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Factors influencing mine rescue team behaviors

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ABSTRACT

A focus group study of the first moments in an underground mine emergency response was conducted by the National Institute for Occupational Safety and Health (NIOSH), Office for Mine Safety and Health Research. Participants in the study included mine rescue team members, team trainers, mine officials, state mining personnel, and individual mine managers. A subset of the data consists of responses from participants with mine rescue backgrounds. These responses were noticeably different from those given by on-site emergency personnel who were at the mine and involved with decisions made during the first moments of an event. As a result, mine rescue team behavior data were separated in the analysis and are reported in this article. By considering the responses from mine rescue team members and trainers, it was possible to sort the data and identify seven key areas of importance to them. On the basis of the responses from the focus group participants with a mine rescue background, the authors concluded that accurate and complete information and a unity of purpose among all command center personnel are two of the key conditions needed for an effective mine rescue operation.

Key words: mining, underground coal mining, mine rescue, emergency response

PURPOSE OF THE STUDY

A focus group study was conducted by researchers at National Institute for Occupational Safety and Health (NIOSH) with individuals who had experienced a mine emergency. These participants included mine rescue team members, team trainers, mine officials, state mining personnel, and individual mine managers. The purpose was to identify what happens during the first critical moments after a mine emergency is discovered and to determine how to improve response during these initial moments. Although this study was conducted shortly before the 2006 and 2007 mine disasters at Sago, Darby, Alma, and Crandall Canyon,[1-4] subsequent follow-ups, mostly at mine rescue contests, with several study participants indicate the data remain valid.

INTRODUCTION

The focus groups, along with individual interviews, included personnel from underground nonmetal and coal mines located in the eastern, midwestern, southern, and western parts of the United States. The underground emergencies the subjects faced include fires, explosions, and water inundations. All group and individual interviews were conducted by the same researcher to ensure consistency, while other researchers served as scribes. When the data were collected and analyzed, the input from subjects involved in mine rescue was substantially different from input from those who made the initial decisions at the mine and were directing response activity from the surface. This was a completely unexpected but important outcome, which resulted in the mine rescue data being considered separately and presented here.

BACKGROUND

Mine rescue teams are composed of highly skilled miners who follow a prescribed regimen of classroom and hands-on training. In this way, they prepare themselves to enter a mine after an emergency event to perform rescue and recovery activities. A team is

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composed of five members who explore beyond the fresh air base, plus a member who remains at the fresh air base. The fresh air base is an established location, ventilated with fresh air being brought into the mine and serves as the base of operation for mine rescue teams. This sixth person, while remaining at the fresh air base, works with the other team members and facilitates communication between the team and the command center, which is located on the surface. The team generally arrives at an emergency site after some amount of time has passed; they can arrive within an hour if the team members work on-site or as late as 4-5 hours after the emergency has been determined, depending on when they were summoned and the amount of travel time. However, federal regulations mandate that two teams must be located within 1-hour travel time from every mine in the United States.[5]

Good planning is a critical component of mine emergency preparedness. Kilenschneider and Hyde[6] believe that the main problem with emergency planning is that a specific emergency cannot be planned. At best, the emergency can be anticipated and the response to various possible events can be formulated. A good planning framework will shorten the period of chaos that reigns at the beginning of almost any emergency when things are uncertain and often contradictory; errors can be deadly and time is of the essence.[7]

Good emergency response planning goes hand-in-hand with quality decision making during an event. The initial response to a mine emergency comes from the early on-site decision makers who represent several entities including enforcement agencies, the company, and often a labor organization. Even if the formal plan is an excellent one, these individuals will nevertheless have to work out the relationships necessary to put it into action. Klein[8] discussed several factors that emergency responders, including mine rescue teams, must contend with and overcome in the process of making decisions that can have a successful outcome. Time constraints can throw off coordination. This may result in faulty or incomplete information. Ambiguity increases because not only do individuals feel uncertain, but no one can be sure how others are interpreting events. As a result, the development of shared mental models may be a problem. Noise, which does not always affect individual performance, may seriously degrade group communication and communication constraints can hinder strategic thinking. Responders who feel responsibility could experience frustration since they have less control, in which case, "group think" may occur and group think leads to bad decisions.[9] Finally, the kinds of tasks that individuals must perform will have a bearing on their success, particularly when they have high workloads. It is obvious that leadership should be established as rapidly as possible to maximize the chances of a successful response.

