THE ABCs OF KSAs

Assessing the self-escape knowledge, skills and abilities of coal miners

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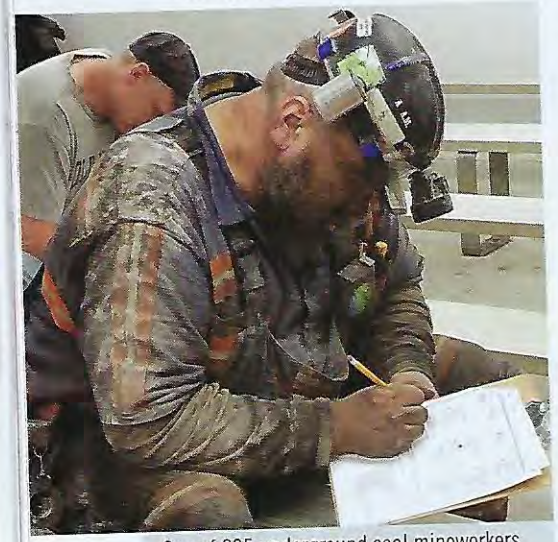
What simple step can help to prevent a mine emergency from becoming a mine disaster? Preparation.

Mine emergencies can happen at any moment. Although all mines and mine emergencies are unique, being equipped with an easily adaptable set of knowledge, skills and abilities (KSAs) can help underground coal miners prevent a dangerous situation from becoming a tragedy.

The Mine Improvement and New Emergency Response Act of 2006 (MINER Act) strengthened existing safety and health training regulations and introduced new measures aimed at improving emergency preparedness and response in underground coal mines. Although the MINER Act also required non-specified assessment of the self-escape KSAs of miners, there is no standard protocol dictating how to teach or evaluate these competencies.

Now more than 10 years later, the National Institute for Occupational Safety and Health (NIOSH) expanded its research to answer these important questions:

- What are the critical self-escape competencies that all miners need in order to be prepared to respond to an emergency?
- In light of training regulations that are now a decade old, how confident are miners in their ability to self-escape in the event of an emergency?



One of 895 underground coal mineworkers who volunteered to participate in NIOSH's self-escape survey study.

Identifying Critical Self-escape KSAs

Prior NIOSH research, the National Research Council 2013 report, "Improving Self-Escape From Underground Coal Mines," and multiple industry reports have addressed the need for improved self-escape training and assessment that emphasizes task mastery over the completion of time-based training requirements. To address this need, under a NIOSH contract, the Group for Organizational Effectiveness (gOE) and Aptima Inc. partnered to conduct a formal task analysis to identify the tasks critical for successful self-escape. The primary goal of this work was to provide detailed descriptions of all tasks critical to successfully self-escape. The protocol was reviewed and approved by the NIOSH Institutional Review Board and found to be in compliance with the Paperwork Reduction Act by the Office of Management and Budget.

Assessing Gaps in Critical Self-escape KSAs in Miners

To identify gaps in the critical self-escape KSAs among mineworkers, NIOSH developed a survey using 28 of the critical self-escape tasks identified in the task analysis. Because standard self-escape competency and assessment protocols are yet to be developed and real-world performance is difficult to assess, mineworker confidence was used as a "proxy" to measure competence. Participating miners were asked, "On a scale of 0-100%, how confident are you that you could correctly demonstrate or explain the following (KSA) to a brand new miner?"

In late 2016, NIOSH researchers visited eight mines and collected surveys from 895 volunteer mineworkers. To the authors' knowledge, this is the first study to assess gaps in the critical self-escape KSAs from the perspective of the mineworkers themselves.

"MAKE SURE YOU HAVE A GOOD UP-TO-DATE MAP AND KNOW THE ESCAPEWAYS OUT OF THERE RIGHT OFF THE BAT. . . IF THE GUYS . . . THAT DIED IN THE FIRE KNEW THEIR ESCAPEWAYS . . . AND KNEW WHERE THEIR SELF-RESCUERS WERE, THEY WOULD HAVE MADE IT OUT."

— Jim Behling, from the 2017 documentary, "Remember Wilberg"

"Remember Wilberg" is a documentary film produced under a grant from NIOSH, written and directed by Elaine Cullen, and produced by the UTA Film School.

Key Results

Survey results suggest that, despite united efforts to improve health and safety training by researchers and industry alike, there are still many gaps in critical self-escape KSAs among mineworkers.

Figure 1 displays the 28 items included on the survey along with the percentage of hourly and salaried mineworkers who report they are not fully confident in each of the self-escape tasks. For example, as shown in Figure 1:

- 23% of the hourly workers surveyed reported less than full confidence in their ability to demonstrate or explain how to properly don a self-contained self-rescuer (SCSR).
- 40% reported being less than fully confident about where to report in the event of an emergency.
- Less than half reported full confidence in their ability to explain the chain of command for reporting an emergency, or how to read mine map symbols.

When reviewing these results, it is especially important to note the wording of the question itself. The question introduced no complicating conditions (stress, smoke, real emergency, etc.), so the re-

sponses reflected how confident each miner is in his or her ability to correctly perform or explain these tasks to a new miner under normal, non-threatening conditions. This, along with other issues related to collecting self-reported data (e.g., potential concerns about confidentiality of answers and overrating of self-confidence), suggest these results could actually be viewed as "best-case scenario" estimates of confidence. This could signify that results might, in fact, overestimate levels of self-escape competency among this sample of mineworkers.

