-of-the-art equipment, MineARC Systems Europe regional manager Kane Read says.

"There are so many intelligent and effective products entering the safety and rescue field," he says. For him, it's the underground mine tracking solutions and refuge chambers - and the ability to monitor these systems - which are most important.

"MineARC are developing new technologies to increase the effectiveness of quick and safe ingress in an emergency into a nearby refuge chamber, such as smart lighting, which will effectively guide you to the nearest chamber in the event of an emergency," he says.

Read is particularly excited about MineARC's GuardIAN refuge chamber monitoring system.

The system allows real-time surface monitoring of a mine's entire fleet of underground refuge chambers with internal and external cameras, chamber diagnostics, leak identification, uninterruptible power supply (UPS) monitoring and 'as it happens' fault reporting.

The system connects all of a mine's refuge chambers to a "central system on the surface", Read says. "This provides a central point for daily checks and maintenance increasing safety, while significantly reducing costs and time spent doing safety checks."

For Dräger, the current research focus is on improving transportation in the mines in the event of an emergency.

Ventilation is a key concern in both operation and in emergency scenarios, Kent Armstrong, Dräger's global business development manager segment mining, says. "There's no perfect blueprint here. Every mine has different conditions."

This is why Dräger is focusing its attention on underground transportation. "That's the key to working with the risks, and developing a mine rescue emergency plan in individual properties."

Dräger has now developed the Mine Rescue Vehicle 9000, an underground vehicle which also comes with an air-purging system in the cassette and the driver's cabin. This system provides breathable air to mine rescuers for extended periods, a necessity when rescuers have to drive longer distances in larger, deeper mines. This breathing apparatus consists of high-pressure breathing air storage, air management panels, and positive pressure relief valves, which can all be measured with gauges.

No matter how technologically advanced rescue technologies are, they will be useless if miners do not receive adequate and frequent training. Photo: iStock.com/DavidMariuz

The MRV 9000 also has fire-extinguishing and gas-detection systems which monitor for oxygen, carbon dioxide, carbon monoxide and nitrogen dioxide, and also boasts communication gear which connects crew in the front cabin and the cassette.

For Ted Hanley, who serves as vice president for Ontario Mine Rescue, the installation of underground wireless networks is the single most important technological advancement for the improvement of mine rescue.

"The main purpose [of installing the networks] was to support production," Hanley says. "In the background, mine rescue workers said, ‘This is great, let's piggyback on that'." As more and more mines adopted the practice, due to dropping prices for the technology, mine rescue teams began to formulate how they could use the technology for their own purposes.

"Ontario Mine Rescue kicked off a project to develop live communications between underground rescue teams and control operations on surface," Hanley says. "We handed the team a tablet device, created software that would communicate and track reporting functions of the mine rescue team, send that information back to surface operations, so that the main decision-makers who weren't underground can assess the situation and make better decisions."

Hanley and his team then presented this model to the International Mine Rescue Body in 2017, and he says the idea has been welcomed by the association.

Like many in the industry, Read is also encouraged by the increases in releases of safety technology, not only by MineARC but also by other competitor firms. "We've seen the safety culture increase significantly in the past five years," he says.

In an indication of just how seriously the mining industry considers rescue chambers and other safety apparatus to be, PT Freeport Indonesia, a subsidiary of Freeport-McMoRan, just last month announced it had built the world's largest underground refuge chamber at its Grasberg mine.

Costing US$5 million and taking a full year to build, the refuge chamber has the capacity to shelter 500 miners at a time. The refuge chamber is now one of five refuge chambers in operation at Grasberg, with two having the capacity to shelter 300, while the other two can house 200 and 100 miners, respectively, in times of emergency.

FT Freeport Indonesia is also constructing a sixth refuge chamber for its Grasberg mine, which will have a capacity of 600.

Concerns about transparency

Within the mine safety and mine rescue community, the death of six miners in a fire at a Palabora Copper mine in South Africa last year weighs heavily on their minds.

Information about what actually happened at the site is hard to come by, the International Tunneling Association's Donald Lamont says.

"I'm not sure I ever found out exactly why it happened," Lamont says. "At first, we got the impression that the miners concerned had used the refuge chamber, but they hadn't been able to operate the refuge chamber properly."

But then Lamont heard other information that indicated other factors were in play, and that the chamber wasn't where it should have been. "I never felt that I got enough information."

The incident raises a lot of questions to this day, Hanley says.

"When the mine rescue teams responded, they found people [in the mine] who were unable to take refuge" in the chambers, he says, and it's important to take a look at the measures and requirements in place at the mine at the time of the incident. "Were we making places of refuge to workers within a reasonable travel distance? Were the requirements good enough for those places of refuge?" he asks.

Though details of this incident have been very slow to be released, Hanley points out that mine rescue bodies are often caught between the mining companies, which have their own legal reasons for clamping down on information, and governments. Though he expects details of the South African mine incident to be discussed extensively at the International Mines Rescue Body Conference later this year, he says that details of another incident - the Turkish coal mine disaster in May 2014, which killed 301 people - have yet to be released.

Machine operators do not have the day-to-day experience in operating safety technology

"What really needed to happen after that incident was that mining companies and mine rescue organisations needed to understand what happened from a technical and emergency team standpoint," he says. "I went to the 2015 IMRB, when I thought it was Turkey's opportunity to present that information, and at that time, they chose not to present anything about it. From the perspective of those running mine rescue programmes, you wanted to bring learnings back to protect responders, but it seems this was at the mercy of the administrative process" in Turkey, he says.

He contrasts Turkey's response to that of New Zealand, following the Pike River coal mine disaster of November 2010, which killed 29.

"We received up-to-minute updates of what was happening at the site," Hanley says. "They were entirely transparent. Their intention is to share all the information to prevent other mine rescue responders from being affected."

All mining companies and governments need to embrace that level of transparency in order to ensure that miners, and mine rescue staff, will operate at the highest safety levels, Hanley says.

Regular training

Several of the interviewees hit on one central theme: no matter how technologically advanced refuge chambers and rescue technologies are, they will be useless if miners do not receive adequate and frequent training on how to use them properly in times of emergency.

The lack of training was evident in the Sago coal mine tragedy of January 2006 in Utah, US, in which 12 miners died.

"It was quite evident that US coal miners were not trained enough" in how to use the safety equipment, Dräger's Armstrong says.

"Some mining companies are extremely diligent on their training and life-support scenario systems," he says. "Other companies aren't as diligent."

Training is critical because refuge chambers are complicated pieces of equipment, ITA's Lamont says, adding that workers who spend their days as machine operators do not have the day-to-day experience to operate the gas-detection systems and control gas flows, as is needed in refuge chambers

"Everybody underground should be able to operate it," he says. "Each individual every three months or six months should have to spend 30 minutes to an hour in refresher training."

This schedule does cut into labour costs, Lamont says.

"People will lose parts of their shifts to do the training," he says, noting that it will have an impact on production. But he emphasises that this frequency of training is necessary to save lives.