It is accepted practice, understood in mine emergency response, that there should be a unity of purpose when faced with an emergency, so that everyone involved is working toward the same goal, that is, saving lives, and possibly, the mine. The interview subjects believe that it is important that there be one person in charge, someone who has an in-depth working knowledge of the mine and is able and willing to make decisions. In the past two decades, there has been considerable research dealing with how these decisions are made.

One of the best known approaches is the notion of "naturalistic decision making."[10] Naturalistic decision making suggests that an expert in a chaotic event will take immediate action to consciously form order out of chaos. Most models derived from naturalistic decision making share three essential components: First, the decision maker (eg, emergency manager) will attempt to grasp the "big picture" as a starting point. Second, he or she makes an appraisal to determine if the situation is recognizable. In other words, there is a pattern of incidents unfolding that fits a familiar scenario. The third component is that the standard for choosing a course of action is "workable," that is, good enough, criterion rather than an optimal one. This concept was first formulated by Simon[11] and later adopted by Klein[12] when he developed his model of "recognition primed" decision making. Klein's model attempts to explain how an expert responder can adopt a workable strategy to deal with a critical event, even with the chaos that may require him or her to attend to multiple tasks at the same time.

Klein and his associates conducted what he termed a "cognitive task analysis of 30 firefighters (fire ground commanders) who averaged over two decades of experience."[13] What the researchers found was that the responders were not taking time to compare alternative courses of action when confronted with an emergency but were carrying out the first one they identified as acceptable. This led Klein to ask two questions: How could these experts assume that the course of action they chose was good enough to work; and how were they able to evaluate its reliability without comparing it to others until they decided on the optimal way to proceed. The short answer is that because of their experience and expertise, they were "primed" to recognize the situation. So what does this priming entail? According to Chase and Simon,[14] the difference between a novice and an expert is that the expert has acquired many bits of experience that are "chunked" in some knowledgeable way. He or she can respond to a situation by drawing upon these organized chunks of knowledge rather than having to piece together one bit at a time as a novice might have to do. To explain how an expert can solve problems in chaotic surroundings, Gobet and Simon[15] introduced the concept of "templates." They characterized templates as cognitive structures with an unchanging core of chunks and a set of mental slots that can be altered rapidly as they are filled in by context or by additional information from the environment. New information is processed according to how it fits into these slots. Thus, an experienced person can arrive at the scene of an emergency, take a quick reading, and begin problem solving. He or she already has part of the picture stored in templates, so it is just a matter of picking a template that best fits the situation and filling in the slots with information specific to the problem at hand.

This fits with Klein's observation that experts focus on what "type" of emergency situation they are facing based on past cases, that is, their templates.[12,13] They are thus able to choose from decision making strategies that allow them to cope with a variety of ill-defined contingencies in a time frame that would not allow for unhurried and judicious steps to discover and implement the "best" choices. In essence, the expert, in choosing a template, selects one that is "good enough." The template is then used to guide decisions that are "good enough" to work in the situation that he or she presently faces.

By the time a mine rescue team arrives, some of the chaos has lessened, many of the preliminary decisions have been made, a command center has normally been established, a chain of command has been set up, and the initial stages of the mine emergency plan have been executed by command personnel under the leadership of the responsible person. The responsible person is the individual trained and initially assigned to take charge during underground mine emergencies involving a fire, explosion, collapse, or gas or water inundation. Each mine has prepared an emergency response plan that should be used to assist the responsible person in organizing the available resources; calling for assistance; notifying agencies, management, and miners; and initiating an inventory of supplies and personnel.

While the initial response to a mine emergency comes from the early on-site decision makers, their subsequent decisions are influenced by information from the mine rescue teams as they work on the front lines during the event. As the teams arrive and prepare to go underground for the first time, the official information comes to them from the command center. The command center usually has already formulated an initial plan and arranged for necessary supplies and equipment to be available for the teams to do their job.

After the three mine rescue team focus groups and four individual interviews with mine rescue team trainers for this study were completed, explosions and/or fires occurred in three US underground coal mines in which miners were killed (2006).[1,3,4] In 2007, a fatal mine collapse took place[2] resulting in additional fatalities, which were rescuers themselves. These events caused the authors to re-examine their findings.[16] Several of the focus group participants and individual interviewees were contacted to determine if these events altered their opinions and responses. These experienced mine rescue professionals indicated that these subsequent happenings did not change their views.