Importantly, it might not be realistic to expect that every mineworker be 100% confident in each and every self-escape task included on the survey. However, these results provide a clear indication that miners lack confidence in their own self-escape capabilities in multiple areas, and that there is significant room for improvement.

After receiving results representing their miners, individual mine operators and safety managers were able to tailor their training to better address the gaps in KSA confidence. Although the overall study results may not be generalizable to the underground mining population at large, these results (See Figue 1) can help to give mine operators, safety managers and individual miners everywhere an idea of where gaps in self-escape KSAs might exist.

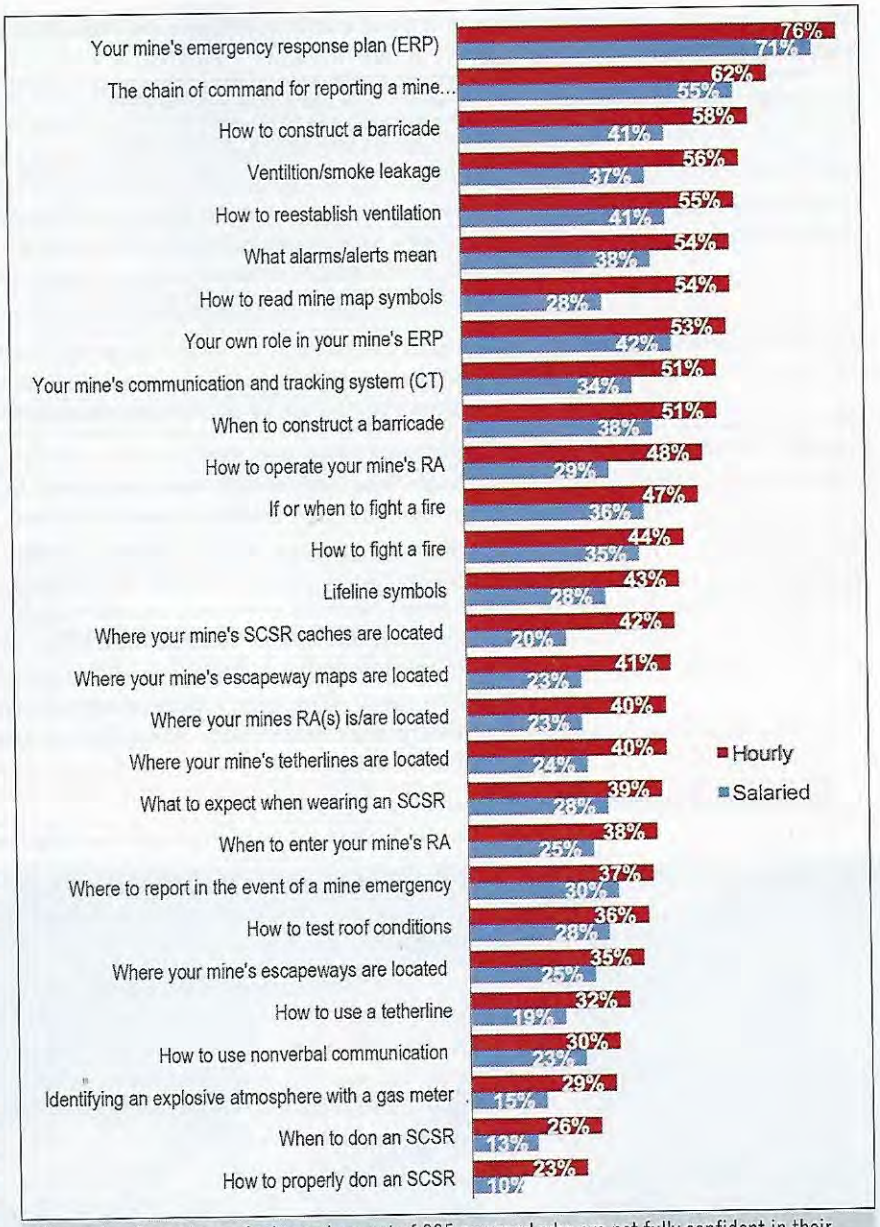


Figure 1—Percentage of mineworkers out of 895 surveyed who are not fully confident in their ability to correctly demonstrate or explain critical self-escape knowledge, skills and abilities.

Improving Critical Self-escape KSAs in Miners: What You Can Do Now

Despite the gaps in critical self-escape KSAs reported here, the good news is that every mine can immediately begin working on increasing worker proficiency in the "basic" knowledge critical to self-escape, including:

- Where the mine's SCSR caches are located.
- Where the mine's escapeway maps are located.
- Where to report in the event of a mine emergency.
- Where the mine's refuge alternatives are located.
- Where the mine's tether lines are located.
- The chain of command for reporting a mine emergency.
- The location of the mine's primary and secondary escapeways.

This critical knowledge can be easily and briefly covered every shift or periodically, as the working sections move, as part of the crew pre-shift meetings or via informal "quizzes" or "spot checks" during the workday. These brief exercises can also serve to increase proficiency in map reading and the correct identification of mine map symbols.

Gaps in KSAs that require procedural skill are being further studied by NIOSH in an effort to develop evidence-based training recommendations for mine operators and safety trainers for dissemination in 2019. In the interim, Table 1 outlines currently available resource materials for critical KSAs, including a number of available training aids.

As NIOSH continues to research self-escape preparedness, these results serve as a reminder of how important it is for mines to continuously review training materials assess the KSAs of their workforce. Defining and developing critical competencies will help to ensure mineworker readiness to avert potential tragedies.

For more information, contact mining@cdc.gov.

Disclaimer

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