The Mine Improvement and New Emergency Response Act of 2006 (MINER Act), an extensive and comprehensive amendment to the Federal Mine Safety and Health Act of 1977, was passed after the 2006 incidents.[5] The MINER Act sought to improve mine safety in a number of areas, including mine emergency response. Section 4 of the Act stipulates specific requirements for mine rescue teams. The Act establishes, among other things, criteria to certify the qualification of mine rescue teams and requires an update of these criteria every 5 years. It requires two certified teams, whose members are familiar with the mine, to be available to cover that mine in the event of an emergency. The team equipment stations must be within 1-hour ground travel from the mine and teams must participate in two local mine rescue contests annually. Annual team training time was increased from 40 to 96 hours.

The MINER Act also addresses specific requirements for state-sponsored rescue teams, single and multicompany composite teams, and commercial mine rescue teams. State-sponsored teams are usually composed of state employees or individuals from the various mines that the teams cover. The law requires that each team visit and be familiar with each mine it covers.[5(Section 4)] In September 2007, the Mine Safety and Health Administration (MSHA) issued its new proposed rules under 30 Code of Federal Regulations Part 49 governing mine rescue teams. These proposed rules became final rules on February 8, 2008.[17]

METHODOLOGY

The research questions for this study were as follows:

- What happens in the first critical moments of an emergency response?
- What are the key issues of importance in the first moments, hours, and early days of the response?
- What *should* be happening—what are the lessons learned?
- How can we improve initial mine emergency response?

A qualitative method was used to gather data with focus groups and individual interviews. Focus groups gather information from people who have first-hand experience, knowledge, and expertise in a specific area. They are small groups, generally four to nine persons and run by an experienced facilitator. A preplanned discussion guide, developed by researchers, was used to guide the sessions which were transcribed. Names of the individuals and organizations represented are not identified. The data are analyzed for specific patterns, key concepts, and trends by experienced researchers, usually from diverse disciplines.

The focus groups were composed of individuals who were knowledgeable in escape, experienced in escape, mine emergency response, and/or who had expertise in the area. Each focus group included different participants and was 2-3 hours in duration. The individual interviews were 1.5-3 hours long. The participants included supervisors, line personnel (mine rescue team members), industry, state, and federal employees.

The questions were structured to be open ended to encourage free discussion. Three different experienced researchers served as scribes and the sessions were mechanically recorded. A research psychologist facilitated all the focus groups and conducted all interviews. Using one facilitator provided a consistency in the data collection method. All subjects were read the following to fulfill human subject requirements:

> Thank you for volunteering to participate in this research focus group. The information you share with us will be used to understand key issues in the first critical moments of a mine emergency. You are the experts in mine emergency response and we are looking to learn from your experiences. We are not concentrated on one event or doing a case study of one event. We are interested in your expertise in mine emergency response. (Focus group leader, Dr. Kathleen M. Kowalski-Trakofler, introduced herself and the recorder to the group.) We will be taking notes, as what you have to say is very

important to us. It is important that you understand that you will not be identified individually or through any organizational affiliation. Your responses are anonymous. This exchange of information is confidential and we ask all participants to respect that confidentiality. Do you have any questions?

NIOSH researchers developed a simple guide to target key areas and generate discussion to allow for interaction among the participants. The guide was focused on four questions:

1. What were your *first reactions* after understanding that there was a real emergency?

2. What were the *first decisions* made?

3. What role did *information* play in the emergency? (Communication)

4. What *recommendations* would you suggest to improve mine emergency response?

In addition, there was opportunity during the focus group sessions and the individual interviews to discuss other issues pertinent to the topic and the participants.

After researchers each completed a preliminary analysis of all the data, major patterns and topic areas were identified. Each topic area was targeted in the second analysis for validation and more in-depth understanding. A third qualitative analysis targeted specific examples of each topic and inter-relatedness of topics. A model was developed to illustrate the relationship between the topic areas. Key concepts were identified within topic areas. Recommendations were the results of the data final analysis.

It was determined that the data from the focus groups composed of the three mine rescue teams responding within the first several days of a mine disaster as well as their trainers provided different information than those focus groups comprised of on-site responders. As the primary goal of the research was to determine what happens in the first critical moments of a disaster, the mine rescue team data were extracted and analyzed separately. These data are presented here. The data from the true first responders were published in a separate paper.[18]

RESULTS

Data on mine rescue issues were collected from two underground coal mine rescue teams, one metal/nonmetal rescue team, and mine rescue team trainers from both company and state-organized mine rescue teams. This resulted in a total of 25 participants. A limitation of focus groups and, thus, this study, is the small subject sample. This limitation must be considered if generalizing the data to all mine rescue teams. However, the focus groups allowed for in-depth discussion in the identification of the issues and a richness of data not otherwise available. No additional focus groups were planned when data saturation was reached.

Team members and trainers emphasized trust, good communication, and support from family and mine management as being critical to their ability to perform their duties as mine rescue teams. Interview participants identified seven areas of importance to mine rescue teams in a mine emergency. These include the following:

- Saving trapped people versus saving the mine.
- Having a strong relationship with the command center (company officials, labor representative, MSHA and state mining agency representative, and the mine rescue team representative).
- Having accurate, up-to-date information on the situation.
- Being well prepared and confident in their abilities.
- Being supported by family and management.

- Losing experienced people in mine rescue due to attrition.

- Following accepted training and established rescue and recovery plans.

Saving trapped people versus saving the mine

There is more of a sense of urgency for a rescue team if people are involved, particularly if the trapped miner is someone known to the team. Almost all team members agreed that they would never hesitate and are willing to take risks to go into a mine after a victim unless they were specifically forbidden to do so. Along with this attitude, the tendency today is to seal a mine or part of a mine that is on fire or severely damaged if there are no people involved, rather than trying to fight the fire or rehabilitate the mine and endanger team members.

Having a strong relationship with the command center

Mine rescue teams look to the command center for leadership. The subjects in this study discussed the importance of leadership and the need to trust the leader(s) in the command center. Team members may recognize the situation immediately in front of them, but the command center is assumed to have the overall picture of what is happening in the entire affected area of the mine. Subjects believe it is important to make suggestions to the command center so that the decision makers have the best possible situational knowledge with which to make informed decisions. At the same time, the command center should trust the rescue team's observations as they are observing the situation first hand.

It is accepted practice, understood in mine emergency response, that there should be a unity of purpose when faced with an emergency so that everyone involved is working toward the same goal, that is, saving lives and, possibly, the mine. The interview subjects believe that, to facilitate a good relationship between the command center and the teams, it is important that there be one person in charge—someone who has an in-depth working knowledge of the mine, and is able and willing to make decisions. This usually results in a clearly defined and dependable chain of command. Even with the same goal, there may be differences in opinion regarding how the situation should be handled. The rescue teams themselves and the company are often anxious to get rescuers into the mine so they can begin exploration, but say that government officials usually tend to proceed more slowly to better understand the situation and/or prepare for as many hazards as possible. Study participants believe it is important for the command center to trust the teams. In a related vein, subjects felt degrees of trust often are exemplified in the varying amounts of freedom given to different teams in making their own decisions when exploring the mine.

Having accurate, up-to-date information on the situation

Every focus group and individual interviewed believed that accurate information is critical in any emergency situation. In the case of mine emergencies, the key pieces of information identified by participants as being needed by the mine rescue teams are as follows:

Is anyone trapped or missing and where are they located?
What happened to cause the emergency?
Where is the emergency?
How serious is the problem?
How might the situation change over time?

Other important pieces of information include location and availability of equipment such as firefighting hoses and access to a water supply in the mine, availability of supplies such as materials for supporting the mine roof, whether the event is likely to be a long duration incident or one that can be handled relatively quickly, status of the mine ventilation system and the air quality/quantity near the emergency, access to the fire area, and, in the case of a coal mine fire, information on the proximity of the gob (a caved-in area behind the longwall mining unit) and other sealed areas to the emergency site.

The subjects who participated in this study believe that the source of information is a key consideration of its credibility. Study participants said they

must have confidence in that person who is providing them information. Specifically, interviewees reported that they look at the overall experience, reliability, and knowledge of the communicator to help them determine their own level of trust. Subjects report that denial in the face of an abnormal situation or uncertainty on the part of the communicator adds to confusion, particularly in the early stages of an emergency. When the teams arrive, they take in as much information as is available so they can prepare to do their jobs efficiently and safely. However, once they start their exploration, they become a significant source of critical, updated information. This information, provided to the command center, enables those personnel to make quality decisions.

Being well prepared and confident in their abilities

Subjects noted that hands-on training in realistic situations is the best way for a mine rescue team to be adequately prepared and to develop self-confidence. Working and training together enables members to get to know and trust each other. Working as a team means paying attention and listening to each other. In addition, multiple subjects said that, if instincts suggest something different in terms of deciding what to do, they will discuss the issues, while working as a cohesive unit.

Subjects specifically mentioned the following points:

- Trust your instruments (eg, gas meters) and know their limitations.
- Continually communicate with each other as you progress through the mine and, if at any time—whether before entering the mine or while exploring—you have any doubts about your equipment, yourself, and/or your ability to do the job, speak up.
- Do not enter the mine if you are the least bit uncertain and tell your teammates if this uncertainty becomes an issue underground.
- There are simply some situations for which a person cannot train.

Being supported by family and management

Interviewees all agreed that they need the support of their families to enable them to be contributing team members. This is a commitment that must be taken seriously and there is no doubt that being part of the team will result in members' missing out on some family events. For example, it is not uncommon for mine rescue team members to be away from their families for a week or more depending on the nature and seriousness of the mine emergency to which they were called.

In a way, mine rescue team spouses, in particular, can become "victims," too. Fear and family issues are the usual reasons for someone quitting mine rescue. Even after passage of the 2006 MINER Act, some teams and individuals felt they are not well supported by the mining companies for which they work. They were concerned that their families would suffer financially if anything should happen to them in "the line of duty."

On multiple levels, management support for mine rescue teams and their members is critical. Interviewees felt that it is beneficial for mine management to participate in mine rescue training so they can be intelligently involved and know how to best direct and use their teams should they need to do so during a mine emergency. Interviewees suggest mine management must learn to stop thinking of mine rescue as an "unfortunate necessity."

Losing experienced people in mine rescue due to attrition

It is no secret that the mining industry is faced with an increasingly aging work force.[19,20] However, recent personal observation shows many younger miners on the mine rescue teams. Even if a team is presently at full strength, those interviewed believe it would be beneficial to bring new members in now, while those older, experienced members are present and active to share their experience and knowledge. Just as important, the experienced members reported a genuine desire and obligation to pass on what they have learned. The veterans' active participation in passing along this "tacit" knowledge, the complex accumulation of insights into "how things are done,"

is critical because it is very difficult to capture tacit knowledge in databases or documents, including training materials.[20] Although tacit knowledge may make up a large proportion of the body of information any organization must retain to function, it tends not to be employed systematically because it does not lend itself to traditional methods of classification.

Tacit knowledge must be accessed differently.[21] Research has shown that the way this knowledge is best passed in is thorough storytelling. It is in narratives about past events and their participation in them that respondents may reveal how they went about making sense and making decisions about how to organize themselves and others in the emergencies that they faced. In all areas of human experience where numbers and logic are inadequate or need interpretation, it is narrative that serves to translate the unexpected into something intelligible.[22] As the mindset in a training session is different from that in a real emergency, this experience and what is referred to as "institutional knowledge" needs to be passed to the next generation of mine rescuers.

Following accepted training and established rescue and recovery plans

According to participants, in the face of an emergency, especially if a fellow miner is involved, a mine rescue team is likely to experience an initial "adrenaline rush," heightened stress, and sense of urgency to do something. While this is normal, the team must not give in to the "need" to rush in immediately. Rather, the team is trained to follow mine rescue guidelines issued by MSHA and each member must know his or her role on that team. Before entering the mine, the team has to go through all procedures to ensure that they are completely ready to go underground, which includes ensuring that all necessary equipment is on-hand and in good working order; that the entire team is trained; that each member has a current medical examination on file; and that they are satisfied that it is safe to proceed and understand the likely hazards to be encountered.

PSYCHOLOGICAL/PHYSIOLOGICAL RESPONSE

It is normal to experience an emotional, as well as physiological, reaction during mine rescue. Recognizing these reactions will better prepare the individual to respond. Psychologists call an incident like a mine rescue a "traumatic incident" and scientists know how normal humans react in these situations. Responses usually include physical, mental, emotional, and behavioral changes. Strong reactions and emotions are normal in a crisis situation. Each individual is different and can report some or none of the following symptoms: rapid heartbeat, dry mouth, sweaty palms, increased anxiety, fear, overall extreme sweating, feeling confused, feeling overwhelmed, shallow breathing, nausea, and disorientation. These are ordinary human responses to an extraordinary situation.[16]

Many of the mine rescue team members in this study reported experiencing a number of these symptoms. In addition, the seemingly endless waiting for permission from the command center to enter the mine or to proceed once in the mine has caused great frustration and increased tension even though the team members understand that these delays are intended to protect the rescuers.

DISCUSSION

Virtually every group of mine rescue personnel or individual interviewed agreed that issues, including accurate and complete information, preparation and training, and trust, were critical when they were called upon to respond to a mine emergency. They also agreed that their sense of urgency was affected by whether or not miners were trapped and missing. One group in particular was emphatic that they would never refrain from entering a mine to rescue a miner unless specifically forbidden to do so by someone in higher authority. Team safety is an issue given careful evaluation by the command center, especially if there are no missing miners.

One of the best practices in crisis identified by Seeger[23] was the need for continuous collaboration and coordination among those overseeing the emergency. Coordinating information increases the likelihood of consistency, which is critical to effective crisis communication. This coordination is necessary for information going not only to the rescue teams but from them back to the command center. Of necessity, the mine rescue team must work with and have confidence in the ability of the command center

personnel. These personnel are, effectively, coordination managers and decision makers for the responding mine rescue teams.[24] The team members reported that they value command center decisions when they believe that everyone in that command center has a unity of purpose. Members of one team were disheartened when they realized that production at one end of the mine was being conducted "business as usual" while they were risking their health and safety by trying to stop a water inundation and roof collapse at the other end of the mine. Team members must be confident that command center personnel are dedicated to safely resolving the emergency and not worried about politics or concerned with being second guessed in subsequent investigations.

To address these kinds of issues, Kravitz and Peluso[25] developed a Crisis Management Training Program to provide potential command center personnel with opportunity to learn with hands-on training scenarios. In 2002, a computerized mine emergency simulation, Mine Emergency Response Interactive Training Simulation, was created to allow personnel in leadership positions in the command center to test their knowledge and skill.[26] Groups of individuals composed of representatives from mining companies, labor, and government agencies can practice working together during the simulated mine emergency in much the same way as in an actual emergency.

Roles and responsibilities need to be clearly defined, even before an emergency arises. For reliable communication between the command center and the teams, it is important that a chain of command be set up and followed. A single person at the command center should be assigned to communicate with the team to minimize confusion and contradictory instructions and/or information. As the teams explore the mine, the command center relies more and more on the teams' observations, although they may require confirmation at times. In one situation, the team reported the location of a fire to the command center, which responded by telling them that they could not be observing a fire there because the oxygen level was too low for combustion.

In addition, individuals should not have to "wear different hats" during an emergency. As suggested by Seeger[23] and Reynolds et al.,[27] a single individual should not be put in a position where he or she has to choose between separate responsibilities. For example, no person can be in the command center as firefighting coordinator and simultaneously lead the mine rescue team.

Trust is also an issue among members of any individual mine rescue team. If these miners work side by side every day and train together on the same equipment and procedures over a period of time, that trust will grow. This same level of trust is difficult, if not impossible, to achieve if team members only get together once a month to train or are suddenly grouped together at the emergency site. Before going underground for any emergency, each member should ask himself or herself whether or not he or she can deal with the situation at hand. If not, the individual should not go in. One particular team noted that they had worked together as a unit for more than 15 years and had learned to trust the actions and instincts of one another. In one instance, when the command center was not operational and no responsible person had been identified, the team's previous experience in real-life situations helped them recognize the need to change mine ventilation as soon as possible, and this experience made them comfortable in proceeding with the task. Their experience and the need to turn the fire away from a potentially dangerous, abandoned area of the mine required an immediate decision and they made it.

A chain of command not only needs to exist within the command center and between the command center and the rescue teams but is also needed when dealing with the press, families, and the community. Section 7 of the 2006 MINER Act does address this issue by requiring that a Department of Labor official, usually from MSHA, acts as liaison between the Department and the families of victims and that MSHA be responsive to requests from these families, as well as serving as the primary communicator with the operator, miners' families, the press, and the public. For accuracy of information and to avoid confusion, a single person should be assigned or take on the responsibility for briefing the press and families of trapped/missing miners.[12]

Mine rescue teams do not exist in a vacuum. They need to be supported by their companies, their fellow miners, and their families. Many team members felt that mine management does not understand what mine rescue demands from its members. There is little understanding of what is involved in the training, the conditions under which the teams work, and the value of the rescue team to the company. Too often, teams are regarded as an unfortunate necessity or expense that is required by law. Team members reported that a critical reason why a team member might quit the team is the realization that, if he or she is injured or killed while on mine rescue duty, his or her family is likely to suffer. One subject said "If I'm killed or hurt, what will happen to my family?"

It has long been a question as to who will assume the liability for a team if company "A" sends its team to help in an emergency at company "B's" mine. There are even some questions when a team responds to an emergency at its own mine. In the case of the nonmetal team interviewed, they were also paid and designated as the state's mine rescue team. If anyone were injured when called in by the state, they would be covered by the state for injury, etc. However, that would not be the case when they responded to a call from any other operation, unless a mutual aid response contract was in place. In the aftermath of a real mine rescue operation, the fear of being injured or killed becomes more real and can cause an individual to quit mine rescue.

In another case, the "dysfunction" of mine management during an incident and the apparent lack of consideration for the team members caused a team member's resignation. As this former team member remarked, "Why did I risk my life when management doesn't seem to care?"

As older mine rescue team members retire, their experience is lost. The sentiment expressed was, "Success has become our enemy because there is no longer enough experience around to learn from." One focus group voiced their concern that there are fewer people who have experienced an event from which to draw knowledge and build self-confidence. The mining population is getting older.[20] There are more people older than 50 years at many mines than there are people younger than 40 years. Team members feel that the younger miners need to listen to the older miners. The older, more experienced miners say they want to be heard but, too often, the young workers do not seem to listen. The long-time team members feel that manual labor once held job value and a miner started at the bottom and worked up. Participants said that some new, younger miners know computers and technology and do not seem to listen to the older, more experienced miners who are likely to be less technology savvy. Despite this occasional attitude, companies would benefit by adding new members to their teams now, even if those teams are complete, to compensate for the experience drain.

The authors suggest that the problems identified by participants in these focus groups deserve attention and, in fact, some are being addressed now. Younger team members are beginning to compete at mine rescue contests and are learning from experienced team members. More frequent, quality training, as required by the MINER Act (Section 4), and improved equipment can lead to more confidence, cohesion, and better prepared teams.[5] Improved cooperation and communication between the command center and the rescue teams can result in a better, more efficient, and coordinated response in a mine emergency.

CONCLUSIONS

NIOSH personnel conducted focus groups and individual interviews to study the first moments in underground mine emergency response. Participants in this study included mine rescue team members and trainers, mine officials, state mining personnel, and individual mine managers. Because the responses of the mine rescue team members and trainers were noticeably different from those of the other participants, their data were separated out and the results presented in this article.

Their responses to the questions pointed to concerns the team members and trainers had. They fell into the following seven categories:

1. Saving trapped miners versus saving the mine.

2. Having a strong relationship with the command center (company officials, labor representative, MSHA officials, state mining agency representatives, and the mine rescue team representative).

3. Having accurate up-to-date information on the situation.

4. Being well prepared and confident in their abilities.

5. Being supported by family and management.

6. Losing experienced people in mine rescue due to attrition.

7. Following accepted training and established rescue and recovery plans.

According to participants, they would be willing to go into a mine to save a fellow miner much more quickly than to save a mine. The teams must trust the command center personnel and they, in turn, must trust the team. Everyone involved with the emergency must have the same goals in mind and they all must be confident that they are getting the most accurate and up-to-date information possible. The teams must be confident that they can handle the situation facing them.

One of the issues that came out repeatedly is that the team members need the support of their families and mine management. Families need to understand and accept the fact that their family member is likely to miss family activities because of practice or an actual emergency. Similarly, mine management must be supportive and might even participate in some mine rescue activities to familiarize themselves with what the team members actually do.

There was agreement among participants that many experienced team members are no longer part of teams. Regardless of why they are no longer around to mentor the younger team members, their presence and experience are sorely missed.

Finally, participants discussed the importance of following established rescue and recovery plans. They said that if a missing person is involved, there is a temptation for teams to want to rush in to find them. Taking their time and making sure they are following procedures will benefit everyone in the long run.

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